**JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)**

**VIETNAM RAILWAYS (VR)**

# STUDY FOR THE FORMULATION OF HIGH SPEED RAILWAY PROJECTS ON HANOI – VINH AND HO CHI MINH – NHA TRANG SECTION

## FINAL REPORT

## VOLUME III

## ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

**June 2013**

**ALMEC CORPORATION**
**JAPAN INTERNATIONAL CONSULTANTS FOR TRANSPORTATION CO., LTD.**
**ORIENTAL CONSULTANTS CO., LTD.**
**NIPPON KOEI CO., LTD.**
**JAPAN TRANSPORTATION CONSULTANTS, INC.**

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USD 1 = JPY 78 = VND 21,000

(Based on rate on November 2011)

# PREFACE

In response to the request from the Government of the Socialist Republic of Vietnam, the Government of Japan decided to conduct the Study for the Formulation of High Speed Railway Projects on Hanoi – Vinh and Ho Chi Minh – Nha Trang Section and entrusted the program to the Japan International cooperation Agency (JICA).

JICA dispatched a team to Vietnam between April 2011 and June 2013, which was headed by Mr. IWATA Shizuo of ALMEC Corporation and consisted of ALMEC Corporation, Japan International Consultants for Transportation Co., Ltd., Oriental Consultants Co., Ltd., Nippon Koei Co., Ltd. and Japan Transportation Consultants, Inc.

In the cooperation with the Vietnamese Counterpart Team including the Ministry of Transport and Vietnam Railways, the JICA Study Team conducted the study which includes traffic demand analysis, natural and socio-economic conditions, alignment planning, consideration of various options including the upgrading of existing railway, technical standards for high speed railway, implementation schedule and institutions, and human resource development. It also held a series of discussions with the relevant officials of the Government of Vietnam. Upon returning to Japan, the Team duly finalized the study and delivered this report in June 2013.

Reflecting on the history of railway development in Japan, it is noted that Japan has indeed a great deal of experience in the planning, construction, operation, etc., and it is deemed that such experiences will greatly contribute to the railway development in Vietnam. JICA is willing to provide further cooperation to Vietnam to achieve sustainable development of railway sector and to enhance friendly relationship between the two countries.

It is hoped that this report will contribute to the sustainable development of transport system in Vietnam and to the enhancement of friendly relations between the two countries.

Finally, I wish to express my sincere appreciation to the officials of the Government of Vietnam for their close cooperation.

June 2013

Kazuki Miura
Director, Economic Infrastructure Department
Japan International Cooperation Agency

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# ABBREVIATIONS

| | |
|---|---|
| 5ECSR | Five Year Environmental Current Status Report |
| ADB | Asian Development Bank |
| BOD | Biochemical Oxygen Demand |
| CD | Constant Drag |
| $CO_2e$ | Carbon Dioxide Equivalent |
| COD | Chemical Oxygen Demand |
| CSR | Compensation, Support and Resettlement |
| DARD | Department of Agriculture and Rural Development |
| DOCST | Department of Culture, Sport and Tourism |
| DONRE | Department of Natural Resources and Environment |
| DOT | Department of Transport |
| DPC | District People's Committee |
| DMS | Detailed Measurement Survey |
| DPI | Department of Planning and Investment |
| EBA | Endemic Bird Area |
| EIA | Environment Impact Assessment |
| EJ | Expansion Joint |
| ESR | Ecological Sensitive Receptors |
| EQS | Environmental Quality Standard |
| FRA | Federal Railroad Administration |
| GDP | Gross Domestic Product |
| GHG | Green House Gas |
| HCMC | Ho Chi Minh City |
| HSR | High Speed Railway |
| IBA | Important Bird Area |
| IEE | Initial Environmental Examination |
| IPP | Indigenous Peoples Plan |
| IUCN | International Union for Conservation of Nature |
| JBIC | Japan Bank for International Cooperation |
| JICA | Japan International Cooperation Agency |
| KOICA | Korean International Cooperation Agency |
| LTIA | Long Thanh International Airport |
| LURC | Land Use Right Certificate |
| MARD | Ministry of Agriculture and Rural Development |
| MOCST | Ministry of Culture, Sport and Tourism |
| MOLISA | Ministry of Labour Invalid and Social Affairs |
| MONRE | Ministry of Natural Resources and Environment |
| MOT | Ministry of Transport |
| NGO | Non-Governmental Organization |
| NH | National Highway |
| OHS | Occupational Health and Safety |
| Pa | Pascal |
| PAP | Project Affected People |
| PKM | Passenger-kilometer |
| $PM_{10}$ | Particulate Matter 10 |
| PPC | Provincial People's Committee |
| RAP | Resettlement Action Plan |
| ROW | Right-of-Way |
| RRPF | Resettlement and Rehabilitation Policy Framework |
| RTRI | Railway Technical Research Institute |
| SEA | Strategic Environmental Assessment |
| SEDP | Socio-Economic Development Plan |
| SHM | Stakeholder Meeting |
| SIA | Social Impact Assessment |
| SS | Suspended Solid |
| TRICC | Transport Investment and Construction Consultant Joint Stock Company |
| TSP | Total Suspended Particle |

| | |
|---|---|
| VITRANSS2 | The Comprehensive Study on the Sustainable Development of Transport System in Vietnam |
| VND | Vietnamese Dong |
| VNRA | Vietnam Railway Administration |
| VR | Vietnam Railways |
| WWF | World Wide Fund for Nature |

# 1 OVERALL FRAMEWORK OF ENVIRONMENTAL AND SOCIAL CONSIDERATIONS STUDY

## 1.1 Objectives and Scope of the Environmental and Social Considerations of this Study

1.1 The objectives of this environmental and social considerations study are:

(i) To avoid or minimize adverse impacts through a comparison exercise of alternatives and propose mitigation measures to be incorporated into the project planning;

(ii) To identify a range of significant and potentially significant environmental and social considerations impacts to be studied in the subsequent stage of the Environmental Impact Assessment (EIA);

(iii) To propose appropriate resettlement and rehabilitation policy framework (RRPF) for the further stage of land acquisition process, and;

(iv) To form a common understanding of the environmental and social issues confronting the Projects among the wide range of stakeholders.

1.2 Considering the scale (total length) of the Projects and its nature as a high-speed railway (HSR), the environmental and social considerations study is important to avoid, minimize and mitigate the negative impacts of the Projects. For example, impacts on the natural environment, land acquisition, resettlement, and considerations for the poor, minority or indigenous peoples, and noise and vibration issues, which are typical controversies surrounding the HSR, have to be carefully and appropriately studied. Based on the “JICA Guidelines for Environmental and Social Considerations” of 2004 as well as its amendment in 2010 (following the unification of JICA and JBIC), these Projects are classified under “Category A” Projects. In the case of “Category A” projects, JICA encourages project proponents to consult with local stakeholders about their understanding of the development needs and the likely adverse impacts on the environment and on the general society.

1.3 Under these conditions, an Initial Environmental Examination (IEE) study was conducted based on readily available information including existing data (secondary data) and on simple field surveys (field reconnaissance). The following scope has been given to the IEE study as the environmental and social considerations for this study;

(i) Implementation of baseline survey on environmental and social conditions mainly based on secondary data;

(ii) Implementation of assessment of project alternatives to ensure environmental and social considerations from an early stage of the Project;

(iii) Implementation of provisional scoping for the eventual EIA stage including proposal of provisional environmental mitigation measures, environmental monitoring framework and technical requirements of EIA;

(iv) Implementation of case studies on environmental impacts peculiar to the HSR projects which will be incorporated into the project planning;

(v) Holding a series of stakeholder meetings; and

(vi) Preparation of provisional RRPF.

## 1.2 Related Laws and Regulations

### 1) SEA and EIA in Vietnam

1.4 Under the Law on Environmental Protection dated 29th November 2005 (took effect in 2006), MONRE issued a decree and circular on SEA, EIA and environmental protection and its latest amendment, i.e. “Decree No.29/2011/ND-CP of April 18, 2011 on Provisions of Strategic Environmental Assessment, Environmental Impact Assessment, and Environmental Protection Commitment” and ”Circular No.26/2011/TT-BTNMT of July 18, 2011 on Detailing a Number of Articles of the Government’s Decree No.29/2011/ND-CP on Strategic Environmental Assessment, Environmental Impact Assessment and Environmental Protection Commitment. According to the decree, the proposed high-speed railway should conduct an EIA based on Vietnamese environmental legislation.

1.5 Besides these basic laws and regulations, the study referred to other related laws. The laws and regulations listed in Appendix 1A are identified as reference information for environmental and social considerations in the study. Through the study, it is confirmed that the national laws, regulations and standards are, in principle, applied at the city/provincial level.

### 2) Land Acquisition and Compensation in Vietnam

1.6 Under the Law on Land of 2003, several decrees have been issued to stipulate the details on land acquisition and compensation. The major regulations related to land acquisition and compensation are listed in Appendix 1B Laws and Regulations Related to Land Acquisition/Compensation (National Level), and Appendix 1C Laws and Regulations Related to Land Acquisition/Compensation (City/Provincial Level).

### 3) JICA Guidelines

1.7 The objectives of the JICA Guidelines are to encourage project proponents and related entities to have appropriate consideration for environmental and social impacts, as well as to ensure that JICA’s support for the examination of the environmental and social considerations are conducted accordingly. The guidelines define the basic concerns as well as the processes and procedures of environmental and social considerations by type of project.

1.8 JICA recognizes the following seven principles to be very important under the environmental and social considerations of projects:

- Coverage of a wide range of environmental and social impacts to be addressed;
- Implementation of measures for environmental and social considerations from an early stage until the monitoring stage in the project cycle based on analysis of alternatives;
- Paying attention to accountability and transparency when implementing cooperation projects;
- Ensuring the meaningful participation of stakeholders in order to take consideration of environmental and social factors and to reach consensus accordingly;
- Disclosing information on environmental and social considerations in order to ensure accountability and to promote participation of various stakeholders;
- Capacity building of organizations to consider environmental and social factors appropriately and effectively at all times; and
- Addressing requests for prompt implementation of projects while undertaking

environmental and social considerations.

1.9 The JICA Guidelines classifies projects under three categories (i.e. A, B and C) according to the extent of environmental and social impacts similar to other funding agencies categorization like the World Bank (WB), the Asian Development Bank (ADB) and Japan Bank for International Cooperation (JBIC). To make this classification, JICA takes into account an outline of the project, the scale, site condition, and environmental and social considerations study scheme of the host countries.

1.10 As per the JICA Guidelines, the impacts to be assessed with regard to environmental and social considerations include impacts on the living environment, human health and safety as well as the natural environment. Impacts on the natural environment include trans-boundary or global-scale impacts through air, water, soil, noise, vibration, waste, accidents, climate change, ecosystems and biodiversity. The impacts to be assessed also include social impacts, which include land acquisition and involuntary resettlement; local economy such as employment and livelihood; utilization of land and local resources; social institutions such as social infrastructure and local decision-making institutions; existing social infrastructures and services; vulnerable social groups such as the poverty level and indigenous peoples; equality of benefits and losses and equality in development process; gender; children's rights; cultural heritage; local conflict of interests and infectious diseases such as HIV/AIDS. In addition to the direct and immediate impacts of projects, derivative, secondary and cumulative impacts are also to be assessed in regard to environmental and social considerations within the extent possible.

1.11 JICA discloses the information after making inquiries to the recipient governments and related organizations.

## 1.3 Outline of Environmental and Social Considerations (IEE Study)

### 1) Overall Flow of IEE Study

1.12 In accordance with the laws and regulations of Vietnam and JICA Guidelines, the IEE study was conducted as shown in Figure 1.3.1. The flow can be divided into five major steps as follows:

(a) **Preparation of Plan on Environmental and Social Considerations (IEE study) of this Study:** the draft plan on environmental and social considerations (IEE study) of this study was prepared and finalized through consultation with stakeholders especially on the 1st stakeholder meeting (SHM).

(b) **Conduct of Baseline Survey on Environmental and Social Conditions:** as part of the IEE study, the baseline survey on environmental and social conditions were implemented. Environmental sensitively maps were prepared for alignment planning (setting alternatives).

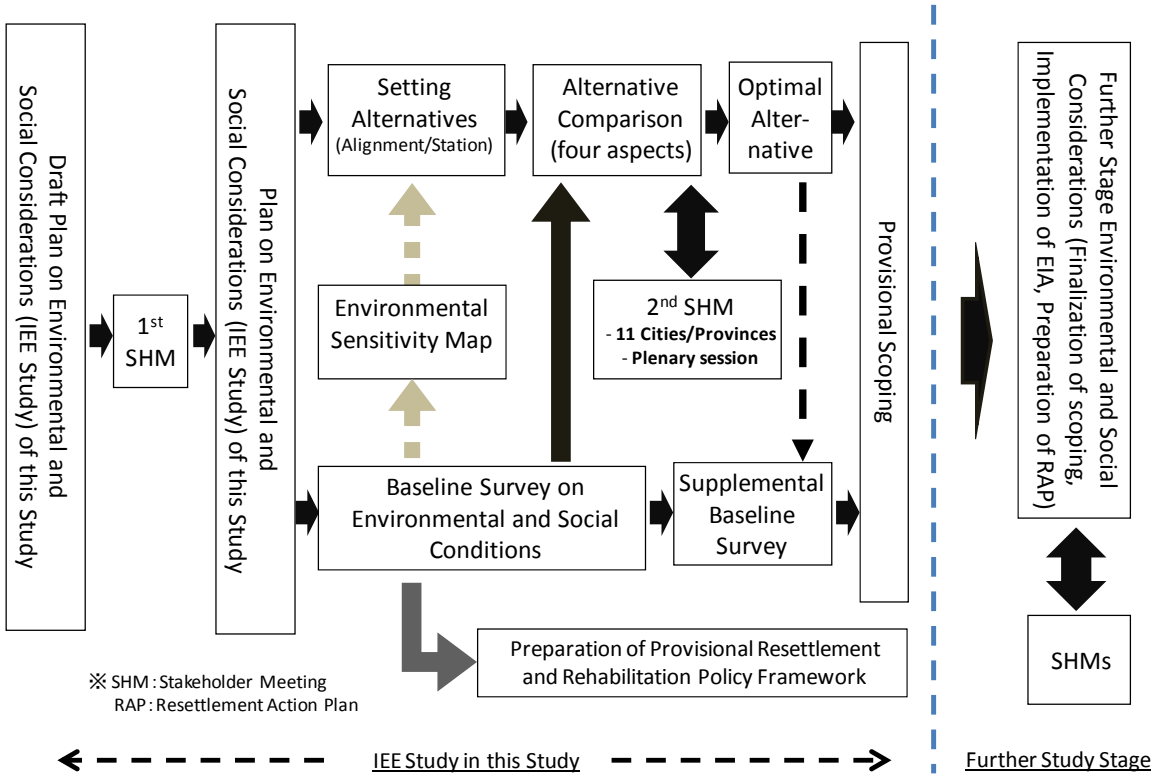
(c) **Selection of Optimal Alternative on Alignment and Station Location:** in parallel with the baseline information collection, alternatives on alignment and station location were developed. On the alternatives, comparison was conducted taking into consideration comprehensive four aspects including environmental and social ones to select the optimal alternative. In the course of alternative comparison, 2nd SHMs including plenary sessions were held to consult with stakeholders.

(d) **Conduct of Provisional Scoping for EIA:** for the EIA to be conducted in the further stage of the Projects, provisional scoping for EIA was conducted in order to identify a range of significant and potentially significant environmental and social impacts. Based on the results of provisional scoping, provisional mitigation measures, monitoring framework and technical requirements for the EIA were proposed, which are also taken into consideration in the further stage EIA and project planning.

(e) **Preparation of Resettlement and Rehabilitation Policy Framework (RRPF):** for the resettlement and rehabilitation action plan to be prepared in the further stage of the Projects, the provisional RRPF was prepared.

1.13 It is noted that the outputs of this study on environmental and social considerations are (i) the selected optimal alignment and station location through alternative comparison analysis, (ii) provisional scoping for EIA and (iii) provisional RRPF.

1.14 It is expected that for the finalization of the scoping, the EIA including finalized mitigation measures and monitoring framework/plan, and the preparation of resettlement action plan (RAP) will be conducted based on the outputs of this study. A series of SHMs need to be conducted at each stage of environmental and social considerations in order to incorporate a wide-range of stakeholders' ideas, needs and feedbacks into the scoping, EIA and RAP as well as into the project planning.




Source: JICA Study Team

**Figure 1.3.1 Overall Flow of Environmental and Social Considerations in the Study**

## 2) Outline of Major Activities

### (1) Baseline Survey

1.15 Baseline survey on environmental and social conditions was conducted mainly based on secondary data. The coverage of the baseline survey is shown in Table 1.3.1.

**Table 1.3.1 Coverage of Baseline Survey**

| Category | Items | Surveyed Information |
|---|---|---|
| Natural Environment | Meteorology | Temperature, wind direction and velocity, and rainfall |
| | Topography | Topographic maps |
| | Geology | Geological maps and distribution of soft ground and sand dune |
| | Soil erosion | Situation of soil erosion |
| | Hydrology | River water system and rail fall |
| | Ground water | Condition of ground water |
| | Ecosystem//Flora and Fauna /Biodiversity | Distribution of flora and fauna including endangered species and condition of ecosystem and biodiversity |
| | Protected area/forest | Distribution and characteristic of special-use forest and protected areas, information on ecologically sensitive areas suggested by environmental NGOs. |
| | Coastal zone | Topography and ecosystem along the coastal area |
| | Landscape | Distribution of landscape to be protected and considered |
| | Natural disaster | Landslide and flooding prone areas and typhoon affected areas |

| Category | Items | Surveyed Information |
|---|---|---|
| Living Environment | Air quality | Condition of air quality and pollution |
| | Offensive odor | Condition of offensive odor |
| | Water quality | Condition of surface and ground water quality and contamination |
| | Bottom sediment | Condition of bottom sediment quality and contamination |
| | Soil quality | Condition of soil quality and contamination |
| | Ground Subsidence | Situation of ground subsidence |
| | Noise/vibration | Condition of noise and vibration |
| | Low frequency noise | Condition of low frequency noise |
| | Wave obstruction | Situation of radio wave disturbance and electromagnetic interference |
| | Disturbance of sunshine | Situation of sunshine disturbance |
| | Solid waste | Situation of solid waste management in relevant districts |
| Social Environment | Land use | Current land use condition (land use map) and distribution of infrastructure (topographic map) including army area |
| | City /regional development plan | Relating regional/city development plans including industrial zone |
| | Urban area/settlement | Current land use and distribution of buildings |
| | Regional economy | Current status of regional economy such as Gross Regional Domestic Product (GRDP) and urbanization rate |
| | Livelihood | Condition of local livelihood such as employment rate and income sources |
| | Cultural and historical heritage areas/assets | Distribution of heritage/cultural assets, and cemeteries, pagodas/churches |
| | Vulnerable groups (ethnic minorities/indigenous peoples) | Distribution of ethnic minorities/indigenous peoples |
| | Public health | Current status of regional sanitation condition |
| Others | Accidents | Current status of various accidents |
| | Climate change | National/regional strategy to address climate change issue |

Source: JICA Study Team

### (2) Comparison of Alternatives

1.16 To avoid irreversible environmental and social impacts of the Projects by selecting the optimal alignment and station location, a comparison exercise of alternatives was conducted during the alignment and station location planning phase covering comprehensive aspects including the environmental and social considerations aspects. The outline of the comparison of alternatives applied in the Study is shown in Table 1.3.2.

**Table 1.3.2 Outline of Comparison of Alternatives**

| Item | Descriptions |
|---|---|
| Objective | To select the optimal alternative on alignment and station location |
| Target Sections | The north section (Hanoi–Vinh)<br>The south section (HCMC–Nha Trang). |
| Alternatives | Alignment and station location options, together with zero-option. |
| Items Considered for Comparison of Alternatives | 1) Convenience and Integrated Development<br>2) Environmental and Social Considerations (Natural, Living and Social Environment)<br>3) High Speed Serviceability<br>4) Economical Efficiency |
| Stakeholder Meeting | 2nd SHM in 11 cities/provinces along the alignment with two plenary sessions in Hanoi and HCMC. |

Source: JICA Study Team

### (3) Provisional Scoping for EIA

1.17 After selecting the optimal alignment and station location, the environmental and social items to be dealt with the EIA in the subsequent project stage were scoped tentatively. The outline of the provisional scoping is shown in Table 1.3.3.

**Table 1.3.3 Outline of Provisional Scoping for EIA**

| Item | Brief Descriptions |
|---|---|
| Objective | Identification of environmental and social considerations items to be studied in the EIA for the selected optimal alignment and station location |
| Target Sections | The selected optimal alignments of the north section (Hanoi–Vinh) and the south section (HCMC–Nha Trang) |
| Scoping for EIA | IEE level study based on the secondary data and information<br>Proposal on the methodologies for data collection and survey, prediction and assessment of significance of potential impacts for the scoped items.<br>Preliminary study on mitigating environmental and social impacts (avoid/minimize/compensate) and monitoring framework. |

Source: JICA Study Team

### (4) Stakeholder Meeting

1.18 To involve a broad range of stakeholders for the alignment and station location planning process, two rounds of SHMs were held as shown in Table 1.3.4.

**Table 1.3.4 Outline of Stakeholder Meetings**

| Meetings | Dates | Places | Main Themes | Participants |
|---|---|---|---|---|
| 1st Stakeholder Meeting | December 9, 2011 | Hanoi City | • Outline of the Study<br>• Overall framework of environmental and social considerations | National administrations such as VR, MOT, city/provincial administrations, and research institutes. |
| 2nd Stakeholder Meeting | July-August 2012 (City/Province)<br>September 2012 (Plenary Sessions) | 11 Cities / Provinces along the alignment of the target sections<br>Hanoi / HCMC for Plenary Sessions | • Comparison of alternatives for selection of optimal alignment and station locations | [Cities / Provinces]<br>National administrations such as VR, MOT, city/provincial administrations, research institutes, private sectors, and social associations (including more representatives from the local public)<br>[Plenary Sessions]<br>National administrations such as VR, MOT, MONRE, MPI and others, the representatives from cities/ provinces, academic society, research institutes, social associations. |

Source: JICA Study Team

# 2 BASELINE SURVEY ON ENVIRONMENT AND SOCIAL ASPECTS

## 2.1 Review of Past Studies on Environmental and Social Considerations

2.1 In this section, the results of previous studies on environmental and social considerations related to HSR in Vietnam are described briefly as part of the IEE study.

### 1) Environmental and Social Considerations Study (SEA) in VITRANSS2

#### (1) Outline of Environmental and Social Considerations Study (SEA) in VITRANSS2

2.2 VITRANSS2 conducted an environmental and social considerations study as a Strategic Environmental Assessment (SEA) of the relevant transport development sectors for the overall transport development strategy up to 2030. Seven relevant transport sectors were covered by the SEA, namely, road, expressway, railway, high-speed railway, port and shipping, inland water transport, and civil aviation sub-sectors. The SEA was conducted on a sub-sector basis.

2.3 As part of the SEA, considering the modal shift, the overall green house gases (GHGs) and air pollutant emissions in the road transport sector were estimated under three assumed scenarios. VITRANSS2 conducted scenario analysis in three cases in 2030, namely (i) Do-nothing scenario (zero-option), (ii) Scenario 1 (base network), and (iii) Scenario 2 (do maximum scenario). The do-nothing scenario is a no project case (zero-option) in which no development plan is assumed. Scenario 1 is the base network scenario in which only all committed road development projects are assumed to be provided. Scenario 2 is the maximum scenario, in which the entire transport development strategy of VITRANSS2, including the entire road development strategy, are assumed to be realized by 2030. Table 2.1.1 shows the alternative scenarios discussed and the preliminary study results of their $CO_2$ and air pollutant emissions in 2030 in VITRANSS2.

**Table 2.1.1 Scenario Analysis Conducted by VITRANSS2 (2030)**

| Scenario | Condition of Each Scenario | $CO_2$ Emission ('000 ton/year) | NOx ('000 ton/year) |
|---|---|---|---|
| Do-nothing (Zero-option) | • Transportation 2008 | 21,450 | 324 |
| Base case | • Improvement of existing railway (max speed: 60km/h to 100km/h)<br>• Development of all expressways planned by MOT excluding HCM route | 14,490 | 218 |
| Do maximum | • Improvement of existing railway (max speed: 60km/h to 100km/h)<br>• Development of all expressways planned by MOT excluding HCM route<br>• Development of HSR (max speed: 300km/h, fare is equal to air transportation) | 9,500 | 174 |

Note: $CO_2$ emission was estimated only for the road transportation sub-sector.
Source: VITRANSS2

2.4 During the SEA, a public consultation meeting was conducted on July 17, 2009. The meeting focused on discussions on potential environmental impacts, alternative development and proposed mitigation measures. The participants of the meeting were representatives of relevant agencies at the national level such as MOT and MONRE, Transport Sustainable Development and Environment and Research Institute, and Hanoi National University. The feedbacks from the meetings were used in the SEA exercise.

### (2) Results of Environmental and Social Considerations Study (SEA) for HSR Sub-sector in VITRANSS2

2.5 As one of subsectors, the SEA was conducted for the HSR sub-sector for two alternatives, namely: (i) construction of a new high-speed railway with maximum speed of 300 km, and (ii) construction of a new high-speed railway with maximum speed of 200 km, running in parallel with the existing railway. For these two alternatives, initial assessments on environmental and social impacts as well as the necessary countermeasures for the scoped items were briefly discussed, as shown in Table 2.1.2.

**Table 2.1.2 Results of Environmental and Social Considerations Study (SEA) for HSR Sub-sector in VITRANSS2**

| Category | Item | Result |
|---|---|---|
| Natural Environment | Topography and landscape | • It is necessary to evaluate impacts on landscape due to long embankment/ elevated structure. |
| | Landslide, ground subsidence and flooding | • The central mountain area has many landslide prone areas, so construction countermeasures against landslides should be adopted as necessary.<br>• Railway alignment should not affect current flooding pattern. |
| | Biodiversity | • Railway alignment should avoid running through protected areas. If railway alignment inevitably runs through protected areas, it was recommended to adopt tunnel structure.<br>• In case that noise and vibration impacts on animals should be considered, the system of train operation should be examined, such as adaptation of low speed operation around protected areas to decrease noise and vibration. |
| Living Environment | Air quality and global warming issue | • It is expected that HSR can contribute to mitigation of air pollution problem and global warming issue by decreasing vehicle traffic and reducing air pollutants and carbon dioxide emission from vehicles. |
| | Noise and vibration | • Generally, HSR has an advanced system and can control noise and vibration problems. However, in urban areas, noise and vibration impact may occur, so countermeasure works should be adopted as necessary. |
| | Solid waste | • Solid waste management plan should be prepared and operated for disposal of construction waste during construction period, and municipal solid waste from stations and trains during operation phase. |
| Social Environment | Land acquisition and resettlement | • To minimize impact of land acquisition and resettlement, elevated/ underground structures should be adopted as necessary.<br>• For preferable land acquisition and resettlement, a resettlement action plan should be prepared, and public consultation should be held. |
| | Heritage and cultural asset | • Railway alignment should avoid running on and near heritage and cultural assets.<br>• If high-speed railway runs around heritage or cultural assets, methods of construction should be examined to avoid impact on them. |
| Others | Safety | • Right of way (ROW) of high-speed railway should be secured enough to avoid accidents with other transportation modes.<br>• To avoid crash or derailment accidents, safety control system should be operated continuously and adequately. Therefore, human resource management program for operating safety control system should be developed, and training should be conducted regularly. |
| | Climate change | • According to estimation by MONRE, sea level is said to rise around 15 to 90 cm till 2070, so it was recommended to plan the HSR alignment to avoid impact due to sea level rise in Thanh Hoa and Nam Dinh provinces. |

Source: VITRANSS2

### (3) Identified Environmental and Social Impacts for HSR Sub-sector in VITRANSS2

2.6 In examining the environmental impacts for all projects proposed in VITRANSS2, the environmental classification was carried out based on environmental zone, populated area, natural protected area and natural disaster-prone area. The proposed projects were classified into three environmental impacts groups based on the environmental

classification.

2.7 As a result of the above study in VITRANSS2, the environmental and social items shown in Table 2.1.3 were suggested as the ones to be considered in the EIA for the HSR subsector.

**Table 2.1.3 Identified Environmental and Social Items to be Considered by VITRANSS2**

| Project | Environmental and Social Items to be Considered | | |
|---|---|---|---|
| | Planning Phase | Construction Phase | Operation Phase |
| Construction of high-speed railway | • Land acquisition and resettlement plan for the project<br>• Geological survey to identify location of settlement and landslide potentiality<br>• Computation and examination of vibration<br>• Impacts of project location on natural ecosystem<br>• Impacts from ground clearance and resettlement<br>• Long-term influences of climate change on project location | • Local air pollution at construction area<br>• Noise impact from construction machine operations<br>• Water pollution when the railway passes through rivers or streams<br>• Changes of landscapes, flowing current, flood<br>• Land occupied in construction period | • Noise and vibration impact<br>• Safety and ride comfort of high-speed train operations |
| Construction of high-speed train stations | • Noise and vibration impact<br>• Safety and ride comfort of high-speed train operations capacity<br>• Impacts from ground clearance and resettlement<br>• Impacts on socioeconomics if the stations are not properly planned | • Local air pollution at construction area<br>• Noise impacts | • Waste treatment for large number of passengers at the stations |

Source: VITRANSS2

### 2) Environmental and Social Considerations Study in the Pre-FS on High-speed Railway by VR

2.8 In the Pre-FS of HSR by VR in 2009, an environmental and social considerations study at the IEE level was conducted to examine required mitigation measures. The proposed mitigation measures as a result of the environmental and social considerations study in the Pre-FS are shown in Table 2.1.4.

**Table 2.1.4 Proposed Mitigation Measures on High-speed Railway Project by Pre-FS**

| Category | Item | Outline of Proposed Mitigation Measures |
|---|---|---|
| Natural Environment | Topography and geology | • Minimize impact by embankment and cutting in planning phase |
| | Hydrology | • Minimize impact on river and channel system in planning phase |
| | Groundwater | • Adopt suitable construction method to avoid impacts on groundwater |
| | Biodiversity, Protected area | • Avoid irreversible impacts on biodiversity in planning phase |
| | Landscape | • Consider structure design to avoid impact on landscape in planning phase |
| Living Environment | Air quality | • Sprinkle with water<br>• Monitor emission from construction vehicles |
| | Surface water | • Adopt suitable construction method to avoid water pollution during bridge construction<br>• Treat wastewater from construction site properly |
| | Soil | • Adopt suitable construction method to avoid soil contamination |
| | Ground subsidence, erosion | • Adopt suitable construction method to avoid ground subsidence |
| | Noise | • Monitor noise by construction vehicles<br>• Monitor noise by operation of high-speed railway |
| | Vibration | • Monitor vibration by construction vehicles |

| Category | Item | Outline of Proposed Mitigation Measures |
|---|---|---|
| | | • Monitor vibration by operation of high-speed railway |
| | Solid waste | • Prepare and operate solid waste management plan |
| | Electromagnetic wave | • Monitor impacts by electromagnetic field<br>• Compensate serious impact<br>• Maintain overhead line well |
| Social Environment | Land acquisition and resettlement | • Minimize impact of land acquisition and resettlement in planning phase |
| | Cultural asset | • Conduct detail survey on cultural asset and buried cultural property in construction phase |
| | Sanitation and safety | • Control working condition in construction sites |

Source: "Establishing Report on Construction Investment of High Speed Railway Line Hanoi – Ho Chi Minh City" (2009), Vietnam Railways

### 3) Environmental Study by KOICA

2.9 Korea International Cooperation Agency (KOICA) conducted the "Feasibility Study for Building and Electrifying the New 1,435mm Double Track Gauge from Hanoi to Vinh on the North-South Trunk Line" and the "Feasibility Study for Building and Electrifying the New 1,435mm Double Track Gauge from Sai Gon to Nha Trang on the North-South Trunk Line." The environmental study was conducted in both these feasibility studies. The results of the environmental study are discussed according to eight items (i.e. topography, flora and fauna, air quality, water quality, noise pollution, electromagnetic interference, sunshine obstruction and solid waste) with regard to the construction phase and operation phase. The outline of the results of assessment on environmental and social impacts is shown in Table 2.1.5.

**Table 2.1.5 Outline of Results of Environmental Study on Double Track Gauge Railway from Hanoi to Vinh and from Sai Gon to Nha Trang by KOICA**

| Environmental and Social Item | Impact | |
|---|---|---|
| | Construction Phase | Operation Phase |
| Topography | Impacts would be generation of slopes and topographic change by embankment and cut. | Generation of slope may affect the stability of the slope and soil erosion. |
| Flora and Fauna | Construction causes deforestation and habitat of flora and fauna would be destroyed.<br>Noise during construction work such as pile driving may affect animals especially during their breeding period. | Operation of trains may generate noise and vibration impacts, which can adversely impact on animals around the railway. |
| Air Quality | Dust may be generated by earthwork. Construction vehicles emit NOx, and SOx. Adequate mitigation measures should be examined. | Existing trains in Vietnam generally uses diesel for operation, and emit NOx, SOx, and diesel particle matters. On the other hand, the railway is planned to use electricity for operation, so it is expected to contribute to mitigating impact on air quality. |
| Water Quality | Turbidity by silt and sand from construction from slope, coffering and excavation work and tunnel construction may affect the water quality. | Wastewater discharged from stations and depots may affect the water quality. |
| Noise Pollution | Construction vehicles can generate noise impacts. Adequate mitigation measures should be examined. | The result of noise impact prediction showed that the equivalent noise level at the speed of 200km/h would exceed Vietnamese Standard (at the residential areas) within a distance of 100m from the centerline of the track. The equivalent noise level at the speed of 350km/h would exceed Vietnamese Standard (at the residential area) within a distance of 250m from the centerline of the track. Mitigation measures on noise impact should be examined. |

| Environmental and Social Item | Impact | |
|---|---|---|
| | Construction Phase | Operation Phase |
| Electromagnetic Interference | No impact is expected. | Generally, electromagnetic interference generated by the train system is the interference of TV and radio reception. |
| Sunshine Obstaction | No impact is expected. | Tall structures such as bridges and station buildings may cause impact on sunshine. |
| Solid Waste | Construction waste and waste from vehicles, workers would be generated. | General waste would be generated from station by visitors and staff. |

Source: "Feasibility Study for Building and Electrifying the New 1,435mm Double Track Gauge from Hanoi to Vinh on the North-South Trunk Line" (2007), KOICA
"Feasibility Study for Building and Electrifying the New 1,435mm Double Track Gauge from Sai Gon to Nha Trang on the North-South Trunk Line" (2007), KOICA

## 2.2 Collection of Information on Current Environmental and Social Conditions

### 1) Methods of Information Collection

2.10 In order to collect the information and data required for the Study, the following surveys were conducted:

(i) Preparation of latest topographic maps from the satellite imagery taken between October 8, 2009 and February 16, 2011

(ii) Questionnaire survey with target cities and provinces

(iii) Interview with the local governments (PPC, DPC, DOT, DARD, DOCST, DONRE and national park office, etc.)

(iv) Interview with the relating ministries (MARD, MOCST, MOLISA and MONRE)

(v) Interview with environmental NGOs and experts

(vi) Internet survey

(vii) Other literature review

(viii) Field reconnaissance

2.11 Information was collected by the questionnaire and direct visits by the JICA Study Team to central/local governments and other related organizations in the following 11 cities/provinces along the alignment: Hanoi, Ha Nam, Nam Dinh, Ninh Binh, Thanh Hoa, Nghe An, Khanh Hoa, Ninh Thuan, Binh Thuan, Dong Nai, and Ho Chi Minh.

### 2) Collected Information

2.12 Although the level and amount of collected information differ in each city/province depending on the availability of information, the most useful secondary information sources were the "Five-Year Environmental Current Status Report (5ECSR)" and “Landuse Map”. However, some information was not available such as those on ground subsidence, low frequency noise, wave obstruction, disturbance of sunshine and accidents. As for the information relating to land acquisition and resettlement and rehabilitation, the information was collected as part of the study for preparation of the provisional RRPF. After the selection of optimal alternative, supplemental information was also collected mainly along the selected alignment and station location.

2.13 The results of the collected information are summarized in Table 2.2.1. More details are compiled in Volume I to Volume III, Appendix 2A Socio-Economic Baseline Data, Technical Report No.3 Baseline Survey on Environmental and Social Considerations, and Technical Report No.4 Environmental Sensitivity Maps.

**Table 2.2.1 Collected Information for Baseline Survey**

| Category | Item | Collected Information | Information Compiled |
|---|---|---|---|
| Natural Environment | Climate and meteorological phenomena | Meteorological information was collected from the five-year environmental current status reports (5ECSR) and annual reports from each city and province. | Volumes I and II |
| | Topography | Topographic maps were prepared from the satellite image and other sources. | Volume II and TR4 |
| | Geology | Geological maps and related information were collected. In addition, field verification was conducted in the target sections.<br>• North Section: Red River Delta (along the alignment through Hanoi, Ha Nam, Nam Dinh, Ninh Binh) was found to be the soft ground area with very deep Alluvium layer.<br>• South Section: the white sand dune composed of quartz sand was identified as not the appropriate area especially in Binh Thuan, | TR3, TR4 and TR6 |
| | Soil erosion | Erosion information in cities/provinces was collected. | TR3 |
| | Hydrology | Rainfall data was collected from the 5ECSR and annual reports from each city and province. | Volumes I and II |
| | Ground water | Ground water information in cities/provinces was collected. | TR3 |
| | Ecosystem/ Flora and Fauna/ Biodiversity | The information on flora and fauna including biodiversity was available mainly on protected areas. Not all national parks reported the inventory result of flora and fauna including the endangered species list.<br>Vietnam Red Data Book (2007) information was also collected. | TR3 and TR4 |
| | Protected area/forest | Special-use forest or the protected areas, and forest aea were identified by the forest area maps prepared by DARD and land use maps prepared by DONRE.<br>Together with national protected areas, information on conservation areas suggested by international environmental NGOs such as Important Bird Area (IBA) and Endemic Bird Area (EBA) was collected as well. | TR3 and TR4 |
| | Coastal zone | Information on topography and some coastal ecosystem were collected. | TR3 |
| | Landscape | Information on landscape was collected as the protected areas and cultural heritages. | TR3 and TR4 |
| | Natural disaster | Information on landslide and flooding prone areas and typhoon affected area was collected from monitoring records by City/Provincial Storm and Flood Control Committee, City/Provincial Sub-department of Flood and Storm Control, and DARD in some city/provinces. The periodical environmental reports of local governments also mention hazards/risks to some extent. | TR3 and TR4 |
| Living Environment | Air quality | Monitoring data was shared by DONRE on 11 cities/provinces, which shows some excessive figure in air quality standards such as dust and $NO_2$. | TR3 |
| | Offensive odor | There was no specific information available. | - |
| | Water quality | Monitoring data were summarized from 5ECSR and annual reports. | TR3 |
| | Bottom sediment | There was no information available. | - |
| | Soil quality | Some monitoring data was collected. | TR3 |
| | Ground subsidence | There was no information available. | - |
| | Noise/vibration | Monitoring data was shared by DONRE of 11 cities/provinces. The monitoring is conducted along major roads, major intersections, some city area and industrial area. | TR3 |
| | Low frequency noise | There was no information available. | - |
| | Wave obstruction | There was no information available. | - |
| | Disturbance of sunshine | There was no information available. | - |

| Category | Item | Collected Information | Information Compiled |
|---|---|---|---|
| | Solid waste | Information on status of solid waste management was collected such as the location of disposal sites. | TR3 |
| Social Environment | Land use | Land use maps (CAD and/or GIS data) were collected from 11 cities/provinces. Latest topographic map were prepared from the satellite imagery which include industrial zones and army areas. | Volumes I and II, TR3 and TR4 |
| | City /Regional development plan | The information on city development plan and other related plans (e.x. planned industrial zone development) was collected from 11 cities/provinces through document collection and interview. | Volumes I and II |
| | Urban area/settlement | Land use maps were collected from 11 cities/provinces. The interpretation of satellite images was conducted for identification of buildings and development areas. | Volumes I and II, TR4 |
| | Regional economy | Statistical information was collected such as GRDP and urbanization rate of cities/provinces. | Volumes I and II, Appendix 2A of Volume III |
| | Livelihood | Statistical information was collected such as employment rate and income sources. | Volumes I and II, Appendix 2A of Volume III |
| | Cultural and historical heritage areas/assets | DOCST of the cities/provinces shared the list of registered heritage areas/assets both on the national level and city/provincial level.<br>• North Section: Hanoi area and Ninh Binh (Hoa Lu) area are the old capitals where heritage areas are concentrated. In addition, there are some protected heritage areas in Thanh Hoa such as Ham Rong War Relics, Den Ba Trieu Temple, and Citadel of the Ho Dynasty of the world cultural heritage.<br>• South Section: Cham culture is remarkable and heritage areas are found in Binh Thaun, Ninh Thuan and Khanh Hoa. Dong Nai DOCST mentioned Dong Nai was the one of the oldest prehistoric settlement areas and there may be undiscovered heritage assets in the area.<br>In addition, land use maps prepared by DONRE were utilized for identification of distribution of cultural and historical heritage areas/assets as well as cemetery and pagodas/churches. | TR3 and TR4 |
| | Vulnerable groups (Ethnic minorities/ Indigenous peoples) | The population of ethnic minority distribution was collected from the latest census.<br>• North Section: Minority population tends to be more in the mountainous area (western part of the provinces such as Thanh Hoa and Nghe An).<br>• South Section: Binh Thuan and Ninh Thuan provinces hold more ethnic minority population density among the target sections. It is noted that in Ninh Thuan, minority population density is high also near the city area and flat plain area more than other provinces. | Appendix 2A of Volume III, TR3 and TR4 |
| | Public health | Relating regulations were collected, while there was little information of the actual situation available. | Volume III |
| Others | Accidents | There was no information available. | - |
| | Climate change | There was information that some donors like the World Bank started the support for city/provincial governments on global warming issues. Some city/provincial reports were collected which mention about the source of GHGs, amount of GHGs emission, recent change of temperature tendency and water flow, etc. | TR3 |

Note: In the Law on Forest Protection and Development (No.29/2004/QH11), forestlands are divided into three categories, namely; special-use forest which is designated to protect nature, ecosystem, historical heritages and landscapes, including national park, nature conservation area, landscape protection area, etc.; protection forest which is designated to the function of water conservation, soil conservation, etc.; and production forest for timber production, etc.

IBA and EBA: Areas identified and advocated for conservation of birds by international NGOs such as Birdlife International, IUCN and so on. IBA (Important Bird Area): key sites for conservation – small enough to be conserved in their entirety and often already part of a protected-area network, selected from four criteria, or existence of globally threatened species, restricted-range species, biome-restricted species and migratory species. EBA (Endemic Bird Areas): the important places for habitat-based conservation of birds, critical regions for the conservation of the world's birds and other biodiversity, where the distributions of two or more of these restricted-range (endemic) species overlap.

Source: JICA Study Team

## 2.3 Preparation of Environmental Sensitivity Maps

### 1) Key Environmental and Social Aspects to be considered for HSR Alignment Planning

2.14 For the alignment planning including development of alternatives, the environmentally and socially sensitive aspects which can be shown geographically on maps were chosen among the collected baseline information on the items in Table 2.2.1 so that the alignment planning can be conducted with due consideration on such aspects.

### 2) Compilation of Alignment Maps for Environmental and Social Considerations

2.15 A set of the maps, namely Environmental Sensitivity Maps, was prepared based on the collected information from cities/provinces and other sources as shown in Table 2.3.1. This set of maps is compiled in Technical Report No.4 Environmental Sensitivity Maps.

**Table 2.3.1 Prepared Environmental Sensitivity Maps**

| No. | Sensitivity Maps | Usage Description | Contents of Maps | Major Information Source |
|---|---|---|---|---|
| 1 | Protected Areas | To avoid protected areas and protected forest: special use forest (national parks, nature reserves, landscape protected area), marine protected areas, and protected forest | Special-use forest area from land use map | • Land use map prepared by DONRE<br>• Forest area map prepared by DARD |
| 2 | Forest | | Production forest and protected forest from land use map | • Land use map prepared by DONRE<br>• Forest area map prepared by DARD |
| 3 | Flood | To avoid flood, landslide and other hazard prone areas, which can be avoided by changing the alignment | Flood prone areas and/or flood affected areas in the record | • Flood prone area map prepared by DARD<br>• Flood affected information by City/Provincial Storm and Flood Control Committee<br>• Interview with DARD |
| 4 | Landslide | | Landslide prone areas and/or landslide affected areas in the record | • Landslide prone area map prepared by DARD<br>• Landslide affected information by City/Provincial Storm and Flood Control Committee<br>• Interview with DARD |
| 5 | Geology | To avoid the inappropriate area for civil works and the difficult area which requires costly civil works such as fault lines, soft ground, and difficult areas for tunnel construction | Geologically sensitive areas | • Geology map |
| 6 | Cultural Heritage | To avoid the impact on heritage areas especially registered heritage areas at national and city/provincial levels | Cultural heritages | • Land use map prepared by DONRE<br>• Tourism map |
| 7 | Ethnic Minority | To avoid important ethnic minorities' settlements such as craft village and villages with traditional livelihood | Population density of ethnic minority by communes | Census data 2009 |
| 8 | Population Density | • To avoid heavily populated areas for resettlement, potential of splitting the communities and noise and vibration issues<br>• To avoid the area with permanent type of buildings<br>• To avoid public buildings<br>• To consider the access from the populated areas for connection with existing railway and other transportation modes | Population density by communes | Census data 2009 |
| 9 | Industrial Zone | To avoid industrial areas and other development areas | Industrial zone areas identified in land use map | • Land use map prepared by DONRE |
| 10 | Cemetery | To avoid cemetery, religious land, army land | Cemetery areas identified in land use map | • Land use map prepared by DONRE |
| 11 | Pagodas/Churches | | Areas identified as faith land and religious land | • Land use map prepared by DONRE |
| 12 | Army Area | | Areas identified as national defense land and security land | • Land use map prepared by DONRE |

| | | | | |
|---|---|---|---|---|
| 13 | Development Area | | Buildings | • Topography map prepared by the JICA Study Team from the latest satellite images |
| 14 | Typhoon | | Typhoon prone areas and/or typhoon affected areas in the record | • Typhoon affected information by City/Provincial Storm and Flood Control Committee |
| 15 | Important Bird Areas and Endemic Bird Areas | To avoid important bird areas and endemic bird areas. | Area of Important Bird Area (IBA)<br>Area of Endemic Bird Area (EBA) | • Digitization of information of Birdlife International by the JICA Study Team |

Source: JICA Study Team

### 3) Information Clarified in Environmental Sensitivity Maps

2.16 Environmental Sensitivity Maps were utilized for (i) the geographical information that was used for the considerations on alignment planning (development of alternatives), (ii) the presentation materials used in stakeholder meetings, and (iii) the comparative analysis to select optimal alignment and station locations.

2.17 The map layers were extracted or prepared mainly from the land use map information from cities/provinces (For details, please refer to Technical Report No. 4 on Environmental Sensitivity Map). The information clarified on the environmental sensitivity maps is summarized in Table 2.3.2.

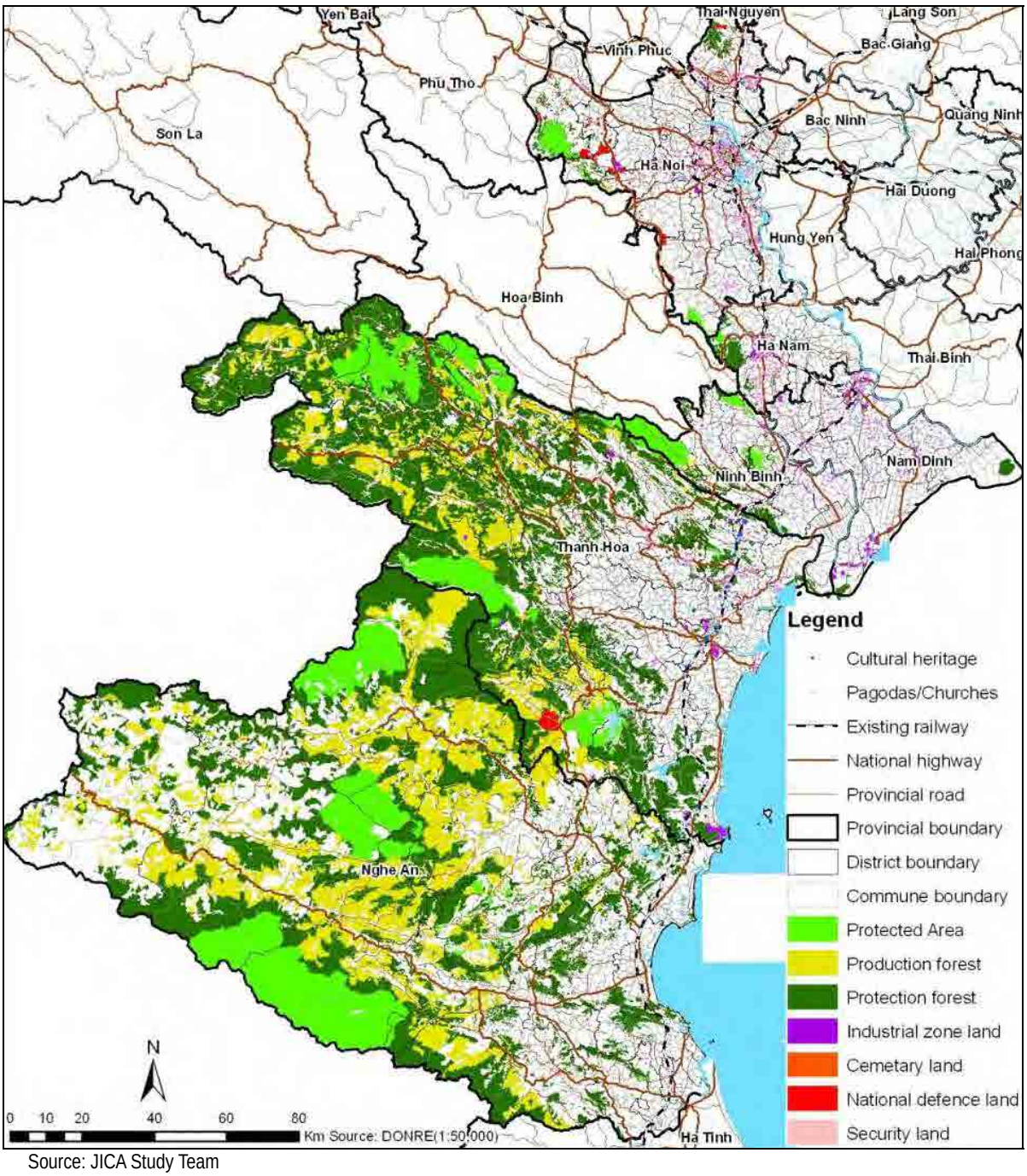
**Table 2.3.2 Information Clarified in Environmental Sensitivity Maps**

| Sensitivity Maps | North Section | South Section |
|---|---|---|
| 1. Protected Area | There is no protected forest along the potential HSR route though some of the pagodas and ancient relics are recognized as protected areas. | Nui Chua National Park and Ta Kou Nature Reserve is near the potential HSR route, but these areas are mountainous and can be avoided with due consideration. |
| 2. Forest<br>• Production Forest<br>• Protection Forest | In the coastal flat plain area, protection forest is designated in Thanh Hoa Province area in the limited scale. | In the coastal flat plain area, protection forest is designated in the part of Binh Thuan and Ninh Thuan Province area on a limited scale. |
| 3. Flood | Only recent secondary information is available, and flood is reported in many areas along the rivers. Notably, Nghe An area often suffers flood, while even Hanoi was flooded heavily in 2008. | Only recent secondary information is available, and flood is reported in many areas along the rivers. |
| 4. Landslide | The secondary information is limited except for Nghe An Province. | The secondary information is limited, while landslide is recorded in the mountainous area of Ninh Thuan. |
| 5. Geology | There is no area identified as geologically sensitive in the north section. | Along the coastal area of the Binh Thuan, sand dune areas are considered to be sensitive and to be avoided. |
| 6. Cultural Heritage | Secondary information were acquired from land use map, DOCST information, tourist maps, internet services (i.e., Google earth pro, Google map, and others), etc. | Secondary information were acquired from land use map, DOCST information, tourist maps, internet services (i.e., Google earth pro, Google map, and others), etc. |
| 7. Ethnic Minority | Ethnic minorities live more densely in the mountainous areas of the southern part or in the Thanh Hoa and Nghe An provinces. | The population ratio of ethnic minorities is higher in provinces like Ninh Thuan, Binh Thuan and Khanh Hoa. |
| 8. Population Density | Compared with the south section, most of the flat areas (potential HSR alignment area) have higher population density. | Besides major cities of provinces, population density is not high. |
| 9. Industrial Zone | Along with the existing railway and National Road No. 1, there are many industrial lands. | Besides HCMC and Dong Nai Province, there are not many industrial zones. |
| 10. Cemetery | In Thanh Hoa and Nghe An Province, there are large scale cemetery areas. | In Binh Thuan, Ninh Thuan and Khanh Hoa Province, large-scale cemetery sites are found. |
| 11. Pagodas/Churches | From land use map, religious buildings are dense in the city areas. | From land use map, religious buildings are dense in the city areas, especially in Ninh Thuan and Khanh Hoa province. |
| 12. Army Area<br>• National Defense | There are not many army areas that may conflict with the railway except for Ninh Binh area. | There are several small-scale airports of air forces near the potential station and railway area, and there are army areas in the coastal areas of Khanh |

| Sensitivity Maps | North Section | South Section |
|---|---|---|
| Land<br>• Security Land | | Hoa province, together with inland army owned area in HCMC and Dong Nai province, which requires consideration. |
| 13. Development Area | The buildings densely exist in the city area and along the national highway as well. | Compared with the north section, the density of buildings are lower outside the city area. |
| 14. Typhoon | No information was available in the north section. | Periodically the provinces in the south section suffer from the damage by typhoons. |
| 15. Important Bird Area (IBA) and Endemic Bird Area (EBA) | IBA exists in the mountainous area only, which will be far from the alignment. Since EBA (Annamese Lowlands) stretches widely in the HSR project area, avoiding the EBA by alignment planning is impossible. Other mitigation measures are required including more detailed survey on such endemic birds. | IBA exists in the mountainous area only, which will be far from the alignment. Since EBA (South Vietnamese Lowlands) stretches widely in the HSR project area, avoiding the EBA by alignment planning is impossible. Other mitigation measures are required including more detailed survey on such endemic birds. |

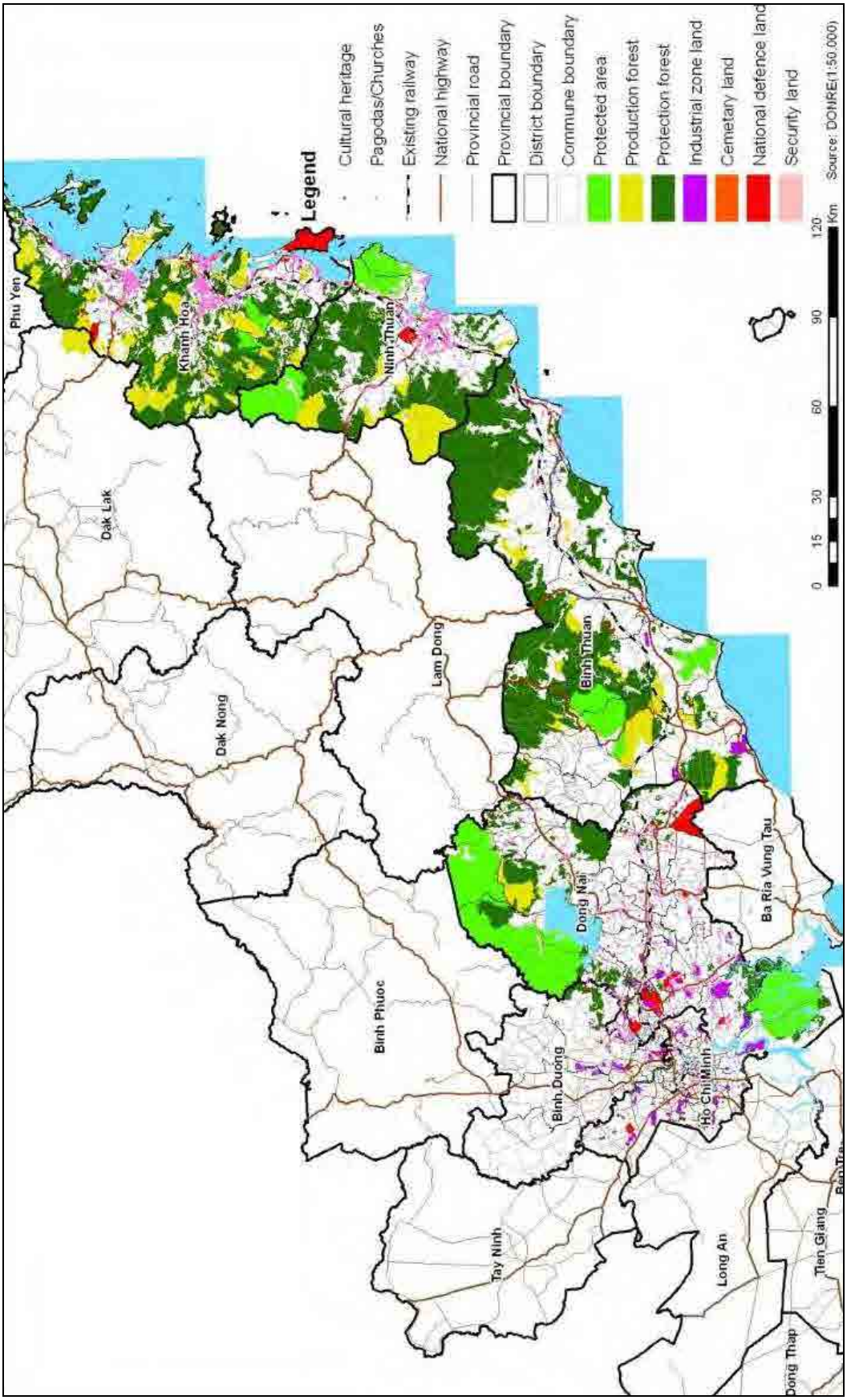
Source: JICA Study Team

2.18 Examples of environmental sensitivity maps (overlaid maps on the north section and south section are the compilation of the layers 1, 2, 6, 9, 10, 11 and 12) are presented in Figure 2.3.1 and Figure 2.3.2. Since other layers overlap with these layers, the layers like ethnic minority, population density, etc. are presented separately in Technical Report No. 4 on Environmental Sensitivity Map.




Source: JICA Study Team

**Figure 2.3.1 Overlaid Environmental Sensitivity Map (partial) - North Section**




Source: JICA Study Team

**Figure 2.3.2 Overlaid Environmental Sensitivity Map (partial) - South Section**

# 3 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS AT IEE LEVEL FOR SELECTION OF OPTIMAL ALTERNATIVE

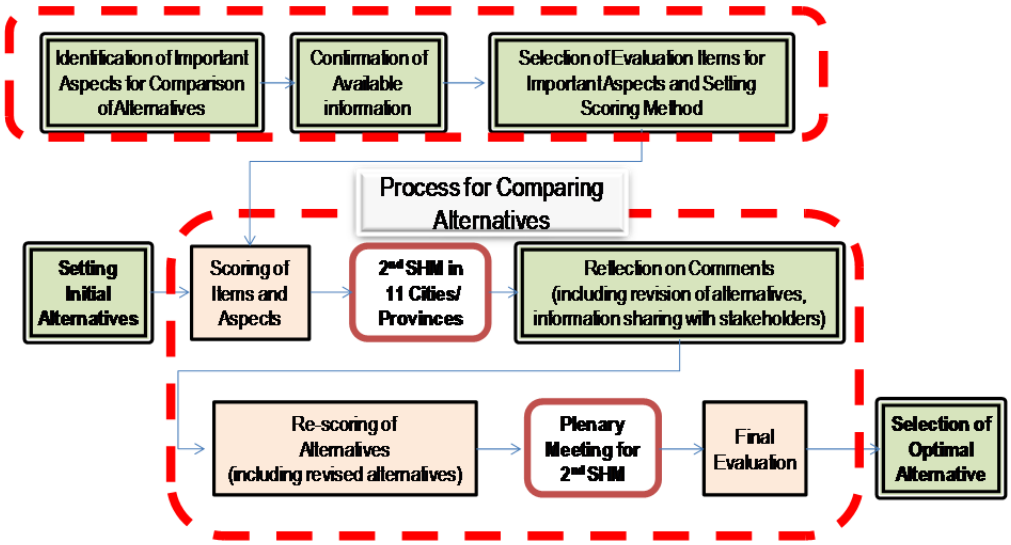
## 3.1 Approach to Environmental and Social Considerations at IEE Level for Selection of Optimal Alternative

### 1) Objective of Environmental and Social Considerations at IEE Level

3.1 The objective of the environmental and social considerations at IEE level is set to select the optimal alternative with due considerations of various aspects and comments from stakeholders. Hereinafter, “Environmental and Social Considerations at IEE Level for Selection of Optimal Alternative” is shown as “IEE on the comparison of alternatives”.

### 2) Flow of IEE on the Comparison of Alternatives

3.2 The flow related to IEE on the comparison of alternatives is shown in Figure 3.2.1. In the preparatory works, a baseline survey and a study on the evaluation methodology were conducted to prepare for the scoring of the alternatives. Based on the set of alternatives and through the study of the socio-economic, engineering and environmental and social aspects, the process of IEE for the alternatives was applied to select the optimal alternative. This was done through consultation with a wide range of stakeholders.




Source: JICA Study Team

**Figure 3.1.1 Flow on Comparison of Alternatives**

### 3) Characteristic of HSR Alignment

3.3 The important point in planning a railway, in general and especially HSR is that the alignment and the location of stations are part of a holistic system. In this study, the unit of the holistic system is each of the target section (i.e., North: Hanoi-Vinh and South: HCMC- Nha Trang).

3.4 The alignment has to be as straight as possible to insure “speediness” for HSR. Location of stations is also the part of the overall alignment. It means that the alignment and the location of stations cannot be considered independently.

3.5 Administratively, the target sections were divided into provinces so that the

alignment and the station locations could be discussed at the provincial level first. Though it should be consistent as much as possible at the national and the provincial levels, the best option for each target section may not always be the combination of the best option for each province.

### 4) Alternatives for the Comparison

3.6 Target alternatives to be compared were set for alignment and station locations as one holistic system for each of the target section mentioned together with the zero-option ("without" project). This is because these plans affect the level of the impacts on the environment, both in positive to be maximized and negative way to be minimized. In addition, zero-option or "without" project case, was also set as one of the alternatives.

### 5) Identification of Four Important Aspects for Comparison of Alternatives

3.7 The important aspects to compare the alternatives were set as explained below. They were identified from the history of successes and failures of HSR in Japan and in the world, together with the focal points discussed in Vietnam especially in the National Assembly so far.

(i) **Convenience and integrated development**: For the success of HSR, passengers' convenience is a key service component, which is prioritized from the experience in Japan and in the world. Convenience is closely related to the potential of integrated development, which indicates that the development of HSR improves the city's functions in aspects of administration, commerce, tourism, industry, art, education, and others if the city plan is well considered to maximize the positive impacts through the development of HSR stations. Although sometimes "the convenience" and "compliance of the project with the city development and landuse plan" are assessed as one of the positive impacts in the social environmental considerations, it should be emphasized that the convenience and integrated development are very important aspects for considering alignment and station location options to maximize the socio-economic development impact and to make the management of HSR more feasible and profitable. Thus, these items are included independently in this study.

(ii) **Environmental and social considerations**: Negative impacts on natural environment, living environment, and social environment should be avoided and minimized, as much as possible, in the alignment planning stage. Especially, from the point of view of the landuse, protected areas and forest, sensitive areas like cultural heritages, religious facilities, cemetery, industrial zones and army areas, are necessary to be avoided. Also, the settlement information has to be studied in order to minimize the impact on resettlement and land acquisition, and future risk on the noise and vibration pollution. Other than that, potential impact on the ethnic minorities, risk by the natural hazard and impact on natural conditions (topography, geology, and hydrology), should be comparatively assessed to be minimized.

(iii) **High speed serviceability**: HSR needs to face competition against other transportation modes, including air and road etc. The strong point for HSR should be the high speed serviceability. The alignment has to be as straight as possible to secure speediness. Thus, engineering issues were also needed to be compared since it could affect the linearity of the alignment.

(iv) **Economical efficiency**: Construction cost is one of the focal point discussed in the National Assembly of Vietnam, and it should be an important information for the

stakeholders to compare the alternatives.

3.8 It is noted that scoring of these four aspects were integrated for the comprehensive comparison of each target section.

### 6) Incorporation of Comments from Stakeholders

3.9 Both Vietnamese laws and JICA guidelines suggest that comments and requests from a wide range of stakeholders should be incorporated into the planning process. This is especially required for the preparation of the policy, the sector plan and the larger scale project to ensure public involvement in the process. During the comparison excise of alternatives, the 2nd SHM in 11 target cities/provinces and the plenary sessions of 2nd SHM in Hanoi and HCMC were held for the discussions on the alternatives. The comments from stakeholders were reflected in the selection of the optimal alternative.

## 3.2 Setting of Initial Alternatives

### 1) Concept of Alternative Setting: Alignment and Station Location

3.10 To set the alternative alignments and station locations, firstly, the areas where the stations are considered are the most important control points for the planning. Then, the alignment to connect these areas was planned considering landuse, topography, geology, potential impacts on natural, living and social environment, straightness, and many other items. Moreover, the minimum curve radius of the alignment was the important concept to insure the speediness of the HSR. The concept of the structure was also closely related to the alignment planning. Potentially important differences to be compared among alternatives are summarized as shown in Table 3.2.1.

**Table 3.2.1 Items Considered to Set Alternatives**

| Items | Potential Difference in Alternative |
|---|---|
| Station Location | Area: Urban or Suburban<br>Connectivity: With the existing railway, or without |
| Alignment | Minimum Curve Radius is R=6,000 or 5,000 |
| Structure | Viaduct or embankment, or the combination |

Source: JICA Study Team

3.11 In this study, the alternative locations where the stations are considered were set for comparison in accordance with following conditions, namely, (i) provincial capitals if alignment allows, (ii) larger towns (such as Class III towns) along the possible alignment, and (iii) special location for passengers' convenience. Table 3.2.2 shows the list of the areas where the stations are considered with the applied conditions.

**Table 3.2.2 Criteria for Station Locations (North and South Sections)**

| Station | i | ii | iii | Station | i | ii | iii |
|---|---|---|---|---|---|---|---|
| Ngoc Hoi | ✔ | ✔ | ✔ | Nha Trang | ✔ | ✔ | |
| Phu Ly | ✔ | ✔ | | Thap Cham | ✔ | ✔ | |
| Nam Dinh | ✔ | ✔ | | Tuy Phong | | ✔ | |
| Ninh Binh | ✔ | ✔ | | Phan Thiet | ✔ | ✔ | |
| Thanh Hoa | ✔ | ✔ | | Long Thanh | | | ✔ |
| Vinh | ✔ | ✔ | | Thu Thiem | ✔ | ✔ | ✔ |

Note: (i) location at provincial capitals, (ii) location at larger towns, and (iii) special Location for passengers' convenience.
Source: JICA Study Team

3.12 One alternative of the alignment and location of the stations was set based on the latest plans and information, field reconnaissance, and the review of existing HSR studies in Vietnam so far. Actually several preliminary alternatives were prepared and studied. Among these, one alignment with corresponding station locations was selected as Alternative 1 after checking the latest topographic maps and environmental sensitivity maps.

3.13 The concept of Alternative 1 include: (i) integration of HSR with urban and existing railway in order to achieve regional development, (ii) application of the minimum curve radius of R=6,000m to insure the high-speed service, (iii) consideration on the cost efficient alignment, and (iv) the latest topographic information (map produced from the

satellite imagery taken between October 8, 2009 and February 16, 2011), development plans and natural and social environmental information).

3.14 The alignment and station locations of the other two alternatives were based on previous studies. For Alternative 2, the alignment was proposed mainly with the application of the viaduct structure. For Alternative 3, the alignment was proposed passing through rural areas by mainly using embankment.

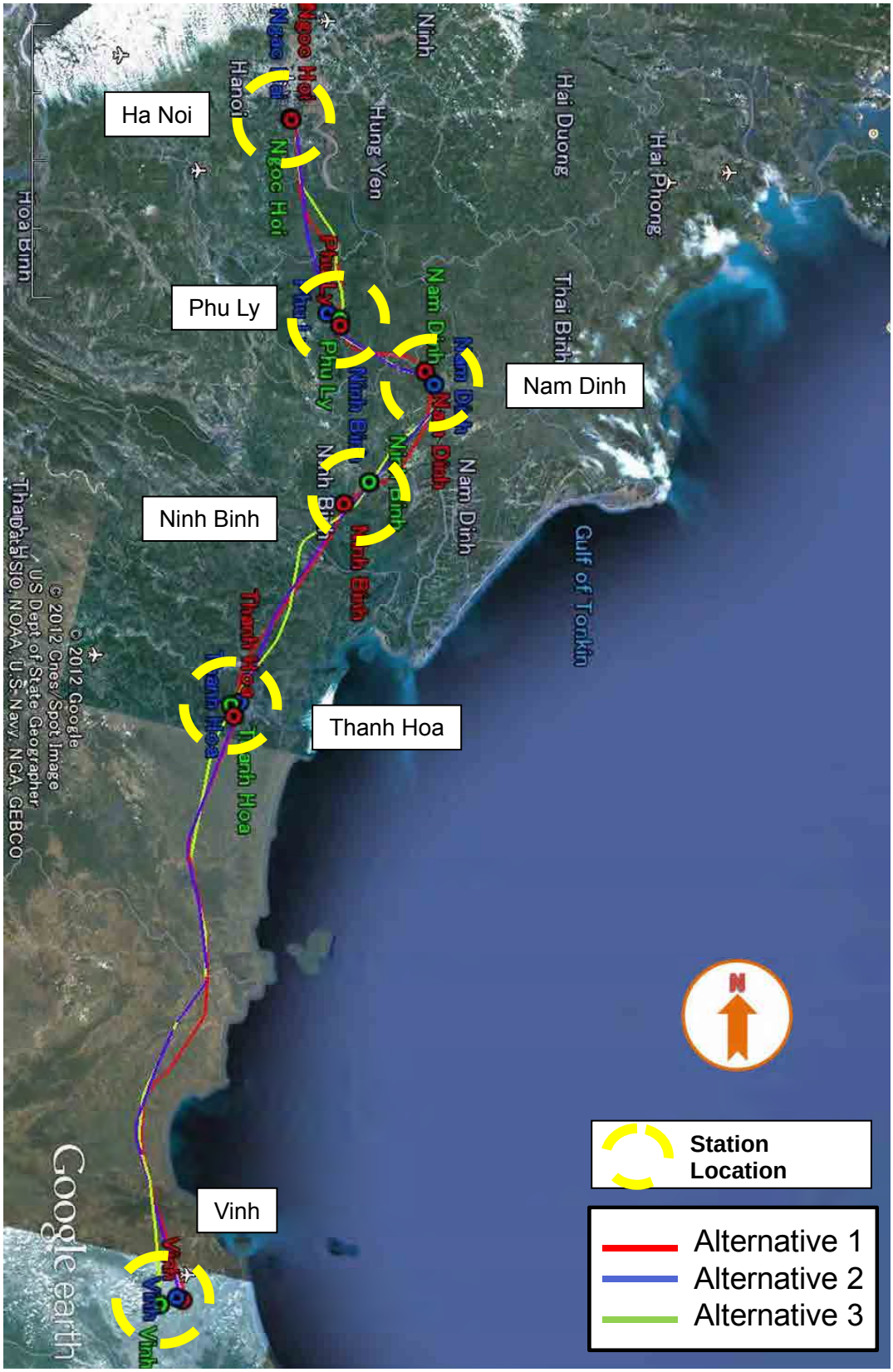
3.15 Station planning concepts for the alternatives are different. That is, (i) Alternative 1 ensures the connectivity of HSR and the existing railway at the station, (ii) Alternative 2 locates the station in the city area, allowing a little distance from the existing stations, and (iii) Alternative 3 places the station in the suburban area. Description for each alternative is summarized in Table 3.2.3.

**Table 3.2.3 Initial Alternatives Set for Comparison**

| Alternative | Station Location | Alignment | Structure |
|---|---|---|---|
| Alternative 1 (Alt1) | In urban area with integrated development in and around station area, connected with the existing railway | Minimum Curve Radius =6,000m | To consider the cost efficient balance of viaduct and embankment, |
| Alternative 2 (Alt2) | In urban area, not necessarily connected with the existing railway | Minimum Curve Radius =6,000m | Free to choose alignment with more of the application of elevated structures |
| Alternative 3 (Alt3) | In suburban area avoiding existing city area, no connection with the existing railway | Minimum Curve Radius =5,000m | To reduce construction cost by choosing the alignment by embankment |

Source: JICA Study Team

3.16 The initial alternatives set for the north section and the south section are shown in Figure 3.3.1 and Figure 3.3.2, respectively.




Source: JICA Study Team

**Figure 3.2.1 Initial Alternatives for the North Section**

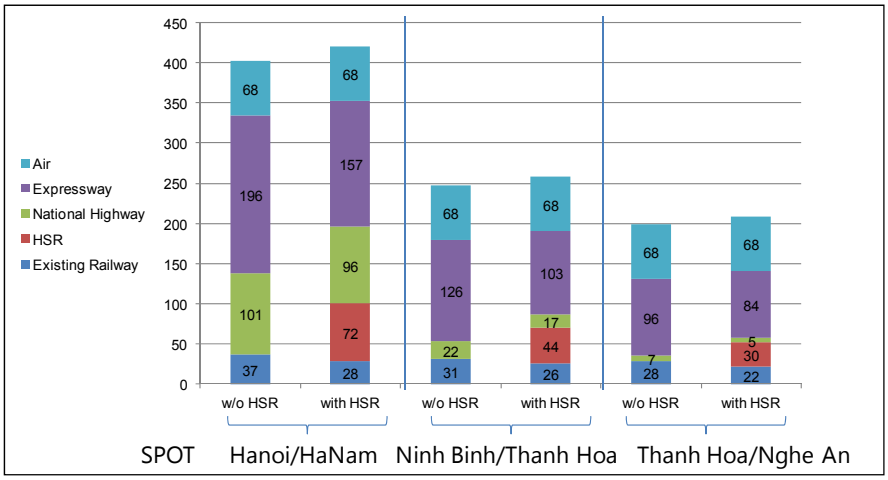

Source: JICA Study Team

**Figure 3.2.2 Initial Alternatives for the South Section**

### 2) Zero-option

3.17 In addition to the above three initial alternatives, the "without" project case was set as the zero-option. If HSR is not developed, the expected passenger demand in the north-south corridor is expected to be shared by other transportation modes, namely, roads, air, and the existing railway.

3.18 Characteristics of the zero-option are: (1) the modal split will be significantly different resulting in changing the impacts on the environment, and (2) investment on the HSR Projects will not be made, even though investments to meet the growing traffic demand would be necessary anyway. The change of the modal split is estimated in Figure 3.2.3, which shows that the passengers estimated to be riding the HSR will be split mostly to expressway and some to national highway and existing railway in the zero-option case ("w/o HSR" case in the figure).




Note: "w/o" stands for "without "
Source: JICA Study Team

**Figure 3.2.3 Estimated Spot Traffic Volume of Passenger (,000) Example of North Section in 2030**

## 3.3 Methodology for Comparison of Alternatives

### 1) Confirmation of Available Information on Four Aspects

3.19 Table 3.3.1 shows the information collected through the baseline survey on four aspects for the comparison of the alternatives.

**Table 3.3.1 Information Collected for the Comparison of Alternatives**

| No | Comparison Aspects | Information Available | Information Source |
|---|---|---|---|
| 1 | Convenience and Integrated Development | [North/South] Capital cities of cities/provinces are under rapid growth in terms of both buildings and areas. | Provincial Development Plan, City Development Plan and Topographic Map |
| 2 | Environmental and Social Considerations | Topography: [North/South] Generally flat, Tunnels will be required in some border areas of provinces. | Topographic map |
| | | Geology: [North/South] In the delta area of major rivers, soft ground area is stretching out . [South] the geological features of the sandy dune area between PhanThiet and Tuy Phong is problematic for the construction of HSR. | Geological Map |
| | | Hydrology [North/South] Some cases of well water use near the mountainous areas are confirmed by the site survey. [South] Binh Thuan Province and Ninh Thuan Province has relatively less rainfall, resulting in more importance in ground water use. | Topographic map |
| | | Hazard: [North/South] Flooding, landslides are common problems along the target cities/provinces. | Hazard record (different in each cities/provinces, few province prepares hazard maps) |
| | | Protected areas/Forest: [North/South]Impact to special use forest should be avoided. Protection forest is recently identified in the landuse map. | Protected area list<br>Landuse map |
| | | Biodiversity: [North/South] Precious flora and fauna, wetlands, forest, migrating birds are important and critical for conservation. | CBD Country Report<br>Redlist<br>IBA/EBA etc., identified by INGO<br>Distribution of precious flora/fauna is not readily available except for a few national parks. |
| | | Living environment [North/South] Basic environmental standards are available. Most provinces conduct monitoring, though the monitored items differ from province to province. There is no vibration monitoring confirmed in the collected data. | Five year environmental report of provinces<br>EIA reports |
| | | Landuse: [North/South] It is known that development affecting army areas is not welcomed. Cemetery is present along the national roads and at the foot of mountains/hills. Many cemeteries in the south section are large scale. Industrial zones are developed and planned especially along the national roads. | Landuse map |
| | | Resettlement: [North/South] Besides two major cities of Vietnam or Hanoi and HCMC, there is no large city with more than 1 million populations along the target sections. In provincial capitals, the population density tends to be high and thus due considerations on alignment and station planning is required. | Topographic map (Building is shown at 1:10,000 scale) |
| | | Cultural Heritages: [North] Hoa Lu area in Ninh Binh, war relics(Ham Rong) in Thanh Hoa<br>[South] Cham relics in Binh Thuan, Ninh Thuan, Khanh Hoa and potential undiscovered relics of primitive civilization in Dong Nai. | Cultural heritage list (national/provincial), without location information<br>Landuse map<br>Internet information |
| 3 | High speed serviceability | Soft ground: [North] Red River delta, [South] Mekong delta and sandy area in Binh Thuan<br>Long-span bridges: Major rivers (ex. Dong Nai River etc) | Topographic map<br>Geological map |

| No | Comparison Aspects | Information Available | Information Source |
|---|---|---|---|
| 4 | Economical efficiency | The previous studies have the structure list and each unit cost, but the estimation period is different and therefore, costs need to be updated. | Structure list<br>Unit cost information |

Source: JICA Study Team

### 2) Selection of Evaluation Items for Aspect 1 "Convenience and Integrated Development"

3.20 One of the most important control points for the alignment planning is the location of stations, which decides its potential of convenience and integrated development. Considering the history of HSR development in the world, the connectivity of HSR with the existing railways and other transportation modes, distance from city centers and the compliance with city development plans are very important. Like HSR in Japan and France, and even some newly operating system in countries like Taiwan, have experienced that station development without connectivity often faces difficulties in attracting further investments. Distance from the city center and compliance with the city plan indicates that the convenience is low, resulting in lesser ridership volume compared to the expected figures.

3.21 Since HSR development is a long term plan with a large investment, the integrated development to maximize the positive socio-economic impacts to the region is needed to be paid due consideration. Therefore, at this stage of comparing alternatives, items for evaluation were selected as shown in Table 3.3.2 based on the collected secondary data and information.

**Table 3.3.2 Evaluation Items for Convenience and Integrated Development**

| Selected Items | Reasons for Selection |
|---|---|
| 1-1. Connectivity with other transportation modes | Considering the convenience of passengers, transferability to other transportation modes is important. Especially considering the history of HSR in the world, connectivity with the existing railway is required. In the Vietnamese context, the north-south corridor is crucial for the country and the north-south railway should be developed as one system by integrating the HSR with the existing railway. |
| 1-2. Accessibility to station and potential for integrated development | Accessibility of the station is important for passengers' convenience and access time to the station should be considered as one of the advantages of HSR against other transportation modes, especially air transport. |
| 1-3. Availability of land for integrated development | To achieve the integrated development, land availability within 500m area of the station should be examined. |

Source: JICA Study Team

### 3) Selection of Evaluation Items for Aspect 2 "Environmental and Social Considerations"

3.22 To select important environmental and social items for the comparison of alternatives, items for natural, living and social environment were selected through the comprehensive identification of environmental and social considerations items in Appendix 3A. Based on the importance of considerations, at this stage of the evaluation, to avoid and/or mitigate the potential negative impacts or to maximize the positive impacts, items were selected as shown in Table 3.3.3 based on the collected secondary data and information.

3.23 While several items are evaluated to cause environmental and social impacts, it does not mean that all of these items are selected at this stage of the comparative analysis due to following reasons:

(i) The level and type of some information items are not appropriate (for example, low frequency noise should be considered more in detail after the optimal alignment is decided and this item does not need to be considered for comparing alternatives), and

(ii) Some items can be evaluated together with other items (for example, "protected area" can be used to preliminarily compare the condition of biodiversity).

**Table 3.3.3 Evaluation Items for Environmental and Social Considerations**

| Sub-Aspects | Selected Items | Reasons |
|---|---|---|
| Natural Environment | 2-1. Topography | To avoid the difficult sections for civil works. This factor is basically considered in the civil engineering phase in accordance with the target speed and the required technical standards to be set by the study. |
| | 2-2. Geology | To minimize the risk and to avoid the difficult sections for civil works.<br>Especially, the sections with quartz sand areas in Phan Thiet. Areas in the south section are considered to be sensitive area since these soil types are regard to be inappropriate for cutting and mounding.<br>Besides that, the geology information can also be utilized to consider the structure design and construction method since it will affect the necessary cost. |
| | 2-3. Hydrology | To avoid or minimize the negative impact on the water utilization in the lower stream and ecosystem by the changes and/or decrease of the flow of the surface water, river-bed water and spring water. |
| | 2-4. Natural Hazard | To minimize the risk and to avoid the difficult sections for civil works. In Vietnam, the hazard area mapping started recently and limited data are available. However, considering the world climate trend in the South-east Asia, there is potential to have bigger and more typhoons and heavy rainfall which cause floods and landslides. |
| | 2-5. Protected Areas/Forest (covering Biodiversity, Flora/Fauna and Landscape) | To avoid and/or minimize impact on the important natural environment (including ecosystem, flora, fauna and landscape) is required. Special-use forest is regarded as the protected areas in Vietnamese legal context, so that the importance is ++, while the protection forest can be regarded as + considering its objectives (e.g., prevention of soil erosion, wind break etc.).<br>Thus, the alignment should be planned so that the protected areas are not affected, while the affect on the protection forest will be considered to be minimized. |
| Living Environment | 2-6 Noise/Vibration | To minimize the number of affected people is important since large impact could be expected on noise and vibration by the HSR. |
| Social Environment | 2-7. Land use | To avoid and/or mitigate the land acquisition in the difficult and sensitive areas.<br>This will be assessed in the "Social Environment".<br>(For the sake of improving the positive impact by the project, connection with existing railway and other transportation modes are important. This will be assessed in "Convenience and Integrated Development") |
| | 2-8. Residential Area/Developed Area | The location of railway should be planned considering the location of development areas<br>- to minimize resettlement of houses, shops and factories<br>- to avoid the impact on community cohesion<br>- to minimize noise and vibration issue<br>- to be convenient for the access from the populated areas |
| | 2-9. Cultural and Historical Heritages | To avoid the negative impact on cultural and historical heritages. Since history of Vietnam is diverse with various ethnic people and foreign interference, there are a lot of cultural and historical heritages. It is worth considering this issue to maintain the potential of the tourism in Vietnam, however, some experts in provincial governments mentioned that the reliable study result on cultural and historical heritages are rare because of the lack of surveys. |
| | 2-10. Ethnic Minorities | To avoid and/or mitigate the impact on ethnic minorities and their culture and way of living. Many ethnic minorities, living in the mountainous region of Vietnam, keep their tradition and identity intact. There are areas like Binh Thuan and Ninh Thuan Province where villages of ethnic minorities (e.g., Cham people) practice traditional agriculture. There are also the craft villages producing traditional pottery and weaving. |

Source: JICA Study Team

### 4) Selection of Evaluation Items for Aspect 3 "High Speed Serviceability"

3.24 The third aspect for evaluation is the high speed serviceability. The items for this aspect are shown in Table 3.3.4. Considering the long distance of Vietnam from north to south, the high-speed service is important for passengers' benefit and convenience. It is also necessary for the HSR to compete against other transportation modes, especially against air transport. Thus, the alignment should be well considered so that high speed service is possible.

3.25 The engineering point should also be considered since more difficult construction locations could jeopardize the construction schedule.

**Table 3.3.4 Evaluation Items for High Speed Serviceability**

| Selected Items | Reason of Selection |
|---|---|
| 3-1. High speed serviceability | High speed service is important for the passengers' convenience and also assures ridership. In order to achieve the high speed, appropriate curve radius has to be applied for the alignment planning. |
| 3-2. Engineering | The difficulties in civil engineering may affect the schedule of the construction. Difficult construction areas include long-span bridges, long tunnels, long cut, and the distribution of the soft ground area and/or special sandy area. |

Source: JICA Study Team

### 5) Selection of Evaluation Items for Aspect 4 "Economical Efficiency"

3.26 The fourth aspect is the economical efficiency, which is evaluated from the point of view of cost as shown in Table 3.3.5. Construction cost is one of the biggest concerns when the HSR development was discussed in the National Assembly.

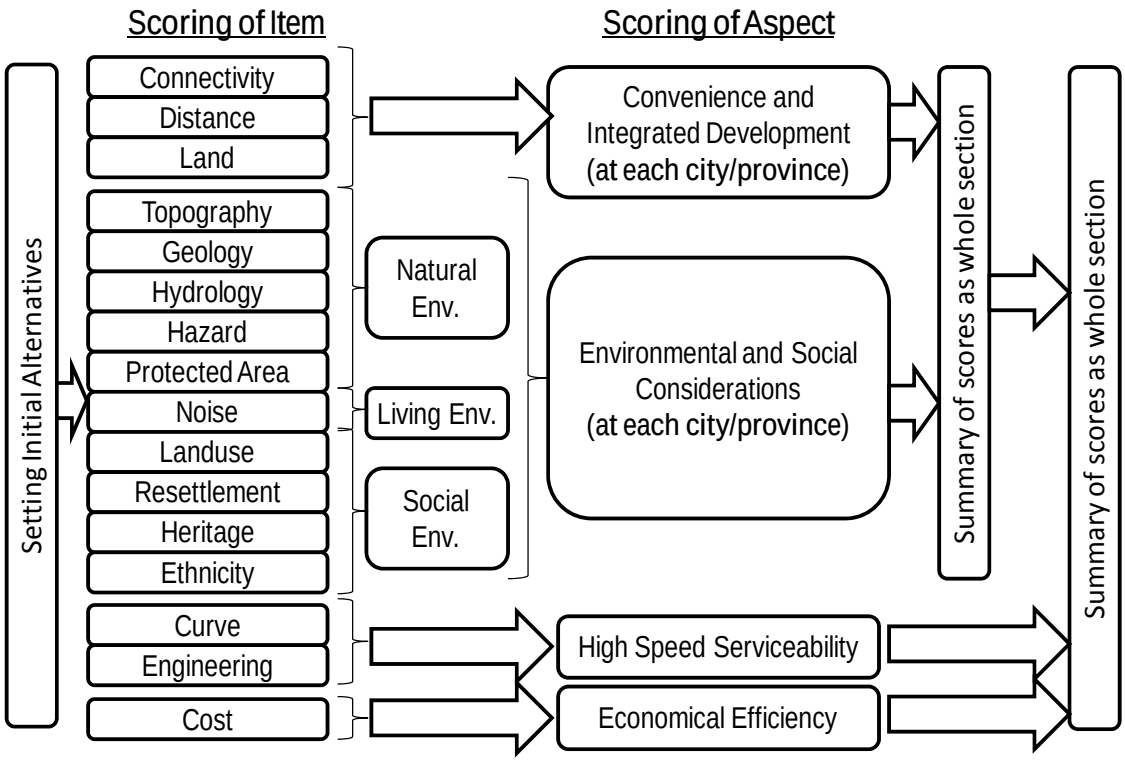
**Table 3.3.5 Evaluation Items for Economical Efficiency**

| Selected Items | Reasons for Selection |
|---|---|
| 4-1. Construction Cost | Cost should be estimated based on the alignment and station locations. |

Source: JICA Study Team

### 6) Scoring of Evaluation Items

3.27 The scoring flow in the comparison of alternatives is shown in Figure 3.3.1. It is noted that the scoring result of each item for each city/province is summed up to reflect the overall score of Aspect 1 (convenience and integrated development) and Aspect 2 (environmental and social considerations) which is in turn separately summed up by section (i.e., the north section and the south section). On the other hand, Aspect 3 (high speed serviceability) and Aspect 4 (economical efficiency) are directly evaluated by section. It means that the first two aspects are scored both at the city/provincial level and at the section level as sum of the city/provincial results, while the third and fourth aspects are only scored at the section level.




Source: JICA Study Team

**Figure 3.3.1 Scoring Process in the Comparison of Alternatives**

3.28 For each aspect, the scoring methods of each item were prepared as explained in Tables 3.3.6 to 3.3.11. Each item is scored not by comparison but by the objective scoring criteria set in this study. The score was assessed based on the criteria of 1-5 first, then, if there is any condition for further addition (+1) or deduction (-1), the score was added or deducted accordingly.

**Table 3.3.6 Scoring Method for Convenience and Integrated Development**

| No | Selected Items | Method of Comparative Analysis | Scoring Criteria |
|---|---|---|---|
| 1-1 | Connectivity with other transportation mode | To confirm the connection with transportation modes | 5: Connected with existing railway or urban railway (including plan) and connected with other transport modes<br>4: Connected with existing railway or urban railway (including plan) but not connected with other transport modes<br>3: Not connected with existing railway or urban railway (including plan) but connected with other transport modes<br>2: No connection to any other transport modes, however there is a plan for connection in the future<br>1: No connection to any other transport modes both at present status and future plan<br>+1: Station location is within 1km from any of the following: residential development areas (exclusively or mainly for residential purposes), industrial areas, higher education centers, and main tourism destinations.<br>Transport modes = road (car, motorcycle, bus, etc.), airway, etc. |
| 1-2 | Accessibility to station and potential for integrated development | To confirm the distances among stations and administrative and business/commercial centers | 5: Within 500m radius from administrative center and business/ commercial centers<br>4: Within 1km radius from administrative center and business/ commercial centers<br>3: Within 3km radius from administrative center and business/ commercial centers<br>2: Within 5km radius from administrative center and business/ commercial centers |

| No | Selected Items | Method of Comparative Analysis | Scoring Criteria |
|---|---|---|---|
| | | | 1: More than 5km from administrative center and business/ commercial centers<br>* Accessibility from administrative center, business/ commercial centers is considered where a high rate of trip generation and attraction is expected.<br>* Since in principle, mixed land use is assumed, business/ commercial centers also include residential areas. |
| 1-3 | Availability of land for integrated development | To confirm the availability of land near the potential station location | 5: Attainment of land for development within a 500m radius is highly possible hence suited for integrated development<br>3: Attainment of land for development within a 500m radius is possible provided with some changes to the future development plan<br>1: Attainment of land for development within a 500m radius is very difficult<br>*Availability of land is assessed by the availability of agricultural land, natural land, and other vacant land such as former industrial areas.<br>*This item is evaluated by 3 grades (5/3/1). |

Note: See Appendix 3B
Source: JICA Study Team

**Table 3.3.7 Scoring Method for Natural Environment**

| No | Selected Items | Method of Comparative Analysis | Scoring Criteria |
|---|---|---|---|
| 2-1 | Topography | Important/valuable topography | 5: Important/valuable topography does not exist.<br>4: Important/valuable topography exists along the alignment, while it is not directly affected.<br>3: Important/valuable topography exists along the alignment, and is affected in terms of landscape.<br>2: Important/valuable topography exists along the alignment, and is partially but directly affected.<br>1: Important/valuable topography exists along the alignment, and is directly affected.<br>*Important/Valuable topography includes: rare topography such as limestone areas in the north section and sand dunes in the south section, which may have touristic value, cultural value and etc. |
| 2-2 | Geology | To identify problematic geological ground | 5: No geological difficulty section<br>4: Passing through area of geological difficulty less than 1 km<br>3: Passing through area of geological difficulty 1-2 km<br>2: Passing through area of geological difficulty 2-5 km<br>1: Passing through area of geological difficulty more than 10 km<br>*Geological difficulty section means: soft ground, weathered mountains, sandy areas (e.g., N-value is low), reclaimed land etc. |
| 2-3 | Hydrology | To identify the tunnels which may cause impact on hydrological situations | 5 : No tunnel over 1km.<br>4: There is a tunnel (1km-5km), while nearby water use (especially in the downstream area) is not confirmed.<br>3: There is a tunnel (over 5km), while nearby water use (especially in the downstream area) is not confirmed.<br>2: There is a tunnel (1km-5km), and nearby water use (especially in the downstream area) is confirmed.<br>1: There is a tunnel (over 5km), and nearby water use (especially in the downstream area) is confirmed. |
| 2-4 | Hazard | To identify the hazard prone communes | 5: Hazard prone commune: -4<br>4: Hazard prone commune: 5-8<br>3: Hazard prone commune: 9-12<br>2: Hazard prone commune: 13-16<br>1: Hazard prone commune: 17 and more |
| 2-5 | Protected Area/Forest | To count Protected Area (Special-use Forest) and Protection Forest | Below individual impacts is to be calculated and deducted from 5. The score is to be rounded and minimum is 1.<br>Impact on Protected Forest:<br>Small impact: -1.5/impact (such as affecting the edge of the forest area)<br>Significant impact: -2/impact (such as the division of ecosystem)<br>Impact on protection forest: |

| | | | |
|---|---|---|---|
| | | | Small (e.g., less than 1 x 1 km): 0<br>Medium (e.g., between 1x1-5x5km): -0.2/forest<br>Large (e.g., between 5x5-10x10km): -0.4/forest<br>Extra Large (e.g., above 10x10km): -0.5/forest |

Source: JICA Study Team

### Table 3.3.8 Scoring Method for Living Environment

| No | Selected Items | Method of Comparative Analysis | Scoring Criteria |
|---|---|---|---|
| 2-6 | Noise/Vibration | To count the number of buildings from the nearest track center of the HSR.<br>Within 25m: 2 people / building are affected<br>50m: 1 people / building is affected<br>100m: 0.5 people / building is affected | 5: Affected population(estimation): Less than 400<br>4: Affected population(estimation) : 400-799<br>3: Affected population(estimation) : 800-1199<br>2: Affected population(estimation) : 1200-1599<br>1: Affected population(estimation) : 1600 and more |

Source: JICA Study Team

### Table 3.3.9 Scoring Method for Social Environment

| No | Selected Items | Method of Comparative Analysis | Scoring Criteria |
|---|---|---|---|
| 2-7 | Landuse | To identify the sensitive areas (army area, industrial zone and cemetery) on the alignment | Below individual impacts is to be calculated and deducted from 5. The score is to be rounded and minimum is 1.<br>Impact on Army area: 0.1/Impact (small), 0.3/impact (large)<br>Impact on Industrial Zone: -1/impact(plan), -0.5/impact (existing)<br>Impact on Cemetery: Small: -0.1/impact (small), -0.3/Impact (large) |
| 2-8 | Residential Area | To estimate the affected house area | 5: Affected buildings: Less than 50<br>4: Affected buildings : 50-199<br>3: Affected buildings : 200-299<br>2: Affected buildings : 300-399<br>1: Affected buildings : 400 and more |
| 2-9 | Cultural Heritages and Religious Facilities | To identify the cultural heritages and religious facilities | To identify the major cultural heritages within 100m from the alignment<br>5: 0-3 locations<br>4: 4-6 locations<br>3: 7-9 locations<br>2: 10-12 locations<br>1: 13 and more locations<br><br>-1: If there is any specially famous and important heritages or religious facilities |
| 2-10 | Ethnic Minorities | Population of ethnic minorities | Below individual impacts is to be calculated and deducted from 5. The score is to be rounded and minimum is 1.<br>Impact on Ethnic Minority in communes::<br>Population of ethnic minority in commune<br>500-1,000: -0.2/commune<br>1,000-5,000: -0.5/commune<br>5,000 over: -1/commune |

Source: JICA Study Team

**Table 3.3.10 Scoring Method for High-speed Serviceability**

| No | Selected Items | Method of Comparative Analysis | Scoring Criteria |
|---|---|---|---|
| 3-1 | High-speed serviceability | To identify the ratio of the alignment with the curve radius of less than R=6,000. | 5 : 0% of the railway is smaller than R=6,000 curve<br>4 : 0-5% of the railway is smaller than R=6,000 curve<br>3 : 5-10% of the railway is smaller than R=6,000 curve<br>2 : 10-20% of the railway is smaller than R=6,000 curve<br>1: More than 20% of the railway is smaller than R=6,000 curve<br><br>-1: If there is any steep curve to restrict the speed near terminal stations (Hanoi/HCMC）<br>-1: If future extension of the alignment is difficult. |
| 3-2 | Engineering Difficulties | Identification of long-span bridges, long tunnels, long cut and soft ground areas along the alignment | 5: No difficult points from civil engineering point of view.<br>4: One difficult point from civil engineering point of view.<br>3: Two difficult points from civil engineering point of view.<br>2: Three difficult points (more than two kinds) from civil engineering point of view.<br>1: More than four difficult points (more than two kinds) from civil engineering point of view<br><br>*Definition of difficult points from engineering point of view: long-span (more than 100m/span) bridges, long tunnels (more than 5km), soft ground areas (more than 10km), and long cut (more than 40m). |

Source: JICA Study Team

**Table 3.3.11 Scoring Method for Economical Efficiency**

| No | Selected Items | Method of Comparative Analysis | Scoring Criteria |
|---|---|---|---|
| 4-1 | Construction Cost | Based on the structure ratio of the alignment, the civil construction cost of the alternatives are calculated in accordance with the same unit cost /km | Cost should be estimated based on the structure in accordance with alignment and station locations alternative. It was scored by the proportional analysis, compared with the cheapest alternative. |

Source: JICA Study Team

### 7) Scoring of Aspects

3.29 As shown in Table 3.3.12, each aspect was scored by summing up the result per item. Each aspect and alternative as a whole are evaluated by 4 rates, namely, A: Better, B: Good, C: Fair and D: No advantage.

**Table 3.3.12 Scoring of Aspects**

| No. | Aspect | Related Items | Scoring Criteria |
|---|---|---|---|
| 1 | Convenience and Integrated Development | 1) Connectivity with other transportation mode<br>2) Accessibility to station and potential for integrated development<br>3) Availability of land for integrated development | A :Total of the score is 13 and more<br>B: Total of the score is 10 and more, less than 13<br>C: Total of the score is 7 and more, less than 10<br>D: Total of the score is less than 7 |
| 2 | Environmental and Social Considerations | | |
| | 2-1 Natural Environment | 1) Topography,<br>2) Geology,<br>3) Hydrology,<br>4) Hazard,<br>5)Protected Area / Forest | A: Total of the score is 18 and more, and all score of the items is 3 and more<br>B: Total of the score is 18 and more, and more than one score of the items is less than 3<br>C: Total of the score is 15 and more, less than 18<br>D Total of the score is less than 15 |
| | 2-2 Living Environment | Noise/Vibration | A:Score: 5<br>B:Score: 4<br>C:Score: 3<br>D:Score: Less than 3 |
| | 2-3 Social Environment | 1) Landuse,<br>2) Residential Area,<br>3) Cultural Heritages and Religious Facilities<br>4) Ethnic Minorities | A: Total of the score is 15 and more, and all score of the items is 3 and more<br>B: Total of the score is 15 and more, and at least one score of the items is 2 or less<br>C: Total of the score is 12-15<br>D: Total of the score is less than 12 |
| 3 | High-speed Serviceability | 1) High-speed serviceability,<br>2) Engineering Difficulties | A: 1)+2) is 9 and more<br>B: 1)+2) is 7 and more, less than 9<br>C: 1)+2) is 4 and more, less than 7<br>D: 1)+2) is less than 4 |
| 4 | Economical efficiency | Construction cost | A : The cheapest alternative<br>B : Less than 1.5 times of the cheapest alternative<br>C : 1.5 times or more than 1.5 times, and less than 2 times of the cheapest alternative<br>D : More than double of the cheapest alternative |

A: Better, B: Good, C: Fair and D: No advantage
Source: JICA Study Team

### 8) Reflection on Comments and Suggestions from Stakeholders

3.30 The information on the alternatives together with their corresponding scores was shared with stakeholders through two official occasions, namely, the 2nd SHMs in 11 target cities/provinces and the plenary meetings of the 2nd SHMs in Hanoi and HCMC.

3.31 After reflecting the comments and suggestions from stakeholders in each city/province, the responses are summarized as reports and sent to each city/province for confirmation, further comments and information sharing.

3.32 Overall plans for the two sections prepared from the process above are shown in the plenary meetings for discussions. After reflecting the comments and suggestions in the plenary meetings, the optimal alternative was selected considering the results from the final evaluation. Besides these official processes, discussions were held during site survey and comments from cities/provinces were always welcomed.

## 3.4 Discussion on Initial Alternatives at the 2nd Stakeholder Meetings in each City/Province

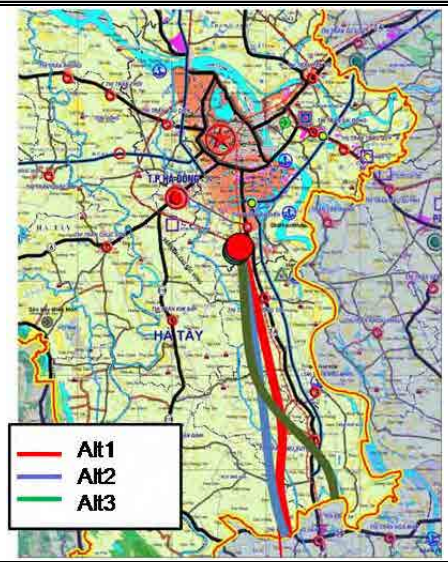
### 1) Scoring of Initial Alternatives

3.33 To guide discussions in the 2nd SHM in each of cities/provinces, the following information was shown for the stakeholders.

#### (1) North Section

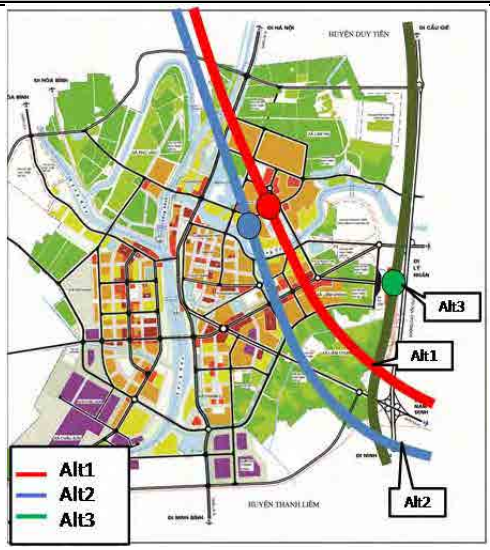
3.34 The following tables show the examples of presentation materials on provincial wise initial evaluation regarding 1) Convenience and Integrated Development, and 2) Environmental and Social Considerations on the north section. In each city/province, the initial result of scoring was comparatively shown with given ratings of A- Better, B- Good, C- Fair for facilitating discussions and questions among the stakeholders. Table 3.4.1 to Table 3.4.6 show the map of alternatives with initial scoring results which were explained and discussed in the 2nd SHM of city/provinces in the north section. The details of the 2nd SHM proceedings are recorded in Chapter 8 while the minutes of discussions and the complete set of presentation materials are attached in Appendices 8A and 8B.

**Table 3.4.1 Initial Scoring Results (Hanoi)**

<table>
<tr><th>Aspect</th><th>Map</th><th>Scoring of Items</th></tr>
<tr><td>Connectivity and Integrated Development</td><td> 
</td><td>
<table>
<tr><th>Items</th><th>Alt 1</th><th>Alt 2</th><th>Alt 3</th></tr>
<tr><td>a) Connectivity with other transportation modes</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>b) Distance from main centers</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>C) Availability of land for integrated development</td><td>A</td><td>A</td><td>A</td></tr>
</table>
</td></tr>
<tr><td>Environmental and Social Considerations</td><td> 
</td><td>
<table>
<tr><th>Items</th><th>Alt 1</th><th>Alt 2</th><th>Alt 3</th></tr>
<tr><td>a) Topography</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>b) Geology</td><td>C</td><td>C</td><td>C</td></tr>
<tr><td>C) Hydrology</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>d) Hazard</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>e) Protected areas and forest</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>f) Noise and vibration</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>g) Landuse</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>h) Resettlement</td><td>A</td><td>A</td><td>B</td></tr>
<tr><td>i) Cultural heritages</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>j) Ethnic minorities</td><td>A</td><td>A</td><td>A</td></tr>
</table>
</td></tr>
</table>

Note: A- Better, B- Good, C- Fair
Source: JICA Study Team

**Table 3.4.2 Initial Scoring Results (Ha Nam)**

<table>
<tr><th>Aspect</th><th>Map</th><th>Initial Scoring of Items</th></tr>
<tr><td>Connectivity and Integrated Development</td><td> 
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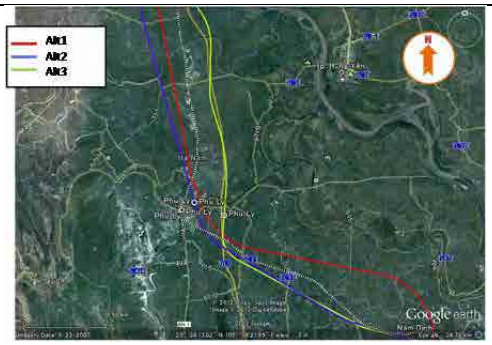
<table>
<tr><th>Items</th><th>Alt 1</th><th>Alt 2</th><th>Alt 3</th></tr>
<tr><td>a) Connectivity with other transportation modes</td><td>B</td><td>B</td><td>A</td></tr>
<tr><td>b) Distance from main centers</td><td>A</td><td>A</td><td>B</td></tr>
<tr><td>C) Availability of land for integrated development</td><td>A</td><td>B</td><td>A</td></tr>
</table>
</td></tr>
<tr><td>Environmental and Social Considerations</td><td> 
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<table>
<tr><th>Items</th><th>Alt 1</th><th>Alt 2</th><th>Alt 3</th></tr>
<tr><td>a) Topography</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>b) Geology</td><td>C</td><td>C</td><td>C</td></tr>
<tr><td>C) Hydrology</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>d) Hazard</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>e) Protected areas and forest</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>f) Noise and vibration</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>g) Landuse</td><td>A</td><td>B</td><td>A</td></tr>
<tr><td>h) Resettlement</td><td>A</td><td>A</td><td>B</td></tr>
<tr><td>i) Cultural heritages</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>j) Ethnic minorities</td><td>A</td><td>A</td><td>A</td></tr>
</table>
</td></tr>
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Note: A- Better, B- Good, C- Fair
Source: JICA Study Team

**Table 3.4.3 Initial Scoring Results (Nam Dinh)**

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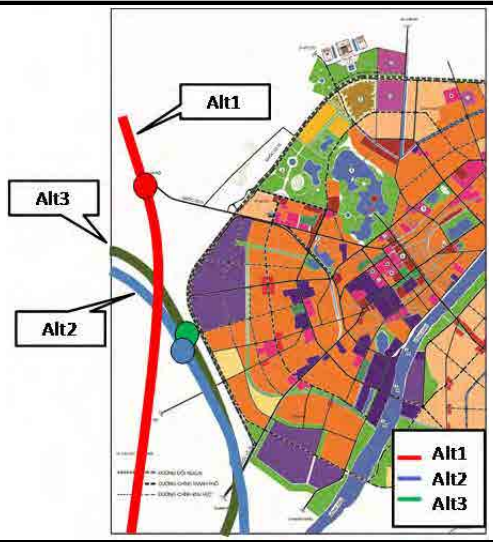
<tr><td>Connectivity and Integrated Development</td><td> 
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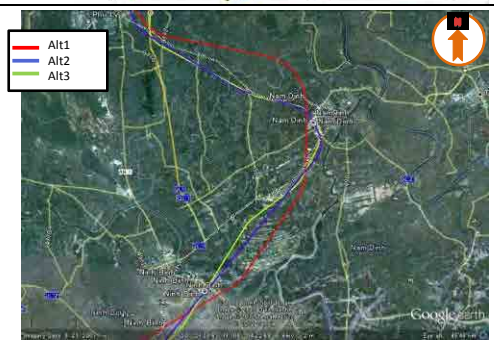
<tr><th>Items</th><th>Alt 1</th><th>Alt 2</th><th>Alt 3</th></tr>
<tr><td>a) Connectivity with other transportation modes</td><td>A</td><td>C</td><td>C</td></tr>
<tr><td>b) Distance from main centers</td><td>B</td><td>B</td><td>B</td></tr>
<tr><td>C) Availability of land for integrated development</td><td>A</td><td>A</td><td>A</td></tr>
</table>
</td></tr>
<tr><td>Environmental and Social Considerations</td><td> 
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<table>
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<tr><td>a) Topography</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>b) Geology</td><td>C</td><td>C</td><td>C</td></tr>
<tr><td>C) Hydrology</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>d) Hazard</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>e) Protected areas and forest</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>f) Noise and vibration</td><td>B</td><td>B</td><td>B</td></tr>
<tr><td>g) Landuse</td><td>B</td><td>C</td><td>C</td></tr>
<tr><td>h) Resettlement</td><td>B</td><td>B</td><td>B</td></tr>
<tr><td>i) Cultural heritages</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>j) Ethnic minorities</td><td>A</td><td>A</td><td>A</td></tr>
</table>
</td></tr>
</table>

Note: A- Better, B- Good, C- Fair
Source: JICA Study Team

**Table 3.4.4 Initial Scoring Results (Ninh Binh)**

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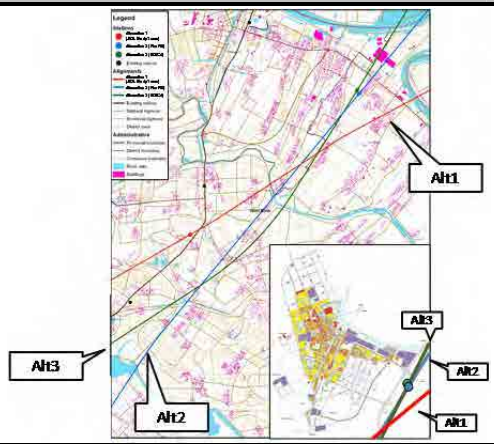
<tr><th>Aspect</th><th>Map</th><th>Scoring of Indicators</th></tr>
<tr><td>Connectivity and Integrated Development</td><td> 
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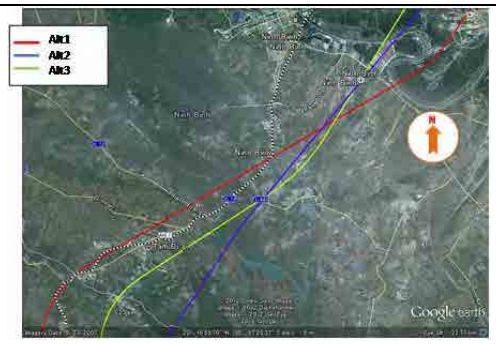
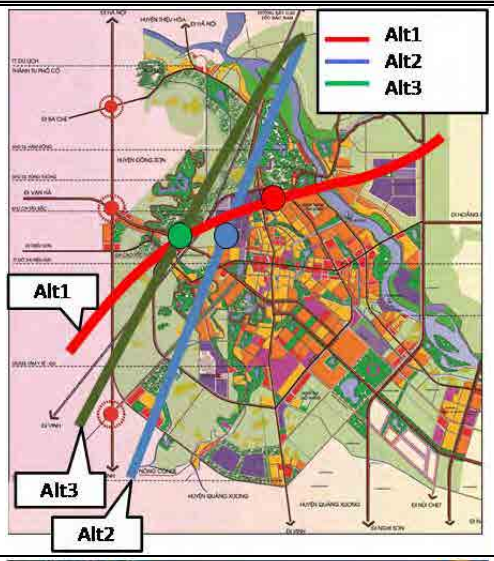
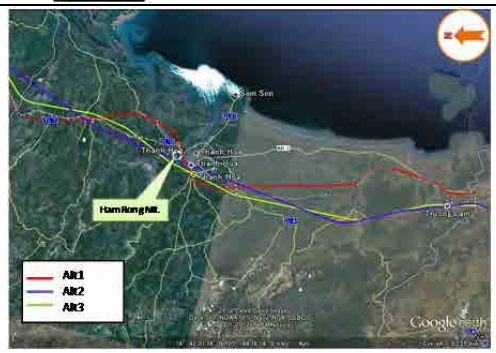
<table>
<tr><th>Items</th><th>Alt 1</th><th>Alt 2</th><th>Alt 3</th></tr>
<tr><td>a) Connectivity with other transportation modes</td><td>A</td><td>C</td><td>C</td></tr>
<tr><td>b) Distance from main centers</td><td>B</td><td>B</td><td>B</td></tr>
<tr><td>C) Availability of land for integrated development</td><td>A</td><td>A</td><td>A</td></tr>
</table>
</td></tr>
</table>

| | | |
|---|---|---|
| Environmental and Social Considerations |  | |

| Items | Alt 1 | Alt 2 | Alt 3 |
|---|---|---|---|
| a) Topography | A | A | A |
| b) Geology | C | C | C |
| C) Hydrology | A | A | A |
| d) Hazard | A | A | A |
| e) Protected areas and forest | A | A | A |
| f) Noise and vibration | A | B | A |
| g) Landuse | A | A | A |
| h) Resettlement | A | B | B |
| i) Cultural heritages | A | A | A |
| j) Ethnic minorities | A | A | A |

Note: A- Better, B- Good, C- Fair
Source: JICA Study Team

**Table 3.4.5 Initial Scoring Results (Thanh Hoa)**

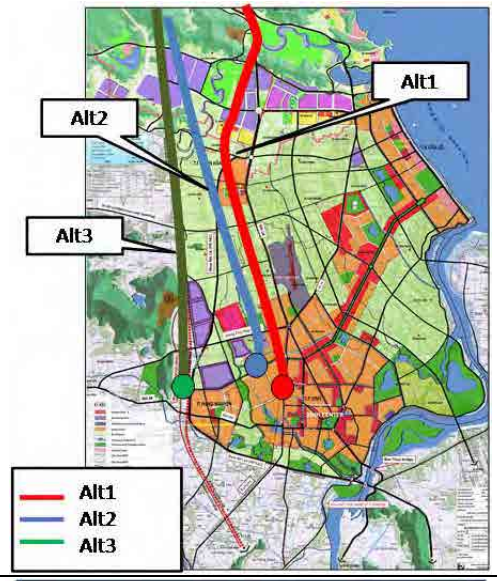
| Aspect | Map | Initial Scoring of Indicators |
|---|---|---|
| Connectivity and Integrated Development |  | |
| Environmental and Social Considerations |  | |

| Items | Alt 1 | Alt 2 | Alt 3 |
|---|---|---|---|
| a) Connectivity with other transportation modes | A | B | B |
| b) Distance from main centers | A | B | B |
| C) Availability of land for integrated development | B | B | B |

| Items | Alt 1 | Alt 2 | Alt 3 |
|---|---|---|---|
| a) Topography | A | A | A |
| b) Geology | A | A | A |
| C) Hydrology | A | B | B |
| d) Hazard | C | B | B |
| e) Protected areas and forest | A | B | B |
| f) Noise and vibration | C | C | C |
| g) Landuse | B | B | B |
| h) Resettlement | B | B | C |
| i) Cultural heritages | A | B | A |
| j) Ethnic minorities | A | A | A |

Note: A- Better, B- Good, C- Fair
Source: JICA Study Team

**Table 3.4.6 Initial Scoring Results (Nghe An)**

<table>
<tr><th>Aspect</th><th>Map</th><th>Initial Scoring of Indicators</th></tr>
<tr><td>Connectivity and Integrated Development</td><td> 
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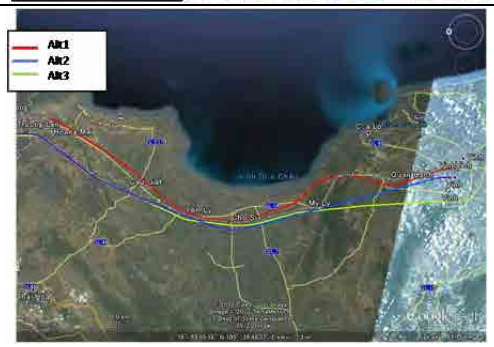
<table>
<tr><th>Items</th><th>Alt 1</th><th>Alt 2</th><th>Alt 3</th></tr>
<tr><td>a) Connectivity with other transportation modes</td><td>A</td><td>B</td><td>B</td></tr>
<tr><td>b) Distance from main centers</td><td>A</td><td>B</td><td>B</td></tr>
<tr><td>C) Availability of land for integrated development</td><td>B</td><td>B</td><td>A</td></tr>
</table>
</td></tr>
<tr><td>Environmental and Social Considerations</td><td> 
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<table>
<tr><th>Items</th><th>Alt 1</th><th>Alt 2</th><th>Alt 3</th></tr>
<tr><td>a) Topography</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>b) Geology</td><td>B</td><td>B</td><td>B</td></tr>
<tr><td>C) Hydrology</td><td>A</td><td>B</td><td>B</td></tr>
<tr><td>d) Hazard</td><td>B</td><td>A</td><td>A</td></tr>
<tr><td>e) Protected areas and forest</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>f) Noise and vibration</td><td>B</td><td>C</td><td>B</td></tr>
<tr><td>g) Landuse</td><td>B</td><td>A</td><td>B</td></tr>
<tr><td>h) Resettlement</td><td>B</td><td>C</td><td>C</td></tr>
<tr><td>i) Cultural heritages</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>j) Ethnic minorities</td><td>A</td><td>A</td><td>A</td></tr>
</table>
</td></tr>
</table>

Note: A- Better, B- Good, C- Fair
Source: JICA Study Team

3.35 Table 3.4.7 shows the comparison of three alternatives based on the initial scoring for the north section presented in the 2nd SHM in cities/provinces. The scoring of each aspect was conducted in accordance with Table 3.3.12. The 1) Convenience and Integrated Development, and 2) Environmental and Social Considerations aspects are evaluated based on the average of the provincial base assessments which are shown in Tables 3.4.1 to 3.4.6. Meanwhile 3) High Speed Serviceability and 4) Economical Efficiency are scored as one target section (the north section from Hanoi to Vinh). To show the initial scoring result to the stakeholders for their comments and discussions, simpler and easy to understand qualitative results, which were derived from the results of the quantitative scoring, was shown so that the discussion would be made effective mainly focusing on the aspects and items for comparing alternatives.

3.36 In the 2nd SHMs, Zero-option was also presented and discussed mainly focusing on changes of GHGs and air pollutants emissions. Both GHGs and air pollutants were considered to be increased in case of Zero-option since the per person-km emission of GHGs and air pollutants is much larger in other transportation modes compared with HSR.

**Table 3.4.7 Initial Scoring Results for the North Section**

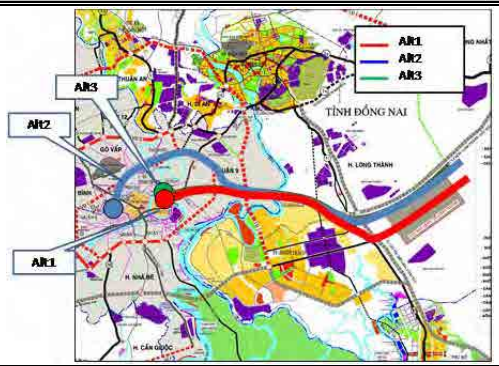
| Aspect | Alt1 | Alt2 | Alt3 | Remarks |
|---|---|---|---|---|
| 1) Convenience and Integrated Development | Better | Good | Good | Summary of provincial base assessment |
| 2) Environmental and Social Considerations | Better | Good | Good | |
| 3) High Speed Serviceability | Better | Good | Fair | The north section base |
| 4) Economical Efficiency | Average | High | Low(*) | |

Note: * If appropriate measures are taken for the soft ground area, the cost would be higher.
Source: JICA Study Team

### (2) South Section

3.37 The same discussion procedure conducted for the north section was followed for the south section as well. Tabular results were shown on provincial wise initial evaluation regarding 1) Convenience and Integrated Development and 2) Environmental and Social Considerations on the south section. In each city/province, the initial result of scoring was comparatively shown with given ratings of A- Better, B- Good, C- Fair for facilitating discussions and questions among the stakeholders. Table 3.4.8 to Table 3.4.12 show the map of alternatives with initial scoring results which were explained and discussed in the 2nd SHM in city/provinces in the south section. Chapter 8 of this report provides the details of 2nd SHM while the minutes of the discussions and the complete set of presentation material are attached in Appendices 8A and 8B.

**Table 3.4.8 Initial Scoring Results (HCMC)**

<table>
<tr><th>Aspect</th><th>Map</th><th>Scoring of Items</th></tr>
<tr><td>Connectivity and Integrated Development</td><td> 
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<table>
<tr><th>Items</th><th>Alt 1</th><th>Alt 2</th><th>Alt 3</th></tr>
<tr><td>a) Connectivity with other transportation modes</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>b) Distance from main centers</td><td>A</td><td>B</td><td>A</td></tr>
<tr><td>C) Availability of land for integrated development</td><td>A</td><td>C</td><td>A</td></tr>
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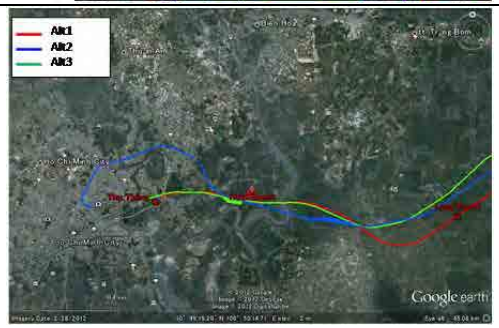
<tr><td>Environmental and Social Considerations</td><td> 
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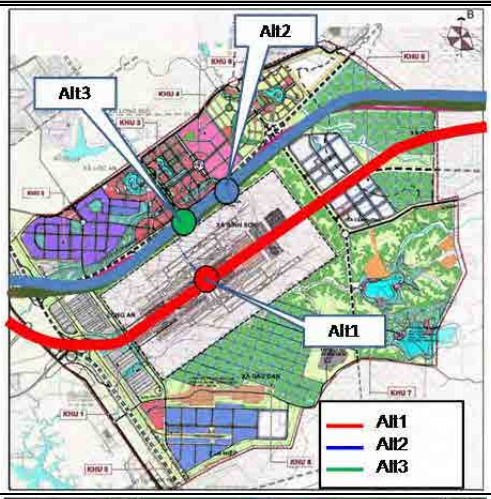
<tr><th>Items</th><th>Alt 1</th><th>Alt 2</th><th>Alt 3</th></tr>
<tr><td>a) Topography</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>b) Geology</td><td>C</td><td>C</td><td>C</td></tr>
<tr><td>C) Hydrology</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>d) Hazard</td><td>A</td><td>C</td><td>B</td></tr>
<tr><td>e) Protected areas and forest</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>f) Noise and vibration</td><td>A</td><td>C</td><td>A</td></tr>
<tr><td>g) Landuse</td><td>A</td><td>B</td><td>B</td></tr>
<tr><td>h) Resettlement</td><td>B</td><td>C</td><td>B</td></tr>
<tr><td>i) Cultural heritages</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>j) Ethnic minorities</td><td>A</td><td>A</td><td>A</td></tr>
</table>
</td></tr>
</table>

Note: A- Better, B- Good, C- Fair
Source: JICA Study Team

**Table 3.4.9 Initial Scoring Results (Dong Nai)**

<table>
<tr><th>Aspect</th><th>Map</th><th>Scoring of Indicators</th></tr>
<tr><td>Connectivity and Integrated Development</td><td> 
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<tr><td>b) Distance from main centers</td><td>C</td><td>B</td><td>A</td></tr>
<tr><td>C) Availability of land for integrated development</td><td>A</td><td>A</td><td>A</td></tr>
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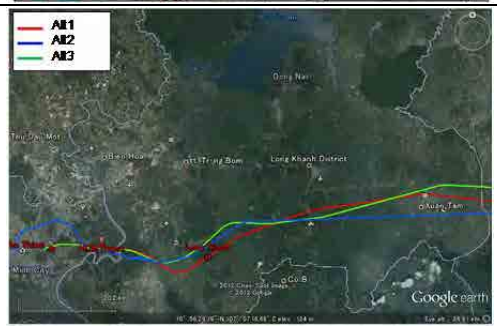
<tr><td>Environmental and Social Considerations</td><td> 
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<tr><td>b) Geology</td><td>C</td><td>C</td><td>C</td></tr>
<tr><td>C) Hydrology</td><td>A</td><td>A</td><td>B</td></tr>
<tr><td>d) Hazard</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>e) Protected areas and forest</td><td>B</td><td>A</td><td>B</td></tr>
<tr><td>f) Noise and vibration</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>g) Landuse</td><td>A</td><td>C</td><td>A</td></tr>
<tr><td>h) Resettlement</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>i) Cultural heritages</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>j) Ethnic minorities</td><td>B</td><td>C</td><td>B</td></tr>
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Note: A- Better, B- Good, C- Fair
Source: JICA Study Team

**Table 3.4.10 Initial Scoring Results (Binh Thuan)**

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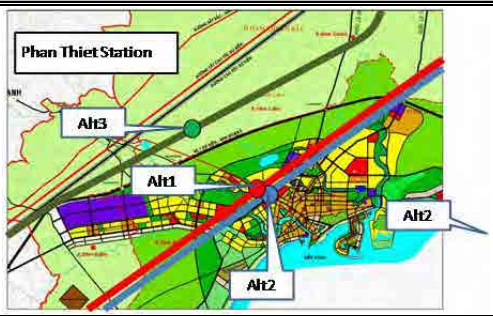
<tr><td>Connectivity and Integrated Development</td><td> 
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<table>
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<tr><td>b) Distance from main centers</td><td>A</td><td>A</td><td>C</td></tr>
<tr><td>C) Availability of land for integrated development</td><td>A</td><td>A</td><td>A</td></tr>
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<table>
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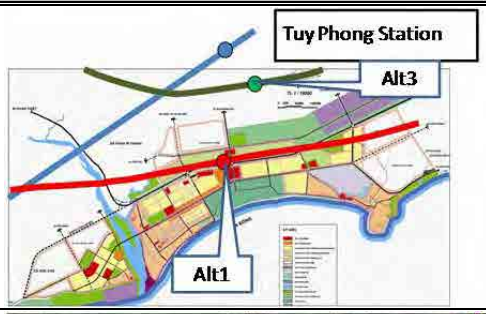
<tr><td></td><td> 
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<tr><td>b) Distance from main centers</td><td>A</td><td>C</td><td>C</td></tr>
<tr><td>C) Availability of land for integrated development</td><td>A</td><td>A</td><td>A</td></tr>
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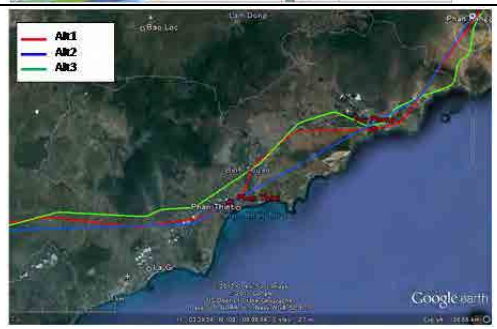
<tr><td>Environmental and Social Considerations</td><td> 
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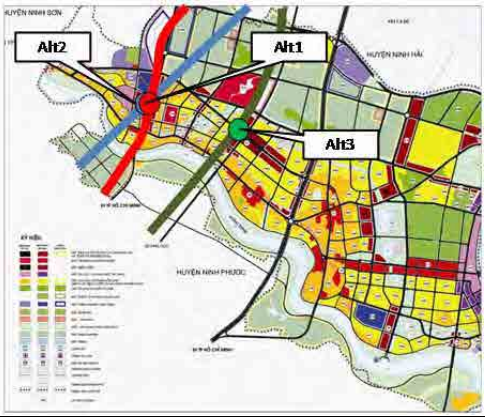
<tr><td>b) Geology</td><td>C</td><td>C</td><td>C</td></tr>
<tr><td>C) Hydrology</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>d) Hazard</td><td>B</td><td>B</td><td>C</td></tr>
<tr><td>e) Protected areas and forest</td><td>A</td><td>A</td><td>B</td></tr>
<tr><td>f) Noise and vibration</td><td>B</td><td>C</td><td>A</td></tr>
<tr><td>g) Landuse</td><td>B</td><td>B</td><td>C</td></tr>
<tr><td>h) Resettlement</td><td>B</td><td>B</td><td>A</td></tr>
<tr><td>i) Cultural heritages</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>j) Ethnic minorities</td><td>B</td><td>B</td><td>C</td></tr>
</table>
</td></tr>
</table>

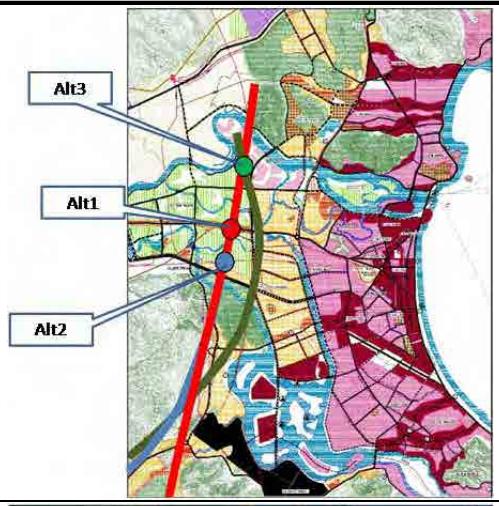
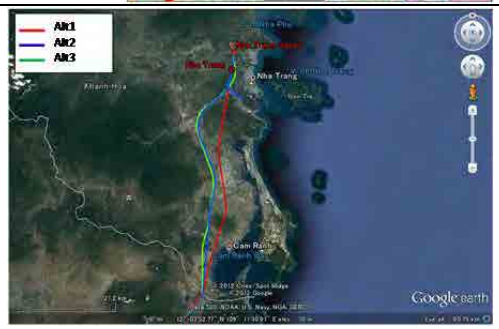
Note: A- Better, B- Good, C- Fair
Source: JICA Study Team

**Table 3.4.11 Initial Scoring Results (Ninh Thuan)**

<table>
<tr><th>Aspect</th><th>Map</th><th>Scoring of Indicators</th></tr>
<tr><td>Connectivity and Integrated Development</td><td> 
</td><td>
<table>
<tr><th>Items</th><th>Alt 1</th><th>Alt 2</th><th>Alt 3</th></tr>
<tr><td>a) Connectivity with other transportation modes</td><td>A</td><td>A</td><td>C</td></tr>
<tr><td>b) Distance from main centers</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>C) Availability of land for integrated development</td><td>B</td><td>B</td><td>A</td></tr>
</table>
</td></tr>
<tr><td>Environmental and Social Considerations</td><td> 
</td><td>
<table>
<tr><th>Items</th><th>Alt 1</th><th>Alt 2</th><th>Alt 3</th></tr>
<tr><td>a) Topography</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>b) Geology</td><td>A</td><td>A</td><td>B</td></tr>
<tr><td>C) Hydrology</td><td>B</td><td>A</td><td>A</td></tr>
<tr><td>d) Hazard</td><td>A</td><td>A</td><td>B</td></tr>
<tr><td>e) Protected areas and forest</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>f) Noise and vibration</td><td>A</td><td>B</td><td>A</td></tr>
<tr><td>g) Landuse</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>h) Resettlement</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>i) Cultural heritages</td><td>A</td><td>C</td><td>A</td></tr>
<tr><td>j) Ethnic minorities</td><td>B</td><td>C</td><td>C</td></tr>
</table>
</td></tr>
</table>

Note: A- Better, B- Good, C- Fair
Source: JICA Study Team

**Table 3.4.12 Initial Scoring Results (Khanh Hoa)**

<table>
<tr><th>Aspect</th><th>Map</th><th>Scoring of Indicators</th></tr>
<tr><td>Connectivity and Integrated Development</td><td> 
</td><td>
<table>
<tr><th>Items</th><th>Alt 1</th><th>Alt 2</th><th>Alt 3</th></tr>
<tr><td>a) Connectivity with other transportation modes</td><td>A</td><td>C</td><td>B</td></tr>
<tr><td>b) Distance from main centers</td><td>A</td><td>A</td><td>C</td></tr>
<tr><td>C) Availability of land for integrated development</td><td>B</td><td>B</td><td>B</td></tr>
</table>
</td></tr>
<tr><td>Environmental and Social Considerations</td><td> 
</td><td>
<table>
<tr><th>Items</th><th>Alt 1</th><th>Alt 2</th><th>Alt 3</th></tr>
<tr><td>a) Topography</td><td>A</td><td>A</td><td>C</td></tr>
<tr><td>b) Geology</td><td>A</td><td>A</td><td>B</td></tr>
<tr><td>C) Hydrology</td><td>B</td><td>C</td><td>C</td></tr>
<tr><td>d) Hazard</td><td>B</td><td>B</td><td>B</td></tr>
<tr><td>e) Protected areas and forest</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>f) Noise and vibration</td><td>A</td><td>A</td><td>B</td></tr>
<tr><td>g) Landuse</td><td>A</td><td>B</td><td>B</td></tr>
<tr><td>h) Resettlement</td><td>B</td><td>B</td><td>C</td></tr>
<tr><td>i) Cultural heritages</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>j) Ethnic minorities</td><td>A</td><td>B</td><td>C</td></tr>
</table>
</td></tr>
</table>

Note: A- Better, B- Good, C- Fair
Source: JICA Study Team

3.38 Table 3.4.13 shows the comparison of three alternatives for the south section based on the initial scoring presented in 2nd SHM in cities/provinces. The scoring of each aspect was conducted in accordance with Table 3.3.12. The 1) Convenience and Integrated Development and 2) Environmental and Social Considerations aspects are evaluated based on the average of the provincial base assessments which are shown in Tables 3.4.8 to 3.4.12. Meanwhile 3) High Speed Serviceability and 4) Economical Efficiency are scored on one target section (the south section from HCMC (Thu Thiem) to Nha Trang). In the same way as the north section, simpler and easy to understand qualitative scoring results were shown at the meetings to solicit comments from the stakeholders mainly focusing on the aspects and items for comparing alternatives.

**Table 3.4.13 Initial Scoring Results of South Section**

| Aspect | Alt1 | Alt2 | Alt3 | Remarks |
|---|---|---|---|---|
| 1) Convenience and Integrated Development | Better | Good | Fair | Summary of provincial base assessment |
| 2) Environmental and Social Considerations | Better | Fair | Good | |
| 3) High Speed Serviceability | Better | Good | Fair | The south section base |
| 4) Economical Efficiency | Low | High | Low | |

Source: JICA Study Team

3.39 In the same way as the north section, Zero-option was also presented and discussed mainly focusing on changes of GHGs and air pollutants emissions. Both GHGs and air pollutants were considered to be increased in case of Zero-option as discussed in the case of the north section.

### 2) 2nd Stakeholder Meetings in 11 Cities/Provinces

3.40 The detailed results of the 2nd SHMs are shown in Chapter 8 of this report. This section summarizes only the implementation record and gives a summary of discussions.

#### (1) Implementation Record of 2nd SHMs

3.41 Table 3.4.14 summarizes the series of the 2nd SHMs conducted in 11 target cities/provinces along the alignment of the planned HSR.

**Table 3.4.14 Implementation Record of the 2nd SHMs**

| Section | City/ Province | HSR Station | Date | No of Participants | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | TOTAL (excl. JICA study team) | Local Gov. | | Business Association | Social Association | Academic Society | Press/TV | Central Gov/VR | JICA Study Team |
| | | | | | Prov. | City/ Dist. | | | | | | |
| North | Hanoi | Ngoc Hoi | 30/7/2012 | 44 | 8 | 1 | 8 | 0 | 2 | 9 | 16 | 13 |
| | Ha Nam | Phu Ly | 27/7/2012 | 40 | 23 | 3 | 3 | 0 | 1 | 4 | 6 | 8 |
| | Nam Dinh | Nam Dinh | 26/7/2012 | 62 | 26 | 17 | 7 | 3 | 0 | 3 | 6 | 9 |
| | Ninh Binh | Ninh Binh | 25/7/2012 | 27 | 16 | 4 | 1 | 0 | 0 | 0 | 6 | 9 |
| | Thanh Hoa | Thanh Hoa | 24/7/2012 | 42 | 11 | 8 | 14 | 2 | 0 | 0 | 7 | 9 |
| | Nghe An | Vinh | 23/7/2012 | 58 | 28 | 10 | 10 | 1 | 1 | 2 | 6 | 9 |
| South | HCMC | Thu Thiem /Hoa Hung | 10/8/2012 | 48 | 9 | 14 | 6 | 1 | 11 | 1 | 6 | 9 |
| | Dong Nai | Long Thanh | 13/7/2012 | 25 | 10 | 4 | 2 | 0 | 0 | 2 | 7 | 6 |
| | Binh Thuan | Tuy Phong, Phan Thiet | 12/7/2012 | 41 | 20 | 11 | 0 | 0 | 0 | 3 | 7 | 6 |
| | Ninh Thuan | Thap Cham | 11/7/2012 | 65 | 21 | 21 | 11 | 3 | 0 | 2 | 7 | 6 |
| | Khanh Hoa | Nha Trang | 9/7/2012 | 46 | 18 | 6 | 14 | 1 | 0 | 0 | 7 | 6 |

Source: JICA Study Team

#### (2) Specific Comments by City and Province in the 2nd SHMs

3.42 Table 3.4.15 summarizes the main discussion points specifically by target city and province along the alignment during the 2nd SHMs and the study's responses and actions addressing said points in the HSR planning.

**Table 3.4.15 Specific Comments by City and Province during the 2nd SHMs**

| Section | City/Province | Main Discussion Points | Responses to Comments |
|---|---|---|---|
| North | Hanoi | • Terminal station options (Hanoi Station or Ngoc Hoi Station).<br>• The alignment in Ha Noi City | • HSR's station will be planned beside Ngoc Hoi station of UMRT Line1<br>• Shift the alignment to be consistent with City's Development Plan |
| | Ha Nam | • The alignment in Ha Nam Province | • Shift the alignment east side of Highway to minimized the social impact by land acquisition<br>• Shift the HSR's station to be consistent with City's Development Plan |
| | Nam Dinh | • The alignment in Nam Dinh Province | • Shift the alignment a little toward west side due to alignment from Ha Nam province and location of Phu Ly station<br>• HSR's station will be planned at crossing point with existing railway |
| | Ninh Binh | • Alignment | • Shift the alignment to mountain area to avoid military lands and populated town.<br>• HSR's station will be planned parallel to current railway & station |

| Section | City/Province | Main Discussion Points | Responses to Comments |
|---|---|---|---|
| | Thanh Hoa | • Alignment passing through Bim Son/Ha Trung (except residential area) | • Shift the alignment to east side of cement factory to avoid important development areas.<br>• HSR's station will be planned at the crossing point with existing railway |
| | Nghe An | • Alignment<br>• The location of HSR's Vinh station and depot | • Shift the alignment considering populated areas and industrial zones.<br>• The learning from Japanese and world's long history of HSR shows the importance of the connection of HSR and the existing railway especially at the terminal stations.<br>• Location of Depot is set at the south of Vinh station. |
| South | HCMC | • Comparison of the station locations in Thu Thiem and Hoa Hung | • In-depth study result shows the advantages / disadvantages of each station location |
| | Dong Nai | • How to ensure the security and safety when HSR runs through the center of LTIA | • In-depth study result shows that the HSR Station location to be in the center of the airport from passengers' convenience point of view and because it will not cause any problem. |
| | Binh Thuan | • To confirm the alignment whether west of Phan Thiet Sta. is on the west side of the NH 1A or not in accordance with the comments by the province prior to SHM | • It was confirmed that the alignment presented in SHM runs on the west side of NH1A parallel with Dau Giay-Phan Thiet express highway. |
| | | • Phan Thiet Station. should be moved outside of the city, to the west | • In-depth study result shows the importance of connecting HSR with existing line for the success of HSR |
| | | • Route between Phan Thiet and Tuy Phong should run straight through the sand area | • In-depth study result shows the difficulties on construction and maintenance when alignment goes through the sand area. |
| | | • To confirm the alignment whether west of Phan Thiet Station is on the west side of the NH1A or not in accordance with the comments by the province prior to SHM | • It was confirmed that the alignment presented in SHM runs on the west side of NH1A parallel with Dau Giay-Phan Thiet Express Highway. |
| | Ninh Thuan | • Station Location and Alignment | • No specific comments requiring actions. |
| | | • Viaduct is preferable to embankment because of agricultural land and hydrology issues | • In-depth study was conducted which clarified the following:<br>• The affected paddy land area is only 0.3% of the total agricultural land in Ninh Thuan Province. Alignment should be evaluated from comprehensive aspects, and viaduct or embankment issues are related especially to balancing resettlement / land acquisition and construction cost.<br>• - 4 box culverts/km will be suitable to solve the hydrology issues |
| | Khanh Hoa | • To confirm if planned provincial administrative area is avoided in accordance with the comments by the province prior to SHM | • It was confirmed that the alignment presented in SHM will not affect the planned administrative area. |

Source: JICA Study Team

### (3) Comments through Questionnaire

3.43 In order to gain more insights from various participants, as much as possible, a questionnaire survey was conducted during the 2nd SHM. The number of valid response was 297 from 11 target cities/provinces. The summary of the questionnaire results is shown in Table 3.4.16.

**Table 3.4.16 Summary of Comments through Questionnaire in the 2nd SHM**

| Theme | Result |
|---|---|
| Project Awareness | 95% were aware of the project. While 99% were in favor of the project, 55% signified HSR as suitable for short-term while 44% favored for long-term plan. |
| Benefits and Impacts | Benefits cited as "most significant" were "high travel speed and time savings (69%)", "safe transport service (72%)", and "increase in tourism (59%)" |
| Convenience and Integrated Development | Results have indicated that Alternative 1 is most advantageous for most provinces |
| Issues and Concerns | While a majority indicated generally a limited impact to natural and social environment, high impacts to certain areas were noted for consideration. Such include "land acquisition and resettlement (49%)", and "displacement of residential and business communities (37%)." |

| | |
|---|---|
| Planning Factors Concerned | Results indicate that "connectivity with other transport modes (83%)" is agreed as most important to consider the location of station, and "transport performance (81%)" is agreed most important for alignment. |

Source: JICA Study Team

### (4) Reflection on Common Comments among Cities and Provinces in the 2nd SHM

3.44 Table 3.4.17 summarizes the major comments which were raised commonly by all 11 target cities/provinces in the 2nd SHM. To respond to these comments, the in-depth study was conducted. The results of the reflection were also presented in the plenary sessions of the 2nd SHM. Details are attached in Appendix 3C.

**Table 3.4.17 Reflection on Common Comments**

| Major Comments | Reflection on Comments |
|---|---|
| [Connectivity]<br>• Indifference to the connectivity<br>• A few km distance of stations (HSR and Existing)<br>• Connectivity with expressway | • Since HSR needs to compete against other transportation modes, the connectivity and convenience is the key of successful HSR.<br>• In this connection, immediate transfer at the station is necessary.<br>• Due to mass transit nature of HSR, even transferring by buses to distant station may not be efficient.<br>• The current condition of the existing railway will be improved at A2 level and it will function as the feeder for the HSR.<br>• Integrated development will be easier at the station with high convenience. |
| [Station Setting (New Station)]<br>Request of new stations | • Current potential stations are selected based on the following criteria;<br>1)Provincial Capitals, if alignment allows<br>2) Larger towns (ex. class III) along the alignment<br>3) Special location for passengers' convenience.<br>• Other stations may be developed later if there is 1) enough demand with 2) potential of integrated development. |
| [Project Schedule]<br>Request of new stations Comments on the timing of investment for HSR such as "it should be developed as soon as possible, and "it should be considered more in the future". | • The timing of the investment is to be carefully studied , based on the demand, the growth of GDP and individual income level.<br>• In terms of the demand, HSR is considered to be required by 2030 to bear the high demand of traffic along the north-south corridor. |
| [Structure]<br>• Application of viaduct in city area<br>Concerns on embankment such as division of community and flooding considering the existing embankments (ex. National highways) | • Viaduct will be applied in populated areas.<br>• Proposed embankment for HSR: box culverts to be applied to ensure the mobility of people and water flow so that community integrity will not be affected and flood will not be worse. |
| [Noise pollution issue]<br>Comments based on the tendency of demography such as "to the eastern side of the province, more residents", "more population near the national highway". | • Resettlement was evaluated by the actual counting of affected buildings based on the latest topographic map (1:10,000).<br>• The other sources of updated information were utilized for avoiding populated areas. |

Source: JICA Study Team

### (5) Reflection on Major Comments of Particular City and Province in the 2nd SHM

3.45 Regarding the comments raised by particular city and province, the in-depth study and reflection on comments were done as summarized in Table 3.4.18. The results of the reflections were also presented in the plenary sessions of the 2nd SHM. Details are attached in Appendix 3D.

**Table 3.4.18 Reflection on Major Comments of Particular City/Province**

| Section | City/Province | Major Comments | Clarification on Comments |
|---|---|---|---|
| North | Hanoi | Terminal station options (Hanoi Station or Ngoc Hoi Station).<br>• Terminal station option (Ngoc Hoi or Hanoi) and the through operation option was explained for the discussion | • HSR's station will be planned beside Ngoc Hoi station of UMRT Line1<br>• Hanoi and Ngoc Hoi can be connected by UMRT Line 1, not by HSR<br>• Through operation will be further discussed |
| | Nghe An | Location of Terminal Station in Nghe An Province<br>• There was strong argument from the province that they want to have station outside the city area (Alternative 3)<br>• The province was afraid of land | • Convenience is the key for successful HSR development.<br>• Especially since Vinh is the terminal of the north section, passengers from Hanoi will need to change trains at Vinh. The same station transfer is a must to consider in mobility by trains. The transfer by connecting bus is possible, but it will be very inconvenient considering the mass transit nature of HSR. Bus |

| Section | City/Province | Major Comments | Clarification on Comments |
|---|---|---|---|
| | | acquisition in the city center in case of Alternative 1 | system cannot handle such volume of passenger effectively<br>• By arranging viaduct over the existing railway, the land acquisition can be minimized. |
| South | HCMC | Location of Terminal Station<br>• Thu Thiem or Hoa Hung | • Comparative analysis was conducted from the view points of accessibility, station plaza, connectivity, resettlement, noise, cost and so on), |
| | Dong Nai | Location of Long Thanh Airport<br>• The concern of train safety in case of the station to be located in the center of the airport was discussed. | • Comparative study on the station location (center or outside of the airport) was conducted from the view points of demand, connectivity, security, road access, noise, resettlement and so on.<br>• It was explained that large scale airports in the world have developed the HSR and connect it with airport.<br>• Safety issue was explained from the Airport Accident Analysis Result, showing that the area parallel to the runway is safe. |
| | Binh Thuan | Alignment through Sandy Area<br>• the straight alignment through sandy area was proposed by stakeholders | • The nature of sand dunes there were explained with photos and drawing that they keep moving.<br>• The foundation in the sand is not stable after sand dunes moves away |
| | Ninh Thuan | Impact on Paddy Area<br>• The provincial official showed their concern on the land acquisition | • The amount of paddy area to be acquired was shown quantitatively to see that the proportion to the total paddy area in the province is small<br>• By changing the structure from embankment to viaduct, the difference of the project cost was shown quantitatively<br>• Environmental and social considerations of three alternatives were discussed comprehensively. |
| | | Hydrological Condition<br>• Concern on flood by the embankment structure was shown by stakeholders | • The design of the embankment was explained to clarify its advantage in function of drainage, safety control, landscape improvement and local convenience.<br>• The calculation of necessary number of culverts was explained to show that the designed structure was good enough for the drainage control. |

Source: JICA Study Team

## 3.5 Revision of Alternatives, Information Sharing and Re-Scoring

### 1) North Section

#### (1) Follow-up Meetings and Follow-up Reports

3.46 After the 2nd SHM, the revised plan on the alignment and station location was prepared. Then, follow-up meetings with all the city/provincial peoples' committees were held for more consultations. Through these consultations with local authorities, further modification was made in accordance with the local plans, such as city development plan and land use plan, and needs.

3.47 Reflecting on the comments of the 2nd SHM and the above follow-up meetings, it was considered that revision of Alternative 1 was necessary. Then, the Alternative 1 (revised) was prepared in accordance with the requests of stakeholders especially the city/provincial governments. The follow up report on this Alternative 1 (revised) was prepared which incorporated comments from each city/province together with the 1:10,000 map. This report was sent to each city/province for their comments. The local governments of Hanoi, Ha Nam, Nam Dinh and Nghe An sent back their official comments by the letter showing their general agreement with the revision of Alternative 1: Hanoi, Ha Nam, Nam Dinh and Nghe An.

#### (2) Re-scoring

3.48 Based on Alternative 1 (revised), the comparative analysis of the three alternatives was updated. The result is summarized in Tables 3.5.1 and 3.5.2. Alternative 1 (revised) was scored better than Alternatives 2 and 3 in terms of 1) Convenience and Integrated Development, 2) Environmental and Social Considerations, and 3) High-speed Serviceability, while Alternative 3 is advantageous in 4) Economical Efficiency.

3.49 Regarding zero-option, by the change of modal split, increase in emission of GHGs ($CO_2$) and air pollutants was still considered as discussed in the 2nd SHMs in cities/provinces.

**Table 3.5.1 Updated Comparative Analysis (North Section, Provincial-wise)**

| Convenience and Integrated Development | Alt1 (rev) | Alt2 | Alt3 |
|---|---|---|---|
| OVERALL EVLUATION | A | B | B |
| 1) Hanoi | A | A | A |
| 2) Ha Nam | A | B | A |
| 3) Nam Dinh | A | C | C |
| 4) Ninh Binh | B | C | C |
| 5) Thanh Hoa | A | B | C |
| 6) Nghe An | A | C | B |
| **Environmental and Social Considerations** | **Alt1 (rev)** | **Alt2** | **Alt3** |
| OVERALL EVLUATION | A | B | B |
| 1) Hanoi | A | A | A |
| 2) Ha Nam | A | A | A |
| 3) Nam Dinh | A | B | B |
| 4) Ninh Binh | A | A | A |
| 5) Thanh Hoa | A | B | B |
| 6) Nghe An | A | A | A |

Note: A- Better, B- Good, C- Fair, D- No advantage Alt: Alternative
Source: JICA Study Team

**Table 3.5.2 Updated Comparative Analysis (North Section, Section-wise)**

| Aspects/Items | Alt1 (rev) | Alt2 | Alt3 |
|---|---|---|---|
| OVERALL EVALUATION | A | C | B |
| 1) Convenience and Integrated Development | A | B | B |
| 2) Environment and Social Considerations | A | B | B |
| 2-1 Natural Environment | (A) | (B) | (B) |
| 2-2 Living Environment | (A) | (C) | (B) |
| 2-3 Social Environment | (A) | (A) | (A) |
| 3) High Speed Serviceability | A | B | C |
| 4) Economical Efficiency | B | D | A |

Note: A- Better, B- Good, C- Fair, D- No advantage; Alt- Alternative
Source: JICA Study Team

## 2) South Section

### (1) Follow-up Reports

3.50 After the 2nd SHM, the comments were studied and the follow up report which incorporated comments from each city/province was prepared and sent together with the 1:10,000 maps to each city/province seeking for their comments. Through careful reflection on the comments, it was considered that no revision is required as the commented issues were already taken into consideration in initial Alternative 1. The provinces of Khanh Hoa, Ninh Thuan and Binh Thuan sent back their official comments by the letter. These comments were either incorporated in the planning or addressed in the reports.

### (2) Re-scoring

3.51 Based on Alternatives 1, 2 and 3 presented in the 2nd SHM, a comparative analysis of the three alternatives was conducted. The result is summarized in Tables 3.5.3 and 3.5.4. Alternative 1 was scored better than Alternatives 2 and 3 in terms of 1) Convenience and Integrated Development, 2) Environmental and Social Considerations, and 3) High-speed Serviceability, while Alternative 3 is advantageous in 4) Economical Efficiency.

3.52 Regarding zero-option, by the change of modal split, increase in emission of GHGs ($CO_2$) and air pollutants was still considered as discussed in the 2nd SHMs in cities/provinces.

**Table 3.5.3 Updated Comparative Analysis (South Section, Provincial-wise)**

| Convenience and Integrated Development | Alt1 | Alt2 | Alt3 |
|---|---|---|---|
| OVERALL EVLUATION | A | B | B |
| 1) HCMC | A | B | A |
| 2) Dong Nai | A | B | A |
| 3) Binh Thuan (two stations) | A, B | A, C | C, C |
| 4) Ninh Thuan | A | A | A |
| 5) Khanh Hoa | B | C | C |
| **Environmental and Social Considerations** | **Alt1** | **Alt2** | **Alt3** |
| OVERALL EVLUATION | A | B | B |
| 1) HCMC | A | B | A |
| 2) Dong Nai | A | A | A |
| 3) Binh Thuan | B | A | B |
| 4) Ninh Thuan | A | B | B |
| 5) Khanh Hoa | A | B | C |

Note: A- Better, B- Good, C- Fair, D- No advantage; Alt- Alternative
Source: JICA Study Team

**Table 3.5.4 Updated Comparative Analysis (South Section, Section-wise)**

| Convenience and Integrated Development | Alt1 | Alt2 | Alt3 |
|---|---|---|---|
| OVERALL EVALUATION | A | C | D |
| 1) Convenience and Integrated Development | A | B | B |
| 2) Environment and Social Considerations | A | B | B |
| 2-1 Natural Environment | (A) | (A) | (C) |
| 2-2 Living Environment | (B) | (C) | (B) |
| 2-3 Social Environment | (A) | (C) | (B) |
| 3) High Speed Serviceability | A | B | D |
| 4) Economical Efficiency | B | C | A |

Note: A- Better, B- Good, C- Fair, D- No advantage; Alt- Alternative
Source: JICA Study Team

## 3.6 Discussion on Updated Alternatives at Plenary Sessions of the 2nd Stakeholder Meeting

3.53 The plenary sessions of the 2nd SHM were held twice, one for the north section in Hanoi and the other for the south section in HCMC. The objectives of the plenary sessions were: 1) the information sharing and consensus building among cities/provinces of each target section in order to select an optimal alternative, and 2) to invite a wide range of stakeholders for information sharing and explanation including the representatives from the central government agencies, resource persons, donors and NGOs.

3.54 The record of the plenary sessions is given in Chapter 8 of this report, while the summaries are provided below. Most of the participants in the plenary sessions of the 2nd SHM showed preference for Alternative 1.

### 1) North Section

3.55 Table 3.6.1 shows the summary of the comments in the plenary sessions of the 2nd SHM for the north section.

**Table 3.6.1 Comments and Suggestions in the Plenary Session for the North Section**

| City/ Province | Comment | Response from VR/JICA Study Team |
|---|---|---|
| Hanoi | (1) The Ngoc Hoi Station as the terminal station was agreed upon because of the high cost to connect to the current Hanoi Station but consideration is given to the Road of No.4 connection | (1) The Ngoc Hoi Station will be constructed as the terminal station of Hanoi City with provision for transfer to the urban railway of Line-1 Station.<br>Connecting to current Hanoi Station will be costly for such an underground tunnel plan, therefore the connective plan will be implemented as necessary at a future time.<br>This new station should have a station plaza layout designed for easy transfer to Line-1 and road No.4. |
| Ha Nam | (1) Ha Nam Province has agreed on Alternative 1 (revised) in general. However, some points should be studied more as follows:<br>・Shift alignment to the east side to avoid the planned Honda's Factory.<br>・The alignment crosses many planned high-ways and so on. | (1) The alignment should be shifted or designed to avoid necessary/ important places, as much as possible, with due consideration for HSR operation curve radius of R ≧ 6,000m.The alignment in next planning stage, i.e., Pre F/S Study by Vietnamese consultant, should be designed with up-to-date information of land usage.<br>Because of viaduct structural plan of HSR, the crossing point with High-way etc. will be erected by PC girder bridge for deduct the influence to other structures. |
| Nam Dinh | (1) Nam Dinh Province has agreed on Alternative 1 (revised) in general. This station would not only serve Nam Dinh Province but also Thai Binh Province. Hence, it is strongly suggested that a big scale station be constructed. | (1) The HSR new station shall be appropriately designed and constructed for the HSR operation, i.e., a world standard station. |
| Ninh Binh | (1) Ninh Binh Province generally agreed on the Alternative 1 (revised) and expected early approval by higher authorities for a new city development plan.<br>(2) Further study should be required for the location of station because a new highway has been planned. | (1) An early approval by higher authorities is desired for the alignment plan.<br>(2) New highway viaduct construction has been taken into consideration of Alternative 1 (revised). The HSR structures shall go under a road viaduct and the station shall be constructed at-grade adjacent to the current railway. |
| Thanh Hoa | (1)The province has prepared a city development plan when KOICA conducted the study in 2007. Alternatives 1 and 2 would conflict with these plans including the station location.<br>(2) The Alternative 1(revised) runs closely to the local railway, a highway and road. Therefore, land use for agriculture cultivation and others will be met with some difficulties. The province recommended shifting the alignment to the west side of the existing railway to ensure a larger distance for the expected development in future.<br>(3) The location of Thanh Hoa Station is in accordance with the city's master plan as approved by the Prime Minister in 2009. The distance of the station to the city center is about 4km. | (1)(3) As planned in Alternative 1 (revised), the station location shall provide good connectivity with the local railway and easy access to city center. The existing railway will be developed in line with the rapid growth of the Vietnamese economy and will carry a high passenger volume during the HSR planning period. Therefore, direct connection between the HSR and the local railway should be considered as quite important.<br>(2) The land use plan will be considered as a serious issue. When HSR is implemented, the alignment shall be more carefully studied with related local authorities and agencies. The alignment shall be finalized with the land use plan in future to ensure the HSR operation at V-350Km/h, i.e., making sure of R≧6,000m. |

| City/ Province | Comment | Response from VR/JICA Study Team |
|---|---|---|
| Nghe An | (1) The alignment should run on the west side of existing railway similar to Alternative 3 and the crossing condition at a cement factory should be checked.<br>(2) The location of HSR station was agreed upon and early approval is expected from higher authorities for the new city development plan. The new city development plan has already started.<br>(3) Further study about the connection between HSR and the roads, airport and other transportation modes is necessary. | (1) Alternative 1 (revised) will not affect the cement factory. Northern part of Nghe An Province has an industrial development planned and further study is required in the future for considering the location of a new station between Thanh Hoa and Vinh.<br>(2) An early approval from higher authorities will be highly desired.<br>(3) The connectivity with other transportation modes will be an important issue. For this reason, station plaza layout plan and other transportation plan will be considered very important study in the future. |

Source: JICA Study Team

### 2) South Section

3.56 Table 3.6.2 shows the summary of the comments in the plenary sessions of the 2nd SHM for the south section.

**Table 3.6.2 Comments and Suggestions in the Plenary Session for the South Section**

| City/ Province | Comment | Response from VR/JICA Study Team |
|---|---|---|
| HCMC | (i) HCMC considers that the terminal station for the HSR should be the Thu Thiem Station. The suggested station location in Alternative 1 coincides with the plan of the city.<br>(ii) HCMC considers that the Alternative 1 reflects well the concept of HCMC. | (i)(ii) It was evaluated that Thu Thiem Station is the optimal station location considered from the view points of convenience and social impacts such as resettlement and noise pollution. |
| Dong Nai | (i) HSR alignment should be on the same corridor with expressway HCM – Dau Giay, Bien – Phan Thiet in order to minimize land acquisition.<br>(ii) It is suggested that the intersection between HSR and local roads, especially with the expressway should be updated in Alternative 1. | (i) HSR alignment is planned to run parallel with Long Thanh – Dau Giay Expressway from Thu Thiem area to Long Thanh area. As the HSR Long Thanh Station location is determined in the center of Long Thanh international airport, the alignment starts to run far from the expressway when getting near to the NH51 until the center of the airport.<br>(ii) The intersection of HSR and local roads are planned already considering the latest information of the plans of Dong Nai Province. In the next design stage, all of the information should be updated and considered more in detail.<br>As a result, there will be no modification in HSR alignment. |
| Binh Thuan | (i) HSR station should be moved towards the west side. In order to ensure connectivity, the province planned to construct an arterial road of 49m wide to connect with the city center, and in the future, the HSR station area would become a developed center of Phan Thiet.<br>(ii) Shifting the HSR station to the west would result in the shift in alignment towards the west. This shift in the alignment would reduce the impacts on industrial zones and residential zones. | It is important to connect the HSR and existing railway. Thus, the HSR station location should be at Phan Thiet existing station for the following reasons:<br>(1) Shifting HSR alignment to the west will affect the new large industrial zone under construction along NH1A and Province Road 707.<br>(2) In order to keep HSR Route out of this industrial zone, the station location should be located near to Muong Man Station which is around 10km far from the city center.<br>(3) The viaduct structure is planned for Alternative 1 when running through Phan Thiet city area to minimize the impacts on existing industrial zone and residential area.<br>More detailed explanations about the station location and route plan will be written in the final report and there will be no modification in HSR alignment. |
| Ninh Thuan | (i) It is said that the slope is steep from the west to the east in Ninh Thuan. Therefore, in addition to safety, flood drainage must be considered.<br>(ii) In order to reduce land acquisition, flood drainage and traffic safety, the provincial representative agreed on the construction of viaducts in the residential zones. | The calculation of rainfall discharge along HSR alignment including Ninh Thuan area is conducted, and a sufficient number of box culverts for drainage is planned accordingly.<br>The viaduct structure is selected in Alternative 1 when running through the city area to minimize the impacts on land acquisition, traffic safety, etc. |
| Khanh Hoa | (i) Regarding the station location, the provincial representative agreed with Alternative 1 and suggested combining the HSR station and the existing station.<br>(ii) HSR Route through Cam Duc and Cam Ranh runs on the east side of the existing railway which does not match with the local planning.<br>(iii) Regarding depot, it is suggested that the JICA | (i) In the Plenary SHM, Nha Trang Station location of Alternative 1 was agreed upon. However, reiterating the comments in the letter from Khanh Hoa Province, the station location should be shifted to the side of the planned 60m wide road to Lam Dong. Considering the importance of connecting the HSR and the existing railway, and also the approval in the meeting with the chairman of Khanh Hoa Province, it is recommended that the HSR station location be at the crossing point of HSR and the existing railway. |

| City/ Province | Comment | Response from VR/JICA Study Team |
|---|---|---|
| | study team presents the connection between Nha Trang Station and the depot because this was a populated area. He noted that the depot area is a flood prone area. | (ii) The route through Cam Ranh area is determined to avoid residential areas and to be as straight as possible. The social impact of Alternative1 is less than Alternative 2 route as Alternative 2 route is running along the NH1A that cause more impact on the resettlement. Moreover the route length of Alternative 2 is around 3km longer than that of Alternative 1, which means more construction cost are needed and this may affect the feasibility and the investment schedule of the project.<br>(iii) Ground height of the depot will be determined taking flood history into account. |

Source: JICA Study Team

### 3) Zero-option

3.57 In like manner as the 2nd SHM in cities/provinces, the zero-option was explained mainly focusing on the impact on GHGs and air pollutants emissions. No participants recommended the zero-option in the meetings.

## 3.7 Final Evaluation

### 1) Final Scoring of Alternatives

3.58 For more clear understanding of stakeholders, the final scoring of the alternatives was conducted. At that time, upon receiving advices from JICA Advisory Committee for Environment and Social Considerations (see Appendix 9A), final scoring was prepared including the zero-option in the comparison table together with Alternatives 1, 2 and 3.

3.59 Considering the objective of the comparison of alternatives with zero-option, “air pollution” in living environment and “regional development” in economical efficiency were added in the comparison items. This was because the original comparison aspects and items were prepared in order to assess the positive and negative impacts by the differences of alignments and stations, and these additions were needed to compare alignments and stations alternatives and the zero-option. Air quality would not be affected much by the alternatives of alignments and stations (see Appendix 3A), however, the HSR development alternatives and zero-option would affect air quality differently. In addition, the contribution to regional development by the HSR development alternatives and zero-option would be significantly different.

3.60 In case there is no HSR to meet the growing traffic demand (the zero-option), improvement of other transportation modes would be necessary. For example, necessary expansion of road network and improvement of existing railway would require investment and cause negative impacts on natural/living/social environment. In order to meet not only the demand in quantity, but also the demand in quality (high-speed with comfort) of transportation, further expansion of air transportation network may also be required with the expansion of airports (such as in the number of runways) and more aircrafts, which would also cause negative impacts such as noise, land acquisition and resettlement together with high investment. However, convenience and integrated development as well as high speed serviceability of HSR was still evaluated to be more advantageous than other transportation modes. The impact on natural and social environment is expected, however, the scale of the impact is unknown without deciding the detail plan of road network expansion, existing railway upgrade and etc. Considering that the alignment of HSR alternatives were planned to run in parallel (to some extent) with the existing railway, national highways and planned expressway under construction to connect the major cities, the average of impacts by Alternatives 1, 2, and 3 was applied as the impact by the zero-option natural and social environment (except for the hydrology and residential/urban area). The negative impact on hydrology caused by the existing embankment of roads (national highway and expressway under construction) was expected to be caused similarly by the expansion of the road network. Impact on residential/urban area was expected since the expansion of width of existing national highway and railway would cause significant resettlement impact due to the concentrated settlements along the existing road and railway. Impact on pollution was expected since it would be worse by the zero-option since the increase of the traffic is required to meet the passenger demand.

3.61 Tables 3.7.1 and 3.7.2 show the final scoring result of the north section and the south section, respectively. This scoring is based on the standardized figures which are adjusted statistically in order to make the summing up and comparison more objective and persuasive. The scoring without statistic adjustment (raw figure, scored following the method explained in Tables 3.3.6 to 3.3.12) and standardized figures (adjustment calculation was done on raw figure utilizing average and standard deviation) with more

detail numbers are discussed in Appendix 3E (the north section) and Appendix 3F (the south section).

**Table 3.7.1 Final Scoring Result of North Section (Standardized)**

| Aspect | Alt1 (revised) | Alt2 | Alt3 | Zero-option |
|---|---|---|---|---|
| Overall Evaluation | A | B | C | D |
| 1) Convenience and Integrated Development | A | B | C | D |
| 2) Environmental and Social Considerations | A | B | C | D |
| 2)-1 Natural Environment | (B) | (C) | (C) | (C) |
| 2)-2 Living Environment | (A) | (B) | (A) | (D) |
| 2)-3 Social Environment | (B) | (C) | (D) | (A) |
| 3) High Speed Serviceability | A | B | C | D |
| 4) Economical Efficiency | B | C | B | C |

Note: A-Better, B-Good, C-Fair, D-No advantage, Alt-Alternative
Source: JICA Study Team

**Table 3.7.2 Final Scoring Result of South Section (Standardized)**

| Aspect | Alt1 | Alt2 | Alt3 | Zero-option |
|---|---|---|---|---|
| Overall Evaluation | A | B | D | D |
| 1) Convenience and Integrated Development | A | B | C | D |
| 2) Environmental and Social Considerations | A | B | C | D |
| 2)-1 Natural Environment | (A) | (A) | (D) | (C) |
| 2)-2 Living Environment | (A) | (B) | (A) | (D) |
| 2)-3 Social Environment | (A) | (D) | (C) | (C) |
| 3) High Speed Serviceability | A | B | C | D |
| 4) Economical Efficiency | B | C | B | C |

Note: A-Better, B-Good, C-Fair, D-No advantage, Alt-Alternative
Source: JICA Study Team

3.62 Both of the results of raw figures and standardized figures suggested that the optimal alternative is Alternative 1 (revised) for the north section and Alternative 1 for the south section. By scoring together with the zero-option and the standardization of scores, the result and order of Alternative 2 and 3 are slightly changed from in the north section from Table 3.5.2 though the optimal options are the same in both of the sections (Tables 3.5.2 and 3.5.4). The final result of scoring is summarized in Appendix 3G.

### 2) Sensitivity Analysis

3.63 In order to confirm the final scoring, sensitivity analysis was conducted by changing the weighting on the scoring aspects. Analysis was made from three view points of emphasizing environment, development and investment.

3.64 Based on the scoring results shown in Tables 3.7.1 and 3.7.2 (namely, base case), sensitivity analysis was conducted for the following cases as is in Tables 3.7.3 and 3.7.4, namely, one case emphasizing on the minimization of environment and social impact (Environment Conscious), one case on the maximization of development impact (Development Conscious), and the other case on cost reduction (Cost Conscious). The analysis was done for two rates of intensity for three cases of 50% and 100%. The detail calculation of the sensitivity analysis is attached as Appendix 3H.

3.65 Table 3.7.3 shows the result of the sensitivity analysis utilizing raw figures (without statistical adjustment), and Table 3.7.4 shows the result utilizing standardized figures.

3.66 All results based on both of the raw figures and the standardized figures showed the same optimal alternative as the base case (Alternative 1(revised) for the north, and

Alternative 1 for the south). Regarding the ranking (raw figure), Alternative 2 was evaluated better than Alternative 3 in the Environment Conscious (100%) case. In the ranking of standardized figure, the evaluation of Alternative 3 was evaluated better than zero-option in the Cost Conscious case (50% and 100%).

**Table 3.7.3 Conditions and Results of Sensitivity Analysis (Raw Figure)**

| Case | Condition | Result (Ranking) |
|---|---|---|
| Base Case | | [North] Alt1(revised)-Alt3-Alt2-Zero<br>[South] Alt1-Alt3-Alt2-Zero |
| Standardized Figure / Environment Conscious (50%) | 1. Convenience and Integrated Development: -20%<br>2. Environment and Social Considerations: +50%<br>3. High Speed Serviceability and Engineering: -10%<br>4. Construction Cost: -20% | The same order as the base case |
| Standardized Figure / Environment Conscious (100%) | 1. Convenience and Integrated Development: -40%<br>2. Environment and Social Considerations: +100%<br>3. High Speed Serviceability and Engineering: -20%<br>4. Construction Cost: -40% | [North] The same order as the base case<br>[South] Alt1 -**Alt2**-**Alt3**-Zero |
| Standardized Figure / Development Conscious (50%) | 1. Convenience and Integrated Development: +40%<br>2. Environment and Social Considerations: -30%<br>3. High Speed Serviceability and Engineering: +10%<br>4. Construction Cost: -20% | The same order as the base case. |
| Standardized Figure / Development Conscious (100%) | 1. Convenience and Integrated Development: +80%<br>2. Environment and Social Considerations: -60%<br>3. High Speed Serviceability and Engineering: +20%<br>4. Construction Cost: -40% | The same order as the base case. |
| Standardized Figure / Cost Conscious (50%) | 1. Convenience and Integrated Development: -10%<br>2. Environment and Social Considerations: -20%<br>3. High Speed Serviceability and Engineering: -20%<br>4. Construction Cost: +50% | The same order as the base case. |
| Standardized Figure / Cost Conscious (100%) | 1. Convenience and Integrated Development: -20%<br>2. Environment and Social Considerations: -40%<br>3. High Speed Serviceability and Engineering: -40%<br>4. Construction Cost: +100% | The same order as the base case. |

Note: Base Case means the scoring result shown in Tables 3.7.1 and 3.7.2 without any weighting among aspects.
Bold and underlined alternative means that its ranking is changed by the case.
Source: JICA Study Team

**Table 3.7.4 Conditions and Results of Sensitivity Analysis (Standardized Figure)**

| Case | Condition | Result (Ranking) |
|---|---|---|
| Base Case | | [North] Alt1(rev)-Alt2-Alt3-Zero<br>[South] Alt1-Alt2-Alt3-Zero |
| Standardized Figure / Environment Conscious (50%) | 1. Convenience and Integrated Development: -20%<br>2. Environment and Social Considerations: +50%<br>3. High Speed Serviceability and Engineering: -10%<br>4. Construction Cost: -20% | The same order as the base case. |
| Standardized Figure / Environment Conscious (100%) | 1. Convenience and Integrated Development: -40%<br>2. Environment and Social Considerations: +100%<br>3. High Speed Serviceability and Engineering: -20%<br>4. Construction Cost: -40% | The same order as the base case. |
| Standardized Figure / Development Conscious (50%) | 1. Convenience and Integrated Development: +40%<br>2. Environment and Social Considerations: -30%<br>3. High Speed Serviceability and Engineering: +10%<br>4. Construction Cost: -20% | The same order as the base case. |
| Standardized Figure / Development Conscious (100%) | 1. Convenience and Integrated Development: +80%<br>2. Environment and Social Considerations: -60%<br>3. High Speed Serviceability and Engineering: +20%<br>4. Construction Cost: -40% | The same order as the base case. |
| Standardized Figure / Cost Conscious (50%) | 1. Convenience and Integrated Development: -10%<br>2. Environment and Social Considerations: -20%<br>3. High Speed Serviceability and Engineering: -20%<br>4. Construction Cost: +50% | [North] Alt1(rev)-Alt3-Alt2-Zero<br>[South] The same order as the base case. |

| Case | Condition | Result (Ranking) |
|---|---|---|
| Standardized Figure / Cost Conscious (100%) | 1. Convenience and Integrated Development: -20%<br>2. Environment and Social Considerations: -40%<br>3. High Speed Serviceability and Engineering: -40%<br>4. Construction Cost: +100% | [North] Alt1(rev)-Alt3-Alt2-Zero<br>[South] Alt1-Alt3-Alt2-Zero |

Note: Base Case means the scoring result shown in Tables 3.7.1 and 3.7.2 without any weighting among aspects.
Bold and underlined alternative means that its ranking is changed by the case.
Source: JICA Study Team

## 3.8 Selection of Optimal Alternative

3.67 The majority of comments from the participants of the plenary session of the 2nd SHM were giving support to Alternative 1(revised) in the north section and Alternative 1 in the south section. The scoring result indicated that Alternative 1(revised) in the north and Alternative 1 in the south should be the optimal alternative from a comprehensive point of view. The sensitivity analysis also showed that the advantage of these optimal alternatives would not be changed by different weighting conditions. Thus, Alternative 1(revised) in the north section and Alternative 1 in the south section were selected as the optimal alternative.

# 4 PROVISIONAL SCOPING ON THE OPTIMAL ALTERNATIVE

## 4.1 Scope of Provisional Scoping

### 1) Supplemental Baseline Survey on the Area Adjacent to the Optimal Alignment

4.1 Upon selecting the optimal alternative (alignment and station locations) through the comparison exercise of alternatives as discussed in Chapter 3, the collected data and information of the baseline survey were reviewed for provisional scoping. In addition, the supplemental data and information related to the optimal alignment, especially in terms of the potentially affected sensitive areas and facilities along the alignment, were collected. A field reconnaissance was also conducted.

### 2) Provisional Scoping

4.2 Based on the additional input and analysis of the information, significant and potentially significant impacts were assessed along the optimal alternative. Potential impact of each environmental and social item was rated for each city and province and city/provincial wise rating tables were prepared. The results of city/ provincial wise rating were summarized for each target section, namely the north section (Hanoi – Vinh) and the south section (HCMC – Nha Trang). This provisional scoping result can be utilized for the future implementation of an EIA after thorough review of it based on the latest information.

### 3) Preliminary Study on Mitigation Measures

4.3 On the scoped items for each section, preliminary study on mitigation measures was conducted. These mitigation measures are conceptual based on the provisional scoping, and it should be further updated and finalized after the provisional scoping is updated in the EIA.

### 4) Preliminary Study on Monitoring Framework

4.4 On the scoped items for each section, preliminary study on monitoring framework was conducted. In the next step of the HSR Projects, the monitoring framework should be updated based on the revised scoping and mitigation measures, which is to be studied in the EIA.

### 5) Preparation of Technical Requirements as Part of TORs for EIA to be Conducted in the Future Stage

4.5 On the scoped items for each section, technical requirements were prepared as part of TORs for an EIA to be conducted in the future stage. It should be noted that these technical requirements should be reviewed and updated later based on the latest information.

## 4.2 Methodology of Provisional Scoping

4.6 The methodology for provisional scoping in this study is summarized in two steps as explained below.

### 1) Methodology of Supplemental Baseline Survey

#### (1) Collection and Analysis of Secondary Data and Information

4.7 The following supplemental data were collected and summarized utilizing the baseline survey result (see Chapter 2), Internet, visit to national and local governments, environmental experts, and other documents/reports: (i) laws and regulations relating to environmental and social considerations; (ii) environmental pollution; (iii) potential pollution sources; (iv) natural environment; (v) social conditions; and (vi) sensitive facilities and areas.

4.8 Sensitive facilities include schools, hospitals, religious facilities, factory with precision machines which requires an area free from noise and vibration pollution.

#### (2) Field Reconnaissance

4.9 With regard to identifying the data for (iii) and (vi) above, field reconnaissance was conducted to confirm the situation at the site. Likewise, interaction with the relevant district and commune governments was done.

#### (3) Consultations with Experts, NGOs and Other Stakeholders

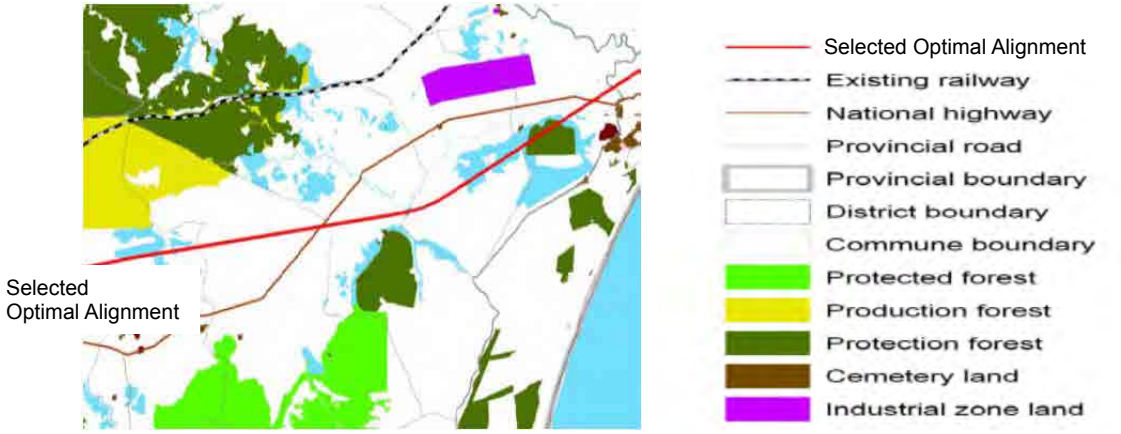
4.10 Consultation was conducted with some resource persons including the city/provincial staff of DONREs, DARDs, DOCSTs and environmental NGOs, namely, (i) Birdlife International; (ii) International Union for Conservation of Nature (IUCN), and (iii) World Wild Fund (WWF) in Vietnam. Proposed alignment was also shown to these experts in order to collect information on the sensitive areas to be considered for evaluation. The results of consultation with NGOs are given in Appendix 4A.

### 2) Methodology of Provisional Scoping

#### (1) Preparation of Overlay Maps

4.11 The environmental sensitivity maps utilized to select the optimal alternative (refer to Chapter 3 and TR 4), were likewise utilized to conduct provisional scoping to identify the impact on protected areas (including information on special-use forest, protection forest, production forest, Important Bird Area/IBA and Endemic Bird Area/EBA) and residential/urban areas. Figure 4.2.1 shows an example of the forest map to identify the impact on a protected area (protected forest or special-use forest, protection forest, and production forest).

4.12 Besides the environmental sensitivity maps, sensitive locations and facilities along the alignment were identified and shown on the map based on the information collected by the survey above. Figure 4.2.2 shows the example of sensitive locations map in the north section.




Source: JICA Study Team

**Figure 4.2.1 Environmental Sensitivity Maps (Example, South Section)**


Source: JICA Study Team

**Figure 4.2.2 Sensitive Locations Map (Example, in North Section)**

### (2) Methodology of Rating of Range of Significance

4.13 The range of significance of potential environmental and social impacts was rated by four levels (i.e., A to D), from the positive and negative aspects as shown in Table 4.2.1. The rating was made on the assumption that any measure is not implemented for the impact.

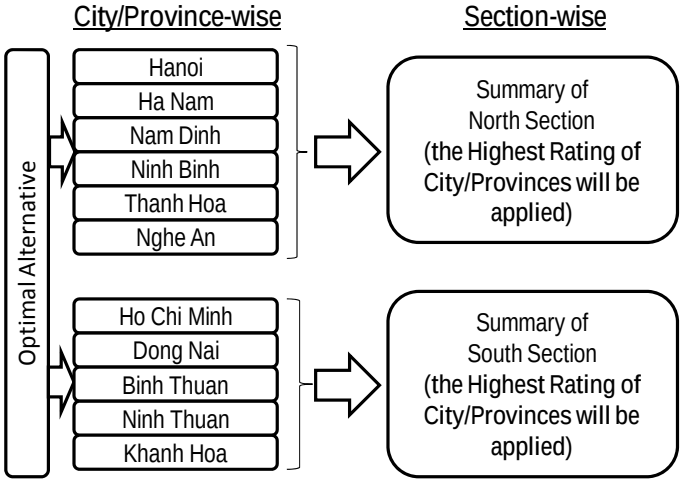
**Table 4.2.1 Rating of Potential Impact**

| Rate | Rating criteria |
|---|---|
| A- | Serious negative impact is expected, if any measure is not implemented for the impact. |
| B- | Some negative impact is expected, if any measure is not implemented for the impact. |
| C- | Extent of negative impact is unknown (A further examination is needed and the impact could be |

| Rate | Rating criteria |
|---|---|
| | defined as study progresses.) |
| D | No impact is expected. Therefore, EIA is not required. |
| A+ | Remarkable positive effect is expected by the project implementation itself and environmental improvement caused by the project. |
| B+ | Some positive effect is expected by the project implementation itself and environmental improvement caused by the project. |
| C+ | Extent of positive impact is unknown (A further examination is needed and the impact could be defined as study progresses.) |

Source: JICA Study Team

4.14 Firstly, the potential impact of each environmental and social item was rated for each city and province. Then, the city/provincial wise rating tables, which show a range of significant and potentially significant impacts, were prepared. The result of the rating of the impacts were summarized for each target section, namely the north section (Hanoi – Vinh) and the south section (HCMC – Nha Trang). The highest rate among the given rates of each city/province becomes the section-wise rate for negative and positive ratings (e.g., even with only one "A-" included in an item among the rates of each city/province, the section-wise rate becomes "A-"). The flow of potential impact assessment was summarized in Figure 4.2.3.




Source: JICA Study Team

**Figure 4.2.3 Flow of Potential Impact Assessment**

4.15 Based on the potential impact assessment, the provisional scoping result was assessed by three levels as shown in Table 4.2.2. It means that the items evaluated to be A and B needs to be studied in the EIA, which is required in the future planning stage.

**Table 4.2.2 Rating of Provisional Scoping Result**

| Rate | Rating criteria |
|---|---|
| A | Most important items for the EIA |
| B | Important items for the EIA |
| n/a | Not applied for the EIA |

Source: JICA Study Team

## 4.3 Identification of Environmental and Social Items relating to the HSR Projects

### 1) Components of HSR Projects

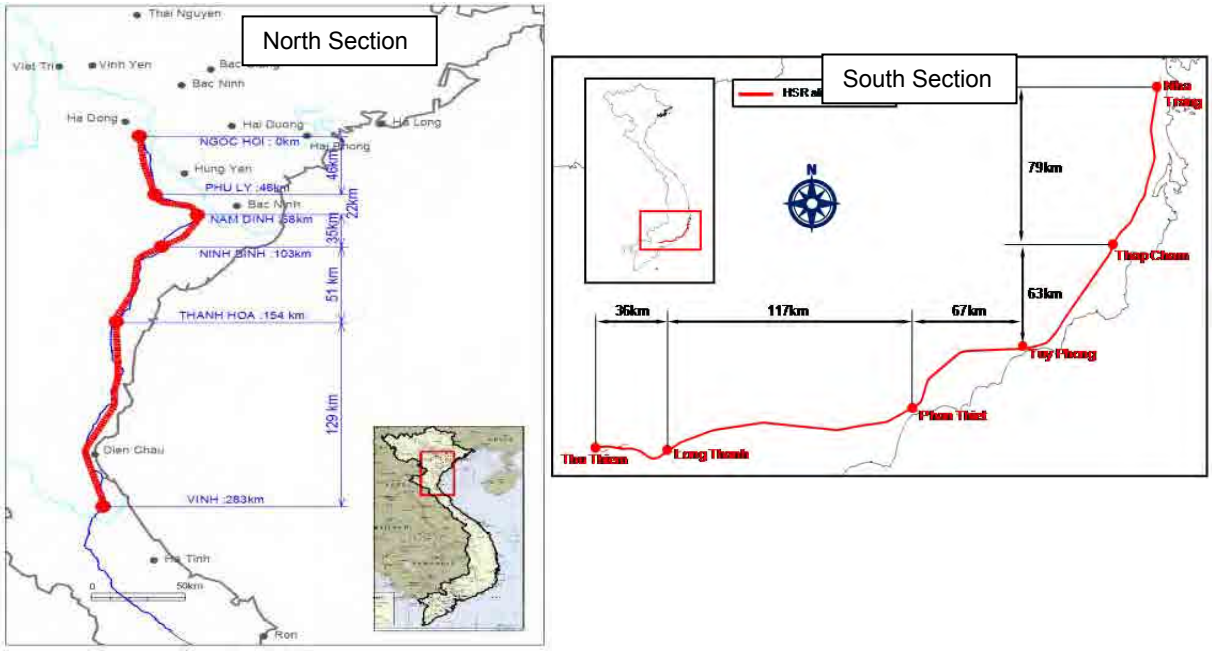
4.16 The components of the HSR Projects relating to the environmental and social impact are summarized in Table 4.3.1 (Major Components), Figure 4.3.1 (Alignment), Figure 4.3.2 (Example of Station Structure), Figure 4.3.3 (Example of Cut/Embankment), and Figure 4.4.4 (Example of Viaduct).

**Table 4.3.1 Components of HSR Projects**

| Project | Project Component | Scale of Component | |
|---|---|---|---|
| | | North Section | South Section |
| Railway Track (Embankment, Viaduct, Bridge, Tunnel and Underground) | Land acquisition<br>Felling trees<br>Civil work<br><br><br>Mobilization of heavy vehicles<br>Construction of railway track<br>Traffic control<br>Existence of railway tracks, etc. | total 1044.9 ha<br>Forest 65.8 ha<br>Embankment(112km), cut(10km), viaduct(140km), bridge(6km), and tunnel(15km).<br><br>287km (including station length)<br><br>287km (including station length) | total 1502.0 ha<br>Forest 146.9 ha<br>Embankment(169km), cut(103km), viaduct(49km), bridge(2km), and tunnel(34km)<br><br>366km (including station length)<br><br>366km (including station length) |
| Depot and Maintenance base (incl. access road) | Land acquisition<br>Felling trees<br>Civil work<br>Mobilization of heavy vehicles<br>Construction of Depot and Maintenance base<br>Existence of Depot | total 79.2 ha<br>Forest 0 ha<br>Embankment<br><br>Depot: 2 locations<br>Maintenance base: 5 locations<br>Depot: 2 locations | total 134.0 ha<br>Forest 5.4 ha<br>Embankment<br><br>Depot: 2 locations<br>Maintenance base: 4 locations<br>Depot: 2 locations |
| Station | Land Acquisition<br>Felling trees<br>Civil work<br><br>Mobilization of heavy vehicles<br>Construction of station<br>Traffic control<br>Existence of station<br>People concentration | total 13.4 ha<br>Forest 0 ha<br>5 Elevated,1 Embankment<br><br><br>6 stations<br><br><br>Ngoc Hoi Station: 70,000 passengers / day in 2030. | total 16.5 ha<br>Forest 0 ha<br>4 Elevated,1 Embankment, 1 shallow trench<br><br><br>6 stations<br><br><br>Thu Thiem Station: 50,000 passengers / day in 2030. |
| Station Plaza (incl. access road) | Land acquisition<br>Felling trees<br>Civil work<br>Mobilization of heavy vehicles<br>Construction of station plaza<br>Traffic control<br>Existence of station plaza<br>People concentration | total 19.0 ha<br>Forest 0 ha<br><br><br><br>6 locations | total 19.8 ha<br>Forest 0 ha<br><br><br><br>6 locations |
| Electric Facilities | Land acquisition<br>Felling trees<br>Civil work<br>Mobilization of heavy vehicles<br>Construction of electric facilities<br><br><br>Traffic control<br>Existence of Electric Facilities | total 18.8 ha<br>Forest 2.7 ha<br><br><br><br>Substations (7), substations in depots (2), sectioning posts (6) and sub-sectioning posts (12) / | total 20.5 ha<br>Forest 3.8 ha<br><br><br><br>Substations (7), substations in depots (2), sectioning posts (0) and sub-sectioning posts (14) |
| Operation of HSR | Operation of HSR | Operational hour 16 hr/day<br>138 trains/day | Operational hour 16 hr/day<br>138 trains/day |

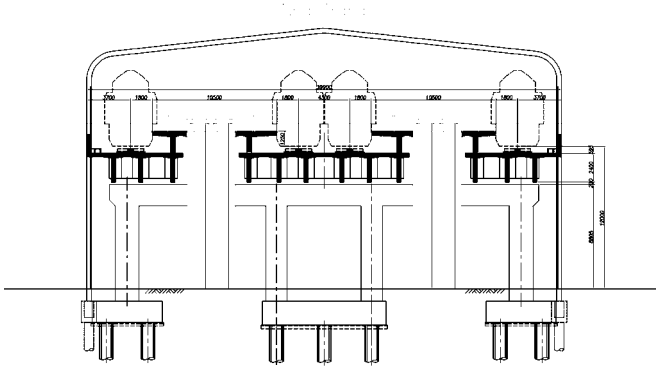
| Project | Project Component | Scale of Component | |
|---|---|---|---|
| | | North Section | South Section |
| | Existence of depots | Maintenance of 230 cars of rolling stocks | Maintenance of 220 cars of rolling stocks |

Source: JICA Study Team



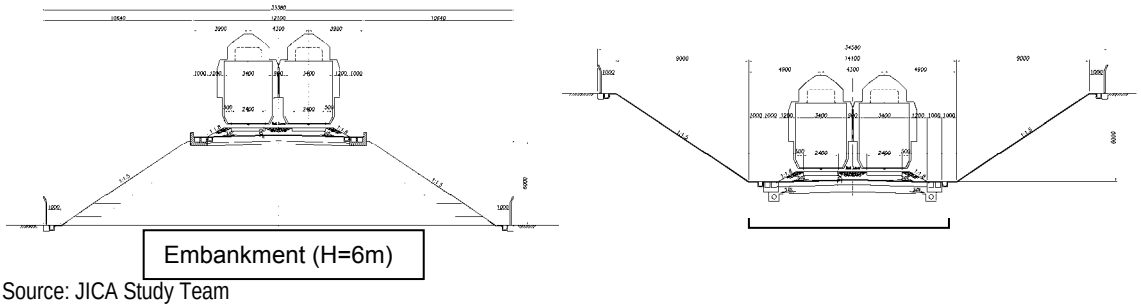

Source: JICA Study Team

**Figure 4.3.1 Optimal Alignment (North and South Sections)**



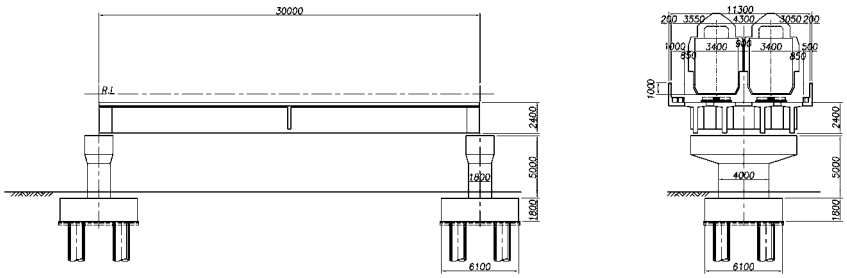
Source: JICA Study Team

**Figure 4.3.2 Typical Cross Section of Station Structure (Two-layer Structure)**




Source: JICA Study Team

**Figure 4.3.3 Typical Cross Section of Cut and Embankment Structure**



Source: JICA Study Team

**Figure 4.3.4 Typical Cross Section of Girder Viaduct**

### 2) Relationship of the Project Components of HSR and Environmental and Social Considerations Items

4.17 Table 4.3.2 summarizes the relationship between the project components of HSR and environmental and social consideration items for each stage of the HSR Projects.

**Table 4.3.2 Relationship of the Project Components of HSR with the Environmental and Social Considerations Items**

| | | Items | Total Assessment | Pre-Construction | | Construction | | | | | Operation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Land Acquisition | Update of Landuse Plan, spatial occupation, etc. | Felling trees | Civil works of the structures (embankment, cutting, tunnel, bridge, viaducts and etc.) | Mobilization of Heavy Vehicles | Construction of depot, station, related facilities, railway tracks, etc. | Traffic control around construction sites | Operation of HSR | Existence of depot, station, related facilities, railway tracks, etc. | People concentration |
| Natural Environment | 1 | Climate/Meteorological Phenomena | | | | | | | | | | | |
| | 2 | Topography | ✔ | | | | ✔ | | | | | | |
| | 3 | Geology | ✔ | | | | ✔ | | | | | | |
| | 4 | Soil Erosion | ✔ | | | | ✔ | | | | | ✔ | |
| | 5 | Hydrology | ✔ | | | | ✔ | | ✔ | | | ✔ | |
| | 6 | Ground water | ✔ | | | | ✔ | | | | | ✔ | |
| | 7 | Ecosystem<br>Flora, Fauna and Biodiversity | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ | | | ✔ | |
| | 8 | Protected Areas/Forest | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ | | | ✔ | |
| | 9 | Coastal zone | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | Landscape | ✔ | ✔ | | ✔ | ✔ | | ✔ | | | ✔ | |
| | 11 | Natural disasters | ✔ | | | ✔ | ✔ | | ✔ | | | ✔ | |
| Living Environment | 12 | Air Pollution | ✔ | | | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| | 13 | Offensive Odor | | | | | | | | | | | |
| | 14 | Water Pollution | ✔ | | | | ✔ | ✔ | ✔ | | | ✔ | ✔ |
| | 15 | Bottom Sediment Contamination | | | | | | | | | | | |
| | 16 | Soil Contamination | ✔ | | | | ✔ | ✔ | ✔ | | | ✔ | |
| | 17 | Ground Subsidence | ✔ | | | | ✔ | | ✔ | | | | |
| | 18 | Noise/vibration | ✔ | | | | ✔ | ✔ | ✔ | ✔ | ✔ | | |
| | 19 | Low frequency noise/micro-pressure wave | ✔ | | | | | | | | ✔ | | |
| | 20 | Wave Obstruction | ✔ | | | | | | | | ✔ | ✔ | |
| | 21 | Sunshine Obstruction | ✔ | | | | | | | | | ✔ | |
| | 22 | Wastes/Hazardous waste | ✔ | | | | ✔ | | ✔ | | | ✔ | ✔ |
| Social Environment | 23 | Involuntary resettlement | ✔ | ✔ | | | | | | | | | |
| | 24 | Land use | ✔ | ✔ | ✔ | ✔ | ✔ | | ✔ | | | ✔ | ✔ |
| | 25 | Utilization of local resources | ✔ | | | | ✔ | | ✔ | | | | |
| | 26 | General, regional /city plans | ✔ | ✔ | ✔ | | ✔ | | ✔ | | | ✔ | |
| | 27 | Social institutions and local decision - making institutions | ✔ | ✔ | ✔ | | ✔ | | ✔ | | | ✔ | |
| | 28 | Social Infrastructures and Services | ✔ | | ✔ | | ✔ | | ✔ | ✔ | | ✔ | |
| | 29 | Local economy and livelihood | ✔ | ✔ | | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ | ✔ |
| | 30 | Unequal Distribution of Benefit and Damage | ✔ | ✔ | ✔ | | ✔ | | ✔ | ✔ | ✔ | ✔ | ✔ |
| | 31 | Local conflicts of interest | ✔ | ✔ | ✔ | | ✔ | | ✔ | ✔ | | ✔ | ✔ |
| | 32 | Water Usage, Water Rights and Communal Rights | ✔ | ✔ | | | ✔ | | ✔ | | | ✔ | |
| | 33 | Cultural and Historical Heritages | ✔ | ✔ | | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | |
| | 34 | Religious Facilities | ✔ | ✔ | | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | |
| | 35 | Sensitive facilities (ex. hospital, school, precision machine factory) | ✔ | ✔ | | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | |
| | 36 | Poor people | ✔ | ✔ | | | ✔ | | ✔ | | | | |
| | 37 | Ethnic Minorities/indigenous people | ✔ | ✔ | | | ✔ | | ✔ | | | | |
| | 38 | Gender | ✔ | ✔ | | | ✔ | | ✔ | | ✔ | | |
| | 39 | Children's rights | | | | | | | | | | | |
| | 40 | Public Health (sanitation and infectious diseases) | ✔ | | | | ✔ | | ✔ | | ✔ | | ✔ |
| | 41 | Occupational Health and Safety (OHS) | ✔ | | | | ✔ | ✔ | ✔ | ✔ | ✔ | | |
| Others | 42 | Accidents | ✔ | | | | ✔ | ✔ | ✔ | ✔ | ✔ | | ✔ |
| | 43 | Climate Change | ✔ | | | ✔ | | ✔ | | ✔ | ✔ | | |

Note: ✔: Related Items, blank: no relationship

Source: JICA Study Team

## 4.4 Results of Provisional Scoping

### 1) Basic Information of Environmental and Social Condition along the Optimal Alignment and Stations

4.18 On top of the baseline information summarized in Chapter 2 and Technical Report No.3, information was additionally collected focused on the areas along the optimal alignment and stations. The major facilities and locations to be considered for the provisional scoping were identified by this supplemental survey, listed and shown in the maps. The major facilities to be considered for the provisional scoping include schools, hospitals and religious facilities located near the alignment that could be potentially affected by the HSR projects. To consider the affect of the low frequency noise, the distribution of the buildings near the exit of the tunnels were also shown on the maps. The summary of such collected data and information are attached as Appendix 4B.

### 2) Rating of Each Environmental and Social Consideration Item

#### (1) North Section

4.19 Potential impacts of each environmental and social considerations item were rated according to four levels (i.e., A to D) for each city/province. The detailed rating results city/provincial wise for the north section are attached as Appendix 4C while the ratings by pre-construction, construction and operation stages of the projects are shown in Tables 4.4.1 to 4.4.3. The section-wise rating was done as an overall rating from all city/province results. In principle, the highest rate given, among the rates from each city/province, was set as the overall rate (e.g., Even with only one "A-" given by one province, the overall rating of the section becomes "A-").

**Table 4.4.1 Results of Rating (Pre-Construction Stage / North Section)**

| | Item | Section | Ha Noi | Ha Nam | Nam Dinh | Ninh Binh | Thanh Hoa | Nghe An |
|---|---|---|---|---|---|---|---|---|
| Natural Environment | Climate/meteorological phenomena | D | D | D | D | D | D | D |
| | Topography | D | D | D | D | D | D | D |
| | Geology | D | D | D | D | D | D | D |
| | Soil Erosion | D | D | D | D | D | D | D |
| | Hydrology | D | D | D | D | D | D | D |
| | Ground water | D | D | D | D | D | D | D |
| | Ecosystem, Flora, Fauna and Biodiversity | D | D | D | D | D | D | D |
| | Protected Areas/Forest | B- | D | D | D | B- | B- | B- |
| | Coastal Zone | D | D | D | D | D | D | D |
| | Landscape | D | D | D | D | D | D | D |
| | Natural disaster | D | D | D | D | D | D | D |
| Living Environment | Air Pollution | D | D | D | D | D | D | D |
| | Offensive Odor | D | D | D | D | D | D | D |
| | Water Pollution | D | D | D | D | D | D | D |
| | Bottom Sediment Contamination | D | D | D | D | D | D | D |
| | Soil Contamination | D | D | D | D | D | D | D |
| | Ground Subsidence | D | D | D | D | D | D | D |
| | Noise/Vibration | D | D | D | D | D | D | D |
| | Low frequency noise/micro-pressure wave | D | D | D | D | D | D | D |
| | Wave Obstruction | D | D | D | D | D | D | D |
| | Sunshine Obstruction | D | D | D | D | D | D | D |
| | Wastes/Hazardous waste | D | D | D | D | D | D | D |

| | Item | Section | Ha Noi | Ha Nam | Nam Dinh | Ninh Binh | Thanh Hoa | Nghe An |
|---|---|---|---|---|---|---|---|---|
| Social Environment | Involuntary resettlement | A- | A- | A- | A- | A- | A- | A- |
| | Change of Land use purpose | B- | B- | B- | B- | B- | B- | B- |
| | Utilization of local resources | D | D | D | D | D | D | D |
| | General, Regional /City Plans | B+/B- | B+/B- | B+/B- | B+/B- | B+/B- | B+/B- | B+/B- |
| | Social institutions and local decision - making institutions | C- | C- | C- | C- | C- | C- | C- |
| | Social Infrastructures and Services | B- | B- | B- | B- | C- | B- | C- |
| | Local economy and livelihood | B- | B- | B- | B- | B- | B- | B- |
| | Unequal Distribution of Benefit and Damage | B- | B- | B- | B- | B- | B- | B- |
| | Local conflicts of interest | C- | C- | C- | C- | C- | C- | C- |
| | Water Usage, Water Rights and Communal Rights | C- | C- | C- | C- | C- | C- | C- |
| | Cultural and Historical Heritages | D | D | D | D | D | D | D |
| | Religious Facilities | B- | B- | C- | B- | C- | C- | C- |
| | Sensitive facilities (e.g., hospital, school, precision machine factory) | A- | B- | A- | A- | C- | A- | C- |
| | Poor people | C- | C- | C- | C- | C- | C- | C- |
| | Ethnic Minorities/indigenous people | C- | D | D | D | D | C- | D |
| | Gender | C- | C- | C- | C- | C- | C- | C- |
| | Children's rights | D | D | D | D | D | D | D |
| | Public Health (sanitation and infectious diseases) | D | D | D | D | D | D | D |
| | Occupational Health and Safety (OHS) | D | D | D | D | D | D | D |
| Others | Accidents | D | D | D | D | D | D | D |
| | Climate Change | D | D | D | D | D | D | D |

Note: A-: Serious negative impact is expected, B-:Some negative impact is expected, C-:Extent of negative impact is unknown, D: No impact is expected, A+:Remarkable positive effect is expected, B+:Some positive effect is expected, and C+:Extent of positive impact is unknown.
Source: JICA Study Team

**Table 4.4.2 Results of Rating (Construction Stage / North Section)**

| | Item | Section | Ha Noi | Ha Nam | Nam Dinh | Ninh Binh | Thanh Hoa | Nghe An |
|---|---|---|---|---|---|---|---|---|
| Natural Environment | Climate/meteorological phenomena | D | D | D | D | D | D | D |
| | Topography | B- | D | D | D | B- | B- | C- |
| | Geology | D | D | D | D | D | D | D |
| | Soil Erosion | B- | B- | B- | B- | B- | B- | B- |
| | Hydrology | D | D | D | D | D | D | D |
| | Ground water | B- | B- | B- | B- | B- | B- | B- |
| | Ecosystem, Flora, Fauna and Biodiversity | B- | B- | B- | B- | B- | B- | B- |
| | Protected Areas/Forest | B- | D | D | D | B- | B- | B- |
| | Coastal Zone | D | D | D | D | D | D | D |
| | Landscape | D | D | D | D | D | D | D |
| | Natural disaster | B- | C- | C- | C- | C- | B- | C- |
| Living Environment | Air Pollution | B- | B- | B- | B- | B- | B- | B- |
| | Offensive Odor | D | D | D | D | D | D | D |
| | Water Pollution | B- | B- | B- | B- | B- | B- | B- |
| | Bottom Sediment Contamination | D | D | D | D | D | D | D |
| | Soil Contamination | C- | C- | C- | C- | C- | C- | C- |
| | Ground Subsidence | D | D | D | D | D | D | D |
| | Noise/Vibration | B- | B- | B- | B- | B- | B- | B- |
| | Low frequency noise/micro-pressure wave | D | D | D | D | D | D | D |
| | Wave Obstruction | D | D | D | D | D | D | D |
| | Sunshine Obstruction | D | D | D | D | D | D | D |
| | Wastes/Hazardous waste | B- | B- | B- | B- | B- | B- | B- |
| Social Environ-ment | Involuntary resettlement | B- | B- | B- | B- | B- | B- | B- |
| | Change of Land use purpose | B- | B- | B- | B- | B- | B- | B- |
| | Utilization of local resources | B- | B- | B- | B- | B- | B- | B- |
| | General, Regional /City Plans | D | D | D | D | D | D | D |
| | Social institutions and local decision - making institutions | C- | C- | C- | C- | C- | C- | C- |
| | Social Infrastructures and Services | B- | B- | B- | B- | B- | B- | B- |
| | Local economy and livelihood | B+ | B+ | B+ | B+ | B+ | B+ | B+ |
| | Unequal Distribution of Benefit and Damage | B- | B- | B- | B- | B- | B- | B- |
| | Local conflicts of interest | C- | C- | C- | C- | C- | C- | C- |
| | Water Usage, Water Rights and Communal Rights | C- | C- | C- | C- | C- | C- | C- |
| | Cultural and Historical Heritages | B- | C- | C- | C- | B- | B- | C- |
| | Religious Facilities | B- | B- | B- | B- | B- | B- | C- |
| | Sensitive facilities (e.g.,. hospital, school, precision machine factory) | B- | B- | B- | B- | C- | B- | C- |
| | Poor people | B+ | B+ | B+ | B+ | B+ | B+ | B+ |
| | Ethnic Minorities/indigenous people | C- | D | D | D | D | C- | D |
| | Gender | C- | C- | C- | C- | C- | C- | C- |
| | Children's rights | D | D | D | D | D | D | D |
| | Public Health (sanitation and infectious diseases) | B- | B- | B- | B- | B- | B- | B- |
| | Occupational Health and Safety (OHS) | B- | B- | B- | B- | B- | B- | B- |
| Others | Accidents | B- | B- | B- | B- | B- | B- | B- |
| | Climate Change | D | D | D | D | D | D | D |

Note: A-: Serious negative impact is expected, B-:Some negative impact is expected, C-:Extent of negative impact is unknown, D: No impact is expected, A+:Remarkable positive effect is expected, B+:Some positive effect is expected, and C+:Extent of positive impact is unknown.

Source: JICA Study Team

**Table 4.4.3 Results of Rating (Operation Stage / North Section)**

| | Item | Section | Ha Noi | Ha Nam | Nam Dinh | Ninh Binh | Thanh Hoa | Nghe An |
|---|---|---|---|---|---|---|---|---|
| Natural Environment | Climate/meteorological phenomena | D | D | D | D | D | D | D |
| | Topography | D | D | D | D | D | D | D |
| | Geology | D | D | D | D | D | D | D |
| | Soil Erosion | B- | C- | C- | C- | C- | B- | B- |
| | Hydrology | B- | B- | B- | B- | B- | B- | B- |
| | Ground water | B- | D | D | D | B- | B- | B- |
| | Ecosystem, Flora, Fauna and Biodiversity | B- | B- | B- | B- | B- | B- | B- |
| | Protected Areas/Forest | B- | D | D | D | B- | B- | B- |
| | Coastal Zone | D | D | D | D | D | D | D |
| | Landscape | B+/B- | B+/B- | B+/B- | B+/B- | B+/B- | B+/B- | B+/B- |
| | Natural disaster | B- | C- | C- | C- | C- | B- | B- |
| Living Environment | Air Pollution | A+/B- | A+/B- | A+/B- | A+/B- | A+/B- | A+/B- | A+/B- |
| | Offensive Odor | D | D | D | D | D | D | D |
| | Water Pollution | B- | B- | B- | B- | B- | B- | B- |
| | Bottom Sediment Contamination | D | D | D | D | D | D | D |
| | Soil Contamination | B- | B- | D | D | D | D | B- |
| | Ground Subsidence | D | D | D | D | D | D | D |
| | Noise/Vibration | A- | A- | A- | A- | A- | A- | A- |
| | Low frequency noise/micro-pressure wave | A- | D | D | D | C- | A- | A- |
| | Wave Obstruction | B- | B- | B- | B- | B- | B- | B- |
| | Sunshine Obstruction | B- | B- | B- | B- | B- | B- | B- |
| | Wastes/Hazardous waste | B- | B- | B- | B- | B- | B- | B- |
| Social Environment | Involuntary resettlement | D | D | D | D | D | D | D |
| | Change of Land use purpose | A+ | A+ | A+ | A+ | A+ | A+ | A+ |
| | Utilization of local resources | D | D | D | D | D | D | D |
| | General, Regional /City Plans | B+ | B+ | B+ | B+ | B+ | B+ | B+ |
| | Social institutions and local decision - making institutions | C- | C- | C- | C- | C- | C- | C- |
| | Social Infrastructures and Services | B+/B- | B+/B- | B+/B- | B+/B- | B+/B- | B+/B- | B+/B- |
| | Local economy and livelihood | A+/B- | A+/B- | A+/B- | A+/B- | A+/B- | A+/B- | A+/B- |
| | Unequal Distribution of Benefit and Damage | B- | B- | B- | B- | B- | B- | B- |
| | Local conflicts of interest | C- | C- | C- | C- | C- | C- | C- |
| | Water Usage, Water Rights and Communal Rights | C- | C- | C- | C- | C- | C- | C- |
| | Cultural and Historical Heritages | B- | C- | C- | C- | B- | B- | C- |
| | Religious Facilities | B- | B- | B- | B- | B- | B- | C- |
| | Sensitive facilities (e.g., hospital, school, precision machine factory) | B- | B- | B- | B- | C- | B- | C- |
| | Poor people | C- | C- | C- | C- | C- | C- | C- |
| | Ethnic Minorities/indigenous people | C- | D | D | D | D | C- | D |
| | Gender | C- | C- | C- | C- | C- | C- | C- |
| | Children's rights | D | D | D | D | D | D | D |
| | Public Health (sanitation and infectious diseases) | B- | B- | B- | B- | B- | B- | B- |
| | Occupational Health and Safety (OHS) | B- | B- | B- | B- | B- | B- | B- |
| Others | Accidents | C+/C- | C+/C- | C+/C- | C+/C- | C+/C- | C+/C- | C+/C- |
| | Climate Change | A+/C- | A+/C- | A+/C- | A+/C- | A+/C- | A+/C- | A+/C- |

Note: A-: Serious negative impact is expected, B-:Some negative impact is expected, C-:Extent of negative impact is unknown, D: No impact is expected, A+:Remarkable positive effect is expected, B+:Some positive effect is expected, and C+:Extent of positive impact is unknown.
Source: JICA Study Team

### (2) South Section

4.20 In a similar way as the north section, potential impacts of each environmental and social considerations item were rated by four levels (i.e., A to D) for each city/province in the south section. The detailed results of city/provincial wise rating in the south section are attached as Appendix 4D while the ratings by pre-construction, construction and operation stages of the projects are shown in Tables 4.4.4 to 4.4.6. The section-wise rating was done as an overall rating from all city/province results. In principle, the highest rate given, among the rates from each city/province, was set as the overall rate.

**Table 4.4.4 Results of Rating (Pre-Construction Stage / South Section)**

| | Item | Section | HCMC | Dong Nai | Binh Thuan | Ninh Thuan | Khanh Hoa |
|---|---|---|---|---|---|---|---|
| Natural Environment | Climate/meteorological phenomena | D | D | D | D | D | D |
| | Topography | D | D | D | D | D | D |
| | Geology | D | D | D | D | D | D |
| | Soil Erosion | D | D | D | D | D | D |
| | Hydrology | D | D | D | D | D | D |
| | Ground water | D | D | D | D | D | D |
| | Ecosystem, Flora, Fauna and Biodiversity | D | D | D | D | D | D |
| | Protected Areas/Forest | B- | D | C- | B- | B- | B- |
| | Coastal Zone | D | D | D | D | D | D |
| | Landscape | D | D | D | D | D | D |
| | Natural disaster | D | D | D | D | D | D |
| Living Environment | Air Pollution | D | D | D | D | D | D |
| | Offensive Odor | D | D | D | D | D | D |
| | Water Pollution | D | D | D | D | D | D |
| | Bottom Sediment Contamination | D | D | D | D | D | D |
| | Soil Contamination | D | D | D | D | D | D |
| | Ground Subsidence | D | D | D | D | D | D |
| | Noise/Vibration | D | D | D | D | D | D |
| | Low frequency noise/micro-pressure wave | D | D | D | D | D | D |
| | Wave Obstruction | D | D | D | D | D | D |
| | Sunshine Obstruction | D | D | D | D | D | D |
| | Wastes/Hazardous waste | D | D | D | D | D | D |
| Social Environment | Involuntary resettlement | A- | A- | A- | A- | A- | A- |
| | Change of Land use purpose | B- | B- | B- | B- | B- | B- |
| | Utilization of local resources | D | D | D | D | D | D |
| | General, Regional /City Plans | B+/B- | B+/B- | B+/B- | B+/B- | B+/B- | B+/B- |
| | Social institutions and local decision - making institutions | C- | C- | C- | C- | C- | C- |
| | Social Infrastructures and Services | B- | B- | C- | B- | B- | C- |
| | Local economy and livelihood | B- | B- | B- | B- | B- | B- |
| | Unequal Distribution of Benefit and Damage | B- | B- | B- | B- | B- | B- |
| | Local conflicts of interest | C- | C- | C- | C- | C- | C- |
| | Water Usage, Water Rights and Communal Rights | C- | C- | C- | C- | C- | C- |
| | Cultural and Historical Heritages | C- | D | C- | D | D | D |
| | Religious Facilities | A- | C- | A- | A- | A- | A- |
| | Sensitive facilities (ex. hospital, school, precision machine factory) | A- | B- | B- | A- | A- | C- |
| | Poor people | B- | C- | C- | C- | C- | C- |
| | Ethnic Minorities/indigenous people | A- | C- | B- | B- | A- | B- |
| | Gender | C- | C- | C- | C- | C- | C- |

| | Item | Section | HCMC | Dong Nai | Binh Thuan | Ninh Thuan | Khanh Hoa |
|---|---|---|---|---|---|---|---|
| | Children's rights | D | D | D | D | D | D |
| | Public Health (sanitation and infectious diseases) | D | D | D | D | D | D |
| | Occupational Health and Safety (OHS) | D | D | D | D | D | D |
| Others | Accidents | D | D | D | D | D | D |
| | Climate Change | D | D | D | D | D | D |

Note: A-: Serious negative impact is expected, B-:Some negative impact is expected, C-:Extent of negative impact is unknown, D: No impact is expected, A+:Remarkable positive effect is expected, B+:Some positive effect is expected, and C+:Extent of positive impact is unknown.
Source: JICA Study Team

### Table 4.4.5 Results of Rating (Construction Stage / South Section)

| | Item | Section | HCMC | Dong Nai | Binh Thuan | Ninh Thuan | Khanh Hoa |
|---|---|---|---|---|---|---|---|
| Natural Environment | Climate/meteorological phenomena | D | D | D | D | D | D |
| | Topography | B- | D | C- | B- | B- | B- |
| | Geology | D | D | D | D | D | D |
| | Soil Erosion | B- | B- | B- | B- | B- | B- |
| | Hydrology | D | D | D | D | D | D |
| | Ground water | B- | D | D | B- | B- | B- |
| | Ecosystem, Flora, Fauna and Biodiversity | B- | B- | B- | B- | B- | B- |
| | Protected Areas/Forest | B- | D | C- | B- | B- | B- |
| | Coastal Zone | D | D | D | D | D | D |
| | Landscape | D | D | D | D | D | D |
| | Natural disaster | B- | B | C- | C- | B- | B- |
| Living Environment | Air Pollution | B- | B- | B- | B- | B- | B- |
| | Offensive Odor | D | D | D | D | D | D |
| | Water Pollution | B- | B- | B- | B- | B- | B- |
| | Bottom Sediment Contamination | D | D | D | D | D | D |
| | Soil Contamination | C- | C- | C- | C- | C- | C- |
| | Ground Subsidence | D | D | D | D | D | D |
| | Noise/Vibration | B- | B- | B- | B- | B- | B- |
| | Low frequency noise/micro-pressure wave | D | D | D | D | D | D |
| | Wave Obstruction | D | D | D | D | D | D |
| | Sunshine Obstruction | D | D | D | D | D | D |
| | Wastes/Hazardous waste | B- | B- | B- | B- | B- | B- |
| Social Environment | Involuntary resettlement | B- | B- | B- | B- | B- | B- |
| | Change of Land use purpose | B- | B- | B- | B- | B- | B- |
| | Utilization of local resources | B- | B- | B- | B- | B- | B- |
| | General, Regional /City Plans | D | D | D | D | D | D |
| | Social institutions and local decision - making institutions | C- | C- | C- | C- | C- | C- |
| | Social Infrastructures and Services | B- | B- | B- | B- | B- | B- |
| | Local economy and livelihood | B+ | B+ | B+ | B+ | B+ | B+ |
| | Unequal Distribution of Benefit and Damage | B- | B- | B- | B- | B- | B- |
| | Local conflicts of interest | C- | C- | C- | C- | C- | C- |
| | Water Usage, Water Rights and Communal Rights | C- | C- | C- | C- | C- | C- |
| | Cultural and Historical Heritages | C- | C- | C- | C- | C- | C- |
| | Religious Facilities | B- | B- | B- | B- | B- | B- |
| | Sensitive facilities (e.g,. hospital, school, precision machine factory) | B- | B- | B- | B- | C- | B- |
| | Poor people | B+ | B+ | B+ | B+ | B+ | B+ |

| | Item | Section | HCMC | Dong Nai | Binh Thuan | Ninh Thuan | Khanh Hoa |
|---|---|---|---|---|---|---|---|
| | Ethnic Minorities/indigenous people | A- | D | D | B- | A- | C- |
| | Gender | C- | C- | C- | C- | C- | C- |
| | Children's rights | D | D | D | D | D | D |
| | Public Health (sanitation and infectious diseases) | B- | B- | B- | B- | B- | B- |
| | Occupational Health and Safety (OHS) | B- | B- | B- | B- | B- | B- |
| Others | Accidents | B- | B- | B- | B- | B- | B- |
| | Climate Change | D | D | D | D | D | D |

Note: A-: Serious negative impact is expected, B-:Some negative impact is expected, C-:Extent of negative impact is unknown, D: No impact is expected, A+:Remarkable positive effect is expected, B+:Some positive effect is expected, and C+:Extent of positive impact is unknown.
Source: JICA Study Team

**Table 4.4.6 Results of Rating (Operation Stage / South Section)**

| | Item | Section | HCMC | Dong Nai | Binh Thuan | Ninh Thuan | Khanh Hoa |
|---|---|---|---|---|---|---|---|
| Natural Environ-ment | Climate/meteorological phenomena | D | D | D | D | D | D |
| | Topography | D | D | D | D | D | D |
| | Geology | D | D | D | D | D | D |
| | Soil Erosion | B- | D | B- | B- | B- | B- |
| | Hydrology | B- | B- | B- | B- | B- | B- |
| | Ground water | B- | D | D | B- | B- | B- |
| | Ecosystem, Flora, Fauna and Biodiversity | B- | B- | B- | B- | B- | B- |
| | Protected Areas/Forest | B- | D | C- | B- | B- | B- |
| | Coastal Zone | D | D | D | D | D | D |
| | Landscape | B+/B- | B+/B- | B+/B- | B+/B- | B+/B- | B+/B- |
| | Natural disaster | B- | B- | B- | B- | B- | B- |
| Living Environment | Air Pollution | A+/B- | A+/B- | A+/B- | A+/B- | A+/B- | A+/B- |
| | Offensive Odor | D | D | D | D | D | D |
| | Water Pollution | B- | B- | B- | B- | B- | B- |
| | Bottom Sediment Contamination | D | D | D | D | D | D |
| | Soil Contamination | B- | B- | D | D | D | B- |
| | Ground Subsidence | D | D | D | D | D | D |
| | Noise/Vibration | A- | A- | A- | A- | A- | A- |
| | Low frequency noise/micro-pressure wave | A- | D | D | C- | C- | A- |
| | Wave Obstruction | B- | B- | B- | B- | B- | B- |
| | Sunshine Obstruction | B- | B- | B- | B- | B- | B- |
| | Wastes/Hazardous waste | B- | B- | B- | B- | B- | B- |
| Social Environment | Involuntary resettlement | D | D | D | D | D | D |
| | Change of Land use purpose | A+ | A+ | A+ | A+ | A+ | A+ |
| | Utilization of local resources | D | D | D | D | D | D |
| | General, Regional /City Plans | B+ | B+ | B+ | B+ | B+ | B+ |
| | Social institutions and local decision - making institutions | C- | C- | C- | C- | C- | C- |
| | Social Infrastructures and Services | B+/B- | B+/B- | B+/B- | B+/B- | B+/B- | B+/B- |
| | Local economy and livelihood | A+/B- | A+/B- | A+/B- | A+/B- | A+/B- | A+/B- |
| | Unequal Distribution of Benefit and Damage | B- | B- | B- | B- | B- | B- |
| | Local conflicts of interest | C- | C- | C- | C- | C- | C- |
| | Water Usage, Water Rights and Communal Rights | C- | C- | C- | C- | C- | C- |
| | Cultural and Historical Heritages | C- | C- | C- | C- | C- | C- |
| | Religious Facilities | B- | B- | B- | B- | B- | B- |
| | Sensitive facilities (ex. hospital, school, precision machine factory) | B- | B- | B- | B- | C- | B- |
| | Poor people | C- | C- | C- | C- | C- | C- |
| | Ethnic Minorities/indigenous people | B- | D | D | B- | B- | C- |
| | Gender | C- | C- | C- | C- | C- | C- |
| | Children's rights | D | D | D | D | D | D |
| | Public Health (sanitation and infectious diseases) | B- | B- | B- | B- | B- | B- |
| | Occupational Health and Safety (OHS) | B- | B- | B- | B- | B- | B- |
| Others | Accidents | C+/C- | C+/C- | C+/C- | C+/C- | C+/C- | C+/C- |
| | Climate Change | A+ | A+ | A+ | A+ | A+ | A+ |

Note: A-: Serious negative impact is expected, B-:Some negative impact is expected, C-:Extent of negative impact is unknown, D: No impact is expected, A+:Remarkable positive effect is expected, B+:Some positive effect is expected, and C+:Extent of positive impact is unknown.

Source: JICA Study Team

### 3) Details of Rating for Each Section

4.21 The following are the details of the rating and its basis for each section:

#### (1) North Section

4.22 Table 4.4.7 shows the results of rating of potential environmental and social impacts by stage (pre-construction, construction and operation) of the north section.

**Table 4.4.7 Results of Rating of the North Section**

| Category | Item | Results of Rating | | | |
|---|---|---|---|---|---|
| | | Pre-construction | Construction | Operation | Rating Basis |
| Natural Environment | Climate / Meteorological Phenomena | D | D | D | P: No impact is expected. |
| | | | | | C/O: Although the elevated structures such as the viaduct of the HSR track and station building will be constructed, the impacts on micro-climate and micro meteorological phenomena are negligible because these structures would not disturb wind path. |
| | Topography | D | B- | D | P: No impact is expected. |
| | | | | | C: While topography between Hanoi-Ninh Binh is generally flat, there will be variations of topography between Ninh Binh and Nghe An where more mountains/hills exist along the alignment requiring about 20km of cut section. Though limited, there is some impact on topographic features. |
| | | | | | O: Completing construction, topography would be stable. No impact is expected |
| | Geology | D | D | D | P: No impact is expected. |
| | | | | | C: Although there are some soft soil areas and soil improvement works will be done there for the constructions, it is not a scale that changes geological features. |
| | | | | | O: No impact is expected. |
| | Soil Erosion | D | B- | B- | P: No impact is expected. |
| | | | | | C: For the earth works, especially when it is raining, some soil erosion is expected. |
| | | | | | O: Total length of the alignment is about 284 km, in which embankment or cut section is about 129.5 km, where new surface may be washed by rain water. |
| | Hydrology | D | D | B- | P: No impact is expected. |
| | | | | | C: In the elevated structure section, construction works would cause little impacts on the hydrological cycle or regimes. In embankment or cut section, piled up soil may cause minor and temporary impact on hydrological cycle or regimes. They are not at a scale that changes hydrological regime. |
| | | | | | O: In the embankment section (mostly in the section in Thanh Hoa and Nghe An), hydrological situation would be affected by the structures. The elevated section will have less and minor impact on the hydrological conditions. |
| | Ground water | D | B- | B- | P: No impact is expected. |
| | | | | | C: Ground water in Red River Delta is generally abundant due to many canals/rivers and its low topographic feature. In addition, ground water utilization by the construction works is not a scale that changes ground water flow. However, there may be impact on the ground water flow by construction activities of tunnels. |

| Category | Item | Results of Rating | | | |
|---|---|---|---|---|---|
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | O: Utilizing ground water by HSR is not at a scale that can change ground water level. However, in the tunnel section, there may be an impact on the ground water flow by the structure. |
| | Ecosystem Flora, Fauna and Biodiversity | D | B- | B- | P: No impact is expected. |
| | | | | | C: Besides some protection and production forest areas, most of the area along the alignment is already developed area including residential and agricultural areas. The affected flora, fauna and biodiversity along the alignment are considered to be not critical, while the construction work may interfere with the habitat of flora and fauna.<br>- There is no Important Bird Area (IBA) affected by the alignment.<br>- The section in Ninh Binh – Nghe An falls within the Endemic Bird Area (EBA) of the Annamese lowlands. |
| | | | | | O: Existence of the HSR structure and HSR operation may cause negative impact on the ecosystem. |
| | Protected Areas/Forest | B- | B- | B- | P: There are special-use forests (protected areas) along the target city/provinces, however those areas are located far from the planned alignment (more than 10km). Besides protected areas, the alignment goes through and affect some protection forests (about 14 ha) and production forests (about 58 ha) in Ninh Binh, Thanh Hoa, Nghe An provinces. Change of forest use purpose into non-forest purpose is required in these areas. |
| | | | | | C: The construction machines could damage the vegetation. Activities of construction workers may also put pressure on the forest. |
| | | | | | O: By the structure of HSR, some of the forest area will be opened. This will mean more sunshine on the inner part of the vegetation area, which would affect the edge of the forest area. |
| | Coastal zone | D | D | D | P/C/O: The closest distance to the alignment from the coastal line is at Nghe An (about 3.5 km) and no mudflats or no mangrove areas are affected. Thus, no impact is expected. |
| | Landscape | D | D | B+/B- | P: No impact is expected. |
| | | | | | C: Change of landscape is temporary and limited during the construction. |
| | | | | | O: By the structures such as viaduct, embankment and station buildings, both positive and negative impacts on landscape are expected. |
| | Natural disasters | D | B- | B- | P: No impact is expected. |
| | | | | | C: Civil works on landslide/ erosion prone areas in Thanh Hoa may trigger landslide. |
| | | | | | O:Between Ha Noi and Ninh Binh, some regularly flooding areas are found but far from the planned alignment. The closest flooding area is at Hoang Xa Commune (Ha Noi), about 4 km from the planned alignment. In Thanh Hoa, the alignment goes through landslide/erosion prone areas.<br>In Nghe An, some flood prone areas exist along the alignment. Embankment construction in some sub-sections may result in a higher risk of flooding. |
| Living Environment | Air Pollution | D | B- | A+/B- | P: No impact is expected. |
| | | | | | C: Some negative impact is expected due to operation of many equipments and vehicles. One is the dust incidental to earth work especially during the dry season, although these impacts are temporary and limited. |

| Category | Item | Results of Rating | | | |
|---|---|---|---|---|---|
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | O: Overall reduction of air pollutants' emission is expected from the modal shift of passengers' transportation to the HSR (+31% of the share between Hanoi and Vinh; 2030 projection) from cars (-6%), buses (-19%), air transport (-1%), and existing railways (-5%). 196 t-NOx/year of air pollutants would be reduced by the development of the HSR in the north section. On the other hand, increase in air pollutants from increased access of cars and buses around the station are expected. |
| | Offensive Odor | D | D | D | P/C/O: No impact is expected. |
| | Water Pollution | D | B- | B- | P: No impact is expected. |
| | | | | | C: Turbid water due to the earth works, bridge piers' construction work, and wastewater effluents from construction workers' camps/yards are expected to pollute the surrounding rivers/canals to some extent. |
| | | | | | O: Wastewater effluents from passengers at the station and maintenance activities in the depot are expected. Some impacts on water quality in surrounding water bodies are expected due to discharged polluted water. |
| | Bottom Sediment Contamination | D | D | D | P: No impact is expected. |
| | | | | | C: Although some construction materials such as cement and sand are expected to be washed out mainly by the rain, the impacts of bottom sediment are small. |
| | | | | | O: Although some impact is expected on bottom sediment by deposition of pollutants from the wastewater discharged from maintenance activities in the depot in Ngoc Hoi and Vinh, the impact is small. |
| | Soil Contamination | D | C- | B- | P: No impact is expected. |
| | | | | | C: Although some impact on soil is expected by deposition of pollutants from construction materials and vehicles, the impacts are small. On the other hand, in case the soil at construction sites is already contaminated, by some other reason, some impacts are expected by the construction activity. Thus, further study is necessary. |
| | | | | | O: Some impact may be expected on soil from deposition of pollutants from maintenance activities in the depot in Ngoc Hoi and Vinh. |
| | Ground Subsidence | D | D | D | P: No impact is expected. |
| | | | | | C: Ground water utilization by the construction works is not at a scale that changes ground water flow. Thus, no ground subsidence is expected. |
| | | | | | O: In general, geological condition of the North section, especially from Hanoi to Ninh Binh, is soft soil layers. As a viaduct section is planned to be applied in such area, no impact is expected. |
| | Noise/vibration | D | B- | A- | P: No impact is expected. |
| | | | | | C: Noise and vibration are generated by operation of heavy equipment and vehicles, although they are temporary. Nonetheless, some impact is expected on the residents and facilities/places where quietness is required. Such areas are schools and hospitals near the construction sites. |
| | | | | | O: Noise and vibration are generated by movement of high speed trains and some impacts are expected on the residents and facilities/places where quietness is required such as schools and hospitals along the HSR alignment. Maintenance of ballast track would also cause noise. |
| | Low frequency noise/micro-pressure wave | D | D | A- | P: No impact is expected. |
| | | | | | C: Construction activities will not cause low frequency noise/micro-pressure wave. |

| Category | Item | Results of Rating | | | |
|---|---|---|---|---|---|
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | O: Significant low frequency/micro-pressure wave at long tunnel sub-sections is expected. Long tunnels over 1km exist at 6 locations, of which two are over 3km long (one in the border of Ninh Binh and Thanh Hoa and the other in Nghe An). Most of the tunnels are in Thanh Hoa Section, followed by Nghe An and Ninh Binh. Low frequency noise from the train passing an open section is small. |
| | Wave Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No wave obstruction is expected from the construction works. |
| | | | | | O: Radio waves would be disturbed by movement of high speed trains and some impacts such as flutter and pulse interferences on TV are expected. In addition, elevated structures such as viaducts (typical design is about 10m high) and station buildings (two-storey station like Thanh Hoa is about 20m high while three-storey like Vinh Station is about 27m high) will be developed. Some wave disturbance impacts are expected due to these structures. |
| | Sunshine Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No sunshine obstruction is expected from the construction works. |
| | | | | | O: There will be elevated structures such as viaduct and station buildings developed; some impacts are expected in terms of the shade created by these structures. |
| | Wastes/Hazardous waste | D | B- | B- | P: No impact is expected. |
| | | | | | C: A certain amount of construction and demolition wastes, which may include hazardous materials, and waste from construction workers' camps are expected to be generated. |
| | | | | | O: A certain amount of wastes from passengers at the station and maintenance works at the depot is expected to be generated. |
| Social Environment | Involuntary resettlement | A- | B- | D | P: About 1,100 ha of land would be necessary for development of the HSR structures (viaduct, station, depot, etc.) in this section. In addition, about 1,300 buildings and about 4,400 households would be affected either by land acquisition or resettlement although the alignment is planned to avoid land acquisition and resettlement, as much as possible, in the alternative analysis. |
| | | | | | C: Land acquisition and resettlement activities are expected to continue even during the construction stage. Temporary relocation is also required for setting up of construction yards and workers' camps for the construction activities. |
| | | | | | O: No impact is expected. |
| | Land use | B- | B- | A+ | P: The current land use needs to be changed by land acquisition and resettlement in accordance with the planned alignment and station location. |
| | | | | | C: Land clearance for construction yards and workers' camps is temporary. The land use around the construction site may be changed by doing business with construction workers without control. |
| | | | | | O: The HSR station will be developed together with areas around the station as an integrated development. In addition, land use is expected to be changed gradually with further development mainly around the station in accordance with a city/provincial plan and private investments. |
| | Utilization of local resources | D | B- | D | P: No impact is expected. |
| | | | | | C: Using a large amount of local resources, such as sand and quarry, for the construction activities would obstruct its utilization by the local people for other purposes. |

| Category | Item | Results of Rating | | | |
|---|---|---|---|---|---|
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | O: No impact is expected because the HSR would not use much local resources. |
| | General, regional /city plans | B+/B- | D | B+ | P: Except for Ngoc Hoi Station and section in Ha Nam along the express way, where other further development is limited for future HSR purpose, HSR will result in changing land use in most of the city/provinces. The current general plan and/or regional/city plan of city/provinces needs to be updated in accordance with the planned alignment and station location. |
| | | | | | C: No impact is expected (updating plans may continue). |
| | | | | | O: In accordance with the HSR development including development of station area, future general plan/city plans, which include future development plan, are expected to be prepared in all city/provinces. |
| | Social institutions and local decision - making institutions | C- | C- | C- | P: Some impacts on social institutions and local decision making institutions are expected from land acquisition and resettlement. However, further examination is necessary. |
| | | | | | C: Some impacts on social institutions and local decision making institutions are expected from the inflow of many construction workers and other people from outside the area. However, further examination is necessary. |
| | | | | | O: Some impacts on social institutions and local decision making institutions are expected from disturbances on movement of local people by the HSR structures. However, further examination is necessary. |
| | Social Infrastructures and Services | B- | B- | B+/B- | P: Some impacts on social infrastructure and services are expected from land acquisition and resettlement, such as resettlement of community facility (village hall, etc.). |
| | | | | | C: Though temporary, impacts on social infrastructures and services from the setting up of construction yards and workers' camps are expected. Notably, impacts on social infrastructures and services are expected from disturbances and interruptions on their utilization by the construction activities such as relocation of public utilities and local roads. |
| | | | | | O: Development of the HSR station together with its surrounding areas would improve social infrastructures and services in the area and the country. On the other hand, some impacts on social infrastructures and services by the existence of the HSR structures are expected. |
| | Local economy and livelihood | B- | B+ | A+/B- | P: Some negative impacts on the local economy and livelihood are expected because of losses in employment opportunities and income sources resulting from land acquisition and resettlement. |
| | | | | | C: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the construction activities. |
| | | | | | O: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the HSR project, especially around the station, and employment of the workers for track maintenance, etc.<br>On the other hand, some negative impacts are also expected after the completion of the construction activities because of termination of temporary employment opportunities of local workers. |
| | Unequal Distribution of | B- | B- | B- | P: Unequal situations are expected among the project affected households/people and not affected households/people. |

| Category | Item | Results of Rating | | | |
|---|---|---|---|---|---|
| | | Pre-construction | Construction | Operation | Rating Basis |
| | Benefit and Damage | | | | C: Some unequal situations are expected among the local people between those who will receive any benefit and those who will incur any damage from the construction activities, e.g., some affected households need to be relocated far away while their non-affected neighbors can do business with the construction workers. |
| | | | | | O: Some unequal situations are expected among the local people between those who live near the station and those who live far from the station. In the latter case, the local people will possibly incur damages such as noise and vibration impacts, and some impacts on social infrastructures, services, livelihood and water usage. Meanwhile, for the former case, the local people may enjoy the benefit from the HSR service and related opportunities of businesses. |
| | Local conflicts of interest | C- | C- | C- | P/C/O: Local conflicts of interest are expected among local people, especially between beneficiaries and project affected people for land acquisition and inconveniences during construction and operation. Further examination would be necessary in case that unequal distribution of benefit and damage is expected to be crucial issues. |
| | Water Usage, Water Rights and Communal Rights | C- | C- | C- | P: Some impacts on water usage for the resettled houses/residents are expected from land acquisition and resettlement. However, further examination would be necessary for water rights and communal rights. |
| | | | | | C: Impacts on water usage such as obstruction to access of water sources for domestic and irrigation uses by the construction activities are small and temporary. However, further examination would be necessary for water rights and communal rights. |
| | | | | | O: Impacts on water usage such as obstruction to access of water sources for domestic and irrigation uses are expected with the existence of the HSR structures. However, further examination would be necessary for disturbance by the structures. |
| | Cultural and Historical Heritages | D | B- | B- | P: Although 4 national cultural and historical heritages are found in Ninh Binh and Thanh Hoa provinces within a distance of 100m from the alignment, they are not affected directly by HSR. Thus, no impact is expected. |
| | | | | | C: Together with above mentioned, many heritages are found near the alignment. These may be affected by the noise and vibration, and the traffic congestions caused by vehicles for the construction. Followings are the examples of heritages near the alignment.<br>- Ninh Binh: Tam Thanh Temple is a national heritage site located about 68 m away from the planned alignment.<br>- Thanh Hoa: the planned alignment is located relatively close to the national heritage places i.e., Nui Nap Martyr Cemetery about 60 m away from planned alignment |
| | | | | | O: The heritage sites that are mainly within 100m range from the alignment may suffer the impact of noise and vibration to some extent. |
| | Religious Facilities | B- | B- | B- | P: Though the well known religious places are not directly affected, small scale village level religious facilities may be relocated (e.g., Tu Thuan Village Temple and Buom Pagoda in Hanoi). |
| | | | | | C/O: Some pagodas and temples are found along the HSR within a distance less than 200m. So impacts such as noise and vibration on these places are expected during the construction and operational stages. |
| | Sensitive facilities (e.g., | A- | B- | B- | P: Since some sensitive places, such as Nam Dinh College (Nam Dinh) and the Center of War Invalid Health Care (Ha Nam), are found on the alignment, those places may have to be relocated. |

| Category | Item | Results of Rating | | | |
|---|---|---|---|---|---|
| | | Pre-construction | Construction | Operation | Rating Basis |
| | hospital, school, precision machine factory) | | | | C: Traffic congestion due to heavy vehicles will affect local people's convenience and safety, especially around school and hospital areas near the planned alignment. E.g., the neurological hospital of Ha Ham at 38 m from the alignment, Yen Nhan School of Nghe An at 60 m, An Hoach School and Ha Trung Hospital of Thanh Hoa at about 60 m and about 77 m, respectively. |
| | | | | | O: More specifically with regard to the school and hospital along the alignment, noise and vibration caused by HSR may affect people's comfort. |
| | Poor people | C- | B+ | C- | P: Poor people (who have poor household certificates issued by local authorities) reside everywhere with particular concentration in Thanh Hoa Province. Further examination would be necessary for the poor people because it is more difficult for them to recover their livelihood, after land acquisition and resettlement, as compared to other PAPs. |
| | | | | | C: There is a possibility that the poor people would also have employment opportunities in construction and its associated business activities. |
| | | | | | O: There is a possibility that the enjoyment of the benefits of the HSR service by the poor people would be difficult. Further examination would be necessary. |
| | Ethnic Minorities/indigenous people | C- | C- | C- | P: In this section, there are ethnic groups such as Muong and Kho Me, particularly in Tinh Gia District, Thanh Hoa Province. Some impact on their culture as well as livelihood is expected. However, further examination would be necessary. |
| | | | | | C: Some impact. on ethnic groups, is expected from the influx of a large number of construction workers and people outside the area. Further examination would be necessary. |
| | | | | | O: Some impact on ethnic groups is expected from the disturbance on people's movement due to the existence of HSR structures. Further examination would be necessary. |
| | Gender | C- | C- | C- | P: Land acquisition and resettlement are an important incident to a family and some women would have a bigger burden for that. Further examination would be necessary. |
| | | | | | C: Equal employment opportunities for both sexes are required for the construction works. Further examination would be necessary. |
| | | | | | O: The HSR service will be equal for both sexes. On the other hand, equal employment opportunities for both sexes are required for the HSR operation. Further examination would be necessary. |
| | Children's rights | D | D | D | P: No impact is expected. |
| | | | | | C/O. Since employment of children for the construction works is strictly prohibited by the Children Protection, Education and Care Law 2004, no impact is expected. |
| | Public Health (sanitation and infectious diseases) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts on public health are expected due to unsanitary conditions caused by the influx of a large number of workers. In addition, increase of risks related to Sexually Transmitted Diseases (STD) or Sexually Transmitted Infections (STI) and HIV/AIDS is expected among the workers and local communities. |

| Category | Item | Results of Rating | | | |
|---|---|---|---|---|---|
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | O: Some impacts on public health are expected in terms of the increase of risks for spreading of infectious diseases. This is due to the influx of a large number of passengers (about 70,000 passengers per day at Ngoc Hoi Station, if Ngoc Hoi - Vinh section is operated in 2030) and business persons around the station area. |
| | Occupational Health and Safety (OHS) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts regarding OHS for the construction workers are expected. |
| | | | | | O: Some impacts regarding OHS for the workers for the HSR operation, especially the workers at the track maintenance and at the depot are expected. |
| Other | Accidents | D | B- | C+/C- | P: No impact is expected. |
| | | | | | C: Increase of risks of accidents associated with construction activities is expected due to the operation of heavy equipment and vehicles. |
| | | | | | O: Increase of risks of accidents associated with the HSR services is expected due to the high speed train operation. On the other hand, positive and/or negative impacts are expected from the modal shift of passengers' transportation from cars, buses, air transport, and existing railways to the HSR. |
| | Climate Change | D | D | A+/C- | P: No impact is expected. |
| | | | | | C: Although increase of GHGs emission is expected due to operation of heavy equipment and vehicles, the impact is temporary and small. |
| | | | | | O: Overall reduction of GHGs emission is expected by the modal shift of passengers' transportation to the HSR (+31% of the share between Hanoi and Vinh, 2030 projection) from cars (-6%), buses (-19%), air transport (-1%), and existing railways (-5%). 63 kt-CO2e/year of GHGs would be reduced by the development of the HSR in the north section.<br>Low elevation areas close to the coastal area may be affected by the rise of sea level by climate change, and further examination would be required. |

Note: A-: Serious negative impact is expected, B-:Some negative impact is expected, C-:Extent of negative impact is unknown, D: No impact is expected, A+:Remarkable positive effect is expected, B+:Some positive effect is expected, and C+:Extent of positive impact is unknown. Rating basis is for P: Pre-Construction; C: Construction; and O: Operation
Source: JICA Study Team

### (2) South Section

4.23 Table 4.4.8 shows the results of rating of potential environmental and social impacts by stage (pre-construction, construction and operation) of the south section.

**Table 4.4.8 Results of Rating of South Section**

| Category | Items | Result of Rating | | | |
|---|---|---|---|---|---|
| | | Pre-construction | Construction | Operation | Rating Base |
| Env | Climate/ | D | D | D | P: No impact is expected. |

| Category | Items | Result of Rating | | | |
|---|---|---|---|---|---|
| | | Pre-construction | Construction | Operation | Rating Base |
| | Meteorological Phenomena | | | | C/O: Although the elevated structures such as viaduct of the HSR track and station building will be constructed, the impacts on micro-climate and micro meteorological phenomena are negligible because these structures would not disturb wind path. |
| | Topography | D | B- | D | P: No impact is expected. |
| | | | | | C: While topography between HCMC-Binh Thuan is generally flat, there will be variations of topography between Binh Thuan and Khanh Hoa where more mountains/hills exist along the alignment requiring about 67km of cut section and about 34km of tunnel section. It is noted that about 35km of cut section is also required in Dong Nai Section even though it is a rather flat area. Though limited, there is some impact on topographic features. |
| | | | | | O: Completing construction, topography would be stable. No impact is expected |
| | Geology | D | D | D | P: No impact is expected. |
| | | | | | C: Although there are some soft soil areas and soil improvement works will be done there for the constructions, it is not a scale that changes geological features. |
| | | | | | O: No impact is expected. |
| | Soil Erosion | D | B- | B- | P: No impact is expected. |
| | | | | | C: For the earth works, especially when it is raining, some soil erosion is expected. |
| | | | | | O: Total length of the alignment is about 366 km, in which embankment or cut section is about 275 km, where new surface may be washed by rain water. |
| | Hydrology | D | D | B- | P: No impact is expected. |
| | | | | | C: In the elevated structure section, construction works would cause little impacts on the hydrological cycle or regimes. In embankment or cut section, piled up soil may cause minor and temporary impact on hydrological cycle or regimes. They are not at a scale that changes hydrological regime. |
| | | | | | O: Since the HSR track will be developed mostly as embankment, the HSR structures may disturb the hydrological cycle or regimes in this section to some extent. |
| | Ground water | D | B- | B- | P: No impact is expected. |
| | | | | | C: Ground water in Mekong River Delta is generally abundant due to many canals/rivers and its low topographic feature. In addition, ground water utilization by the construction works is not a scale that changes ground water flow. However, there may be impact on the ground water flow by construction activities of tunnels. |
| | | | | | O: Utilizing ground water by HSR is not at a scale that can change ground water level. However, in the tunnel section, there may be an impact on the ground water flow by the structure. The average rainfall of major towns, especially in Ninh Thuan Province, is about 650-800mm/year, and ground water resources are limited. Thus, even a small impact may cause more serious issues in such area. |
| | Ecosystem | D | B- | B- | P: No impact is expected. |

| Category | Items | Result of Rating | | | |
|---|---|---|---|---|---|
| | | Pre-construction | Construction | Operation | Rating Base |
| | Flora, Fauna and Biodiversity | | | | C: Besides some protection and production forest areas, most of the area along the alignment is already developed area including residential and agricultural areas. The affected flora, fauna and biodiversity along the alignment are considered to be not critical, while the construction work may interfere with the habitat of flora and fauna.<br><br>- There is no Important Bird Area (IBA) affected by the alignment.<br>- The section in Binh Thuan - Khanh Hoa falls within the Endemic Bird Area (EBA) of the South Vietnamese lowlands. |
| | | | | | O: Existence of the HSR structure and HSR operation may cause negative impact on the ecosystem. |
| | Protected Areas/Forest | B- | B- | B- | P: The closest special-use forests along the alignment are Nui Chua National Park in Ninh Thuan (about 2km from the alignment) and Ta Kou Nature Reserve in Binh Thuan (about 3km from the alignment). No impact is expected on these precious areas. Besides protected areas, the alignment goes through protection forests (about 92 ha) and production forests (about 64 ha) in Dong Nai, Binh Thuan, Ninh Thuan and Khanh Hoa provinces. Change of forest use purpose into non-forest purpose is required in these areas. |
| | | | | | C: The construction machines could damage the vegetation. Activities of construction workers may also put pressure on the forest. |
| | | | | | O: By the structure of HSR, some of the forest area will be opened. This will mean more sunshine on the inner part of the vegetation area, which would affect the edge of the forest area. |
| | Coastal zone | D | D | D | P/C/O: The closest distance to the alignment from the coastal line is at Binh Thuan (about 1.1 km) and no mudflats or no mangrove areas are affected. Thus, no impact is expected. |
| | Landscape | D | D | B+/B- | P: No impact is expected. |
| | | | | | C: Change of landscape is temporary and limited during the construction. |
| | | | | | O: By the structures such as viaduct, embankment and station buildings, both positive and negative impacts on landscape are expected.<br>- There are recreational areas such as Suoi Thien in HCMC and Mui Ne in Binh Thuan. They are far from the alignment and no impact is expected in such areas. |
| | Natural disasters | D | B- | B- | P: No impact is expected. |
| | | | | | C: Civil works on landslide/erosion prone areas in all of the city/provinces along the alignment may trigger landslide. |
| | | | | | O: Some regularly flooding/land slide areas are found in the south section in all of the city/provinces. Typhoon damage is reported as well. Embankment construction will change topography in some sub-sections that may result in a higher risk of flooding.<br>- It is reported that the soil erosion in the major rivers in Khanh Hoa is serious in recent years. |
| Living Environment | Air Pollution | D | B- | A+/B- | P: No impact is expected. |
| | | | | | C: Some negative impact is expected due to operation of many equipments and vehicles. One is the dust incidental to earth work especially during the dry season, although these impacts are temporary and limited. |

| Category | Items | Result of Rating | | | |
|---|---|---|---|---|---|
| | | Pre-construction | Construction | Operation | Rating Base |
| | | | | | O: Overall reduction of air pollutants' emission is expected from the modal shift of passengers' transportation to the HSR (+55%); from cars (-13%), buses (-38%), air transport (-3%), and existing railways (-1%). (Example of HCMC-Nha Trang Section, 2030). 1,122 t-NOx/year of air pollutants would be reduced by the development of the HSR in the north section. On the other hand, increase in air pollutants from increased access of cars and buses around the station are expected. |
| | Offensive Odor | D | D | D | P/C/O: No impact is expected. |
| | Water Pollution | D | B- | B- | P: No impact is expected. |
| | | | | | C: Turbid water due to the earth works, bridge piers' construction work and wastewater effluents from construction workers' camps/yards are expected to pollute the surrounding rivers/canals to some extent. |
| | | | | | O: Wastewater effluents from passengers at the station and maintenance activities in the depot are expected. Some impacts on water quality in surrounding water bodies are expected due to discharged polluted water. |
| | Bottom Sediment Contamination | D | D | D | P: No impact is expected. |
| | | | | | C: Although some construction materials such as cement and sand are expected to be washed out mainly by the rain, the impacts of bottom sediment are small. |
| | | | | | O: Although some impact is expected on bottom sediment by deposition of pollutants from the wastewater discharged from maintenance activities in the depot in Thu Thiem and Nha Trang, the impact is small. |
| | Soil Contamination | D | C- | B- | P: No impact is expected. |
| | | | | | C: Although some impact on soil is expected by deposition of pollutants from construction materials and vehicles, the impacts are small. On the other hand, in case the soil at construction sites is already contaminated, by some other reason, some impacts are expected by the construction activity. Thus, further study is necessary. |
| | | | | | O: Some impact may be expected on soil from deposition of pollutants from maintenance activities in the depot in Thu Thiem and Nha Trang. |
| | Ground Subsidence | D | D | D | P: No impact is expected. |
| | | | | | C: Ground water utilization by the construction works is not at a scale that changes ground water flow. Thus, no ground subsidence is expected. |
| | | | | | O: In general, geological condition of Mekong Delta in HCMC section is soft soil layers. As a viaduct section is planned to be applied in such area, no impact is expected. |
| | Noise/vibration | D | B- | A- | P: No impact is expected. |
| | | | | | C: Noise and vibration are generated by operation of heavy equipment and vehicles, although they are temporary. Nonetheless, some impact is expected on the residents and facilities/places where quietness is required. Such areas are schools and hospitals near the construction sites. |
| | | | | | O: Noise and vibration are generated by movement of high speed trains and some impacts are expected on the residents and facilities/places where quietness is required such as schools and hospitals along the HSR alignment. Maintenance of ballast track would also cause noise. |
| | Low frequency noise/micro-pressure wave | D | D | A- | P: No impact is expected. |
| | | | | | C: Construction activities will not cause low frequency noise/micro-pressure wave |

| Category | Items | Result of Rating | | | |
|---|---|---|---|---|---|
| | | Pre-construction | Construction | Operation | Rating Base |
| | | | | | O: Significant low frequency/micro-pressure wave at long tunnel sub-sections is expected. Long tunnels over 1km exist at 7 locations, of which 4 are over 3km long (the longest one is about 14km in the border of Binh Thuan and Ninh Thuan, one in the border of Ninh Thuan and Khanh Hoa, and the other 2 in Khanh Hoa). Including the shorter ones, most of the tunnels are in Khanh Hoa Section, followed by Ninh Thuan and Binh Thuan. Low frequency noise from the train passing an open section is small. |
| | Wave Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No wave obstruction is expected from the construction works. |
| | | | | | O: Radio waves would be disturbed by movement of high speed trains and some impacts such as flutter and pulse interferences on TV are expected. In addition, elevated structures such as viaducts (typical design is about 10m high) and station buildings (two-storey station like Phan Thiet, Nha Trang is about 20m high) will be developed. Some wave disturbance impacts are expected due to these structures. |
| | Sunshine Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No sunshine obstruction is expected from the construction works. |
| | | | | | O: There will be elevated structures such as viaduct and station buildings developed; some impacts are expected in terms of the shade created by these structures. |
| | Wastes/Hazardous waste | D | B- | B- | P: No impact is expected. |
| | | | | | C: A certain amount of construction and demolition wastes, which may include hazardous materials, and waste from construction workers' camps are expected to be generated. |
| | | | | | O: A certain amount of wastes from passengers at the station and maintenance works at the depot is expected to be generated. |
| Social Environment | Involuntary resettlement | A- | B- | D | P: About 1,700 ha of land would be necessary for development of the HSR structures (viaduct, station, depot, etc.) in this section. In addition, about 1,250 buildings and about 6,100 households would be affected either by land acquisition or resettlement although the alignment is planned to avoid land acquisition and resettlement, as much as possible, in the alternative analysis. |
| | | | | | C: Land acquisition and resettlement activities are expected to continue even during the construction stage. Temporary relocation is also required for setting up of construction yards and workers' camps for the construction activities. |
| | | | | | O: No impact is expected. |
| | Land use | B- | B- | A+ | P: The current land use needs to be changed by land acquisition and resettlement in accordance with the planned alignment and station location. |
| | | | | | C: Land clearance for construction yards and workers' camps is temporary. The land use around the construction site may be changed by doing business with construction workers without control. |
| | | | | | O: The HSR station will be developed together with areas around the station as an integrated development. In addition, land use is expected to be changed gradually with further development mainly around the station in accordance with a city/provincial plan and private investments. |
| | Utilization of local resources | D | B- | D | P: No impact is expected. |
| | | | | | C: Using a large amount of local resources such as sand and quarry for the construction activities would obstruct its utilization by the local people for other purposes. |

| Category | Items | Result of Rating | | | |
|---|---|---|---|---|---|
| | | Pre-construction | Construction | Operation | Rating Base |
| | | | | | O: No impact is expected because the HSR would not use much local resources. |
| | General, regional /city plans | B+/B- | D | B+ | P: Except for Thu Thiem Station and section in HCMC - Dong Nai along the express way, where other further development is limited for future HSR purpose, HSR will result in changing land use in most of the provinces. The current general plan and/or regional/city plan of city/provinces needs to be updated in accordance with the planned alignment and station location. |
| | | | | | C: No impact is expected (updating plans may continue). |
| | | | | | O: In accordance with the HSR development, future general plan/city plans, which include future development plan, are expected to be prepared in all city/provinces. |
| | Social institutions and local decision - making institutions | C- | C- | C- | P: Some impacts on social institutions and local decision making institutions are expected from land acquisition and resettlement. However further examination is necessary. |
| | | | | | C: Some impact on social institutions and local decision making institutions are expected from the inflow of many construction workers and other people from outside the area. However, further examination would be necessary. |
| | | | | | O: Some impacts on social institutions and local decision making institutions are expected from disturbances on movement of local people by the HSR structures. However, further examination is necessary. |
| | Social Infrastructures and Services | B- | B- | B+/B- | P: Some impacts on social infrastructure and services are expected from land acquisition and resettlement, such as resettlement of community facility (village hall, etc.). |
| | | | | | C: Though temporary, impacts on social infrastructures and services from the setting up of construction yards and workers' camps are expected. Notably, impacts on social infrastructures and services are expected from disturbances and interruptions on their utilization by the construction activities such as relocation of public utilities and local roads. |
| | | | | | O: Development of the HSR station together with its surrounding areas would improve social infrastructures and services in the area and the country. On the other hand, some impacts on social infrastructures and services by the existence of the HSR structures are expected. |
| | Local economy and livelihood | B- | B+ | A+/B- | P: Some negative impacts on the local economy and livelihood are expected because of losses in employment opportunities and income sources resulting from land acquisition and resettlement. |
| | | | | | C: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the construction activities. |
| | | | | | O: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the HSR project, especially around the station, and employment of the workers for track maintenance, etc.<br>On the other hand, some negative impacts are also expected after the completion of the construction activities because of termination of temporary employment opportunities of local workers. |
| | Unequal | B- | B- | B- | P: Unequal situations are expected among the project affected households/people and not affected households/people. |

| Category | Items | Result of Rating | | | |
|---|---|---|---|---|---|
| | | Pre-construction | Construction | Operation | Rating Base |
| | Distribution of Benefit and Damage | | | | C: Some unequal situations are expected among the local people between those who will receive any benefit and those who will incur any damage from the constriction activities, e.g., some affected households need to be relocated far away while their non-affected neighbors can do business with the construction workers. |
| | | | | | O: Some unequal situations are expected among the local people between those who live near the station and those who live far from the station. In the latter case, the local people will possibly incur damages such as noise and vibration impacts, and some impacts on social infrastructures, services, livelihood and water usage. Meanwhile, for the former case, the local people may enjoy the benefit from the HSR service and related opportunities of businesses |
| | Local conflicts of interest | C- | C- | C- | P/C/O: Local conflicts of interest are expected among local people, especially between beneficiaries and project affected people for land acquisition and inconveniences during construction and operation. Further examination would be necessary in case that unequal distribution of benefit and damage is expected to be crucial issues. |
| | Water Usage, Water Rights and Communal Rights | C- | C- | C- | P: Some impacts on water usage for the resettled houses/residents are expected from land acquisition and resettlement. However, further examination would be necessary for water rights and communal rights. |
| | | | | | C: Impacts on water usage such as obstruction to access of water sources for domestic and irrigation uses by the construction activities are small and temporary. However, further examination would be necessary for water rights and communal rights. |
| | | | | | O: Impacts on water usage such as obstruction to access of water sources for domestic and irrigation uses with the existence of the HSR structures are small. However, there may be larger impacts in some areas like the province of Ninh Thuan because domestic water sources and irrigation facilities are limited and further examination would be necessary for disturbance by the structures. |
| | Cultural and Historical Heritages | C- | C- | C- | P: There are no registered cultural and historical heritages found within a distance of 100m from the alignment. However, in Dong Nai Section, potential existence of undiscovered underground heritages was indicated by DOCST of Dong Nai. |
| | | | | | C: Registered heritages are not found within 100m from the alignment. Unknown heritages or heritages at some distance may be affected by the traffic congestions caused by vehicles for the construction. |
| | | | | | O: Besides the undiscovered heritages, the registered heritages are located far from the alignment and they may not suffer from the impact of noise and vibration. |
| | Religious Facilities | A- | B- | B- | P: Though the well known religious places are not directly affected, small scale village level religious facilities may be relocated (e.g., Pho Quang Pagoda in Binh Thuan and several cemeteries). |
| | | | | | C/O: Some pagodas and temples are found along the HSR within a distance less than 200m. So impacts such as noise and vibration on these places are expected during the construction and operational stages. |
| | Sensitive facilities (ex. hospital, school, precision | A- | B- | B- | P: Since some sensitive places such as an elementary school in Dong Nai Province and others are found near the planned alignment, these places may have to be relocated. |
| | | | | | C: Traffic congestion due to heavy vehicles will affect local people's convenience and safety, especially the areas around schools and hospitals. |

| Category | Items | Result of Rating | | | |
|---|---|---|---|---|---|
| | | Pre-construction | Construction | Operation | Rating Base |
| | machine factory) | | | | O: More specifically with regard to the school and hospital along the alignment, noise and vibration caused by HSR may affect people's comfort. |
| | Poor people | C- | B+ | C- | P: Poor people (who have poor household certificates issued by local authorities) reside everywhere with particular concentration in the provinces of Ninh Thuan and Binh Thuan. Further examination would be necessary for the poor people because it is more difficult for them to recover their livelihood, after land acquisition and resettlement, as compared to other PAPs. |
| | | | | | C: There is a possibility that the poor people would also have employment opportunities in construction and its associated business activities. |
| | | | | | O: There is a possibility that the enjoyment of the benefits of the HSR service by the poor people would be difficult. Further examination and special considerations are necessary. |
| | Ethnic Minorities/indigenous people | A- | A- | B- | P: In this section, there are many ethnic groups. Ninh Thuan Province, in particular, has about 30 ethnic groups (such as Ra Glai and Cham). Though the planned HSR runs through the plain area, where there is less ethnic groups, land acquisition and resettlement may still affect their livelihood and culture. |
| | | | | | C: Some impact on ethnic groups is expected from the influx of a large number of construction workers and people outside the area. Since the HSR runs through the plain area where the ethnic minorities are comparatively less, the impact would not be significant. |
| | | | | | O: Some impact on ethnic groups is expected from the disturbance on people's movement due to the existence of HSR structures. Since the HSR runs through the plain area where the ethnic minorities are comparatively less, the impact would not be significant. |
| | Gender | C- | C- | C- | P: Land acquisition and resettlement are an important incident to a family and some women would have a bigger burden for that. Further examination would be necessary. |
| | | | | | C: Equal employment opportunities for both sexes are required for the construction works. Further examination would be necessary. |
| | | | | | O: The HSR service will be equal for both sexes. On the other hand, equal employment opportunities for both sexes are required for the HSR operation. Further examination would be necessary. |
| | Children's rights | D | D | D | P: No impact is expected. |
| | | | | | C/O. Since employment of children for the construction works is strictly prohibited by the Children Protection, Education and Care Law 2004, no impact is expected. |
| | Public Health (sanitation and infectious diseases) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts on public health are expected due to unsanitary conditions caused by the influx of a large number of workers. In addition, increase of risks related to Sexually Transmitted Diseases (STD) or Sexually Transmitted Infections (STI) and HIV/AIDS is expected among the workers and local communities. |
| | | | | | O: Some impacts on public health are expected in terms of the increase of risks for spreading of infectious diseases. This is due to the influx of a large number of passengers (about 50,000 passengers per day at Thu Thiem Station, if Thu Thiem – Nha Trang section is operated in 2030) and business persons around the station area. |
| | Occupational | D | B- | B- | P: No impact is expected. |

| Category | Items | Result of Rating | | | |
|---|---|---|---|---|---|
| | | Pre-construction | Construction | Operation | Rating Base |
| | Health and Safety (OHS) | | | | C: Some impacts regarding OHS for the construction workers are expected. |
| | | | | | O: Some impacts regarding OHS on the workers for the HSR operation, especially the workers at the track maintenance and at the depot are expected. |
| Other | Accidents | D | B- | C+/C- | P: No impact is expected. |
| | | | | | C: Increase of risks of accidents associated with construction activities is expected due to the operation of heavy equipment and vehicles. |
| | | | | | O: Increase of risks of accidents associated with the HSR services is expected due to the high speed train operation. On the other hand, positive and/or negative impacts are expected from the modal shift of passengers' transportation from cars, buses, air transport, and existing railways to the HSR. |
| | Climate Change | D | D | A+/C- | P: No impact is expected. |
| | | | | | C: Although increase of GHGs emission is expected due to operation of heavy equipment and vehicles, the impact is temporary and small. |
| | | | | | O: Overall reduction of GHGs emission is expected by the modal shift of passengers' transportation to the HSR (+55% of the share between HCMC and Nha Trang, 2030 projection) from cars (-13%), buses (-38%), air transport (-3%), and existing railways (-1%). 72 kt-CO2e/year of GHGs would be reduced by the development of the HSR in the south section. Low elevation areas close to the coastal area may be affected by the rise of sea level by climate change, and further examination would be required |

Note: A-: Serious negative impact is expected, B-:Some negative impact is expected, C-:Extent of negative impact is unknown, D: No impact is expected, A+:Remarkable positive effect is expected, B+:Some positive effect is expected, and C+:Extent of positive impact is unknown. Rating basis is for P: Pre-Construction; C: Construction; and O: Operation
Source: JICA Study Team

### 4) Results of Provisional Scoping

4.24 Based on the results of the rating for each section, each of the environmental and social consideration items has been scoped to select the items to be studied further in the subsequent EIA for the north and the south sections.

#### (1) North Section

4.25 Table 4.4.9 summarizes the results of provisional scoping for the north section.

**Table 4.4.9 Results of Provisional Scoping for North Section**

| Cate-gory | Item | Result of Scoping | |
|---|---|---|---|
| | | Scoping Result | Scoping Base |
| Natural Environment | Climate/ meteorological phenomena | n/a | No impact is expected. |
| | Topography | C | Impacts in the mountainous sections should be assessed. |
| | Geology | n/a | No impact is expected. |
| | Soil Erosion | C/O | Since soil erosion would be significant during construction and operation, detailed assessment is required. |
| | Hydrology | O | The impacts on hydrology, which may trigger flooding and other problems, should be assessed. |

| Cate-gory | Item | Result of Scoping | |
|---|---|---|---|
| | | Scoping Result | Scoping Base |
| | Ground Water | C/O | Outside the delta area, the impact on ground water is an important issue for the local residents. |
| | Ecosystem, Flora, Fauna and Biodiversity | C/O | Impacts on ecosystems, even common ecosystems such as the paddy ecosystem, secondary forest ecosystem, and on flora and fauna and its habitats, require detailed assessment. |
| | Protected Areas/Forest | P/C/O | Protection and production forests would be affected and compensatory plantation would be required for the affected protection forest based on the detailed assessment. |
| | Coastal Zone | n/a | No impact is expected. |
| | Landscape | O | Since the HSR structures such as viaduct and high embankment may affect the landscape, detailed assessment is required. |
| | Natural disaster | C/O | Flood, landslide, typhoon, tornado are common occurrences in city/provinces along the alignment. Detailed assessment is required. |
| Living Environment | Air Pollution | C/O | Reduction of air pollution is one of the strong points of the HSR. Its effect should be estimated. |
| | Offensive Odor | n/a | No impact is expected. |
| | Water Pollution | C/O | Impact assessment in the construction and operation phases (control of discharged water) is required. |
| | Bottom Sediment Contamination | n/a | No impact is expected. |
| | Soil Contamination | C/O | Not only the contamination by construction and operation, but also digging up of contaminated soil (including the residuals during Vietnam War) should be assessed. |
| | Ground Subsidence | n/a | No impact is expected. |
| | Noise/Vibration | C/O | Noise/vibration during construction and operation are the major impact by HSR, detail assessment is required. |
| | Low Frequency Noise/Micro-pressure wave | O | Micro-pressure wave from the HSR operation is one of characteristic and distinctive problems. Detailed assessment is required.. |
| | Wave Obstruction | O | Wave obstruction by applied elevated structures and high speed train movement should be assessed. |
| | Sunshine Obstruction | O | Sunshine obstruction by applied elevated structures should be assessed. |
| | Wastes/Hazardous Materials | C/O | Waste management is important for construction and operation to reduce the impact on environment. Detailed assessment is required. |
| Social Environment | Involuntary resettlement | P/C | One of the most important issues in the HSR development would be the involuntary resettlement and land acquisition issue. |
| | Landuse | P/C/O | In order to minimize the negative impact and maximize positive impact, detailed assessment is necessary. |
| | Utilization of Local Resources | C | Since management of local resource use is required to avoid excessive use during construction, detailed assessment is required. |
| | General, Regional /City Plans | P/O | In order to minimize the negative impact and maximize positive impact, detailed assessment is necessary. |
| | Social Institutions and Local Decision - making Institutions | P/C/O | In order to minimize the potential negative impact, further study is necessary. |
| | Social Infrastructures and Services | P/C/O | In order to minimize the potential negative impact and maximize positive impact on convenience of local people, detailed assessment is necessary. |
| | Local Economy and Livelihood | P/C/O | Since negative impact related to resettlement should be minimized and positive impact should be maximized, detailed assessment is required. |
| | Unequal Distribution of Benefit and Damage | P/C/O | In order to avoid unequal distribution of benefits and damages, detailed assessment is necessary. |

| Cate-gory | Item | Result of Scoping | |
|---|---|---|---|
| | | Scoping Result | Scoping Base |
| | Local Conflicts of Interest | P/C/O | In order to avoid local conflicts of interest, detailed assessment is necessary. |
| | Water Usage, Water Rights and Communal Rights | P/C/O | To avoid unnecessary conflict, detailed assessment of water rights and community rights is required. |
| | Cultural and Historical Heritages | C/O | Since some national heritages are located near the alignment, detailed assessment is required. |
| | Religious Facilities | P/C/O | Since some religious facilities would be affected directly, and the neighboring facilities may be affected as well, detailed assessment is required. |
| | Sensitive facilities (ex. hospital, school, precision machine factory) | P/C/O | Since many sensitive facilities would be affected, detailed assessment is required. |
| | Poor people | P/C/O | Since poor people are spread throughout the area, more especially in Thanh Hoa, further study and assessment is required. |
| | Ethnic Minorities/indigenous people | P/C/O | Although ethnic minorities are not many in the north section, except for some in Thanh Hoa, careful assessment is required. |
| | Gender | P/C/O | As there may be potentials for the negative impacts, further study and assessment is required. |
| | Children's rights | n/a | No impact is expected. |
| | Public Health (sanitation and infectious diseases) | C/O | To control and manage infectious diseases, detailed assessment is required. |
| | Occupational Health and Safety (OHS) | C/O | To manage OHS of construction labor and maintenance staff during operation, detailed assessment is required. |
| Other | Accidents | C/O | Careful assessment is required since causes of accidents are complex. |
| | Climate Change | O | Since reduction of GHGs is one of the strong points of HSR, detailed estimation is required. Impacts of the sea level rise in the low elevation areas need assessment. |

Note: P: Scoped Items for Pre-Construction Stage, C: Scoped Items for Construction Stage, O: Scoped Items for Operation Stage, n/a:Not applicable for the EIA
Source: JICA Study Team

### (2) South Section

4.26 Table 4.4.10 summarizes the results of provisional scoping for the south section.

**Table 4.4.10 Result of Provisional Scoping for South Section**

| Cate-gory | Item | Scoping | |
|---|---|---|---|
| | | Scoping Result | Reason for Scoping |
| Natural Environment | Climate/ meteorological phenomena | n/a | No impact is expected. |
| | Topography | C | Impacts in the mountainous sections should be assessed. |
| | Geology | n/a | No impact is expected. |
| | Soil Erosion | C/O | Since soil erosion would be significant during construction and operation, detailed assessment is required. |
| | Hydrology | O | The impacts on hydrology, which may trigger flooding and other problems, should be assessed. |
| | Ground Water | C/O | Outside the delta area, the impact on ground water is an important issue for the local residents. |
| | Ecosystem, Flora, Fauna and Biodiversity | C/O | Impacts on ecosystems, even common ecosystems such as the paddy ecosystem, secondary forest ecosystem, and on flora and fauna and its habitats require detailed assessment. |

| Cate-gory | Item | Scoping | |
|---|---|---|---|
| | | Scoping Result | Reason for Scoping |
| | Protected Areas/Forest | P/C/O | Protection and production forests would be affected and compensatory plantation would be required for the affected protection forest based on the detailed assessment. |
| | Coastal Zone | n/a | No impact is expected. |
| | Landscape | O | Since the HSR structures such as viaduct and high embankment may affect the landscape, detailed assessment is required. |
| | Natural disaster | C/O | Flood, landslide, typhoon, tornado are common occurrences in city/provinces along the alignment. Detailed assessment is required. |
| Living Environment | Air Pollution | C/O | Reduction of air pollution is one of the strong points of the HSR. Its effect should be estimated. |
| | Offensive Odor | n/a | No impact is expected. |
| | Water Pollution | C/O | Impact assessment in the construction and operation phases (control of discharged water) is required. |
| | Bottom Sediment Contamination | n/a | No impact is expected. |
| | Soil Contamination | C/O | Not only the contamination by construction and operation, but also digging up of contaminated soil (including the residuals during Vietnam War) should be assessed. |
| | Ground Subsidence | n/a | No impact is expected. |
| | Noise/ Vibration | C/O | Noise/vibration during construction and operation are the major impacts by HSR. Detailed assessment is required. |
| | Low Frequency Noise/Micro-pressure wave | O | Micro-pressure wave from the HSR operation is one of characteristic and distinctive problems. Detailed assessment is required. |
| | Wave Obstruction | O | Wave obstruction by applied elevated structures and high speed train movement should be assessed. |
| | Sunshine Obstruction | O | Sunshine obstruction by the elevated structures should be assessed. |
| | Wastes/Hazardous Materials | C/O | Waste management is important for construction and operation to reduce the impact on environment. Detailed assessment is required. |
| Social Environment | Involuntary resettlement | P/C | One of the most important issues in the HSR development would be the involuntary resettlement and land acquisition issue. |
| | Landuse | P/C/O | In order to minimize the negative impact and maximize positive impact, detailed assessment is necessary. |
| | Utilization of Local Resources | C | Since management of local resource use is required to avoid excessive use during construction, detail assessment is required. |
| | General, Regional /City Plans | P/O | In order to minimize the negative impact and maximize positive impact, detailed assessment is necessary. |
| | Social Institutions and Local Decision - making Institutions | P/C/O | In order to minimize the potential negative impact, further study is necessary. |
| | Social Infrastructures and Services | P/C/O | In order to minimize the potential negative impact and maximize positive impact on convenience of local people, detailed assessment is necessary. |
| | Local Economy and Livelihood | P/C/O | Since negative impact related to resettlement should be minimized and positive impact should be maximized, detailed assessment is required. |
| | Unequal Distribution of Benefit and Damage | P/C/O | In order to avoid unequal distribution of benefits and damages, detailed assessment is necessary. |
| | Local Conflicts of Interest | P/C/O | In order to avoid local conflicts of interest, detailed assessment is necessary. |
| | Water Usage, Water Rights and Communal Rights | P/C/O | To avoid unnecessary conflict, detailed assessment of water rights and community rights is required. |
| | Cultural and Historical Heritages | P/C/O | Since some heritage assets would be directly affected and there may be undiscovered underground heritages according to the information from DOCST, detailed assessment is required. |

| Cate-gory | Item | Scoping | |
|---|---|---|---|
| | | Scoping Result | Reason for Scoping |
| | Religious Facilities | P/C/O | Since some religious facilities would be directly affected, and the neighboring facilities may be affected as well, detailed assessment is required. |
| | Sensitive facilities (ex. hospital, school, precision machine factory) | P/C/O | Since many sensitive facilities would be affected, detailed assessment is required. |
| | Poor people | P/C/O | Since poor people are commonly spread throughout the area, more especially in Ninh Thuan and Binh Thuan, further study and assessment is required. |
| | Ethnic Minorities/indigenous people | P/C/O | Since many ethnic minorities are living respecting their own traditional way in Ninh Thuan, Binh Thuan and Khanh Hoa, careful assessment is required. |
| | Gender | P/C/O | As there may be potentials for the negative impacts, further study and assessment is required. |
| | Children's rights | n/a | No impact is expected. |
| | Public Health (sanitation and infectious diseases) | C/O | To control and manage the infectious diseases, detailed assessment is required. |
| | Occupational Health and Safety (OHS) | C/O | To manage OHS of construction labor and maintenance staff during operation, detailed assessment is required. |
| Other | Accidents | C/O | Careful assessment is required since causes of accidents are complex. |
| | Climate Change | O | Since reduction of GHGs is one of the strong points of HSR, detailed estimation is required. Impacts of the sea level rise in the low elevation areas need assessment. |

Note: P: Scoped Items for Pre-Construction Stage, C: Scoped Items for Construction Stage, O: Scoped Items for Operation Stage, n/a:Not applicable for the EIA
Source: JICA Study Team

## 4.5 Provisional Mitigation Measures

4.27 Based on the results of scoping, provisional mitigation measures have been proposed to avoid and reduce the adverse impacts caused by the HSR project activities during planning/design, construction and operation stages.

### 1) North Section

4.28 The proposed provisional mitigation measures for the north section are summarized in Table 4.5.1.

**Table 4.5.1 Provisional Mitigation Measures for North Section**

| Aspect | Item | Stage | Potential Impact | Mitigation Measure |
|---|---|---|---|---|
| Natural Environment | Topography | C | - C: There will be variations of topography between Ninh Binh and Nghe An where more mountains/hills exist along the alignment requiring about 20km of cut section. | - Select appropriate alignment at the detail design stage to avoid unnecessary change of topography. |
| | Soil Erosion | C/O | - C: Due to earth works, especially when it is raining, some soil erosion is expected. | - Clear demarcation of the ROW;<br>- Design and provide sufficient walls/terraces to obstruct mud where soil erosion has high risk;<br>- Design and provide sufficient gutters to divert rain water flow to the destination areas;<br>- Design appropriate slope (not too steep); and<br>- Design and provide grass and wet masonry, if necessary, to cover areas along the alignment where new soil surfaces and high slopes exist. |
| | | | - O: Total length of the alignment is about 284 km, in which embankment or cut section is about 129.5 km, where new surface may be washed by rain water. | - The new surface should be covered with vegetation; and<br>- In vulnerable new surface section, other civil engineering method for soil erosion control may be applied. |
| | Hydrology | C/O | - C: In embankment or cut section, piled up soil may cause minor and temporary impact on hydrological cycle or regimes. Tunnel construction may also cause impact on hydrology. | - Design and provide sufficient gutters to divert rain water flow to the destination areas in embankment/open cutting sub-sections;<br>- Remove all odd solid waste right after each day of construction; and<br>- Minimize cutting/embankment construction during rainy/flooding season. |
| | | | - O: In the embankment section (mostly in the section in Thanh Hoa and Nghe An), hydrological situation will be affected by the structures. In the downstream area from the long tunnels, there may be the impact on hydrology. | - In the embankment area, culverts for smooth water flow are designed and constructed. The existing water way such as streams and canals should be carefully identified and such water flow will not be obstructed; and<br>- The water flow of the downstream area of long tunnels will be carefully monitored. |
| | Ground water | C/O | - C: There may be impact on the ground water flow by construction activities of tunnels. | - The utilized ground water source will be monitored especially in the downstream area of the tunnel sections. |
| | | | - O: In the tunnel section, there may be impact on the ground water flow by the structure. | - The utilized ground water source will be monitored especially in the downstream area of the tunnel sections. |
| | Ecosystem Flora, Fauna and Biodiversity | C | - C: The construction work may interfere with the habitat of some flora and fauna species.<br>- The section in Ninh Binh – Nghe An falls within the boundary of Endemic Bird Area of Annamese lowlands. | - Minimize the clearance of vegetation areas;<br>- Conduct inventory survey before starting construction, with due consideration on seasonal changes;<br>- Avoid/minimize the construction during the breeding season; |

| Aspect | Item | Stage | Potential Impact | Mitigation Measure |
|---|---|---|---|---|
| | | | | - Avoid/minimize the construction in the period when vulnerable migrating birds are flying to that area; and<br>- Educate workers/staff of contractors on awareness and on importance of ecosystem, flora, fauna and biodiversity protection. |
| | | O | - O: Existence of the HSR structure and HSR operation may cause negative impact on the ecosystem. | - Inventory survey on fauna/flora (especially endangered/endemic species);<br>- Educate workers/staff of contractors on awareness and on importance of ecosystem, flora, fauna and biodiversity protection;<br>- Post up notices on endangered animal/botanical species and their possible habitats and Issue regulations and fine to those who try to catch/hunt the species;<br>- Compensatory plantation of local species;<br>- Development of Green Belt; and<br>- Close monitoring by competent authority. |
| | Protected Areas/Forest | P | - P: Besides protected areas, the alignment goes through and affect some protection forests (about 14 ha) and production forests (about 58 ha) in Ninh Binh, Thanh Hoa, and Nghe An provinces , | - Compensatory plantation of local species;<br>- Close monitoring by competent authority;<br>- Minimize destruction of vegetation cover;<br>- Educate workers/staff of contractors on awareness and on importance of protection forests; and<br>- Establish signboards on forest protection in public places and near the forest, particularly near the roads that will lead to protected areas. |
| | | C | - C: The construction machines could damage the vegetation. | - The temporary road will be designed carefully to minimize the impact on forest and to mitigate the soil erosion from its surface. |
| | | O | - O: The HSR structure will open up some of the forest areas so that there will be more sunshine on the inner vegetation areas. This will affect the edge of the forest area. | - The change of the vegetation will be monitored and re-plantation will be done when necessary. |
| | Landscape | O | - O: Structures such as viaducts, embankments and station buildings of HSR are expected to have both positive and negative impacts on the landscape. | - Identify the landscape to be considered and list them up;<br>- Slope plantation in the embankment section;<br>- Consider the appropriate color for the structures; and<br>- Consider the low impact structure design on landscape. |
| | Natural Disasters | C/O | - C: Civil work in landslide/ erosion prone areas in Thanh Hoa may trigger landslide.<br>- O: The risk of flood would be higher in embankment section. | - Carefully investigate and consult with local and key stakeholders about regular flooding areas and landslide areas;<br>- Design effective number and location of culverts for drainage in the embankment section;<br>- Design drainage system in flood prone areas especially in the embankment section; and<br>- Avoid landslide area, or design appropriate structure to mitigate landslide risks such as retaining wall and leaning wall works, grating crib works (concrete frame), soldier pile works, anchoring works, etc. |
| Living Environment | Air Pollution | C | - C: Some negative impact is expected due to operation of many equipments and vehicles, such as dust incidental to earth work especially during the dry season. | - Water at construction sites which are near residential areas or sensitive sites such as schools/hospitals or pagodas, etc;<br>- Cover trucks used to transport dust-easy-materials;<br>- Wash trucks at necessary places;<br>- Use low emission construction machines;<br>- Regular air quality monitoring; and<br>- Regular sprinkling of water on unpaved haul |

| Aspect | Item | Stage | Potential Impact | Mitigation Measure |
|---|---|---|---|---|
| | | | | roads and vulnerable area near the construction sites. |
| | | O | - O: Overall reduction of air pollutants' emission is expected from the modal shift of passengers' transportation to the HSR. On the other hand, increase in air pollutants may result from increased access of cars and buses around the station. | - Forecast number of passengers at each station and plan bus linking stops and design feeder roads so that buses and other means of transport can access the station conveniently and minimize traffic jams around the station. |
| | Water Pollution | C | - C: Turbid water from the earth work and bridge piers' construction work and wastewater effluents from construction workers' camps/yards are expected to pollute the surrounding rivers/canals water to some extent. | - Plan to minimize disruption of water flow during monsoon season and disturbance of river bed and river banks;<br>- Proper storage of construction materials (such as sand) so that they will not be washed away into rivers;<br>- Proper management of soil surface by civil works; and<br>- Proper arrangement of sanitation facilities. |
| | | O | - O: Wastewater effluents from passengers at the station and maintenance activities in the depot are expected. Some impacts on water quality in surrounding water bodies are expected due to discharged polluted water. | - Waste water will be treated before discharging in accordance with the national standards such as QCVN 24/2009/BTNMT (industrial wastewater such as from depots) and QCVN 14/2009/BTNMT (domestic wastewater such as from stations). Nearby river water will also be monitored in accordance with QCVN 08/2008/BTNMT (surface water) and QCVN 09/2008/BTNMT (ground water). |
| | Soil Contamination | C | - C: Some impact on soil is expected by deposition of pollutants from construction materials and vehicles. On the other hand, in case the soil at construction sites is already contaminated by some other reason, some impacts are expected from the construction activity. | - Harmless materials will be selected for utilization;<br>- Construction vehicles will be properly maintained so that it will not discharge pollutants; and<br>- The soil contamination situation should be checked before starting the construction. |
| | | O | - O: Some impact may be expected on soil by deposition of pollutants from maintenance activities in the depot in Ngoc Hoi and Vinh. | - Depots will be designed so that no pollutants will be discharged without proper treatment process. |
| | Noise/ Vibration | C | - C: Noise and vibration are generated by operation of heavy equipment and vehicles. | - Apply temporary noise reduction walls;<br>- Use low noise and vibration type vehicles and equipment;<br>- Regular maintenance of construction vehicle and equipment; and<br>- Coordination with relevant authorities about traffic flow. |
| | | O | - O: Noise and vibration are generated by movement of high speed trains. Maintenance of ballast track may also cause noise. | - Using low noise and vibration type rolling stock;<br>- Regular maintenance of rolling stock and railway track, and other related facilities (e.g., Appropriate tension of electric wiring);<br>- Noise mitigating wall; and<br>- Other noise/vibration mitigating structure (e.g., on-ground ditch, slurry wall, etc.). |
| | Low Frequency Noise/Micro-pressure Wave | O | - O: Significant low frequency/micro-pressure wave at long tunnel sub-sections is expected. | - Using low micro-pressure wave type of rolling stock;<br>- Application of mitigation cover; and<br>- Landuse management (to prevent new construction of houses) near the exit of the long tunnels. |

| Aspect | Item | Stage | Potential Impact | Mitigation Measure |
|---|---|---|---|---|
| | Wave Obstruction | O | - O: Radio waves would be disturbed by the movement of high speed trains and some impacts such as flutter and pulse interferences on TV are expected. In addition, wave may be disturbed by the elevated structures. | - Appropriate monitoring and compensatory measures such as connecting cable TVs. |
| | Sunshine Obstruction | O | - O: Some impacts are expected by shade created by the elevated structures. | - Appropriate monitoring and compensation. |
| | Wastes / Hazardous Materials | C | - C: A certain amount of construction and demolition wastes which may include hazardous materials, and waste from construction workers' camps is expected to be generated. | - Prepare and implement appropriate waste management plan for construction sites and worker camps;<br>- Secure designated solid waste disposal sites away from the residential area;<br>- Storing hazardous materials/wastes at the designated area with appropriate arrangement;<br>- Minimize and control usage of hazardous wastes;<br>- Minimize waste generation through a careful plan (such as soil management); and<br>- Public information of waste management in worker camps. |
| | | O | - O: A certain amount of wastes from passengers at the station and maintenance works at the depot is expected to be generated. | - Comply with relevant laws on waste disposal;<br>- Secure designated solid waste disposal sites away from the residential area;<br>- Store hazardous materials/wastes at the designated area with appropriate arrangement; and<br>- Minimize and control usage of hazardous wastes. |
| Social Environment | Involuntary Resettlement | P/C | - P: About 1,100 ha of land would be necessary for development of the HSR structures and about 1,500 buildings and about 4,600 households would be affected in this section.<br>- C: Land acquisition and resettlement activities are expected to be continued even during construction stage. | - Providing compensation for the affected land and structures as per the policy established in the Resettlement Action Plan (RAP);<br>- Use latest satellite images and social survey at sites to plan optimal alignment in terms of impact on residential areas;<br>- Application of viaducts in the populated area to reduce the land acquisition;<br>- Analyze alignment alternatives to minimize land acquisition;<br>- Consult with key local stakeholders about the alignment in detail at sub-sections;<br>- Prepare and implement a RAP with participation of affected household; and<br>- Externally monitor RAP implementation. |
| | Landuse | P | - P: The current land use needs to be changed by land acquisition and resettlement in accordance with the planned alignment and station location. | - Proper planning of land use by the local government; and<br>- Consult with key stakeholders to identify adverse impact then suggest and implement practical mitigation measures in each case. |
| | | C | - C: Land use change for construction yards and workers' camps would be required. | - Proper planning and management of land use by the local government is necessary. |
| | | O | - O: The HSR station will be developed together with areas around the station as an integrated development. In addition, land use is expected to be changed gradually for further development mainly around the station in accordance with a city/provincial plan and private investments. | - Proper planning and management of land use by the local government should be in place to maximize the socio-economic benefit from the development. |
| | Utilization of Local Resources | C | - C: Using a large amount of local resources such as sand and quarry for the construction activities would | - The material procurement plan should be well considered in terms of not only the distance and cost of transportation, but the avoidance of |

| Aspect | Item | Stage | Potential Impact | Mitigation Measure |
|---|---|---|---|---|
| | | | obstruct its utilization by the local people for other purposes. | excessive use of local resources. |
| | General, Regional /City Plans | P/O | - P: The current general plan and/or regional/city plan of city/provinces needs to be updated in accordance with the planned alignment and station location.<br>- O: In accordance with the HSR development including development of station area, further general plan/city plans are expected to be prepared in all the local governments along the alignment . | - Securing land for the development is crucial for the HSR development, and the general and regional/city plans should be updated as soon as possible after the official approval of the projects is given by the central government; and<br>- In accordance with the general and regional/city plans, landuse management should be started prior to land acquisition (for example, restricting the land from further development into other purpose). |
| | Social institutions and Local Decision - Making Institutions | P/C/O | - P: Some impact on social institutions and local decision making institutions is expected for land acquisition and resettlement.<br>- C: Some impact on social institutions and local decision making institutions is expected with the inflow of many construction workers and other people from outside the area.<br>- O: Some impact on social institutions and local decision making institutions is expected due to disturbances in the movement of local people by the HSR structures. | - The social impact assessment would be conducted to monitor the unexpected impact on the communities; and<br>- Necessary countermeasures would be considered and taken in accordance with the result of the monitoring. |
| | Social Infrastructures and Services | P/C/O | - P: By land acquisition and resettlement, some impacts on social infrastructure and services such as resettlement of community facility (village hall, etc) are expected.<br>- C: Though temporary, impacts on social infrastructures and services by setting up of construction yards and workers' camps are expected. Impacts, especially, on social infrastructures and services are expected due to the disturbance and interruption of their utilization by the construction activities such as relocation of public utilities and local roads.<br>- O: Development of the HSR station together with its surrounding areas would improve social infrastructures and services in the area and the country. On the other hand, some impacts on social infrastructures and services by the existence of the HSR structures are expected. | - Finalize the alignment so as not to divide the existing community;<br>- Secure access to local infrastructure including religious places by providing a road, bridge and/or underpass;<br>- Arrange cross drainage works such as bridges and culverts;<br>- Construct or replace public facilities at convenient distance; and<br>- Consider the comprehensive development of HSR and the existing railway so that the accessibility to public transport could benefit the local people along the alignment. |
| | Local Economy and Livelihood | P | - P: Some negative impacts on the local economy and livelihood are expected because of losses of employment opportunities and income sources by land acquisition and resettlement. | - Provide job opportunities related to the Project for the local people and PAPs to the extent possible;<br>- Periodical monitoring will be conducted to minimize the adverse impacts on local economy and livelihood; and<br>- Opportunity of vocational training will be prepared for the people who are forced to change their livelihood due to HSR projects. |
| | | C | - C: Some positive impact on the local economy is expected because of possible increment of business/ employment opportunities generated by the construction activities. | - No mitigation is required while consideration for the training and recruiting is needed for as many local people as possible to maximize the positive impact. |

| Aspect | Item | Stage | Potential Impact | Mitigation Measure |
|---|---|---|---|---|
| | | O | - O: Some positive impact on the local economy is expected because of possible increment of business/ employment opportunities generated by the HSR project, especially around the station and employment of the workers for track maintenance, etc.<br>- On the other hand, some negative impacts are also expected after the completion of the construction activities because of termination of temporary employment opportunities of local workers. | - Plan to train and recruit local people to work at HSR facilities such as stations, HSR trains or at depots; and<br>- Plan to train local people to work not only as construction workers but as employees in the newly developed city area around HSR stations. |
| | Unequal Distribution of Benefit and Damage | P/C/O | - P: Unequal situations are expected among the project affected households/people as well as those not affected households/people.<br>- C: Some unequal situations are expected among the local people between those who receive any benefit and those who incur any damage from the constriction activities, e.g., some affected households need to be relocated far away, while their neighbors, who are not affected, can do business with construction workers.<br>- O: Some unequal situations are expected among the local people between those who live near the station and those who live far from the station. In the latter case, they have the possibility to incur damages such as noise and vibration impacts, and some impacts on social infrastructures and services, livelihood and water usage, while in the former case, they may enjoy the benefits from the HSR service and related opportunities of businesses. | - Periodic monitoring on socio-economic situation of PAPs will be conducted to minimize the unequal distribution of benefits and damages. |
| | Local Conflicts of Interest | P/C/O | - P/C/O: Local conflicts of interest are expected among local peoples, especially between beneficiaries and project affected peoples for land acquisition and inconveniences during construction and operation. Further examination would be necessary in case that unequal distribution of benefit and damage is expected to be crucial issues. | - Transparency of information related to the project and consultation with stakeholders on advantages/disadvantages due to project implementation; and<br>- Provide appropriate compensation for disadvantaged titleholders. |
| | Water Usage, Water Rights and Communal Rights | P/O | - P: Some impacts on water usage for the resettled residents are expected from land acquisition and resettlement.<br>- O: Impacts on water usage such as obstruction of accessibility to water sources for domestic and irrigation uses are expected by the existence of the HSR structures. | - In case of the resettlement, water use and water rights should be planned in the relocation places; and<br>- Construct or replace water supply facilities. |
| | Cultural and Historical Heritages | C | - C: Many heritages are found near the alignment. These may be affected by noise and vibration, and the traffic congestions caused by vehicles for the construction. | - Construction works should not affect the heritages and surrounding areas. The construction will be done in a way that noise/vibration, and traffic congestion will not affect the heritages near the alignment.<br>- Rules and procedures will be prepared, for cases that the heritages are found during the construction work, in accordance with the law. |

| Aspect | Item | Stage | Potential Impact | Mitigation Measure |
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| | | O | - O: The heritages mainly within 100m from the alignment may suffer the impact of noise and vibration to some extent. | - Noise/vibration mitigating works will be done based on the monitoring result. |
| | Religious Facilities | P | - P: Though the well known religious places are not directly affected, small scale village level religious facilities may be relocated. | - Consultation with local people and plan the relocation of the religious facilities following the cultural practice. |
| | | C/O | - C/O: Some pagodas and temples are found along the HSR within a distance less than 200m. So impacts such as noise and vibration are expected during the construction and operational phases. | - Plan the construction so that traffic congestion would have no or as little as possible affect the access to religious facilities;<br>- Plan the improvement of local roads/crossings in consideration of the access to religious facilities; and<br>- Plan and implement noise/vibration mitigation works based on impact estimation and/or the result of monitoring |
| | Sensitive Facilities (e.g., hospital, school, precision machine factory) | P | - P: If some sensitive places are found on the alignment, then those places may have to be relocated. | - Consult with the related local authorities for relocation of the affected facilities. |
| | | C | - C: Regarding the school and hospital, the traffic congestion with heavy vehicles may affect the local people's convenience and safety. | - Plan the construction so that the traffic congestion would have no or as little as possible affect to the access of sensitive facilities; and<br>- Plan the improvement of local roads / crossings in consideration to the access to sensitive facilities. |
| | | O | - O: Regarding to the school and hospital along the alignment, noise and vibration caused by HSR may affect people's comfort. | - Plan and implement noise/vibration mitigation works based on impact estimation and/or the result of monitoring. |
| | Poor People | P/C/O | - P: Poor people live everywhere with particular concentration in Thanh Hoa Province. Further examination would be necessary for them because it is more difficult for them to recover their livelihood after land acquisition and resettlement as compared to other PAPs.<br>- C: There is a possibility that the poor people would also have employment opportunities in construction and its associated business activities.<br>- O: There is a possibility that the enjoyment of the benefits of the HSR service by the poor people would be difficult. Further examination would be necessary. | - Conduct further and detailed examination, in close coordination with the local authorities to recover their living conditions after land acquisition and resettlement. This should be done carefully for the poor people since they are more vulnerable compared to other PAHs/PAPs. |
| | Ethnic Minorities/Indigenous People | P | - P: In this section, there are ethnic groups such as Muong and Kho Me, particularly in Tinh Gia District, Thanh Hoa Province. Some impact on their culture as well as livelihood is expected. | - Consult with the local authorities to have support policies in order to improve their living conditions; and<br>- If necessary, an Indigenous People Plan (IPP) will be prepared to conserve the livelihood and culture of ethnic minorities. |
| | | C | - C: Some impact on ethnic groups is expected from the influx of a large number of construction workers and people from outside the area. | - Consult with the local authorities and monitor the unexpected negative impacts; and<br>- If required, public information to reduce the negative impact will be conducted. |
| | | O | - O: Some impact on ethnic groups is expected in terms of disturbance of movement of people by the existence of HSR structures. | - Consult with the local authorities and monitor the unexpected negative impacts; and<br>- If required, public information to reduce the negative impact will be conducted. |
| | Gender | P/C/O | - P: Land acquisition and resettlement are an important incident to a family and some women would have a bigger | - Consider the way of compensation payment so that the women will be able to have appropriate access to the compensation; and |

| Aspect | Item | Stage | Potential Impact | Mitigation Measure |
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| | | | burden for that. Further examination would be necessary.<br>- C: Equal employment opportunities for both sexes are required for the construction works.<br>- O: The HSR service will be equal to both sexes. On the other hand, equal employment opportunities for both sexes are required for the HSR operation. | - Assure equal employment opportunity for both sexes in construction and operation phases. |
| | Public Health (sanitation and infectious diseases) | C | - C: Some impacts on public health are expected due to unsanitary conditions caused by the influx of a large number of workers. In addition, increase of risks related to Sexually Transmitted Diseases (STD) or Sexually Transmitted Infections (STI) and HIV/AIDS is expected among the workers and local communities. | - Design and implement HIV/AIDS and STI prevention programs at construction sites; and<br>- Design and implement HIV/AIDS and STI prevention programs at communities near the alignment. |
| | | O | - O: Some impacts on public health are expected due to the influx of a large number of passengers and business persons around the station area. | - Assess social impacts periodically; and<br>- Design and implement mass communication programs at communities to enhance local people awareness on possible risks. |
| | Occupational Health and Safety (OHS) | C | - C: Some impacts regarding OHS for the construction workers are expected. | - Establish OHS rules to be followed by construction workers;<br>- Regulate and publicize compulsory labor insurance;<br>- Train construction workers regarding OHS;<br>- Cooperate with local health agencies about health treatment; and<br>- Design and implement HIV/AIDS and STI prevention programs at construction sites. |
| | | O | - O: Some impacts regarding OHS for the workers for the HSR operation, especially the workers at the track maintenance and at the depot are expected. | - Train workers regarding OHS. |
| Others | Accidents | C | - C: Increase in risks of accidents associated with construction activities is expected due to the operation of heavy equipment and vehicles. | - Strengthen education on safety and daily supervision on work/labor safety at construction sites; and<br>- Plan the route and time of the operation of construction vehicles outside the construction sites so that the risk of the accidents will be minimized. |
| | | O | - O: Increase of risks of accidents associated with the HSR services is expected due to the high speed train operation. On the other hand, positive and/or negative impacts are expected by the modal shift of passengers' transportation from cars, buses, air transport, and existing railways to the HSR. | - Arrangement of necessary facilities such as level crossing, pedestrian subway, rail flyovers, fence, signboard for public information;<br>- Periodic training of HSR operator on safe operation;<br>- Monitoring and analysis of the traffic accidents of various modes; and<br>- Education and public information on traffic safety. |
| | Climate Change | O | - O: Overall reduction of GHGs emission is expected due to the modal shift of passengers' transportation to the HSR.<br>- Impacts of sea level rise in the low lying areas need assessment. | - Design the public transport system to access the station easily so that traffic congestion will be minimized around the station area; and<br>- Avoid the low lying areas in the coastal area through alignment planning and/or planning of elevated structures (viaduct /embankment) to mitigate the impact in such low lying areas. |

Note: P: Scoped Items for Pre-Construction Stage, C: Scoped Items for Construction Stage, O: Scoped Items for Operation Stage
Source: JICA Study Team

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### 2) South Section

4.29 The proposed provisional mitigation measures for the south section are summarized in Table 4.5.2.

**Table 4.5.2 Provisional Mitigation Measures for South Section**

| Aspect | Item | Stage | Potential Impact | Mitigation Measure |
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| Natural Environment | Topography | C | - C: There will be variations of topography between Binh Thuan and Khanh Hoa where more mountains/hills exist along the alignment requiring about 67km of cut section and 34km of tunnel section. | - Select appropriate alignment at the detail design stage to avoid unnecessary change of topography. |
| | Soil Erosion | C | - C: Due to earth works, especially when it is raining, some soil erosion is expected. | - Clear demarcation of the ROW;<br>- Design and provide sufficient walls/terraces to obstruct mud where soil erosion has high risk;<br>- Design and provide sufficient gutters to divert rain water flow to the destination areas;<br>- Design appropriate slope (not too steep); and<br>- Design and provide grass and wet masonry, if necessary, to cover areas along the alignment where new soil surfaces and high slopes exist. |
| | | O | - O: Total length of the alignment is about 366 km, in which embankment or cut section is about 275 km, where new surface may be washed by rain water. | - The new surface should be covered with vegetation; and<br>- In vulnerable new surface section, other civil engineering method for soil erosion control may be applied. |
| | Hydrology | C | - C: In embankment or cut section, piled up soil may cause minor and temporary impact on hydrological cycle or regimes. Tunnel construction may also cause impact on hydrology. | - Design and provide sufficient gutters to divert rain water flow to the destination areas in embankment/open cutting sub-sections;<br>- Remove all odd solid waste right after each day of construction; and<br>- Minimize cutting/embankment construction during rainy/flooding season; |
| | | O | O: Since the HSR track will be developed mostly as embankment, the HSR structures may disturb the hydrological cycle or regimes in this section to some extent. | - In the embankment area, culverts for smooth water flow are designed and constructed. The existing water way such as streams and canals should be carefully identified and such water flow will not be obstructed; and<br>- The water flow of the downstream area of long tunnels will be carefully monitored. |
| | Ground water | C | - C: There may be impact on the ground water flow by construction activities of tunnels. | - The utilized ground water source will be monitored especially in the downstream area of the tunnel sections. |
| | | O | - O: In the tunnel section, there may be impact on the ground water flow by the structure. | - The utilized ground water source will be monitored especially in the downstream area of the tunnel sections. |
| | Ecosystem, Flora, Fauna and Biodiversity | C | - C: The construction work may interfere with the habitat of some flora and fauna species.<br>- All section in Binh Thuan - Khanh Hoa falls within the boundary of Endemic Bird Area of South Vietnamese lowlands. | - Minimize the clearance of vegetation areas;<br>- Conduct inventory survey before starting construction, with due consideration on seasonal changes;<br>- Avoid/minimize the construction during the breeding season;<br>- Avoid/minimize the construction in the period when vulnerable migrating birds are flying to that area; and<br>- Educate workers/staff of contractors on awareness and on importance of ecosystem, flora, fauna and biodiversity protection. |
| | | O | - O: Existence of the HSR structure and HSR operation may cause negative impact on the ecosystem. | - Inventory survey on fauna/flora (especially endangered/endemic species);<br>- Educate workers/staff of contractors on awareness and on importance of ecosystem, flora, fauna and biodiversity protection; |

| Aspect | Item | Stage | Potential Impact | Mitigation Measure |
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| | | | | - Post up notices on endangered animal/botanical species and their possible habitats and issue regulations and fine to those who try to catch/hunt the species;<br>- Compensatory plantation of local species;<br>- Development of Green Belt; and<br>- Close monitoring by competent authority |
| | Protected Areas/Forest | P | - C: The alignment goes through and affect protection forests (about 92 ha) and production forests (about 64 ha) in Dong Nai, Binh Thuan, Ninh Thuan and Khanh Hoa provinces, | - Compensatory plantation of local species;<br>- Close monitoring by competent authority;<br>- Minimize destruction of vegetation cover;<br>- Educate workers/staff of contractors on awareness and on importance of protection forests; and<br>- Establish signboards on forest protection in public places and near the forest, particularly near the roads that will lead to protected areas. |
| | | C | - C: The construction machine could damage the vegetation. | - The temporary road will be designed carefully to minimize the impact on forest and to mitigate the soil erosion from its surface. |
| | | O | - O: The HSR structure will open up some of the forest area so that there will be more sunshine on the inner vegetation areas. This will affect the edge of the forest area. | - The change of the vegetation will be monitored and re-plantation will be done when necessary. |
| | Landscape | O | - O: Structures such as viaducts, embankments and stations buildings of HSR are expected to have both positive and negative impacts on the landscape. | - Identify the landscape to be considered and list them up;<br>- Slope plantation in the embankment section;<br>- Consider the appropriate color for the structures; and<br>- Consider the low impact structure design on landscape. |
| | Natural disaster | C/O | - C/O: Some regularly flooding/land slide areas are found in the south section in all of the city/provinces. Typhoon damage is reported as well. Embankment construction will change topography in some sub-sections that may result in a higher risk of flooding. | - Carefully investigate and consult with local and key stakeholders about regular flooding areas and landslide areas;<br>- Design effective number and location of culverts for drainage in the embankment section;<br>- Design drainage system in flood prone area especially in the embankment section; and<br>- Avoid landslide area, or design appropriate structure to mitigate landslide risks such as retaining wall and leaning wall works, grating crib works (concrete frame), soldier pile works, anchoring works, etc. |
| Living Environment | Air Pollution | C | - C: Some negative impact is expected due to operation of many equipments and vehicles, such as dust incidental to earth work especially during the dry season. | - Water at construction sites which are near residential areas or sensitive sites such as schools/hospitals or pagodas etc;<br>- Cover trucks used to transport dust-easy-materials;<br>- Wash trucks at necessary places ;<br>- Use low emission construction machines;<br>- Regular air quality monitoring; and<br>- Regular sprinkling of water on unpaved haul roads and vulnerable area near the construction sites. |
| | | O | - O: Overall reduction of air pollutants' emission is expected from the modal shift of passengers' transportation to the HSR. On the other hand, increase in air pollutants may result from increased access of cars and buses around the station. | - Forecast number of passengers at each stations and plan bus linking stops and design feeder roads so that buses and other means of transport can access the station conveniently and minimize traffic jams around the station. |
| | Water Pollution | C | - C: Turbid water from the earth work and bridge piers' construction work and | - Plan to minimize disruption of water flow during monsoon season and disturbance of river bed |

| Aspect | Item | Stage | Potential Impact | Mitigation Measure |
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| | | | wastewater effluents from construction workers' camps/yards are expected to pollute the surrounding rivers/canals water to some extent. | and river banks;<br>- Proper storage of construction materials (such as sand) so that they will not be washed away into rivers;<br>- Proper management of soil surface by civil works; and<br>- Proper arrangement of sanitation facilities. |
| | | O | - O: Wastewater effluents from passengers at the station and maintenance activities in the depot are expected. Some impacts on water quality in surrounding water bodies are expected due to discharged polluted water. | - Waste water will be treated before discharging in accordance with the national standards such as QCVN 24/2009/BTNMT (industrial wastewater, such as from depots) and QCVN 14/2009/BTNMT (domestic wastewater, such as from stations). Nearby river water will also be monitored in accordance with QCVN 08/2008/BTNMT (surface water) and QCVN 09/2008/BTNMT (ground water). |
| | Soil Contamination | C | - C: Some impact on soil is expected by deposition of pollutants from construction materials and vehicles. On the other hand, in case the soil at construction sites is already contaminated by some other reason, some impacts are expected from the construction activity. | - Harmless materials will be selected for utilization;<br>- Construction vehicles will be properly maintained so that it will not discharge pollutants; and.<br>- The soil contamination situation should be checked before starting the construction. |
| | | O | - O: Some impact may be expected on soil by deposition of pollutants from maintenance activities in the depot in Thu Thiem and Nha Trang. | - Depots will be designed so that no pollutants will be discharged without proper treatment process. |
| | Noise/ Vibration | C | - C: Noise and vibration are generated by operation of heavy equipment and vehicles. | - Apply temporary noise reduction walls;<br>- Use low noise and vibration type vehicles and equipment;<br>- Regular maintenance of construction vehicle and equipment; and<br>- Coordination with relevant authorities about traffic flow. |
| | | O | - O: Noise and vibration are generated by movement of high speed trains. Maintenance of ballast track would also cause noise. | - Using low noise and vibration type rolling stock;<br>- Regular maintenance of rolling stock and railway track, and other related facilities (e.g., appropriate tension of electric wiring);<br>- Noise mitigating wall; and<br>- Other noise/vibration mitigating structure (e.g., on-ground ditch slurry wall, etc.) |
| | Low Frequency Noise/Micro-pressure Wave | O | - O: Significant low frequency/micro-pressure wave at long tunnel sub-sections is expected. | - Using low micro-pressure wave type of rolling stock;<br>- Application of mitigation cover; and<br>- Landuse management (to prevent new construction of houses) near the exit of the long tunnels. |
| | Wave Obstruction | O | - O: Radio waves are disturbed by the movement of high speed trains and some impacts such as flutter and pulse interferences on TV are expected. In addition wave may be disturbed by the elevated structures. | - Appropriate monitoring and compensatory measures such as connecting cable TVs. |
| | Sunshine Obstruction | O | - O: Some impacts are expected by shade created by the elevated structures. | - Appropriate monitoring and compensation. |
| | Wastes/Hazardous Materials | C | - C: A certain amount of construction and demolition wastes, which may include hazardous materials, and waste from construction workers' camps is expected to be generated. | - Prepare and implement appropriate waste management plan for construction sites and worker camps;<br>- Secure designated solid waste disposal sites away from the residential area;<br>- Storing hazardous materials/wastes at the designated area with appropriate arrangement; |

| Aspect | Item | Stage | Potential Impact | Mitigation Measure |
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| | | | | - Minimize and control usage of hazardous wastes;<br>- Minimize waste generation by careful plan (such as soil management); and<br>- Public information of waste management in worker camps. |
| | | O | - O: A certain amount of wastes from passengers at the station and maintenance works at the depot is expected to be generated. | - Comply with relevant laws on waste disposal;<br>- Secure designated solid waste disposal sites away from the residential area;<br>- Store hazardous materials/wastes at the designated area with appropriate arrangement; and<br>- Minimize and control usage of hazardous wastes. |
| Social Environment | Involuntary resettlement | P/C | - P: About 1,700 ha of land would be necessary for development of the HSR structures, and about 1,250 buildings and about 6,100 households would be affected either by land acquisition or resettlement although the alignment is planned to avoid land acquisition and resettlement, as much as possible, through alternative analysis.<br>- C: Land acquisition and resettlement activities are expected to be continued even during construction stage. | - Providing compensation for the affected land and structures as per the policy established in the Resettlement Action Plan (RAP);<br>- Use latest satellite images and social survey at sites to plan optimal alignment in term of impact on residential areas;<br>- Application of viaducts in the populated areas to reduce land acquisition;<br>- Analyze alignment alternatives to minimize land acquisition;<br>- Consult with key local stakeholders about the alignment in detail at sub-sections;<br>- Prepare and implement a RAP with participation of affected household; and<br>- Externally monitor RAP implementation. |
| | Landuse | P | - P: The current land use needs to be changed by land acquisition and resettlement in accordance with the planned alignment and station location. | - Proper planning of land use by the local government; and<br>- Consult with key stakeholders to identify adverse impact then suggest and implement practical mitigation measures in each case. |
| | | C | - C: Land clearance for construction yards and workers' camps is temporary. The land use around the construction site may be changed by doing business with construction workers without control. | - Proper planning and management of land use by the local government is necessary. |
| | | O | - O: The HSR station will be developed together with areas around the station as an integrated development. In addition, land use is expected to be changed gradually for further development mainly around the station in accordance with a city/provincial plan and private investments. | - Proper planning and management of land use by the local government should be in place to maximize the socio-economic benefit from the development. |
| | Utilization of Local Resources | C | - C: Using a large amount of local resources such as sand and quarry for the construction activities would obstruct its utilization by the local people for other purposes. | - The material procurement plan should be well considered in terms of not only the distance and cost of transportation, but the avoidance of excessive use of local resources. |
| | General, Regional /City Plans | P/O | - P: The current general plan of city/provinces needs to be updated in accordance with the planned alignment and station location.<br>- O: In accordance with the HSR development, further general plan/city plans are expected to be prepared in all local governments along the alignment. | - Securing land for the development is crucial for the HSR development, and the general and regional/city plans should be updated as soon as possible after the official approval of the projects is given by the central government, and<br>- In accordance with the general and regional/city plans, landuse management should be started prior to land acquisition (for example, restricting the land from further development into other purpose). |

| Aspect | Item | Stage | Potential Impact | Mitigation Measure |
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| | Social institutions and Local Decision - Making Institutions | P/C/O | - P: Some impact on social institutions and local decision making institutions is expected for land acquisition and resettlement.<br>- C: Some impact on social institutions and local decision making institutions is expected with the inflow of many construction workers and other people from outside the area.<br>- O: Some impact on social institutions and local decision making institutions is expected due to disturbances in the movement of local people by the HSR structures. | - The social impact assessment would be conducted to monitor the unexpected impact on the communities; and<br>- Necessary countermeasures would be considered and taken in accordance with the result of the monitoring. |
| | Social Infrastructures and Services | P/C/O | - P: By land acquisition and resettlement, some impacts on social infrastructure and services such as resettlement of community facility (village hall, etc) are expected.<br>- C: Though temporary, impacts on social infrastructures and services by setting up of construction yards and workers' camps are expected. Impacts, especially, on social infrastructures and services are expected due to the disturbance and interruption of their utilization by the construction activities such as relocation of public utilities and local roads.<br>- O: Development of the HSR station together with its surrounding areas would improve social infrastructures and services in the area and the country. On the other hand, some impacts on social infrastructures and services by the existence of the HSR structures are expected. | - Finalize the alignment so as not to divide the existing community;<br>- Secure access to local infrastructure including religious places by providing a road, bridge and/or underpass;<br>- Arrange cross drainage works such as bridges and culverts;<br>- Construct or replace public facilities at convenient distance; and<br>- Consider the comprehensive development of HSR and the existing railway so that the accessibility to public transport could benefit the local people along the alignment. |
| | Local Economy and Livelihood | P | - P: Some negative impacts on the local economy and livelihood are expected because of losses of employment opportunities and income sources by land acquisition and resettlement. | - Provide job opportunities related to the Project for the local people and PAPs to the extent possible;<br>- Periodical monitoring will be conducted to minimize the adverse impacts on local economy and livelihood; and<br>- Opportunity of vocational training will be prepared for the people who are forced to change their livelihood due to HSR projects. |
| | | C | - C: Some positive impact on the local economy is expected because of possible increment of business/ employment opportunities generated by the construction activities. | - No mitigation is required while consideration for the training and recruiting is needed for as many local people as possible to maximize the positive impact. |
| | | O | - O: Some positive impact on the local economy is expected because of possible increment of business/ employment opportunities generated by the HSR project.<br>- Some negative impacts are also expected after the completion of the construction activities because of termination of temporary employment opportunities of local workers. | - Plan to train and recruit local people to work at HSR facilities such as stations, HSR trains or at depots; and<br>- Plan to train local people to work not only as construction workers but as employees in the newly developed city area around HSR stations. |

| Aspect | Item | Stage | Potential Impact | Mitigation Measure |
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| | Unequal Distribution of Benefit and Damage | P/C/O | - P: Unequal situations are expected among the project affected households/people as well as those not affected households/people.<br>- C: Some unequal situations are expected among the local people between those who receive any benefit and those who incur any damage from the constriction activities, e.g., some affected households need to be relocated far away, while their neighbors, who are not affected, can do business with construction workers.<br>- O: Some unequal situations are expected among the local people between those who live near the station and those who live far from the station. In the latter case, they have the possibility to incur damages such as noise and vibration impacts, and some impacts on social infrastructures and services, livelihood and water usage, while in the former case, they may enjoy the benefits from the HSR service and related opportunities of businesses. | - Periodic monitoring on socio-economic situation of PAPs will be conducted to minimize the unequal distribution of benefit s and damages. |
| | Local Conflicts of Interest | P/C/O | - P/C/O: Local conflicts of interest are expected among local people, especially between beneficiaries and project affected people for land acquisition and inconveniences during construction and operation. | - Transparency of information related to the project and consultation with stakeholders on advantages/disadvantages due to project implementation; and<br>- Provide appropriate compensation for disadvantaged titleholders. |
| | Water Usage, Water Rights and Communal Rights | P/O | - P: Some impacts on water usage for the resettled residents are expected from land acquisition and resettlement.<br>- O: Impacts on water usage such as obstruction of accessibility to water sources for domestic and irrigation uses are expected by the existence of the HSR structures. | - In case of the resettlement, water use and water rights should be planned in the relocation places.<br>- Construct or replace water supply facilities. |
| | Cultural and Historical Heritages | P | - P: There are no registered cultural and historical heritages found within a distance of 100m from the alignment. However, in Dong Nai Section, potential existence of undiscovered underground heritages was indicated by DOCST of Dong Nai. | - Identify the latest registered heritages and other potential heritages to consider in the detail design of the alignment; and<br>- Consider the conduct of the heritage survey in Dong Nai section, if required. |
| | | C | - C: Registered heritages are not found within 100m from the alignment. However, impacts may be felt by those located some distance away due to the traffic congestions caused by vehicles for the construction. | - Construction works should not affect the heritages and surrounding areas. The construction will be done in a way that noise/vibration, and traffic congestion will not affect the heritages near the alignment; and<br>- Rules and procedures will be prepared, for cases that the heritages are found during the construction work, in accordance with the law. |
| | | O | - O: Besides the undiscovered heritages, the registered heritages are located far from the alignment and they may not suffer from the impact of noise and vibration. | - If any undiscovered heritages are found, impact of noise/vibration and traffic congestions would be considered. |
| | Religious Facilities | P | - P: Small scale village level religious facilities on the alignment may be relocated. | - Consultation with local people and plan the relocation of the religious facilities following the cultural practice. |
| | | C/O | - C/O: Some pagodas and temples are found along the HSR within a distance | - Plan the construction so that traffic congestion would have no or as little as possible affect the |

| Aspect | Item | Stage | Potential Impact | Mitigation Measure |
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| | | | less than 200m, So impacts such as noise and vibration are expected during the construction and operational phases. | access to religious facilities; and<br>- Plan the improvement of local roads/crossings in consideration of the access to religious facilities. |
| | Sensitive Facilities (e.g., hospital, school, precision machine factory) | P | - P: If some sensitive places are found on the alignment, then those places may have to be relocated. | - Consult with the related local authorities for relocation of the affected facilities. |
| | | C | - C: Regarding the school and hospital, the traffic congestion with heavy vehicles may affect the local people's convenience and safety. | - Plan the construction so that the traffic congestion would have no or as little as possible affect to the access of sensitive facilities; and<br>- Plan the improvement of local roads / crossings in consideration to the access to sensitive facilities. |
| | | O | - O: Regarding to the school and hospital along the alignment, noise and vibration caused by HSR may affect people's comfort. | - Plan and implement noise/vibration mitigation works based on impact estimation and/or the result of monitoring |
| | Poor People | P/C/O | - P: Poor people live everywhere. Further examination would be necessary for them because it is more difficult for them to recover their livelihood after land acquisition and resettlement as compared to other PAPs.<br>- C: There is a possibility that the poor people would also have employment opportunities in construction and its associated business activities.<br>- O: There is a possibility that the enjoyment of the benefits of the HSR service by the poor people would be difficult. Further examination would be necessary. | - Conduct further and detailed examination, in close coordination with the local authorities, to recover their living conditions after land acquisition and resettlement. This should be done carefully for the poor people since they are more vulnerable compared to other PAPs. |
| | Ethnic Minorities/Indigenous People | P | - P: In this section, there are as many as 30 ethnic groups (such as Ra Glai and Cham), particularly in Ninh Thuan Province. Land acquisition and resettlement may affect their livelihood and culture. | - Consult with the local authorities to have support policies in order to improve their living conditions; and<br>- If necessary, an Indigenous Peoples Plan (IPP) will be prepared to conserve the livelihood and culture of ethnic minorities. |
| | | C | - C: Some impact on ethnic groups is expected from the influx of a large number of construction workers and people from outside the area. | - Consult with the local authorities and monitor the unexpected negative impacts; and<br>- If required, public information to reduce the negative impact will be conducted. |
| | | O | - O: Some impact on ethnic groups is expected in terms of disturbance of movement of people by the existence of HSR structures. | - Consult with the local authorities and monitor the unexpected negative impacts; and.<br>- If required, public information to reduce the negative impact will be conducted. |
| | Gender | P/C/O | - P: Land acquisition and resettlement are an important incident to a family and some women would have a bigger burden for that. Further examination would be necessary.<br>- C: Equal employment opportunities for both sexes are required for the construction works.<br>- O: The HSR service will be equal to both sexes. On the other hand, equal employment opportunities for both sexes are required for the HSR operation. | - Consider the way of compensation payment so that the women will be able to have appropriate access to the compensation; and<br>- Assure equal employment opportunity for both sexes in construction and operation phases. |
| | Public Health (sanitation and infectious | C | - C: Some impacts on public health are expected due to unsanitary conditions caused by the influx of a large number of workers. In addition, increase of | - Design and implement HIV/AIDS and STI prevention programs at construction sites; and<br>- Design and implement HIV/AIDS and STI prevention programs at communities near the |

| Aspect | Item | Stage | Potential Impact | Mitigation Measure |
|---|---|---|---|---|
| | diseases) | | risks related to Sexually Transmitted Diseases (STD) or Sexually Transmitted Infections (STI) and AIDS/HIV is expected among the workers and local communities. | alignment. |
| | | O | - O: Increase in risks on the spread of infectious diseases is expected due to the influx of a large number of passengers and business persons around the station area. | - Assess social impacts periodically; and<br>- Design and implement mass communication programs at communities to enhance local people awareness on possible risks. |
| | Occupational Health and Safety (OHS) | C | - C: Some impacts regarding OHS for the construction workers are expected. | - Establish OHS rules to be followed by construction workers;<br>- Regulate and publicize compulsory labor insurance;<br>- Train construction workers regarding OHS;<br>- Cooperate with local health agencies about health treatment; and<br>- Design and implement HIV/AIDS and STI prevention programs at construction sites. |
| | | O | - Some impacts regarding OHS on the workers for the HSR operation, especially the workers at the track maintenance and at the depot are expected. | - Train workers regarding OHS. |
| Others | Accidents | C | - C: Increase in risks of accidents associated with construction activities is expected due to the operation of heavy equipment and vehicles. | - Strengthen education on safety and daily supervision of work/labor safety at construction sites; and<br>- Plan the route and time of the operation of construction vehicles outside the construction sites so that the risk of the accidents will be minimized. |
| | | O | - O: Increase in risks of accidents associated with the HSR services is expected due to the high speed train operation. On the other hand, positive and/or negative impacts are expected by the modal shift of passengers' transportation from cars, buses, air transport, and existing railways to HSR. | - Arrangement of necessary facilities such as level crossing, pedestrian subway, rail flyovers, fence, and signboard for public information;<br>- Periodic training of HSR operator on safe operation;<br>- Monitoring and analysis traffic accidents of various modes; and<br>- Education and public information on traffic safety. |
| | Climate Change | O | - O: Overall reduction of GHGs emission is expected by the modal shift of passengers' transportation to the HSR.<br>- Impacts of sea level rise in the low lying areas need assessment. | - Design the public transport system to access the station easily so that traffic congestion will be minimized around the station area; and<br>- Avoid the low lying areas in the coastal area through alignment planning and/or planning of elevated structures (viaduct /embankment) to mitigate the impact in such low lying areas. |

Note: P: Scoped Items for Pre-Construction Stage, C: Scoped Items for Construction Stage, O: Scoped Items for Operation Stage
Source: JICA Study Team

### 3) Mitigation Measures for Environmental Impacts Peculiar to the HSR

4.30 When trains run at a high speed, various environmental impacts are expected. In particular, railway noise and vibration, and micro-pressure wave from the exit of long tunnels are considered to be assessed carefully to minimize the impacts. Therefore, preliminary studies on railway noise and vibration and micro-pressure wave impacts have been conducted. The results of the studies are discussed in Chapter 5.

## 4.6 Environmental Monitoring Framework

### 1) Introduction

4.31 Environmental monitoring provides a basis to identify potential adverse environmental and social impacts of the projects during its execution. In general, environmental monitoring activities involve two main types of activities.

- Environmental and social impact monitoring: Monitoring (measurement and field survey) to determine the actual environmental and social conditions and the impacts.
- Inspection of the projects works: Observation of the construction/operation works to ensure mitigation measures are conducted.

4.32 The information derived from the environmental monitoring activities can be used to mitigate and reduce environmental impacts and enhance project benefits through adaptive management. In addition, environmental monitoring will assist in detecting the development of any unexpected environmental or social situations and provide opportunities for adopting appropriate control, management or mitigation measures. Thus, environmental monitoring frameworks were proposed preliminarily based on the results of the scoping to be applied for the north and south sections of HSR. The frameworks are expected to provide useful information and help to:

- Define the monitoring targets and methodology including monitoring indicators and duration/frequency; and
- Define the responsibilities of the project proponent including the supervising consultants and contractors.

### 2) Proposed Environmental Monitoring Framework

#### (1) North Section

4.33 The proposed environmental monitoring framework to grasp the impacts of HSR and evaluate the effectiveness of the mitigation measures is summarized in Table 4.6.1 for the north section.

**Table 4.6.1 Proposed Environmental Monitoring Framework for the North Section**

| Aspect | Item | Stage | Target Area | Survey Method/Parameters | Duration /Frequency | Responsibility |
|---|---|---|---|---|---|---|
| Natural Environment | Topography | C | Areas having specific topographic conditions and with some predicted negative impacts along the planned alignment | - Check construction work with specification on measures for soil erosion prevention | - Regular monitoring based on the instruction of project proponent | Contractor |
| | Soil Erosion | C | Embankment and cut sections with some predicted negative impacts | - Check construction work with specification on measures for land slide and soil erosion prevention | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | - Visual check of the sections at regular basis | - After heavy rainfall of which amount is instructed by the prepared monitoring plan | Project proponent |

| Aspect | Item | Stage | Target Area | Survey Method/Parameters | Duration /Frequency | Responsibility |
|---|---|---|---|---|---|---|
| | Hydrology | O | Rivers with some predicted negative impacts | - Check water flow by field measurement. | - Regular monitoring based on the prepared monitoring plan. | Project proponent |
| | Ground water | C | Areas with some predicted negative impacts on groundwater level | - Check ground water level by field measurement. | - Regular monitoring based on the instruction of project proponent. | Contractor |
| | | O | | | - Quarter of a year. | Project proponent |
| | Ecosystem, Flora, Fauna and Biodiversity | C | Areas with some predicted negative impacts along the planned alignment and surrounding area | - Implement a series of field surveys to indentify flora and fauna and its habitats, especially Ecological Sensitive Receptors (ESRs) such as breeding places, nesting places and water drinking places of wildlife during (at least) rainy and dry seasons.<br>- Implement biodiversity index survey<br>- Implement interviews to environmental experts and NGOs, etc. | - Regular monitoring based on the instruction of project proponent, considering breeding period of ESRs and construction work plan | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan, considering breeding period of ESRs | Project proponent |
| | Protected Areas / Forest | P | Areas with some predicted negative impacts along the planned alignment in Ninh Binh, Thanh Hoa, and Nghe An provinces | - Implement field reconnaissance to check environmental status of protection forests and production forests affected by the planned alignment<br>- Confirm information on new protected areas designated after the Study, if any | - Once during pre-construction phase | Project proponent |
| | | C | | - Implement field reconnaissance to check environmental status of protection forests and production forests affected by the planned alignment | - Regular monitoring based on the instruction of project proponent, considering breeding period of ESRs and construction work plan | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan, considering breeding period of ESRs | Project proponent |
| | Landscape | O | Areas with some predicted some negative impacts along the planned alignment. | - Implement field reconnaissance and interview with the concerned district representatives to confirm distribution of existing landscape to be cared and viewpoints | - Once at the beginning of operation phase. | Project proponent |
| | Natural Disasters | C | Areas having risks of natural disasters such as flood prone areas in Thanh Hoa | - Check length and location of embankment structures.<br>- Collect past record of | - Regular monitoring based on the instruction of project proponent. | Contractor |

| Aspect | Item | Stage | Target Area | Survey Method/Parameters | Duration /Frequency | Responsibility |
|---|---|---|---|---|---|---|
| | | O | and Nghe An. | flooding | - Regular monitoring based on the prepared monitoring plan. | Project proponent |
| Living Environment | Air Pollution | C | Main residential areas along the planned alignment | - Monitor air pollutants, $NO_x$, CO, TSP and $PM_{10}$, related to the parameters in QCVN05/2009/BTNMT | - At least 2 weeks each during the rainy season and the dry season (Frequency increases depending on construction work plan). | Contractor |
| | | O | Main cities/towns affected by modal shift | | - (using city/provincial monitoring data) | Project proponent |
| | Water Pollution | C | Rivers with some predicted impacts related to main construction sites of bridges and planned areas of construction worker's camps/yards | - Monitor river water quality, pH, BOD, COD and SS, related to the parameters in QCVN08:2008/BTNMT | - At least 2 times a year during the rainy season and the dry season (Frequency increases depending on construction work plan). | Contractor |
| | | O | Rivers with some predicted impacts related to stations and depots | | - At least 2 times a year during the rainy season and the dry season | Project proponent |
| | Soil Contamination | C | Sites of cut work with concerns on soil contamination due to history of land use or natural condition | - Survey soil quality for toxic substances which are suspected for soil contamination | - Regular monitoring based on the instruction of project proponent considering construction work plan | Contractor |
| | | O | Sites planned for the construction of a depot in Ngoc Hoi and Vinh. | - Survey soil quality for toxic substances which are found by the survey during construction stage | - As required | Project proponent |
| | Noise / vibration | C | Main residential areas with some predicted serious impacts, especially near sensitive facilities/ places which require quietness along the planned alignment and the existing railways | - Measure equivalent continuous A-weighted noise levels and vibration levels | - 3 days monitoring regularly, based on the instruction of project proponent, considering construction work plan | Contractor |
| | | O | | | - 3 days monitoring regularly, based on the prepared monitoring plan. | Project proponent |
| | Low Frequency Noise / Micro-pressure Wave | O | Areas around the exits of HSR long tunnels where houses and buildings requiring special attention are located. | - Measure low frequency noise/micro-pressure wave | - Once at the beginning of operation phase (If required, additional monitoring is conducted after adaptation of the mitigation measure). | Project proponent |

| Aspect | Item | Stage | Target Area | Survey Method/Parameters | Duration /Frequency | Responsibility |
|---|---|---|---|---|---|---|
| | Wave Obstruction | O | Main residential areas with some predicted impacts along the elevated structure of the planned alignment | - Survey wave obstruction condition | - Once at the beginning of operation phase (If required, additional monitoring is conducted after adaptation of the mitigation measure). | Project proponent |
| | Sunshine Obstruction | O | Main residential and agricultural areas with some predicted impacts along the elevated structure of the planned alignment | - Survey sunshine obstruction condition. | - The winter solstice day in the first year of operation | Project proponent |
| | Waste / Hazardous Waste | C | Districts where large workers' camps are located | - Survey amount and type of generated waste including adopted measures for waste/hazardous waste disposal. | - Regular monitoring based on the instruction of project proponent, considering construction work plan. | Contractor |
| | | O | Districts where stations and depots are located during operation phase | | - Regular monitoring based on the prepared monitoring plan. | Project proponent |
| Social Environment | Involuntary Resettlement | P | Areas affected by involuntary resettlement due to construction of tracks, stations, depots and required areas for construction work. | - Monitor implementation condition of the required processes instructed by the prepared RAPs | - Regular and occasional monitoring based on the prepared RAPs | Project proponent<br>External bodies designated by RAPs |
| | | C | | | | Contractor<br>External bodies designated by RAPs |
| | Land Use | P | Areas affected by construction of tracks, stations, depots, and required areas for construction work | - Update land use condition obtained by EIA by analysis of satellite image and field reconnaissance | - Once prior to the construction phase. | Project proponent |
| | | C | Areas affected by construction work | - Confirm change of land use condition and field reconnaissance | - Regular monitoring based on the instruction of project proponent, considering construction work plan. | Contractor |
| | | O | Surrounding areas of stations | - Confirm change of land use condition by analysis of satellite image and field reconnaissance.<br>- Confirm future land use plan. | - Once after operation of HSR is stable and its benefit is being realized | Project proponent |
| | Utilization of Local Resources | C | Districts providing sands and rocks for construction activities | - Survey amount of sands, rocks, etc. used for construction work<br>- Implement interviews to the concerned organizations to confirm impact on local resources in the concerned districts | - Regular monitoring based on the instruction of project proponent, considering construction work plan | Contractor |

| Aspect | Item | Stage | Target Area | Survey Method/Parameters | Duration /Frequency | Responsibility |
|---|---|---|---|---|---|---|
| | General, Regional/city Plans | P | City/Province with some predicted impacts on general, regional and city plans | - Confirm general, regional, and city plans | - Once prior to the construction phase | Project proponent |
| | | O | | | - Once after operation of HSR is stable and its benefit is being realized | Project proponent |
| | Social Institutions and Local Decision-Making Institutions | P | Districts with some predicted impacts on social institutions and local decision-making institutions | - Review EIA survey result | - Once prior to the construction phase | Project proponent |
| | | C | | - Implement interviews to the concerned bodies to confirm impact on social institutions and local decision-making institutions | - Regular monitoring based on the instruction of project proponent. | Contractor |
| | | O | | | - Once at the beginning of operation phase. | Project proponent |
| | Social Infra-structures and Services | P | Districts with some predicted impacts on social infrastructures and services | - Review EIA survey results. | - Once prior to the construction stage. | Project proponent |
| | | C | | - Survey status of social infrastructures and services such as regional roads, electricity supply, water supply, and education along the planned alignment<br>- Implement interviews to the concerned bodies to confirm impact on social infrastructures and services | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | | - Once at the beginning of operation stage (If required, additional monitoring is conducted after adaptation of the mitigation measure) | Project proponent |
| | Local Economy and Livelihood | P | City/Province with some predicted impacts on local economy and livelihood | - Review EIA survey results | - Once prior to the construction stage | Project proponent |
| | | C | | - Survey status of local economy and livelihood in the districts concerned with HSR | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | | - Once after operation of HSR is stable and its benefit is being realized | Project proponent |
| | Unequal Distribution of Benefit and Damage | P | City/Province with some predicted impact on unequal distribution of benefit and damage. | - Review identified factors which cause unequal distribution of benefit and damage. | - Once prior to the construction stage | Project proponent |
| | | C | | - Implement interviews to the concerned bodies to confirm existence of unequal distribution of benefit and damage. | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| | Local Conflicts of Interest | P | City/Province with some predicted impacts on local conflicts of interest. | - Review identified main stakeholder groups which would possibly initiate local conflicts in EIA | - Once prior to the construction stage | Project proponent |

| Aspect | Item | Stage | Target Area | Survey Method/Parameters | Duration /Frequency | Responsibility |
|---|---|---|---|---|---|---|
| | | C | | - Implement interviews to the identified main stakeholder groups to confirm existence of local conflict of interest. | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| | Water Usage, Water Rights and Communal Rights | P | Districts with some predicted impacts on water usage, water rights and communal rights. | - Review EIA survey results | - Once prior to the construction stage | Project proponent |
| | | C | | - Survey status of water usage condition of the relevant rivers/pond/other water sources. | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| | Cultural and Historical Heritage | P | Districts with some predicted impacts on cultural and historical heritage | - Review EIA survey results | - Once prior to the construction stage | Project proponent |
| | | C | | - Survey status of cultural and historical heritage<br>- Implement interviews to the concerned organizations to confirm any impact on cultural and historical heritage | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| | Religious Facilities | P | Districts with some predicted impacts on religious facilities | - Monitor implementation condition of the required processes instructed by the prepared RAPs | - Regular and occasional monitoring based on the prepared RAPs | Project proponent<br><br>External bodies designated by RAPs |
| | | C | | - Survey impacts on religious facilities, such as noise/vibration<br>- Implement interviews to the concerned organizations to confirm any impact on religious facilities | - Regular monitoring based on the instruction of project proponent, considering construction work plan | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| | Sensitive Facilities | P | Districts with some predicted impacts on sensitive facilities | - Monitor implementation condition of the required processes instructed by the prepared RAPs | - Regular and occasional monitoring based on the prepared RAPs | Project proponent<br><br>External bodies designated by RAPs |
| | | C | | - Survey impacts on religious facilities, such as noise/vibration.<br>- Implement interviews to the concerned organizations to confirm any impact on sensitive faculties | - Regular monitoring based on the instruction of project proponent, considering construction work plan | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan | Project proponent |

| Aspect | Item | Stage | Target Area | Survey Method/Parameters | Duration /Frequency | Responsibility |
|---|---|---|---|---|---|---|
| | Poor People | P | Districts with some predicted impacts on poor people. | - Monitor implementation condition of the required processes instructed by the prepared RAPs | - Regular and occasional monitoring based on the prepared RAPs | Project proponent<br>External bodies designated by RAPs |
| | | C | | - Survey employment condition of poor people | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | - Survey distribution of poor people along the planned alignment including their livelihood and lifestyle | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| | Ethnic Minorities / Indigenous People | P | Districts with some predicted impacts on ethnic minorities/ indigenous people. | - Monitor implementation condition of the required processes instructed by the prepared RAPs | - Regular and occasional monitoring based on the prepared RAPs | Project proponent<br>External bodies designated by RAPs |
| | | C | | - Survey status of ethnic minorities/indigenous people, and their livelihood, lifestyle and culture along the planned alignment.<br>- Implement interviews to confirm any impact on ethnic minorities/ indigenous people | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| | Gender | P | Districts with some predicted impacts on gender | - Review EIA survey results | - Once prior to the construction stage. | Project proponent |
| | | C | | - Implement interviews to confirm any impact on gender | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| | Public Health | C | City/Province with some predicted impacts on public health | - Survey trend of STD, STI, AIDS/HIV, and other infectious diseases | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| | Occupational Health, and Safety | C | City/Province with some predicted impacts on occupational health and safety | - Survey occupational health condition related to construction work | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | - Survey occupational health condition related to maintenance work. | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| Others | Accidents | C | City/Province with some predicted impacts on occupational health and safety | - Survey the occurrence of accidents related to construction work | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | - Survey the occurrence of accidents related to operation of HSR | - Regular monitoring based on the prepared monitoring plan | Project proponent |

| Aspect | Item | Stage | Target Area | Survey Method/Parameters | Duration /Frequency | Responsibility |
|---|---|---|---|---|---|---|
| | Climate Change | O | City/Provinces along the planned alignment | - Collect relevant information to climate change and GHGs emission | - Regular monitoring based on the prepared monitoring plan | Project proponent |

Note: P stands for Preconstruction, C stands for Construction and O stands for Operation.
Source: JICA Study Team

### (2) South Section

4.34 The proposed environmental monitoring framework on the south section to grasp impacts by HSR and evaluate effectiveness of mitigation measures is summarized in Table 4.6.2.

**Table 4.6.2 Proposed Environmental Monitoring Framework for the South Section**

| Aspect | Item | Stage | Target Area | Survey Method/Parameters | Duration /Frequency | Responsibility |
|---|---|---|---|---|---|---|
| Natural Environment | Topography | C | Areas having specific topographic conditions and with some predicted negative impacts along the planned alignment | - Check construction work with specification on measures for soil erosion prevention | - Regular monitoring based on the instruction of project proponent | Contractor |
| | Soil Erosion | C | Embankment and cut sections with some predicted negative impacts | - Check construction work with specification onmeasures for land slide and soil erosion prevention | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | - Visual check of the sections at regular basis | - After heavy rainfall of which amount is instructed by the prepared monitoring plan | Project proponent |
| | Hydrology | O | Rivers with some predicted negative impacts | - Check water flow by field measurement | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| | Ground water | C | Areas with some predicted negative impacts on groundwater level | - Check ground water level by field measurement | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | | - Quarter of a year | Project proponent |
| | Ecosystem, Flora, Fauna and Biodiversity | C | Areas with some predicted negative impacts along the planned alignment and surrounding areas | - Implement a series of field surveys to indentify flora and fauna and its habitats, especially Ecological Sensitive Receptors (ESRs) such as breeding places, nesting places and water drinking places of wildlife during (at least) rainy and dry seasons.<br>- Implement biodiversity index survey<br>- Implement interviews to environmental experts and NGOs, etc. | - Regular monitoring based on the instruction of project proponent, considering breeding period of ESRs and construction work plan | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan, considering breeding period of ESRs | Project proponent |

| Aspect | Item | Stage | Target Area | Survey Method/Parameters | Duration /Frequency | Responsibility |
|---|---|---|---|---|---|---|
| | Protected Areas/Forest | P | Areas with some predicted negative impacts along the planned alignment in Dong Nai, Binh Thuan, Ninh Thuan and Khanh Hoa provinces. | - Implement field reconnaissance to check environmental status of protection forests and production forests affected by the planned alignment<br>- Confirm information on new protected areas designated after the Study, if any | - Once during pre-construction phase | Project proponent |
| | | C | | - Implement field reconnaissance to check environmental status of protection forests and production forests affected by the planned alignment | - Regular monitoring based on the instruction of project proponent, considering breeding period of ESRs and construction work plan | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan, considering breeding period of ESRs | Project proponent |
| | Landscape | O | Areas with some predicted negative impacts along the planned alignment. | - Implement field reconnaissance and interview with the concerned district representatives to confirm distribution of existing landscape to be cared and viewpoints | - Once at the beginning of operation phase. | Project proponent |
| | Natural Disasters | C | Areas having risks of natural disasters such as flood prone areas | - Check length and location of embankment structures<br>- Collect past record of flooding | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| Living Environment | Air Pollution | C | Main residential areas along the planned alignment | - Monitor air pollutants, $NO_x$, CO, TSP and $PM_{10}$, related to the parameters in QCVN05/2009/BTNMT. | - At least 2 weeks each during the rainy season and the dry season (Frequency increases depending on construction work plan) | Contractor |
| | | O | Main cities/towns affected by modal shift | | - (using city/provincial monitoring data) | Project proponent |
| | Water Pollution | C | Rivers with some predicted impacts related to main construction sites of bridges and planned areas of construction worker's camps/yards | - Monitor river water quality, pH, BOD, COD and SS, related to the parameters in QCVN08:2008/BTNMT. | - At least 2 times a year during the rainy season and the dry season (Frequency increases depending on construction work plan). | Contractor |
| | | O | Rivers with some predicted impacts related to stations and depots | - | - At least 2 times a year during the rainy season and the dry season | Project proponent |
| | Soil Contamination | C | Sites of cut work with concerns on soil contamination due to history of land use or natural condition. | - Survey soil quality for toxic substances which are suspected for soil contamination | - Regular monitoring based on the instruction of project proponent, considering construction work plan. | Contractor |
| | | O | Sites planned for the construction of a depot in Thu Thiem and Nha Trang. | - Survey soil quality for toxic substances which are found by the survey during construction stage. | As required | Project proponent |

| Aspect | Item | Stage | Target Area | Survey Method/Parameters | Duration /Frequency | Responsibility |
|---|---|---|---|---|---|---|
| | Noise / vibration | C | Main residential areas with some predicted serious impacts, especially near sensitive facilities/ places which require quietness along the planned alignment and the existing railways | - Measure equivalent continuous A-weighted noise levels and vibration levels | - 3 days monitoring regularly, based on the instruction of project proponent, considering construction work plan | Contractor |
| | | O | | | - 3 days monitoring regularly, based on the prepared monitoring plan | Project proponent |
| | Low Frequency Noise / Micro-pressure Wave | O | Areas around the exits of HSR long tunnels where houses and buildings requiring special attention are located | - Measure low frequency noise/micro-pressure wave. | - Once at the beginning of operation phase (If required, additional monitoring is conducted after adaptation of the mitigation measure). | Project proponent |
| | Wave Obstruction | O | Main residential areas with some predicted impacts along the elevated structure of the planned alignment | - Survey wave obstruction condition. | - Once at the beginning of operation phase (If required, additional monitoring is conducted after adaptation of the mitigation measure). | Project proponent |
| | Sunshine Obstruction | O | Main residential and agricultural areas with some predicted impacts along the elevated structure of the planned alignment | - Survey sunshine obstruction condition. | - The winter solstice day in the first year of operation | Project proponent |
| | Waste / Hazardous Waste | C | Districts where large workers' camps are located | - Survey amount and type of generated waste including adopted measures for waste/hazardous waste disposal | - Regular monitoring based on the instruction of project proponent, considering construction work plan | Contractor |
| | | O | Districts located stations and depots during operation phase | | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| Social Environment | Involuntary Resettlement | P | Areas affected by involuntary resettlement due to construction of tracks, stations, depots and required areas for construction works. | - Monitor implementation condition of the required processes instructed by the prepared RAPss.<br>- | - Regular and occasional monitoring based on the prepared RAPs | Project proponent<br>External bodies designated by RAPs |
| | | C | | | | Contractor<br>External bodies designated by RAPs |
| | Land Use | P | Areas affected by construction of tracks, stations, depots, and required areas for construction work. | - Update land use condition obtained by EIA by analysis of satellite image and field reconnaissance | - Once prior to the construction phase. | Project proponent |
| | | C | Areas affected by construction work | - Confirm change of land use condition and field reconnaissance | - Regular monitoring based on the instruction of project proponent, considering construction work plan | Contractor |
| | | O | Surrounding areas of stations | - Confirm change of land use condition by analysis of satellite image and field reconnaissance<br>- Confirm future land use plan | - Once after operation of HSR is stable and its benefit is being realized | Project proponent |

| Aspect | Item | Stage | Target Area | Survey Method/Parameters | Duration /Frequency | Responsibility |
|---|---|---|---|---|---|---|
| | Utilization of Local Resources | C | Districts providing sands and rocks for construction activities | - Survey amount of sands, rocks, etc. used for construction work<br>- Implement interviews to the concerned organizations to confirm impact on local resources in the concerned districts | - Regular monitoring based on the instruction of project proponent, considering construction work plan | Contractor |
| | General, Regional/city plans | P | City/Province with some predicted impacts on general, regional and city plans | - Confirm general, regional and city plans. | - Once prior to the construction staggge | Project proponent |
| | | O | | | - Once after operation of HSR is stable and its benefit is being realized | Project proponent |
| | Social Institutions and Local Decision-Making Institutions | P | Districts with some predicted impacts on social institutions and local decision-making institutions | - Review EIA survey results | - Once prior to the construction stage | Project proponent |
| | | C | | - Implement interviews to the concerned bodies to confirm impact on social institutions and local decision-making institutions | - Regular monitoring based on the instruction of project proponent. | Contractor |
| | | O | | | - Once at the beginning of operation phase. | Project proponent |
| | Social Infrastructures and Services | P | Districts with some predicted impacts on social infrastructures and services | - Review EIA survey results | - Once prior to the construction phase | Project proponent |
| | | C | | - Survey status of social infrastructures and services such as regional roads, electricity supply, water supply, and education along the planned alignment<br>- Implement interviews to the concerned bodies to confirm impact on social infrastructures and services | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | | - Once at the beginning of operation stage (If required, additional monitoring is conducted after adaptation of the mitigation measure) | Project proponent |
| | Local Economy and Livelihood | P | City/Province with some predicted impacts on local economy and livelihood | - Review EIA survey results | - Once prior to the construction stage. | Project proponent |
| | | C | | - Survey status of local economy and livelihood in the districts concerned with HSR. | - Regular monitoring based on the instruction of project proponent. | Contractor |
| | | O | | | - Once after operation of HSR is stable and its benefit is being realized | Project proponent |
| | Unequal Distribution of Benefit and Damage | P | City/Province with some predicted impacts on unequal distribution of benefit and damage. | - Review identified factors which cause unequal distribution of benefit and damage | - Once prior to the construction stage | Project proponent |
| | | C | | - Implement interviews to the concerned bodies to confirm existence of unequal distribution of benefit and damage | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| | Local Conflicts of Interest | P | City/Province with some predicted impacts on local conflicts of interest. | - Review identified main stakeholder groups which would possibly initiate local conflicts in EIA | - Once prior to the construction stage. | Project proponent |
| | | C | | - Implement interviews to the identified main stakeholder groups to confirm existence of local conflict of interest | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| | Water Usage, Water Rights | P | Districts with some predicted impacts on | - Review EIA survey results | - Once prior to the construction phase | Project proponent |

| Aspect | Item | Stage | Target Area | Survey Method/Parameters | Duration /Frequency | Responsibility |
|---|---|---|---|---|---|---|
| | and Communal Rights | C | water usage, water rights and communal rights. | - Survey status of water usage condition of the relevant rivers/pond/other water sources | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| | Cultural and Historical Heritage | P | Districts with some predicted impacts on cultural and historical heritage | - Review EIA survey results | - Once prior to the construction stage | Project proponent |
| | | C | | - Survey status of cultural and historical heritage<br>- Implement interviews to the concerned organizations to confirm any impact on cultural and historical heritage | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| | Religious Facilities | P | Districts with some predicted impacts on religious facilities | - Monitor implementation condition of the required processes instructed by the prepared RAPs | - Regular and occasional monitoring based on the prepared RAPs. | Project proponent<br>External bodies designated by RAPs |
| | | C | | - Survey impacts on religious facilities, such as noise/vibration<br>- Implement interviews to the concerned organizations to confirm any impact on religious facilities | - Regular monitoring based on the instruction of project proponent, considering construction work plan | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| | Sensitive Facilities | P | Districts with some predicted impacts on sensitive facilities. | - Monitor implementation condition of the required processes instructed by the prepared RAPs | - Regular and occasional monitoring based on the prepared RAPs | Project proponent<br>External bodies designated by RAPs |
| | | C | | - Survey impacts on religious facilities, such as noise/vibration<br>- Implement interviews to the concerned organizations to confirm any impact on sensitive faculties | - Regular monitoring based on the instruction of project proponent, considering construction work plan | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| | Poor People | P | Districts with some predicted impacts on poor people | - Monitor implementation condition of the required processes instructed by the prepared RAPs | - Regular and occasional monitoring based on the prepared RAPs | Project proponent<br>External bodies designated by RAPs |
| | | C | | - Survey employment condition of poor people | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | - Survey distribution of poor people along the planned alignment including their livelihood and lifestyle | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| | Ethnic Minorities/Indigenous People | P | Districts with some predicted impacts on ethnic minorities/ indigenous people. | - Monitor implementation condition of the required processes instructed by the prepared RAPs | - Regular and occasional monitoring based on the prepared RAPs | Project proponent<br>External bodies designated by RAPs |
| | | C | | - Survey status of ethnic minorities/indigenous people, and their livelihood, | - Regular monitoring based on the instruction of project proponent | Contractor |

| Aspect | Item | Stage | Target Area | Survey Method/Parameters | Duration /Frequency | Responsibility |
|---|---|---|---|---|---|---|
| | | O | | lifestyle and culture along the planned alignment<br>- Implement interviews to confirm any impact on ethnic minorities/indigenous people | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| | Gender | P | Districts with some predicted impacts on gender | - Review EIA survey results | - Once prior to the construction stage | Project proponent |
| | | C | | - Implement interviews to confirm any impact on gender | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| | Public Health | C | City/Province with some predicted impacts on public health | - Survey trend of STD, STI, AIDS/HIV, and other infectious diseases | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| | Occupational Health, and Safety | C | City/Province with some predicted impacts on occupational health and safety | - Survey occupational health condition, related to construction work | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | - Survey occupational health condition, related to maintenance work | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| Others | Accidents | C | City/Province with some predicted impacts on occupational health and safety | - Survey the occurrence of accidents related to construction work | - Regular monitoring based on the instruction of project proponent | Contractor |
| | | O | | - Survey the occurrence of accidents related to operation of HSR | - Regular monitoring based on the prepared monitoring plan | Project proponent |
| | Climate Change | O | City/Province along the planned alignment | - Collect relevant information to climate change and GHGs emission | - Regular monitoring based on the prepared monitoring plans | Project proponent |

Note: P stands for Preconstruction, C stands for Construction and O stands for Operation.
Source: JICA Study Team

## 4.7 Recommendations for the EIA

### 1) Technical Requirements for the EIA

4.35 Provisional scoping has been carried out on the selected optimal alternative as part of the IEE study based on JICA Guidelines for Environmental and Social Considerations 2004 and 2010 in order to clarify potential important environmental and social impacts with a range of significant impacts which need to be assessed in detail in the subsequent EIA study.

4.36 The EIA report, in general, should include the following items (not necessarily in the order given) as a prerequisite to the above JICA Guidelines 2010.

- Executive summary: This concisely discusses significant findings and recommended actions.
- Policy, legal, and administrative framework: This is the framework within which the EIA report is to be carried out.
- Project description: This describes the proposed project and its geographic, ecological, social and temporal context, including any off-site investments that may be required. It also indicates the need for any resettlement or social development plan. It normally includes a map showing the project site and the area affected by the project.
- Baseline data: This assesses the dimensions of the study area and describes relevant physical, biological, and socio-economic conditions, including all changes anticipated to occur before the project commences. Additionally, it takes into account current and proposed development activities within the project area but not directly connected to the project. Data should be relevant to decisions about project site, design, operation, or mitigation measures, and it is necessary to indicate the accuracy, reliability, and sources of the data.
- Environmental impacts: This predicts and assesses the project's likely positive and negative impacts in quantitative terms, to the extent possible. It identifies mitigation measures and any negative environmental impacts that cannot be mitigated, and explores opportunities for environmental enhancement. It identifies and estimates the extent and quality of available data, essential data gaps and uncertainties associated with predictions, and it specifies topics that do not require further attention.
- Analysis of alternatives: This systematically compares feasible alternatives to the proposed project site, technology, design, and operation including the "without" project situation in terms of the following: the potential environmental impacts; the feasibility of mitigating these impacts; their capital and recurrent costs; their suitability under local conditions; and their institutional, training, and monitoring requirements. For each of the alternatives, it quantifies the environmental impacts to the extent possible, and attaches economic values where feasible. It also states the basis for selecting the particular proposed project design, and offers justification for recommended emission levels and approaches to pollution prevention and abatement.
- Environmental Management Plan (EMP): This describes mitigation, monitoring, and institutional measures to be taken during construction and operation in order

to eliminate adverse impacts, offset them, or reduce them to acceptable levels.

- Consultation: This includes a record of consultation meetings (date, venue, participants, procedures, opinions of major local stakeholders and responses to them, and other items), including consultations for obtaining the informed views of the affected people, local NGOs, and regulatory agencies.

4.37 Among the above overall requirements in the EIA, based on the results of provisional scoping, technical requirements for the EIA study, i.e., methodologies of survey, prediction and evaluation has been proposed tentatively for the north and the south sections, which can be used as parts of a TOR for the EIA study.

### (1) Proposed Methodologies for EIA Study on the North Section

4.38 The proposed methodologies for survey for grasping existing conditions which will be used in impacts prediction and evaluation on the north section are summarized in Table 4.7.1.

**Table 4.7.1 Proposed Methodologies for EIA Study on the North Section**

| Aspect | Item | Stage | Target Area | Survey for Grasping Existing Condition | Prediction | Evaluation |
|---|---|---|---|---|---|---|
| Natural Environ-ment | Topography | C | Along the planned alignment | - Implement field reconnaissance to check specific topographic conditions to be cared in the area. | Considering relationship between HSR structures and topographic conditions, magnitude of topographic change is predicted. | Based on magnitude of impacts and proposed mitigation measures. |
| | Soil Erosion | C,O | Along the planned alignment | - Check length and location of embankment and cut structure.<br>- Collect statistical information on amount and intensity of rainfall in the area planned for embankment and cut structure. | Considering amount and intensity of rainfall, possibility of soil erosion from embankment and cut structure is predicted. | Based on possibility to cause soil erosion and proposed mitigation measures. |
| | Hydrology and Ground Water | C, O | Districts located along the planned alignment | - Check length and location of embankment and tunnel structures.<br>- Collect existing information on groundwater level, distribution of main aquifer and its usage conditions<br>- Collect results from boring survey to be conducted in F/S<br>- Collect past record of flooding | Considering relationship between HSR structures and hydrology and groundwater conditions, possibility of increase in flooding and impact on ground water level are predicted. | Based on possibility to increase flooding and impact on ground water level, and proposed mitigation measures. |
| | Ecosystem, Flora, Fauna and Biodiversity | C, O | Along the planned alignment and surrounding area | - Implement a series of field surveys to indentify flora and fauna and its habitats, especially Ecological Sensitive Receptors (ESRs) such as breeding places, nesting places and water drinking places of wildlife during (at least) rainy and dry seasons.<br>- Implement biodiversity index survey.<br>- Implement interviews for environmental experts and NGOs, etc. | Considering locations of confirmed flora and fauna and habitants etc. and the HSR structures (areas to be cleared), impact is predicted. In addition, disturbance of movement of wildlife by the HSR structures is predicted. | Based on magnitude of impacts and proposed mitigation measures. |

| Aspect | Item | Stage | Target Area | Survey for Grasping Existing Condition | Prediction | Evaluation |
|---|---|---|---|---|---|---|
| | Protected Area/Forest | P, C, O | Along the planned alignment | - Implement field reconnaissance to check environmental status of protection forests and production forests affected by the planned alignment in Ninh Binh, Thanh Hoa, and Nghe An provinces.<br>- Confirm information on new protected areas designated after the Study, if any. | Considering confirmed environmental status of the affected protected areas and location of the HSR structures, magnitude of impacts is predicted. | Based on magnitude of impacts and proposed mitigation measures. |
| | Landscape | O | Along the planned alignment | - Implement field reconnaissance and interview with the concerned district representatives to confirm distribution of existing landscape to be cared and viewpoints. | If existing landscape to be cared is confirmed, magnitude of impacts is predicted based on the HSR structures including preparation of future images from viewpoints of district representatives. | Based on possibility and magnitude of impacts on landscape, especially from viewpoints of district representatives. |
| | Natural Disasters | C,O | Areas having risks of natural disasters such as flood prone areas in Thanh Hoa and Nghe An. | - Check length and location of embankment structures.<br>- Collect past record of flooding | Considering relationship between HSR structures and possibility of increase of risks of natural disasters, impact is predicted. | Based on possibility to increase risks of flooding and proposed mitigation measures. |
| Living Environ-ment | Air Pollution | C, O | Main cities/towns affected by modal shift and main residential areas along the planned alignment | - Monitor air pollutants, $NO_x$, CO, TSP and $PM_{10}$, related to the parameters in QCVN05/2009/BTNMT (at least) during 2 weeks in rainy and dry seasons.<br>- Collect existing air quality monitoring results from the concerned DONREs. | - Generated air pollutants are estimated by emission factors and number of heavy machine and vehicles during construction.<br>- Reduction amounts of air pollutants from vehicles (cars, buses), air transport and existing railways by modal shift are calculated during operation. | Considering magnitudes (ratios) of increased or decreased air pollutants and proposed mitigation measures. |
| | Water Pollution | C, O | Rivers, related to main construction sites of bridges, planned area of construction worker's camps/yards, stations and depots | - Monitor river water quality, pH, BOD, COD and SS, related to the parameters in QCVN08:2008/BTNMT (at least) during rainy and dry seasons.<br>- Collect existing water quality monitoring results from the concerned DONREs. | - Considering river water quality monitoring results and construction work plan, impact during construction work is predicted.<br>- By water quality monitoring results and designed wastewater quality discharged from stations and depots, change of surface water quality is predicted. | Considering magnitudes (ratios) of increased water pollution loads and proposed mitigation measures. |
| | Soil Contamination | C, O | - The sites of cut work concerned soil contamination due to history of land use or natural condition.<br>- The site planned for the construction of a depot in Ngoc Hoi and Vinh. | - Collect existing information of soil contamination in the target areas.<br>- Collect information on history of land use which may cause soil pollution.<br>- Based on the above information, survey soil quality. | - Considering collected information related to soil contamination, impact by construction work is predicted.<br>- Based on maintenance plan, impacts by possible hazardous substances used for maintenance is predicted. | Based on results and existing condition surveys and construction work plan, and proposed mitigation measures. |

| Aspect | Item | Stage | Target Area | Survey for Grasping Existing Condition | Prediction | Evaluation |
|---|---|---|---|---|---|---|
| | Noise / Vibration | C, O | Main residential areas, especially near sensitive facilities/places, which require quietness along the planned alignment and the existing railways. | - Measure equivalent continuous A-weighted noise levels and vibration levels during 3 days of railway noise and vibration.<br>- Conduct interview/ questionnaire survey to the local residents along the existing railways. | - Considering construction work plan, impact of noise and vibration level is predicted qualitatively.<br>- Noise level and vibration level during operation of HSR is estimated by equations developed by RTRI etc. | Comparing conservation targets (to be set) and predicted noise and vibration levels, and proposed mitigation measures such as adoption of noise barrier. |
| | Low frequency noise / micro-pressure wave | O | Around the exits of HSR long tunnels | - Confirm distribution and location of houses and buildings which require special attention | Considering location of facilities/places which require special attention, impact is predicted (generated micro-pressure wave has been calculated in this study) | Comparing conservation targets (to be set) and predicted pressure wave level, together with consideration of distribution of houses and buildings, and proposed mitigation measures. |
| | Wave Obstruction | O | Main residential areas along the elevated structure of the planned alignment. | - Confirm areas affected by the HSR elevated structure by field reconnaissance.<br>- Conduct interview/ questionnaire survey to the local residents along the existing railways. | Considering locations of radio wave transmission places and the HSR elevated structures and radio wave receiving conditions by the residents, impact is predicted. | Considering possible affected areas, distribution of residents and their TV reception condition, and proposed mitigation measures (compensation). |
| | Sunshine obstruction | O | Main residential and agricultural areas along the elevated structure of the planned alignment. | - Confirm areas affected by the elevated structure of HSR by field reconnaissance.<br>- Conduct interview/ questionnaire survey to the local residents along the existing railways. | Considering location of the HSR elevated structures and its surrounding land use, and elevation angle of the sun, impact is predicted. | Considering possible affected areas, surrounding land use, and proposed mitigation measures (compensation). |
| | Waste / Hazardous waste | C, O | Districts where large workers' camps are located during construction phase and stations and depots during operation phase | - Confirm current status and future plan of domestic solid waste/hazardous waste management system in the concerned districts.<br>- Amount and type of generated waste is estimated quantitatively. | Comparing regional waste disposal system and amount/type of generated waste estimated, impact is predicted qualitatively. | Based on possibility of appropriate treatment of waste/hazardous waste and proposed mitigation measures. |
| Social Environment | Involuntary Resettlement | P, C | Areas affected by involuntary resettlement due to construction of track, stations, depots and required areas for construction work | - Implement census on the households to be resettled.<br>- Survey condition of areas prepared for resettlement | Prepare RAP which follows requirements of the World Bank Operation Policy (OP) 4.12. Annex A. | Based on contents and scheme proposed in RAP. |
| | Land Use | P, C, O | Areas affected by construction of tracks, stations, depots and required areas for construction work with surrounding areas of stations | - Confirm current land use condition by analysis of satellite image and field reconnaissance.<br>- Confirm future land use plan. | Considering current land use, future land use plan, and possible change of land use, impact is predicted. | Based on possibility of uncontrolled land use changes and proposed mitigation measures. |
| | Utilization of Local Resources | C | Districts providing sands and rocks for construction activities | - Estimate required amount of sands, rocks etc. based on the construction work plan.<br>- Survey status of utilization of local resources in the concerned districts. | Considering construction work plan and status of utilization of local resources, impact is predicted. | Based on possibility of disturbance of utilization of local resources and proposed mitigation measures. |

| Aspect | Item | Stage | Target Area | Survey for Grasping Existing Condition | Prediction | Evaluation |
|---|---|---|---|---|---|---|
| | General, Regional and City Plans | P, O | City/Province along the planned alignment | - Confirm general, regional and city plans. | Considering the confirmed plan and the HSR alignment and station, impact is predicted. | Based on possibility of change of general plan/city plans. |
| | Social Institutions and Local Decision-making Institutions | P, C, O | Districts along the planned alignment | - Survey status of social institutions and local decision-making institutions of the concerned districts. | Considering relationship between status of social institutions and local decision-making institutions of the concerned districts, and project activities, impact is predicted. | Based on possibility or magnitude of impact on social institutions and local decision-making institutions of the concerned districts. |
| | Social Infrastructures and Services | P, C, O | Districts along the planned alignment | - Survey status of social infrastructures and services such as regional roads, electricity supply, water supply, and education along the planned alignment. | Considering locations of both identified infrastructures and services and HSR structures, impact is predicted. | Based on possibility or magnitude of impact on social infrastructures and service and proposed mitigation measures. |
| | Local Economy and Livelihood | P, C, O | City/Province along the planned alignment | - Survey status of local economy and livelihood in the districts concerned with HSR. | Based on the survey results, impact is predicted. | Based on possibility or magnitude of impact on local economy, and proposed mitigation measures. |
| | Unequal Distribution of Benefit and Damage | P, C, O | City/Province along the planned alignment | - Identify factors which cause unequal distribution of benefit and damage. | Considering identified factors causing unequal distribution of benefit and damage, impact is predicted. | Based on possibility to cause unequal distribution and proposed mitigation measures. |
| | Local Conflicts of Interest | P,C, O | City/Province along the planned alignment | - Confirm main stakeholder groups which can possibly initiate local conflicts. | Considering characteristics of main stakeholder groups identified, impact is predicted. | Based on possibility to cause local conflicts and proposed mitigation measures. |
| | Water Usage, Water Rights and Communal Rights | P, C, O | Districts along the planned alignment | - Prepare inventory of water rights/common rights of the relevant lands/rivers/pond/other water sources.<br>- Survey current status of water usage condition of the relevant rivers/pond/other water sources. | Based on the survey results, impact is predicted. | Based on possibility to cause impact on water usage and rights etc. and proposed mitigation measures. |
| | Cultural and Historical Heritage | C, O | Districts along the planned alignment | - Survey distribution of cultural and historical heritage along the planned alignment.<br>- Collect list of historical heritages by the concerned organizations. | Considering locations of both identified heritages and HSR structures, impact is predicted. | Based on possibility to cause impact on heritages and proposed mitigation measures. |
| | Religious Facilities | P, C, O | Districts along the planned alignment | - Survey distribution of religious facilities along the planned alignment. | Considering locations of both identified facilities and HSR structures, impact is predicted. | Based on possibility to cause impact on religious facilities and proposed mitigation measures. |
| | Sensitive Facilities | P, C, O | Districts along the planned alignment | - Survey distribution of sensitive facilities such as schools, hospitals and libraries along the planned alignment. | Considering locations of both identified facilities and HSR structures, impact is predicted. | Based on possibility to cause impact on sensitive facilities and proposed mitigation measures. |
| | Poor People | P, C, O | Districts along the planned alignment | - Survey distribution of poor people and their livelihood, lifestyle along the planned alignment. | Based on the survey results, impact is predicted. | Based on possibility to cause impact on poor people and proposed mitigation measures. |

| Aspect | Item | Stage | Target Area | Survey for Grasping Existing Condition | Prediction | Evaluation |
|---|---|---|---|---|---|---|
| | Ethnic Minorities/Indigenous People | P, C, O | Districts along the planned alignment | - Survey distribution of ethnic minorities/indigenous people, and their livelihood, lifestyle and culture along the planned alignment. | Prepare indigenous peoples plan (IPP) which follows requirements of the World Bank OP4.10, Annex B for indigenous peoples. For others, based on the survey results, impact is predicted. | Based on contents and scheme proposed in IPP, or on possibility to cause impact on ethnic minorities and proposed mitigation measures. |
| | Gender | P, C, O | Districts along the planned alignment | - Survey examples of impacts and measures taken on gender by similar projects. | Factors to arise issues on gender are identified. | Based on possibility to cause impact on gender and proposed mitigation measures. |
| | Public Health | C, O | City/Province along the planned alignment | - Survey current situation including trend of STD, STI, AIDS/HIV, and other infection diseases. | Risks to increase disease rate of TSD, STI, AIDS/HIV, and other infection diseases are identified. | Based on possibility or magnitude of impact on public health and proposed mitigation measures. |
| | Occupational Health, and Safety | C, O | City/Province along the planned alignment | - Confirm relevant legislative system for securing good condition of OHS in the concerned city/province. | Risks on occupational health due to construction and operation of HSR are identified. | Based on possibility to increase risks on OHS and proposed mitigation measures. |
| Other | Accidents | C, O | City/Province along the planned alignment | - Confirm statistical data of traffic accident. | - Risks of accident by HSR are identified.<br>- Impact on traffic accident by modal shift is predicted. | Based on possibility to increase risks on accidents and proposed mitigation measures. |
| | Climate Change | O | City/Province along the planned alignment | - Confirm impact of modal shift by the result of traffic demand forecast.<br>- Collect relevant information to climate change and GHGs emission in Vietnam | Considering the results of the traffic demand forecast, discharge amount of GHGs is estimated in "with" project and "without" project cases. | Based on the estimated impact of modal shift. |

Note: P stands for preconstruction, C stands for Construction and O stands for Operation.
Source: JICA Study Team

### (2)Proposed Methodologies for EIA Study on South Section

4.39 The proposed methodologies for survey for grasping existing conditions which will be used in impacts prediction and evaluation, and for impacts prediction and evaluation itself on the south section are summarized in Table 4.7.2.

**Table 4.7.2 Proposed Methodologies for EIA Study on South Section**

| Aspect | Item | Stage | Target Area | Survey for Grasping Existing Condition | Prediction | Evaluation |
|---|---|---|---|---|---|---|
| Natural Environment. | Topography | C | Along the planned alignment | - Implement field reconnaissance to check specific topographic conditions to be cared in the area. | Considering relationship between HSR structures and topographic conditions, magnitude of topographic change is predicted. | Based on magnitude of impacts and proposed mitigation measures. |
| | Soil Erosion | C,O | Along the planned alignment | - Check length and location of embankment and cut structure.<br>- Collect statistical information on amount and intensity of rainfall in the planned for embankment and cut structure. | Considering amount and intensity of rainfall, possibility of soil erosion from embankment and cut structure is predicted. | Based on possibility to cause soil erosion and proposed mitigation measures. |

| Aspect | Item | Stage | Target Area | Survey for Grasping Existing Condition | Prediction | Evaluation |
|---|---|---|---|---|---|---|
| | Hydrology and Ground Water | C, O | Districts located along the planned alignment | - Check length and location of embankment and tunnel structures.<br>- Collect existing information on groundwater level, distribution of main aquifer and its usage conditions<br>- Collect results from boring survey to be conducted in F/S<br>- Collect past record of flooding | Considering relationship between HSR structures and hydrology and groundwater conditions, possibility of increase in flooding and impact on ground water level are predicted. | Based on possibility to increase flooding and impact on ground water level, and proposed mitigation measures. |
| | Ecosystem, Flora, Fauna and Biodiversity | C, O | Along the planned alignment and surrounding area | - Implement a series of field surveys to indentify flora and fauna and its habitats, especially Ecological Sensitive Receptors (ESRs) such as breeding places, nesting places and water drinking places of wildlife during (at least) rainy and dry seasons.<br>- Implement biodiversity index survey.<br>- Implement interviews for environmental experts and NGOs, etc. | Considering locations of confirmed flora and fauna and habitants etc. and the HSR structures (areas to be cleared), impact is predicted. In addition, disturbance of movement of wildlife by the HSR structures is predicted. | Based on magnitude of impacts and proposed mitigation measures. |
| | Protected Area/Forest | P, C, O | Along the planned alignment | - Implement field reconnaissance to check environmental status of protection forests and production forests affected by the planned alignment in Dong Nai, Binh Thuan, Ninh Thuan and Khanh Hoa provinces.<br>- Confirm information on new protected areas designated after the Study, if any. | Considering confirmed environmental status of the affected protected areas and location of the HSR structures, magnitude of impacts is predicted. | Based on magnitude of impacts and proposed mitigation measures. |
| | Landscape | O | Along the planned alignment | - Implement field reconnaissance and interview with the concerned district representatives to confirm distribution of existing landscape to be cared and viewpoints. | If existing landscape to be cared is confirmed, magnitude of impacts is predicted based on the HSR structures including preparation of future images from viewpoints of district representatives. | Based on possibility and magnitude of impacts on landscape, especially from viewpoints of district representatives. |
| | Natural Disasters | C,O | Areas having risks of natural disasters such as flood prone areas. | - Check length and location of embankment structures.<br>- Collect past record of flooding | Considering relationship between HSR structures and possibility of increase of risks of natural disasters, impact is predicted. | Based on possibility to increase risks of flooding and proposed mitigation measures. |
| Living Environment | Air Pollution | C, O | Main cities/towns affected by modal shift and main residential areas along the planned alignment | - Monitor air pollutants, $NO_x$, CO, TSP and $PM_{10}$, related to the parameters in QCVN05/2009/BTNMT (at least) during 2 weeks in rainy and dry seasons.<br>- Collect existing air quality monitoring results from the concerned DONREs. | - Generated air pollutants are estimated by emission factors and number of heavy machine and vehicles during construction.<br>- Reduction amounts of air pollutants from vehicles (cars, buses), air transport and existing railways by modal shift are calculated during operation. | Considering magnitudes (ratios) of increased or decreased air pollutants and proposed mitigation measures. |

| Aspect | Item | Stage | Target Area | Survey for Grasping Existing Condition | Prediction | Evaluation |
|---|---|---|---|---|---|---|
| | Water Pollution | C, O | Rivers, related to main construction sites of bridges, planned area of construction worker's camps/yards, stations and depots | - Monitor river water quality, pH, BOD, COD and SS, related to the parameters in QCVN08:2008/BTNMT (at least) during rainy and dry seasons.<br>- Collect existing water quality monitoring results from the concerned DONREs. | - Considering river water quality monitoring results and construction work plan, impact during construction work is predicted.<br>- By water quality monitoring results and designed wastewater quality discharged from stations and depots, change of surface water quality is predicted. | Considering magnitudes (ratios) of increased water pollution loads and proposed mitigation measures. |
| | Soil Contamination | C, O | - The sites of cut work concerned soil contamination due to history of land use or natural condition.<br>- The site planned for the construction of a depot in Thu Thiem and Nha Trang. | - Collect existing information of soil contamination in the target areas.<br>- Collect information on history of land use which may cause soil pollution.<br>- Based on the above information, survey soil quality. | - Considering collected information related to soil contamination, impact by construction work is predicted.<br>- Based on maintenance plan, impacts by possible hazardous substances used for maintenance is predicted. | Based on results and existing condition surveys and construction work plan, and proposed mitigation measures. |
| | Noise/ Vibration | C, O | Main residential areas, especially near sensitive facilities/places, which require quietness along the planned alignment and the existing railways. | - Measure equivalent continuous A-weighted noise levels and vibration levels during 3 days of railway noise and vibration.<br>- Conduct interview/ questionnaire survey to the local residents along the existing railways. | - Considering construction work plan, impact of noise and vibration level is predicted qualitatively.<br>- Noise level and vibration level during operation of HSR is estimated by equations developed by RTRI etc. | Comparing conservation targets (to be set) and predicted noise and vibration levels, and proposed mitigation measures such as adoption of noise barrier. |
| | Low frequency noise/micro-pressure wave | O | Around the exits of HSR long tunnels | - Confirm distribution and location of houses and buildings which require special attention | Considering location of facilities/places which require special attention, impact is predicted (generated micro-pressure wave has been calculated in this study) | Comparing conservation targets (to be set) and predicted pressure wave level, together with consideration of distribution of houses and buildings, and proposed mitigation measures. |
| | Wave Obstruction | O | Main residential areas along the elevated structure of the planned alignment. | - Confirm areas affected by the HSR elevated structure by field reconnaissance.<br>- Conduct interview/ questionnaire survey to the local residents along the existing railways. | Considering locations of radio wave transmission places and the HSR elevated structures and radio wave receiving conditions by the residents, impact is predicted. | Considering possible affected areas, distribution of residents and their TV reception condition, and proposed mitigation measures (compensation). |
| | Sunshine obstruction | O | Main residential and agricultural areas along the elevated structure of the planned alignment. | - Confirm areas where may be affected by the elevated structure of HSR by field reconnaissance.<br>- Conduct interview/ questionnaire survey to the local residents along the existing railways. | Considering location of the HSR elevated structures and its surrounding land use, and elevation angle of the sun, impact is predicted. | Considering possible affected areas, surrounding land use, and proposed mitigation measures (compensation). |

| Aspect | Item | Stage | Target Area | Survey for Grasping Existing Condition | Prediction | Evaluation |
|---|---|---|---|---|---|---|
| | Waste/Hazardous waste | C, O | Districts where large workers' camps are located during construction phase and stations and depots during operation phase | - Confirm current status and future plan of domestic solid waste/hazardous waste management system in the concerned districts.<br>- Amount and type of generated waste is estimated quantitatively. | Comparing regional waste disposal system and amount/type of generated waste estimated, impact is predicted qualitatively. | Based on possibility of appropriate treatment of waste/hazardous waste and proposed mitigation measures. |
| Social Environment | Involuntary Resettlement | P, C | Areas affected by involuntary resettlement due to construction of tracks, stations, depots and required areas for construction work | - Implement census on the households to be resettled.<br>- Survey condition of areas prepared for resettlement | Prepare RAP which follows requirements of the World Bank Operation Policy (OP) 4.12. Annex A. | Based on contents and scheme proposed in RAP. |
| | Land Use | P, C, O | Areas affected by construction of tracks, stations, depots and required areas for construction work with surrounding areas of stations | - Confirm current land use condition by analysis of satellite image and field reconnaissance.<br>- Confirm future land use plan. | Considering current land use, future land use plan, and possible change of land use, impact is predicted. | Based on possibility of uncontrolled land use changes and proposed mitigation measures. |
| | Utilization of Local Resources | C | Districts providing sands and rocks for construction activities | - Estimate required amount of sands, rocks etc. based on the construction work plan.<br>- Survey status of utilization of local resources in the concerned districts. | Considering construction work plan and status of utilization of local resources, impact is predicted. | Based on possibility of disturbance of utilization of local resources and proposed mitigation measures. |
| | General, Regional and City Plans | P, O | City/Province along the planned alignment | - Confirm general, regional and city plans. | Considering the confirmed plan and the HSR alignment and station, impact is predicted. | Based on possibility of change of general plan/city plans. |
| | Social Institutions and Local Decision-making Institutions | P, C, O | Districts along the planned alignment | - Survey status of social institutions and local decision-making institutions of the concerned districts. | Considering relationship between status of social institutions and local decision-making institutions of the concerned districts, and project activities, impact is predicted. | Based on possibility or magnitude of impact on social institutions and local decision-making institutions of the concerned districts. |
| | Social Infrastructures and Services | P, C, O | Districts along the planned alignment | - Survey status of social infrastructures and services such as regional roads, electricity supply, water supply, and education along the planned alignment. | Considering locations of both identified infrastructures and services and HSR structures, impact is predicted. | Based on possibility or magnitude of impact on social infrastructures and service and proposed mitigation measures. |
| | Local Economy and Livelihood | P, C, O | City/Province along the planned alignment | - Survey status of local economy and livelihood in the districts concerned with HSR. | Based on the survey results, impact is predicted. | Based on possibility or magnitude of impact on local economy, and proposed mitigation measures. |
| | Unequal Distribution of Benefit and Damage | P, C, O | City/Province along the planned alignment | - Identify factors which cause unequal distribution of benefit and damage. | Considering identified factors causing unequal distribution of benefit and damage, impact is predicted. | Based on possibility to cause unequal distribution and proposed mitigation measures. |
| | Local Conflicts of Interest | P, C, O | City/Province along the planned alignment | - Confirm main stakeholder groups which can possibly initiate local conflicts. | Considering characteristics of main stakeholder groups identified, impact is predicted. | Based on possibility to cause local conflicts and proposed mitigation measures. |

| Aspect | Item | Stage | Target Area | Survey for Grasping Existing Condition | Prediction | Evaluation |
|---|---|---|---|---|---|---|
| | Water Usage, Water Rights and Communal Rights | P, C, O | Districts along the planned alignment | - Prepare inventory of water rights/common rights of the relevant lands/rivers/pond/other water sources.<br>- Survey current status of water usage condition of the relevant rivers/pond/other water sources. | Based on the survey results, impact is predicted. | Based on possibility to cause impact on water usage and rights etc. and proposed mitigation measures. |
| | Cultural and Historical Heritage | P, C, O | Districts along the planned alignment | - Survey distribution of cultural and historical heritage along the planned alignment.<br>- Collect list of historical heritages by the concerned organizations. | Considering locations of both identified heritages and HSR structures, impact is predicted. | Based on possibility to cause impact on heritages and proposed mitigation measures. |
| | Religious Facilities | P, C, O | Districts along the planned alignment | - Survey distribution of religious facilities along the planned alignment. | Considering locations of both identified facilities and HSR structures, impact is predicted. | Based on possibility to cause impact on religious facilities and proposed mitigation measures. |
| | Sensitive Facilities | P, C, O | Districts along the planned alignment | - Survey distribution of sensitive facilities such as schools, hospitals and libraries along the planned alignment. | Considering locations of both identified facilities and HSR structures, impact is predicted. | Based on possibility to cause impact on sensitive facilities and proposed mitigation measures. |
| | Poor People | P, C, O | Districts along the planned alignment | - Survey distribution of poor people and their livelihood/ lifestyle along the planned alignment. | Based on the survey results, impact is predicted. | Based on possibility to cause impact on poor people and proposed mitigation measures. |
| | Ethnic Minorities/Indigenous People | P, C, O | Districts along the planned alignment | - Survey distribution of ethnic minorities/indigenous people, and their livelihood, lifestyle and culture along the planned alignment. | Prepare indigenous peoples plan (IPP) which follows requirements of the World Bank OP4.10, Annex B for indigenous peoples.<br>For others, based on the survey results, impact is predicted. | Based on contents and scheme proposed in IPP, or on possibility to cause impact on ethnic minorities and proposed mitigation measures. |
| | Gender | P, C, O | Districts along the planned alignment | - Survey examples of impacts and measures taken on gender by similar projects. | Factors to arise issues on gender are identified. | Based on possibility to cause impact on gender and proposed mitigation measures. |
| | Public Health | C, O | City/Province along the planned alignment | - Survey current situation including trend of STD, STI, AIDS/HIV, and other infection diseases. | Risks to increase disease rate of TSD, STI, AIDS/HIV, and other infection diseases are identified. | Based on possibility or magnitude of impact on public health and proposed mitigation measures. |
| | Occupational Health, and Safety | C, O | City/Province along the planned alignment | - Confirm relevant legislative system for securing good condition of OHS in the concerned city/province. | Risks on occupational health due to construction and operation of HSR are identified. | Based on possibility to increase risks on OHS and proposed mitigation measures. |
| Other | Accidents | C, O | City/Province along the planned alignment | - Confirm statistical data of traffic accident. | - Risks of accident by HSR are identified.<br>- Impact on traffic accident by modal shift is predicted. | Based on possibility to increase risks on accidents and proposed mitigation measures. |
| | Climate Change | O | City/Province along the planned alignment | - Confirm impact of modal shift by the result of traffic demand forecast.<br>- Collect relevant information to climate change and GHGs emission in Vietnam | Considering the results of the traffic demand forecast, discharge amount of GHGs is estimated in “with”project and “without” project cases. | Based on the estimated impact of modal shift. |

Note: P stands for preconstruction, C stands for Construction and O stands for Operation.
Source: JICA Study Team

### 2) Suggestions for the EIA Implementation

4.40 In the EIA study, various environmental and social considerations items need to be assessed carefully. Among the assessment items, some items are not common in the past EIA studies in Vietnam or are just specific for the HSR projects. Social acceptability of the projects should be also secured for its smooth implementation. Thus, for the effective implementation of the EIA study, it is suggested for the project proponent to pay attention on the following technical issues:

#### (1) Natural Environment

4.41 Especially in the embankment or tunnel sections, the impacts on hydrological situation and water use should be paid attention such as the change in flooding risks and ground water flow. Quantitative detail analysis including hydro-geological simulation should be conducted to predict the impacts in detail and to propose concrete mitigation and management measures.

4.42 Available secondary information on flora and fauna, and ecosystems outside special use forest is limited, especially the endangered species and endemic species. Thus, collection of the primary information about them is indispensable for the EIA study. Avifauna including migratory birds should be surveyed carefully especially since the HSR projects will pass Endemic Bird Area (EBA)[1] which is designated by Birdlife International. In addition, Ecological Sensitive Receptors (ESRs) such as breeding places, nesting places and water drinking places of wildlife should be surveyed in order to assess the impacts on wildlife habitats. For natural condition survey, the long enough survey periods should be secured to take seasonal changes into considerations in the EIA study.

4.43 There are also ecosystems and habitats of flora and fauna even in the human-affected areas, so-called Satoyama, such as agricultural fields and the areas near the residential areas. These areas are also important in terms of the supply of natural resources, landscape, livelihood and culture. Impacts on these ecological functions should be taken into considerations in the EIA study.

4.44 The impact on forest should be assessed and especially for the protection forest, the functions of the affected areas should be well compensated. Avoidance of Illegal logging of forests should be discussed in the EIA so that project proponent is encouraged to obtain certification by forest certification systems as a way to ensure the prevention of illegal logging.

#### (2) Living Environment

4.45 Since the existing monitoring data on railway noise and vibration and peoples' response to noise and vibration impacts is not enough in Vietnam, appropriate site survey (measurement) should be conducted in the EIA study. Especially regarding the railway noise and vibration caused by HSR, the clear-cut conservation target should be set, together with the scientific assessment methodologies.

4.46 Impacts by low-pressure wave by HSR operation should be assessed taking into consideration the distribution of houses and buildings near the proposed exits of the long tunnels in the EIA study. The detail mitigation measures should be proposed based on the assessment.

[1] EBA is the area designated by Birdlife International as the most important places for habitat-based conservation of birds.

4.47 Due to lack of the study cases on wave obstructions in Vietnam, the methodologies of survey, impact assessment and management should be well studied in the EIA. If any impact is identified on wave of TV/radio/phone/Internet etc., mitigation measures including compensation should also be proposed.

4.48 Eight mountain tunnels in the north section and 11 in the south section are planned with total length of approximately 15km in the north section and approximately 74km in the south section. Consequently, since a large amount of soil is expected to be excavated for the construction of the tunnels, the excavated soil needs to be handled appropriately. Actually the amount of soil material required for construction of the embankments is estimated to be more than the amount of soil excavated for construction of the tunnels, utilization of the excavated soil as materials of the embankments should be considered in the EIA so that surplus soil waste from the construction can be minimized.

### (3) Social Environment

4.49 There are some religious facilities (such as pagodas and churches), cemeteries, cultural heritage and assets identified along the alignment based on the secondary data collected from each city and province and topographic maps prepared by satellite images. Impacts on these facilities and areas are avoided or minimized, as much as possible, through the comparison of alternatives. However, there is a possibility that unidentified local religious facilities and buried cultural assets may be found during the construction. It is, therefore necessary that careful and detail surveys on these kind of facilities and assets should be conducted in the field with cooperation from relevant agencies/institutions and experts in the EIA study. If the relocation cannot be avoided, the existing conditions should be recorded together with relevant agencies/institutions and compensation should be made appropriately.

4.50 Distribution of vulnerable social groups, their livelihood, lifestyle and culture should be surveyed in detail in order to assess the impacts on them by the HSR projects. In particular, if any adverse impacts are identified on indigenous peoples/ethnic minority groups, appropriate measures should be prepared as an indigenous peoples plan (IPP) which would be a part of the EIA report and RAP and/or CSR plan. It is desirable that the IPP should include the elements laid out in the World Bank Safeguard Policy, OP4.10, Annex B.

### (4) Others

4.51 In the course of an EIA study, stakeholder meetings and/or public consultation meetings should be organized in a socially acceptable manner in order to reflect comments and opinions of local stakeholders, such as local residents including illegal dwellers, on the HSR projects. In addition, sufficient information should be disclosed in an appropriate time and manner.

4.52 During this study, various information and data on environmental and social aspects, which were used for planning the projects (alignment) as well as the IEE Study, has been collected. The collected data has been summarized in Technical Report No.3 Results for Baseline Survey for Environmental and Social Considerations and Technical Report No.4 Environmental Sensitivity Maps. These sets of baseline information and data will also be useful for the further study stage, i.e., the projects planning for the feasibility

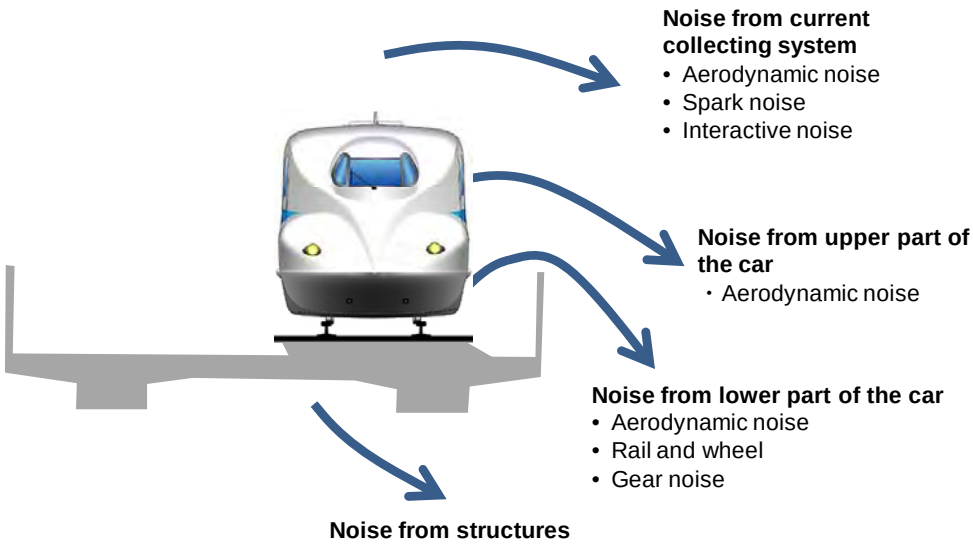
study and the environmental and social considerations for the EIA study and RAP preparation. Since it may take a certain amount of time to commence the HSR projects, the environmental and social baseline data should be updated periodically so that the EIA can be started without delay. In addition, even after the projects start, the projects are expected to be implemented over a long period of time, the information and data should be also updated even during the project implementation period so that appropriate management and mitigation measures can be done based on the updated information.

# 5 PRELIMINARY STUDY ON ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES PECULIAR TO HSR

## 5.1 Environmental Impacts Peculiar to HSR

5.1 Railway is a suitable means for mass transport of passenger and goods, hence it imposes less adverse impacts to the environment compared to automobiles. On the other hand, in Japan, after the start of operation of HSR (Shinkansen), various environmental issues have been experienced related to high speed train operation. Among the particularly well known environmental impacts of high-speed train operation are railway noise and vibration, micro-pressure wave and radio wave disturbance. In general, the extent of these problems tends to become more serious with the increase in speed. Actually, these environmental impacts associated with HSR have been experienced not only for Shinkansen in Japan but also for HSR in various countries.

5.2 Railway noise is not only generated by friction between train and structures, such as between rail and track and between pantographs and electric cable, but also aerodynamically when trains run at high speed. These noises are generated at various places of the car and structure, as shown in Figure 5.1.1. Noises are categorized into four based on the location of its sources, namely (i) noise from current collecting system, (ii) noise from upper part of the car, (iii) noise from lower part of the car, and (iv) noise from structure. Current collecting system noise consists of aerodynamic noise, spark noise and interactive noise (or sliding noise), while noise from upper part of the car is mainly aerodynamic noise. Noise from lower part of the car consists of aerodynamic noise, rail and wheel (or rolling noise) and gear noise.

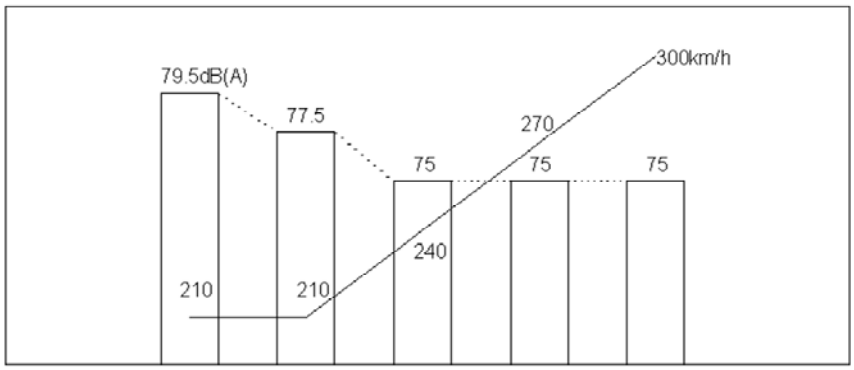



Source: JICA Study Team

**Figure 5.1.1 Location and Type of Noise Generated by High Speed Train Operation**

5.3 In fact, railway noise and vibration problems by Shinkansen operation became a legal case in 1974 in Nagoya, Japan. The case was settled in 1986. With this as a turning point, various mitigation measures have been developed and in parallel, institutional set up such as constitution of environmental standards for Shinkansen has been made.

5.4 Figure 5.1.2 shows the trend of relation between the operation speed of the Shinkansen and peak noise level measured at 25m from the center of nearest rail track. The structure is concrete viaduct (rail level is 7.9m above the ground) with slab tracks. Since various measures have been developed and carried out as “75 Phones Measures”, the noise level from Shinkansen has been reduced even though the operation speed has increased in order to meet the social needs for high speed serviceability. The major measures taken in each time period are summarized in Table 5.1.1.




| | A | B | C | D | E |
|---|---|---|---|---|---|
| Year | 1964 | 1982 | 1986 | 1992 | 1997 |
| Train Type | 0 series | 0 series | 200 series | 300 series | 500 series |
| Velocity (km/h) | 210 | 210 | 240 | 270 | 300 |

Source: Website of Ministry of Land, Infrastructure ,Transport and Tourism

**Figure 5.1.2 Trend of Operation Speed of Train (Shinkansen) and Noise Level**

**Table 5.1.1 Major Measures Taken for Noise from Shinkansen Operation**

| Period* | Major Measures Taken |
|---|---|
| A→B (1964-1982) | - Implementation of rail grinding<br>- Installation of sound proof wall (Height: 2m) |
| B→C (1982-1986) | - Covering pantographs<br>- Pulling-through of bus cable (extra high voltage line)<br>- Installation of reverse L-shape sound proof wall with acoustic material (Height: 2m), etc. |
| C→D (1986-1992) | - Smoothing the car body<br>- Installation of reverse L-shape sound proof wall with acoustic material (Height: 2m), etc. |
| D→E (1992-1997) | - Smoothing the car body<br>- Installation of low-noise type pantographs<br>- Installation of reverse L-shape sound proof wall with acoustic material (Height: 2m), etc. |

Note: *Periods correspond to Figure 5.1.2.
Source: Website of Ministry of Land, Infrastructure, Transport and Tourism

5.5 Regarding railway vibration, compared to the existing railway, shock factors associated with train operation speed as well as excitation power between wheel and rail is relatively large when the train is running at high speed. Various mitigation measures on railway vibration have been also developed together with measures on railway noise.

5.6 When the train is running into the tunnel at high speed, it generate compression wave, which is propagated through the tunnel at the speed of sound and reach the exit side portal, when part of the compression wave is emitted outward as pulse-shaped compression wave to cause a phenomenon of micro-pressure wave. When Snayo

Shinkansen started its operation in March 1975, complaints were lodged from wayside residents to the effects that micro-pressure wave was radiated from the long slab-track tunnels to cause blasting sound to shake windows and doors of the houses. After the investigations of this phenomenon, various mitigation measures have been developed against the phenomenon such as installation of buffer hood at tunnel entrance and measures on the rolling stock (e.x, long nose head).

5.7 Radio wave disturbance has been also experienced for Shinkansen. When the train is passing at high speed, some flutter or pulse disturbance on TV happens. In addition, there is a possibility of some disturbance on electromagnetic waves especially around the facilities where AC feeding is adopted.

5.8 This chapter discusses the above-cited potential environmental impacts peculiar to HSR mainly from the experiences for Shinkansen in Japan and provides recommendations on provisional target levels to be achieved for conservation of the environment, which would be applied to the HSR projects in Vietnam. In addition, necessary countermeasures on railway noise and vibration and micro-pressure wave are proposed.

## 5.2 Preliminary Study of Noise from HSR

### 1) Railway Noise Standards

#### (1) Evaluation Value of Noise Level

5.9 In general, peak noise level ($L_{Amax}$) and equivalent noise level ($L_{Aeq}$) are used as evaluation values of railway noise in the world. Peak noise level value ($L_{Amax}$) is controlled as peak value of the loudest noise, while equivalent noise level value ($L_{Aeq}$) is the total energy of noise given in a fixed time which relates to the annoyance of noise more. In other words, it is basically said that exposure to noise with a big peak in a short period of time or a small noise in a longer period of time generates the same level of annoyance.

5.10 Noise from high-speed train operation, i.e. from Shinkansen, is evaluated based on “peak noise level” in Japan because of its high operating density. Meanwhile, “equivalent noise level” is mainly used for evaluation of railway noise level from the existing lines as well as that generally experienced in other countries.

#### (2) Railway Noise Standards in Japan

5.11 Environmental standards on high speed railway in Japan are written in “Shinkansen Superexpress Railway Noise Standards” (Notification No. 46 of the Environment Agency of Japan, July 29, 1975) that regulate peak noise levels of each Shinkansen train running on the tracks. The standard values of peak noise ($L_{Amax}$) are 70 dB(A) for areas used mainly for residential purpose (Category area I) and 75 dB(A) for other areas, including commercial and industrial areas, where the normal living conditions shall be preserved (Category area II). Prefectural governors shall designate the category of the area. There is no time zone for the standards because the train operating time is 6:00–24:00 and sleeping time is assumed out of the operation time.

5.12 Measurements are carried out by recording the peak noise level of each of the Shinkansen trains passing in both directions, in principle, for 20 successive trains. Measurements shall be carried out outdoors, in principle, at the height of 1.2 m above the ground. Measurement points shall be selected to represent the Shinkansen railway noise levels in the area concerned, as well as points where the noise is posing a problem. The Shinkansen railway noise shall be evaluated by the energy mean value of the higher half of the measured peak noise levels.

5.13 As per the Manual on Shinkansen Railway Noise Measurement (Ministry of the Environment, May 2010), the measurement point of noise level shall be set at 25 m from the track center for continuous and unified monitoring.

5.14 On the other hand, for the existing lines in Japan, equivalent noise level ($L_{Aeq}$) is adopted for evaluation of railway noise level based on the notification on “Guidance for Countermeasures for Noise on New Construction or Large Scale Rehabilitation of Railway” (the Environment Agency of Japan, December 20, 1995). The guideline values are set at 60 dB(A) as equivalent noise level at daytime and 55 dB(A) at nighttime.

5.15 In order to compare the values of peak noise level and equivalent noise level, equivalent noise level was tentatively calculated from 70dB(A) of peak noise level for Tokaido Shinkansen by using an approximate expression given in the above Guidance, which is applied to existing railways. The following preconditions were assumed for

the calculation:

(i) Measuring point: 25m away from the center of adjacent track and 1.2m above the ground;

(ii) Time: divided into 15 hours at daytime (7:00–22:00) and 9 hours at nighttime (22:00–7:00);

(iii) Number of trains: 280 trains at daytime (7:00–22:00) and 20 trains at nighttime;

(iv) Speed of train: 270 km/h; and

(v) Length of cars: 400m.

5.16 The calculated equivalent noise levels are 55dB(A) at daytime and 44dB(A) at nighttime. These values are lower than the guideline values.

### (3) Railway Noise Standards in Vietnam

5.17 Environmental standard values for noise in Vietnam are decided in QCVN 26: 2010/BTNMT as shown in Table 5.2.2. In ordinary zones, the equivalent noise level (LAeq) at daytime (from 6:00 to 21:00) is 70dB(A) and at night (from 21:00 to 6:00) is 55dB(A). However, although it is not clearly mentioned in QCVN 26, these standard values apply to general noise (environmental noise) and not to any specific noise like railway noise.

**Table 5.2.1 Environmental Standard for Noise in Vietnam**

| No. | Zone[2] | From 6:00 to 21:00 | From 21:00 to 6:00 |
|---|---|---|---|
| 1 | Special Zones | 55 | 45 |
| 2 | Ordinary Zones | 70 | 55 |

[1] Maximum acceptable levels of noise (according to equivalent loudness, dB(A). Sources of noise due to manufacturing, construction, trade, service, and daily household activities shall not exceed regulated levels as shown above.

[2] Special zones are areas inside the perimeters of medical facilities, libraries, kindergartens, schools, churches, communal houses in villages, pagodas, and zones which are under other special regulations. Ordinary zones include: apartment blocks, detached or terraced restaurants, hotels, hostels, administrative offices.

Source: QCVN 26:2010/BTNMT – National Technical Regulation on Noise of Vietnam

5.18 On the other hand, VNRA has prepared noise standards along railway line as TCCS 03:2009/VNRA, which are applied to noise levels during train operation and construction or upgrading/improvement of national railways in public and residential areas. For the noise from train operation, 70dB(A) is suggested as a permitted level for both daytime and nighttime. However, since these standards are internal ones and have not been approved by MONRE, they are not strictly enforced and may not be directly applied to the HSR Projects.

### (4) Railway Noise Standards in Various Countries

5.19 According to the Study on Noise Evaluation and Control Methods by the Ministry of the Environment (Japan) in 2006, many countries adopt equivalent noise level ($L_{Aeq}$) for the control of railway noise. Table 5.2.1 shows the standard values for railway noise adopted in various countries.

**Table 5.2.2 Standards for Railway Noise Adopted in Various Countries**

| Country | Category | Space of Assessment | Index | Value (dB) (time zone) | Notes |
|---|---|---|---|---|---|
| Austria | Guideline (Immission) | Free field | $L_{Aeq}$ | 60-65 (06-22)<br>50-55 (22-06) | Railway noise is adjusted by -5dB as a railway bonus. |
| Belgium Walloon Region | Guideline (Immission) | Free field | $L_{Aeq}$ | 60-65 (08-20)<br>55-60 (20-08) | Values depend on the conditions of areas. |
| Denmark | Guideline (Immission) | Free field | $L_{Aeq}$ ,24h | 60 | 1) Limit value for the noisiest train normally used on the railway line. |
| | Regulation(Emission) | | $L_{Amax}$ | 85[1)] | |
| France | Guideline (Immission) | 2m in front of windows | $L_{Aeq}$ | 60(06-22),55(22-06)<br>65(06-22),60(22-06) | New or modified land infrastructure.<br>After modification: If noise from existing infrastructure is more than 70 dB (06-22) and/or 65 dB(06-22). |
| Germany | Guideline (Immission) | Free field | $L_{Aeq}$ | 64(06-22)<br>54(22-06) | Limits for new and significantly modified railway.5dB rail bonus are included. |
| Italy | Guideline (Immission) | Facade | $L_{Aeq}$ | 55(06-22)<br>45(22-06) | All sources and for residential area. |
| Japan | Guideline (Immission) | Free field | $L_{Amax}$ | 70[1)] | EQS for Shinkansen super-express[1)] areas for residential use |
| | Guideline (Emission) | At 12.5m from the nearest track | $L_{Aeq}$ | 60(07-22),<br>55(22-06) | Newly constructed existing railways |
| Korea | Guideline (Immission)<br>Regulation (Emission) | Outdoor | $L_{Aeq}$ | 60 for existing, 63 for under construction[1)] | EQS for high-speed train (residential area) |
| | | Outdoor | $L_{Aeq}$ ,1h | 70(07-22),65(22-07) [1)] | Existing railways[1)] Areas for mainly residential use. |
| The Netherlands | Statutory (Immission) | Free field | $L_{Aeq}$ | Lower limit range 55-57, upper limit range 65-73 for day (07-19).<br>(depending on circumstances) | Upper and lower threshold noise limits apply to new building work. New dwellings are not permitted at noise levels exceeding the upper threshold, or the use of existing buildings must be modified or any new railroads cannot be opened to the public until appropriate measures are taken. |
| Norway | Guideline (Immission) | Free field | $L_{Aden}$ | 58 | Noise at sensitive areas |
| Spain | Guideline (Immission) | Façade | $L_{Aeq}$<br>$L_{Aeq,24h}$ | 65(7-22),55(22-07)<br>65 | New long distance lines |
| Turkey | Regulation(Immission) | Free field | $L_{Aeq}$ | 65(7-19),60(19-23),<br>55(23—07) | These values are applied to residential and natural life areas. |
| UK | Regulation(Immission) | 1m from the facade of eligible premises | $L_{Aeq}$ | 68(06-24),63(24-06) | New railways |
| | Guideline (Immission) | Free field | $L_{Aeq}$ | Category Day, Night<br>A <55, <45<br>B 55-66, 45-59<br>C 66-74, 59-66<br>D >74, >66<br>(Day:07-23, Night:23-07) | Planning Policy Guidance (PPG) 24 applies to residential situations where development is planned close to an existing noise source. |
| USA | Regulation (Immission) | Free field | $L_{dn}$ | 65 | Severe impact (FRA,1998) |

Note: EQS stands for Environmental Quality Standard
Source: Study of Noise Evaluation and Control Methods, Ministry of the Environment (Japan), 2006

5.20 The above standards can be divided into “emission standards” and “exposure (immission) standards”. Emission standards are the restricted values controlling noise generated from sound sources or noise from a constant distance of sound sources. In other words, it is often taken from a system of law as the noise regulation. As for the exposure (immission) standards, they are considered as the tolerance limits of the residents along the railway line. In many cases, they are more of guidelines rather than regulations for noise, serving to protect the surrounding environment. When noise is exposed, it is considered to generate various effects on the human body.

5.21 Compared to the equivalent noise level which is applied in many countries for railway noise standards, peak noise level standards applied for Shinkansen in Japan are relatively stringent as also shown in the above tentative calculation for Tokaido Shinkansen. On the other hand, the noise level of the standard value in other countries turns out to be gradual than in Japan especially for the existing railways. When comparing railways to other transportation modes, the railway is mass transit transportation and reduces the loads on the environment. In addition, since the existing railway is community-based transportation, there is a little generous evaluation as a resident reaction to the noise of existing railways.

5.22 In the survey of Yokoshima (the 12th Environmental Science Center Research Symposium in 2003, Kanagawa Prefecture), from the viewpoint of the life obstruction feeling to Shinkansen, more stringent standard with 5-10dB(A) lower than the one for the existing railway should be set for Shinkansen. This was discussed based on the results of the survey that the residents understood the necessity of the existing railway in daily life and there was some dissatisfaction with HSR due to vibration or tunnel micro-pressure wave which might cause a strict reaction to Shinkansen.

### 2) Proposed Provisional Target Level for Railway Noise Control

5.23 Provisional noise target levels on HSR to be documented were proposed because the existing noise standards in Vietnam (QCVN 26:2010/BTNMT) are not considered to be the ones set specifically for railway noise and environmental or regulatory standards on HSR noise have not been established yet.

5.24 When providing target level, the corresponding technical capability should be considered to define the railway noise level through surveys about residents’ opinions on noise or by referring to the experiences in other countries. As shown in Table 5.2.1, the standard environment value (the strictest value) as equivalent noise level in various countries is around 60–65 dB(A) at daytime and 55dB(A) at nighttime. In Japan, when there is new construction for an existing line or large-scale improvement, the equivalent noise level value is set at 60dB(A) at daytime and 55dB(A) at nighttime as the guideline value. Considering these values, the equivalent noise level values which are being adopted as railway noise standards or guidelines in many countries and in Japan, which are 60dB(A) (6:00–21:00) and 55dB(A) (21:00–6:00), are tentatively proposed as target levels for the control of railway noise for HSR to be documented for environmental conservation.

5.25 The height of the evaluation point is proposed at 1.2m from the ground level and outdoor where it easily affects humans. However, for elevated structures, where there is a possibility of the trains running near high buildings in urban areas, 10.0m above the ground level is also proposed as a supplemental evaluation point.

### 3) Recommended Mitigation Measures for Railway Noise from HSR

5.26 Mitigation measures for railway noise should be considered from various approaches. One approach is to take measures on the sides of cars and structures as the ones to be adopted for noise sources. Various measures for the cars have been developed and applied in practice for Shinkansen in Japan as discussed above.

5.27 The other approaches are to take measures to be adopted on noise propagation paths and/or for noise receiving points. The former is securing the distance between sound sources and noise receiving points by arranging appropriate land use along the alignment such as the setting of buffer area. In the latter case, soundproofing of houses and sensitive facilities is one of the measures that can be considered. In this study, however, measures in the sides of cars and structures are mainly discussed as this is the essential approach to be initially taken. Then, if it is difficult to archive the target levels by this approach (taking measures in the sides of cars and structures), the other approach may be discussed.

5.28 As discussed above, railway noise comes from various places of the car such as current collecting system including pantographs, upper and lower parts of the car, and structure. There is several types of noise from different places. Aerodynamic noise is generated from all places of the car; spark noise and interactive noise are specific from the current collecting system; and rail and wheel and gear noise are specific from the lower part of the car. Thus, mitigation measures have been developed for HSR (Shinkansen) corresponding to these places and types so that the noise can be reduced as much and as effectively as possible.

5.29 Table 5.2.3 summarizes major mitigation measures to reduce noise impacts from the cars and structures which are recommended to be adopted for the HSR in Vietnam considering expected results and costs. Figures 5.2.1 to 5.2.7 show examples of each of the recommended measures.

**Table 5.2.3 Recommended Mitigation Measures for Railway Noise**

| Mitigation Measure | | Characteristics | Advantages | Disadvantages | Workability | Expected Results | Cost |
|---|---|---|---|---|---|---|---|
| On the side of structure | Install sound-proof wall | The effect of the installation is predictable. | It is possible to reduce noise of lower part of the car mainly. | There are some problems on sunshine obstruction and view from the car window. | Relatively easy, but it is necessary to set up the base for installation. | Big | Relatively cheap |
| | Adopt long rail and Expansion Joint (EJ) | It is possible to reduce noise by reducing the number of joints by adopting longer rails. | It is possible to reduce not only noise but also vibration. | When replacing the rails, workability is relatively difficult. | It requires professional and special hardware for the rail welding. | Big | Relatively expensive (as part of project costs) |
| | Thorough maintenance of track such as grinding rail | Adjust the wear-out of running surface of rail or the track part above the ground to reduce operation noise. | It can be done as part of routine maintenance. It is possible to reduce not only noise but also vibration. | The effect is relatively short in a few months by the realignment of track. | It requires special devices or skills for grinding rail or track realignment. | Medium | Part of maintenance costs (Relatively expensive for procurement of a grinding car) |

| Mitigation Measure | | Characteristics | Advantages | Disadvantages | Workability | Expected Results | Cost |
|---|---|---|---|---|---|---|---|
| On the side of cars | Streamlining of car head shape | By reducing constant drag (CD) value by decreasing the roughness of the car body, it is possible to reduce aerodynamic noise. | The effect is continuously maintained. | The trial of obtaining effects of reducing noise will be required. | As it is not easy after the operation, streamlining of the cars needs to be considered from the planning and order stages. | Big | Part of car procurement costs |
| | Smoothing of car shape | By reducing CD value by decreasing the roughness of the car body, it is possible to reduce aerodynamic noise. | The effect is continuously maintained. | The trial of obtaining effects of reducing noise will be required. | As it is not easy after the operation, smoothing of the cars needs to be considered from the planning and order stages. | Small | Part of car procurement costs |
| | Adopt low-noise type pantograph and reduction of the number | By decreasing the opportunities interaction between electric cables and pantographs, it is possible to reduce the noise. | It changes dramatically only by changing the pantographs and the cover. | The trial of obtaining effects of reducing noise will be required. | It takes time to change at the car factory. But, as it is not easy after the operation, adoption of said pantographs needs to be considered from the planning and order stages. | Big | Relatively expensive (part of car procurement costs) |
| | Covering of car seam parts | By decreasing the roughness of the car body, it is possible to reduce aerodynamic noise. | It is possible to repair partly between boogies. | The trial of obtaining effects of reducing noise will be required. | It takes time to covering works at the car factory. But, adoption of covers needs to be considered from the planning and order stages. | Small | Relatively cheap (part of car procurement costs) |
| | Thorough maintenance of cars | By decreasing the roughness and maintenance of accessories, the initial condition of lower part's noise is maintained. | It can be done as part of routine maintenance. | Adjustment of train operation schedule or for maintenance is necessary. | Relatively easy as it can be done as part of routine maintenance. | Medium | Part of maintenance costs |

Source: JICA Study Team

5.30 Among the above mitigation measures, the ones to be adopted for the cars such as streamlining of the head shape of the car, smoothing of the car shape, adopting low-noise type pantographs and reduction of its number, and installation of cover in seam parts of the cars are normally incorporated in the design or specification of the cars, as in the case of Shinkansen recently. Thus, it can be said that rolling stocks to be used for HSR in Vietnam are expected to adopt these mitigation measures as preinstalled ones.

5.31 As for mitigation measures to be adopted on the structure, long rail and expansion joint (EJ) is now fundamental track for Shinkansen in Japan and HSR in other countries for its' smooth operation. Thus, it can also be said that these are prerequisite measures to be adopted for HSR in Vietnam.

5.32 Thorough maintenances of the tracks and cars are fundamental practices for safely and smooth operation of high speed trains, but also contribute to reduce noise impacts.

5.33 On the other hand, other than the above measures, scattering of ballasts can be considered for noise reduction at the slab track section. However, as adoption of anti-

vibration type slab (at the slab track section) is quite expensive, it would not be feasible for HSR in Vietnam and could only be considered for specific sections where special measures are required for noise impacts.

5.34 As for installation of sound-proof walls, it is said that it is an effective, proven and comparatively cheap measure. Based on the above conditions, installation of sound-proof walls can be a possible mitigation measure to be examined to comply with the target levels. Thus, a preliminary case study on noise from HSR was conducted so that necessary height and length of sound-proof walls can be explored tentatively. The process and results of the case study are summarized in the next section.

**(1) On the Side of Structure**

- **Characteristics:** The effect of the installation is predictable.
- **Advantages:** It is possible to reduce noise of the lower part of car mainly.
- **Disadvantages:** There are some problems of sunshine obstruction and view from the car window.
- **Workability:** Relatively easy, but it is necessary to set up the base.
- **Expected Results:** Big
- **Cost:** Relatively cheap

Source: JICA Study Team (Sample Photo from Internet)

**Figure 5.2.1 Example of Sound-proof Wall**

- **Characteristics:** It is possible to reduce noise by reducing the number of joints by adopting longer rails.
- **Advantages:** It is possible to reduce not only noise but also vibration.
- **Disadvantages:** When replacing the rails, workability is relatively difficult.
- **Workability:** It requires professional and special hardware for the rail welding.
- **Expected Results:** Big
- **Cost:** Relatively expensive (as part of project costs)

Source: JICA Study Team (Sample Photo from Internet)

**Figure 5.2.2 Example of Long Rail and Expansion Joint (EJ)**

- **Characteristics:** Adjust the wear-out of running surface of rail or the track part above the ground to reduce operation noise.
- **Advantages:** It can be done as part of routine maintenance. It is possible to reduce not only noise but also vibration.
- **Disadvantages:**.The effect is relatively short in a few months by the realignment of track.
- **Workability:** It requires special devices or skills for grinding rail or track realignment.
- **Expected Results:** Medium
- **Cost:** As part of maintenance costs (Relatively expensive for procurement of a grinding car)

Source: JICA Study Team (Sample Photo from Internet)

**Figure 5.2.3 Thorough Maintenance of Tracks such as Grinding Rail**

### (2) On the Side of Cars

- **Characteristics:** By streamlining the car body, aerodynamic noise can be reduced by reducing constant drag (CD) value.
- **Advantages:** The effect is continuously maintained.
- **Disadvantages:** The trial of obtaining effect of reducing noise will be required
- **Workability:** As it is not easy after the operation, streamlining of the cars needs to be considered from the planning and order stages.
- **Expected Results:** Big
- **Cost:** Part of car procurement costs.

Source: JICA Study Team

**Figure 5.2.4 Example of Streamlined Head Shape**

- **Characteristics:** By decreasing the roughness of the car body, aerodynamic noise can be reduced by reducing CD value.
- **Advantages:** The effect is continuously maintained.
- **Disadvantages:** The trial of obtaining effect of reducing noise will be required
- **Workability:** As it is not easy after the operation, smoothening of the car shape needs to be considered from the planning and order stages.
- **Expected Results:** Small
- **Cost:** Part of car procurement costs.

Source: JICA Study Team (Sample Photo from Internet)

**Figure 5.2.5 Example of Smoothened Car Shape**

Former bullet train with many pantographs

Current bullet train with few pantographs

Advanced pantograph and pantograph cover

- **Characteristics:** By decreasing the opportunities interaction between electric cables and pantographs, it is possible to reduce the noise.
- **Advantages:** It changes dramatically only by changing the pantograph and the cover.
- **Disadvantages:** The trial of obtaining effect of reducing noise will be required
- **Workability:** It takes time to change at the car factory.
- **Expected Results:** Big
- **Cost:** Relatively expensive (part of car procurement costs).

Source: JICA Study Team (Sample Photo from Internet)

**Figure 5.2.6 Example of Low-Noise Type Pantograph and Reduction of its Number**


- **Characteristics:** By decreasing the roughness of the car body, aerodynamic noise can be reduced.
- **Advantages:** It is possible to repair partly between boogies.
- **Disadvantages:** The trial of obtaining effect of reducing noise will be required.
- **Workability:** It takes time to covering works at the car factory. But, adoption of covers needs to be considered from the planning and order stages.
- **Expected Results:** Small
- **Cost:** Relatively cheap (part of car procurement costs)

Source: JICA Study Team

**Figure 5.2.7 Example of Covering of Vehicle Seam Part**

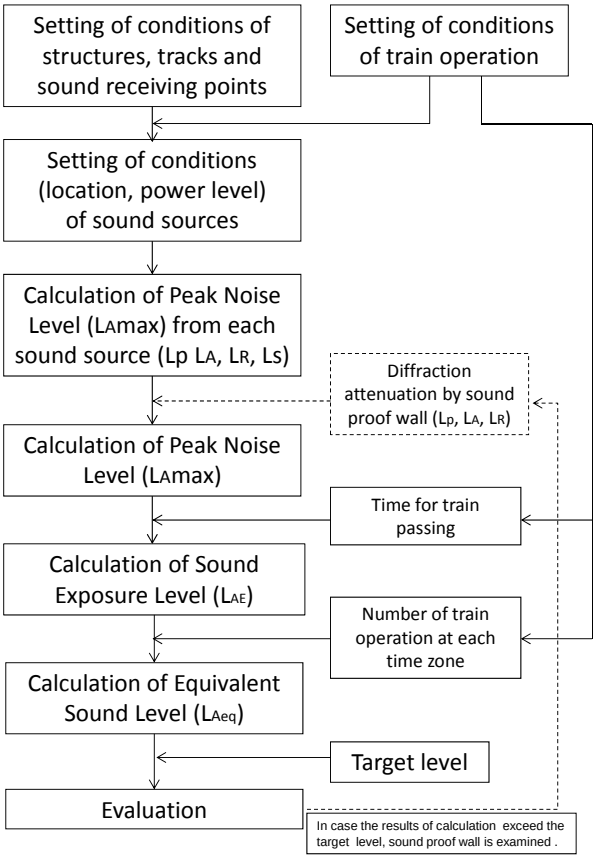
### 4) Preliminary Case Study on Railway Noise from HSR

#### (1) Objective of the Case Study

5.35 From the experiences on the impacts of railway noise, various countermeasures have been taken for Shinkansen in Japan and HSR in other countries. These include contraction of number pantographs and streamlining of rolling stocks, adaptation of long-rails and EJ, and installation of sound-proof walls, etc. Among the environmental countermeasures for railway noise, necessity and necessary height and length of the sound-proof walls, if it is required, are elaborated further in this preliminary case study along with rapid estimation and tentative assessment of potential impacts from noise.

#### (2) Process of Rapid Estimation and Assessment of Noise Impacts

5.36 First of all, prerequisite conditions of structures, tracks, sound receiving points, and train operation are set, followed by the setting of conditions for location and power level of sound sources. Next, peak noise levels ($L_{Amax}$) is calculated for the four sound sources, also in consideration to the diffraction attenuation by sound-proof walls. Subsequently, sound exposure level ($L_{AE}$) is calculated under the conditions of the time of train passing, and provided the number of train operation at each time zone, the equivalent sound level is derived which is subject for evaluation against the set provisional target levels. In case this exceeds the target levels, the setting of sound-proof walls are re-examined. Figure 5.2.8 shows the basic procedure for the rapid estimation and assessment of noise impacts adopted in this case study.




Source: JICA Study Team.

**Figure 5.2.8 Flowchart for Rapid Estimation and Assessment of Noise Impacts**

### (3) Conditions of Train Operation

5.37 Since the operation year of HSR in Vietnam was set in 2030 in this study, a basic case was set for this year. However, foreseeing the situation that the frequency of train operation may increase in the future, cases for 2035 and 2040 were considered as well for reference. Table 5.2.4 shows conditions set for train operation with the assumption that the operation hours are from 6 a.m. to midnight.

**Table 5.2.4 Conditions of Train Operation**

| Section | Year | No. of Operation | Operation Speed | No. Cars/train Length of train |
|---|---|---|---|---|
| North Section (Ngoc Hoi – Vinh) | 2030 (base case) | 69 round-trips (138) | 320km/h | 10 cars/ 250m in total |
| | 2035 | 87 round-trips (174) | | |
| | 2040 | 111 round-trips (222) | | |
| Southern Section (Thu Thiem – Nha Trang) | 2030 (base case) | 59 round-trips (118) | | |
| | 2035 | 75 round-trips (150) | | |
| | 2040 | 96 round-trips (192) | | |

Source: JICA Study Team.

### (4) Structures, Tracks, and Sound Receiving Points

5.38 The prerequisite conditions for structures, tracks and sound receiving points are indicated in Table 5.2.5.

**Table 5.2.5 Conditions of Structures, Tracks, and Sound Receiving Points**

| Items | | Prerequisite Conditions |
|---|---|---|
| Tracks | | Viaduct sections: Slab tracks<br>Embankment sections: Ballast tracks |
| Track formation width | | 11.3 m |
| Distance between track centers | | 4.3 m |
| Rail Level (R.L.) | | Viaduct sections: 10m from the ground level (R.L.= Floor Level + 0.5m).<br>Embankment sections: 5m from the ground level (R.L.= Floor Level + 0.5m) |
| Sound Receiving Points (Estimation Points) | Viaduct Sections | Sound receiving points were set 8.5m, 12.5m, 25,0m, and 50.0m from the center of the track (track nearer to the sound receiving point)<br>1.2m from the ground level (additional points were taken at rail level =10m for viaduct sections because some high-rise buildings are expected along the viaduct sections) |
| | Embankment Sections | Sound receiving points were set 10.25m, 12.5m, 25,0m, and 50.0m from the center of the track (track nearer to the sound receiving point)<br>1.2m from the ground level |

Source: JICA Study Team.

### (5) Conditions of Sound Sources

5.39 **Compatibility with Rolling Stocks:** While E5 series rolling stocks is assumed to be adopted for HSR in Vietnam in this study, the power levels of E5 series are yet to be disclosed. Therefore, calculation is done based on E2 series. According to a paper on the reduction of external sound from HSR rolling stocks, it was concluded that E5 series can reduce sound levels by 4.5 dB compared to E2 series (see Figures 5.2.9 and 5.2.10). Hence, 4.5 dB is deducted from the results calculated by applying E2 unit power levels.

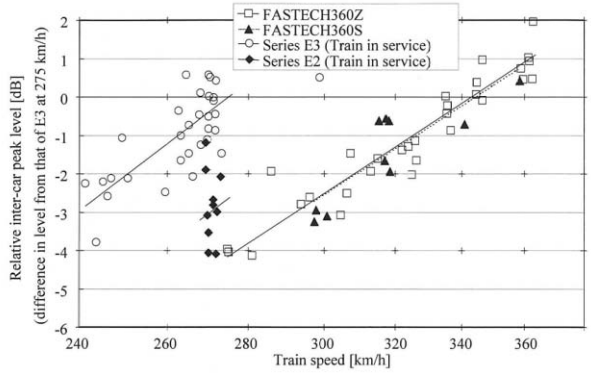



**Figure 5.2.9 Inter-car Peak Levels (between first and second cars) using Microphone Array [1) 2)]**

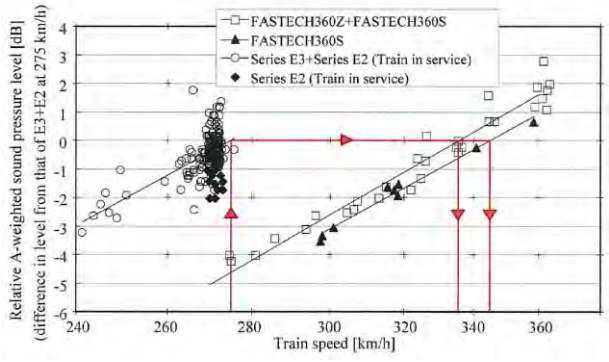



**Figure 5.2.10 A-weighted Sound Pressure Levels Using Non-directional Microphone [1) 3)]**

1) Fastech 360 is the name given to a pair of former experimental high-speed trains developed by East Japan Railway Company (JR East) to test technology for the next-generation Shinkansen rolling stock. The name is a portmanteau of Fast, Technology, and 360 km/h (360 km/h/224 mph), the target operational speed for production trains based on the new technologies. Speeds of up to 405 km/h (251.7 mph) were targeted during performance testing.[1] Results of testing using these trains was incorporated into the E5 series and E6 series trains, entering revenue service from 2011, eventually operating at 320 km/h (198.8 mph).
2) Microphone array is a set of omnidirectional microphones distributed about the perimeter of a space, linked to a computer that records and interprets the results into a coherent form.
3) Non-directional microphone is a perfect sphere in three dimensions, and being pressure-sensitive they also have a very flat low-frequency response.

Source: "Reduction of External-Sound from High-Speed Shinkansen Trains" (Kurita, 2012).

5.40 **Environmental Countermeasures considered on Rolling Stocks:** For setting the power level for the calculation, as 4.5 dB(A) is deducted from the power levels of E2 series rolling stocks, the following mitigation measures are assumed to be taken on the side of cars: streamlined head shape, smoothened car shape, low-noise type pantographs and reduction of its number, and covering of seam parts of the cars, etc.

### (6) Calculation of Peak Noise Levels

5.41 **Approach:** Peak noise levels were calculated by sound origin, i.e., noise generated by pantographs of current collecting system (aerodynamic noise, interactive noise, spark noise), aerodynamic noise from upper part of train body, noise from lower part of train body (rolling noise, gear noise, aerodynamic noise), and noise of structures. The peak noise levels for all four sound origins are expressed as follows:

- Noise generated by pantograph $L_P$
- Noise from upper part of train body $L_A$
- Noise from lower part of train body $L_R$
- Noise of structures $L_S$

Peak noise level (S-weighted sound pressure level) L (P) at estimation point P is calculated by the sum of decibels by four sound origins as follows:

$$L(P) = 10\log(10^{L_P/10} + 10^{L_A/10} + 10^{L_R/10} + 10^{L_S/10})$$

5.42 Each noise is calculated by the following formulas developed by the Railway Technical Research Institute (RTRI) et al. Although these formulas are not the ones developed for the train operation speed of 320km/h, it is assumed that these formulas can be used for this operation speed as well.

5.43 **Noise Generated by Pantographs:** This is considered as an omnidirectional sound origin at two points. The sound origin was set 5m above the rail level, taking the point vertically above from the track center. Two sound origins are set for each contacting point with the pantograph, ensuring that one of these two sound origins come directly across from the set estimation point (see rp' in Figure 5.2.4). Hence, the sound level $L_P$ (P) at estimation point P is given as follows:

$$L_P(P) = PWL_P(V) - 11 + 10\log\left(\frac{1}{r_P^{\,2}} + \frac{1}{r_P^{\,2} + X^2}\right) - \Delta L_P$$

Where;

$PWL_P$ (V): Power level (dB) of sound generated from 1 pantograph

$PWL_P(V) = PWL_P(V_{320}) + 60 \log (V/320)$

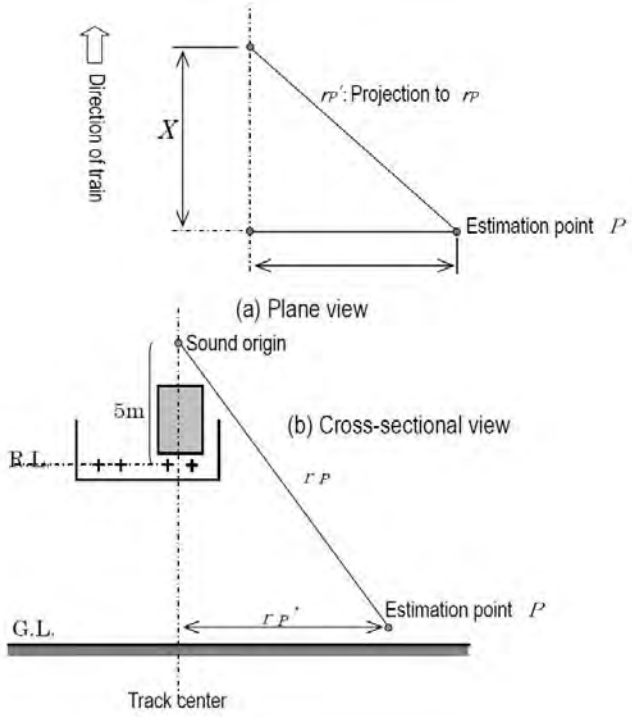
$PWL_P(V_{320})$: Power level (dB) for speed at 320km/h

V: Train velocity (km/h)

$r_p$: Distance from sound origin and estimation point (m)

X: Distance between two sound origins

$\Delta L_P$: Diffraction attenuation level due to pantograph covers and sound proof walls (dB)




Source: JICA Study Team.

**Figure 5.2.11 Sound Origin and Estimation Point for Noise Generated by Pantographs**

5.44 **Noise from Upper Part of Train Body:** This is considered as an omnidirectional finite length sound origin. This sound origin is set at the upper side (shoulder) of the train, as shown in Figure 5.2.5. It is considered that the sound level is proportionate to the length of the train, therefore, the sound level is functional to the train length. Hence, the sound level $L_S$ (P) at estimation point P is given as follows:

$$L_A(P) = PWL_A(V) - 8 + 10\log\left(\frac{2}{r_A}\tan^{-1}\frac{l}{2r_A}\right) - \Delta L_A$$

Where;

$PWL_A$ (V): Power level (dB) of sound generated from 1m unit length of sound origin

$PWL_A(V) = PWL_A(V_{320}) + 60 \log (V/320)$

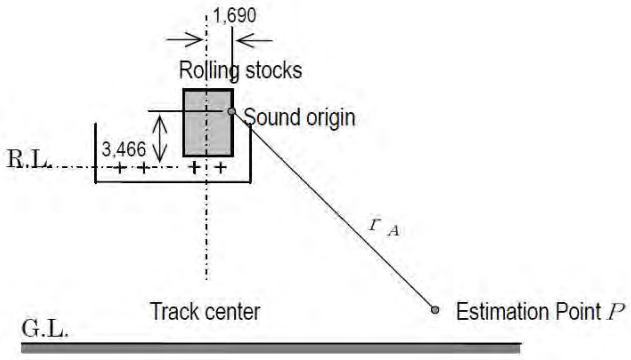
$PWL_A$ (V320): Power level (dB) for speed at 320km/h

V: Train velocity (km/h)

$r_A$: Distance between sound origin and estimation point (m)

$l$ : Length of train (m)

$\Delta L_A$: Diffraction attenuation level due to sound proof walls (dB)




Source: JICA Study Team.

**Figure 5.2.12 Sound Origin and Estimation Point for Noise from Upper Part of Train Body**

5.45 **Sound from Lower Part of Train Body:** This is considered as an omnidirectional finite length sound origin. The sound origin is set on top of the exterior rail (track nearer to the sound receiving points), as shown in Figure 5.2.6. It is considered that the sound level is proportionate to the length of the train, therefore, the sound level is functional to the train length. The sound becomes maximum when the center of the train comes directly across from the set estimation point. Hence, the sound level $L_R$ (P) at estimation point P is given as follows:

$$L_R(P) = PWL_R(V) - 8 + 10\log\left(\frac{2}{r_R}\tan^{-1}\frac{l}{2r_R}\right) - \Delta L_R$$

Where;

$PWL_R$ (V): Power level (dB) of sound generated from 1m unit length of sound origin

$PWL_R(V) = PWL_R(V_{320}) + 20 \log (V/320)$

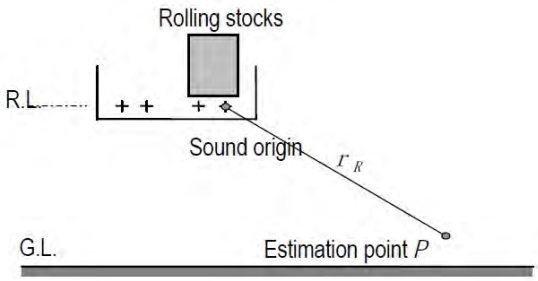
$PWL_R(V_{320})$: Power level (dB) for speed at 320km/h

V: Train velocity (km/h)

$r_R$ :Distance from sound origin and estimation point (m)

$l$ : Length of train (m)

$\Delta L_R$: Diffraction attenuation level due to sound proof walls (dB)




Source: JICA Study Team.

**Figure 5.2.13 Sound Origin and Estimation Point for Noise from Lower Part of Train Body**

5.46 **Sound of Structures:** This is considered as an omnidirectional finite length sound origin. One of the sound origins ($S_1$) is set at the center of underside of the structure (viaduct), and another virtual sound origin ($S_2$) is set (virtual point, which is underground, mirrored from sound origin $S_1$) so that the echoing sound from the ground is also considered in this calculation (see Figure 5.2.7). Note that the distance from the ground level is equal for both $S_1$ and $S_2$. The total sound from structures is considered as a sum of the two. Hence, the sound level $L_S$ (P) at estimation point P is given as follows:

$$L_S(P) = 10\log\left(10^{L_{S1}/10} + 10^{L_{S2}/10}\right)$$

$$L_{S1} = PWL_S(V) - 8 + 10\log\left(\frac{2}{r_{S1}}\tan^{-1}\frac{l}{2r_{S1}}\right)$$

$$L_{S2} = \left(PWL_S(V) - 1\right) - 8 + 10\log\left(\frac{2}{r_{S2}}\tan^{-1}\frac{l}{2r_{S2}}\right)$$

Where;

$PWL_S$ (V): Power level (dB) of sound generated from 1m unit length of sound origin

$PWL_S(V) = PWL_R(V_{320}) + 20\log(V/320)$

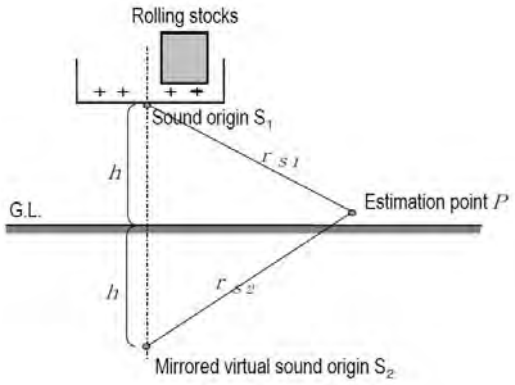
$PWL_S(V_{320})$: Power level (dB) for speed at 320km/h

V: Train velocity (km/h)

$r_{s1}$: Distance from sound origin and estimation point (m)

$r_{s2}$: Distance from sound origin (mirrored virtual sound origin) and estimation point (m)

$l$ : Length of train (m)




Source: JICA Study Team.

**Figure 5.2.14 Sound Origin and Estimation Point for Noise of Structures**

### (7) Calculation of Sound Exposure Levels

5.47 According to the notification on "Guidance for Countermeasures for Noise on New Construction or Large Scale Rehabilitation of Railway" (former Environmental Agency of Japan, December 20, 1995), sound exposure levels ($L_{AE}$) are calculated approximately from the peak noise level ($L_{Amax}$) of one passing train, as follows:

$$L_{AE} \approx L_{A\max} + 10\log 10t$$

Where;

t: time for train passing (seconds)

### (8) Calculation of Equivalent Sound Levels

5.48 Likewise according to the notification on "Guidance for Countermeasures for Noise on New Construction or Large Scale Rehabilitation of Railway" (former Environmental Agency of Japan, December 20, 1995), equivalent sound levels ($L_{Aeq}$) are calculated from the sound exposure level ($L_{AE}$) and the number of train operation by time zone (daytime and nighttime), as follows:

$$L_{Aeq} = 10\log_{10}\left[\left(\sum_{i=1}^{n} 10^{L_{AEi}/10}\right)/T\right]$$

Where;

$L_{AEi}$: $L_{AE}$ for the $i^{th}$ train passing within time zone T

n: number of train passing per time zone

T: daytime: from 7 a.m. to 10 p.m. (54,000 seconds), nighttime: from 10 a.m. to 7 a.m. (32,400 seconds)

### (9) Calculation of Diffraction Attenuation by Sound Proof Walls

5.49 In the case that the results of calculation of equivalent sound levels exceed the target levels, installation of sound proof walls is considered. Diffraction attenuation levels due to the sound proof walls are calculated for each sound origins except the structure. Based on this, peak sound levels are calculated by origin, and then summed up as aforementioned. In the calculation of the diffraction attenuation levels, acoustic material and particular shape on the top such as reverse L-shape are not considered on the sound proof walls.

### (10) Results of Rapid Estimation and Assessment of Noise Impacts

5.50 According to the results of rapid estimation, for the 2030 operation case, the noise levels at 1.2m above ground level for both embankment and viaduct sections are passive as shown in Tables 5.2.6 and 5.2.7. However, noise levels at 10m above ground level exceed the provisional target levels (60dB(A) at daytime, 55dB(A) at nighttime) for viaduct sections. This can be resolved by the application of a 1m height sound proof wall. On the other hand, for the 2035 and 2040 cases, estimated noise levels at 10m above ground level at viaduct sections still slightly exceed the provisional target levels even after the assumption of 1m height sound proof walls. Thus, further mitigation measures may be required depending on the conditions. The sections, which are in need of sound proof walls, were considered based on these results in the next section for the 2030 operation case.

### Table 5.2.6 Results for Northern Section (Unit: dB(A))

| Year | Structure | Application of SPW | | Daytime (6 a.m. to 9 p.m.) :Provisional Target Level at 60dB(A) | | | | | Nighttime (9 p.m. to midnight) :Provisional Target Level at 55dB(A) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sound receiving point | SPW | 8.50m | 10.25m | 12.50m | 25.00m | 50.00m | 8.50m | 10.25m | 12.50m | 25.00m | 50.00m |
| 2030 | Embankment | 1.2m | No | - | 56 | 56 | 54 | 52 | - | 49 | 49 | 48 | 45 |
| | | 1.2m | Yes | - | 54 | 53 | 52 | 49 | - | 47 | 47 | 45 | 43 |
| | Viaduct | 1.2m | No | 52 | - | 53 | 54 | 53 | 45 | - | 46 | 47 | 46 |
| | | 10m | No | 64 | - | 61 | 59 | 55 | 58 | - | 54 | 53 | 48 |
| | | 1.2m | Yes | 51 | - | 52 | 51 | 50 | 44 | - | 45 | 44 | 43 |
| | | 10m | Yes | 60 | - | 59 | 56 | 53 | 54 | - | 52 | 50 | 46 |
| 2035 | Embankment | 1.2m | No | - | 57 | 57 | 55 | 53 | - | 50 | 50 | 48 | 46 |
| | | 1.2m | Yes | - | 55 | 54 | 53 | 50 | - | 48 | 47 | 46 | 43 |
| | Viaduct | 1.2m | No | 53 | - | 54 | 55 | 54 | 46 | - | 47 | 48 | 47 |
| | | 10m | No | 65 | - | 62 | 60 | 56 | 58 | - | 54 | 53 | 49 |
| | | 1.2m | Yes | 52 | - | 53 | 52 | 51 | 45 | - | 46 | 45 | 44 |
| | | 10m | Yes | 61 | - | 60 | 57 | 54 | 54 | - | 53 | 50 | 46 |
| 2040 | Embankment | 1.2m | No | - | 58 | 58 | 56 | 54 | - | 51 | 51 | 50 | 47 |
| | | 1.2m | Yes | - | 56 | 55 | 54 | 51 | - | 49 | 49 | 47 | 45 |
| | Viaduct | 1.2m | No | 54 | - | 55 | 56 | 55 | 47 | - | 48 | 49 | 48 |
| | | 10m | No | 66 | - | 63 | 61 | 57 | 60 | - | 56 | 55 | 50 |
| | | 1.2m | Yes | 53 | - | 54 | 53 | 52 | 46 | - | 47 | 47 | 46 |
| | | 10m | Yes | 62 | - | 61 | 58 | 55 | 56 | - | 55 | 52 | 48 |

Notes: SPW = Sound Proof Walls. For viaduct sections, sound receiving points of both 1.2m and 10m were applied. 1.0m SPWs were applied for calculation.
Source: JICA Study Team.

### Table 5.2.7 Results for Southern Section (Unit: dB(A))

| Year | Structure | Application of SPW | | Daytime (6 a.m. to 9 p.m.) :Provisional Target Level 60dB(A) | | | | | Nighttime (9 p.m. to midnight) :Provisional Target Level 55dB(A) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sound receiving point | SPW | 8.50m | 10.25m | 12.50m | 25.00m | 50.00m | 8.50m | 10.25m | 12.50m | 25.00m | 50.00m |
| 2030 | Embankment | 1.2m | No | - | 56 | 55 | 54 | 52 | - | 45 | 45 | 44 | 41 |
| | | 1.2m | Yes | - | 54 | 53 | 52 | 49 | - | 43 | 43 | 41 | 38 |
| | Viaduct | 1.2m | No | 51 | - | 53 | 53 | 52 | 41 | - | 42 | 43 | 42 |
| | | 10m | No | 64 | - | 60 | 59 | 54 | 53 | - | 50 | 48 | 44 |
| | | 1.2m | Yes | 50 | - | 51 | 51 | 50 | 40 | - | 41 | 40 | 39 |
| | | 10m | Yes | 60 | - | 59 | 56 | 52 | 49 | - | 48 | 45 | 42 |
| 2035 | Embankment | 1.2m | No | - | 57 | 56 | 55 | 52 | - | 46 | 46 | 45 | 42 |
| | | 1.2m | Yes | - | 54 | 54 | 53 | 50 | - | 44 | 44 | 43 | 40 |
| | Viaduct | 1.2m | No | 52 | - | 54 | 54 | 53 | 42 | - | 43 | 44 | 43 |
| | | 10m | No | 65 | - | 61 | 60 | 55 | 55 | - | 51 | 50 | 45 |
| | | 1.2m | Yes | 51 | - | 52 | 52 | 51 | 41 | - | 42 | 42 | 40 |
| | | 10m | Yes | 61 | - | 60 | 57 | 53 | 51 | - | 49 | 47 | 43 |
| 2040 | Embankment | 1.2m | No | - | 57 | 57 | 56 | 53 | - | 50 | 50 | 48 | 46 |
| | | 1.2m | Yes | - | 55 | 55 | 54 | 51 | - | 46 | 47 | 46 | 43 |
| | Viaduct | 1.2m | No | 53 | - | 54 | 55 | 54 | 46 | - | 47 | 48 | 47 |
| | | 10m | No | 66 | - | 62 | 61 | 56 | 58 | - | 54 | 53 | 49 |
| | | 1.2m | Yes | 52 | - | 53 | 53 | 52 | 45 | - | 46 | 45 | 44 |
| | | 10m | Yes | 62 | - | 61 | 58 | 54 | 54 | - | 53 | 50 | 46 |

Notes: SPW = Sound Proof Walls. For viaduct sections, sound receiving points of both 1.2m and 10m were applied. 1.0m SPWs were applied for calculation.
Source: JICA Study Team.

### (11) Necessary Sound Proof Walls

5.51 In principle, the 1m height of sound proof walls were assumed for viaduct sections for the base case of 2030 in this study. However they was excluded for the following sections; intersection of bridges and roads, and sections without structures along the alignment which may be affected. For station sections, as all stations excluding terminal stations (Hanoi and HCMC) have the possibility of trains passing by (for example express trains), sound proof walls were applied.

5.52 In order to identify necessary length of sound proof walls, it was checked whether structures under potential affect existed (100m width from ROW) for every 500m along the alignment. For station sections, since the station structure concurrently functions as sound proof walls, 300m length was deducted (platform length = 260m plus 20m margin for both sides) from the proposed length of sound proof walls. The results are shown in Table 5.2.8 for the base case of 2030.

**Table 5.2.8 Identified Provisional Sections where Sound Proof Walls are Proposed for 2030 Operation Case**

| North | KM Post | Total (m) |
|---|---|---|
| 1 | Ngoc Hoi Station | 0 |
| 2 | 00-45 | 18,745 |
| 3 | Phu Ly Station | 350 |
| 4 | 45-66 | 11,104 |
| 5 | Nam Dinh Station | 350 |
| 6 | 67-103 | 18,481 |
| 7 | Ninh Binh Station | 0 |
| 8 | 103-154 | 13,166 |
| 9 | Thanh Hoa Station | 700 |
| 10 | 154-283 | 29,404 |
| 11 | Vinh Station | 520 |
| Total for North Section | | 92,820 |
| South | KM Post | Total (m) |
| 1 | Thu Thiem Station | 0 |
| 2 | 00-36 | 16,000 |
| 3 | Long Thanh Station | 0 |
| 4 | 36-153 | 10,115 |
| 5 | Phan Thiet Station | 350 |
| 6 | 153-220 | 8,955 |
| 7 | Tuy Phong Station | 0 |
| 8 | 220-283 | 1,970 |
| 9 | Thap Cham Station | 350 |
| 10 | 283-362 | 3,665 |
| 11 | Nha Trang Station | 520 |
| 12 | 363-366 | 2,490 |
| Total for South Section | | 44,415 |

Source: JICA Study Team.

## 5.3 Preliminary Study on Vibration from HSR

### 1) Railway Vibration Standards

5.53 Vibration regulation value for Shinkansen in Japan is recommended at 70dB in the notification on "Urgently Required Mitigation Measures for Shinkansen Vibration for Environmental Protection" (the Environmental Agency in Japan, March 12, 1976). According to this notification, measuring of vibration shall be done outdoor on the ground, continuously for 20 passing Shinkansen trains up or down in principle, and the peak level of each passing train shall be read, and then evaluation shall be done based on arithmetically calculated average of the level with large upper half. As for distance from the track center, it is recommended that this be set at 12.5 m point.

5.54 As for vibration standard values of Vietnam, which is not limited to railways, are regulated by QCVN 27:2010/BTNMT as shown in Table 5.3.1.

**Table 5.3.1 Vibration Standard Value of Vietnam**

| Table 1 – Maximum Degree of Vibration Permitted in Construction Activities | | | |
|---|---|---|---|
| No | Zones | Time of Application Intraday | Permitted Degree of Vibration, dB |
| 1 | Special zones | 06:00 – 18:00 | 75 |
| | | 18:00 – 06:00 | Base level |
| 2 | Normal zones | 06:00 – 21:00 | 75 |
| | | 21:00 – 06:00 | Base level |

| Table 2 - Maximum degree of vibration permitted in production, trading and services activities | | | |
|---|---|---|---|
| No | Zones | Time of application intraday and permitted degree of vibration, dB | |
| | | 06:00 – 21.00 | 21.00 – 6.00 |
| 1 | Special zones | 60 | 55 |
| 2 | Normal zones | 70 | 60 |

This regulation is applied to organizations, individuals who are engaged in activities causing vibration, shocks which have an influence on areas where people live and work within Vietnam's territory.
Special zones are areas lying inside the perimeter of medical facilities, libraries, kindergartens, schools, churches, communal houses of villages, pagodas and zones which are under other special regulations.
Normal zones include: apartment blocks, separate restaurants which are situated detached or terraced, hotels, hostels, administrative offices.
Base level is the degree of vibration measured when there are no production, trading, services and construction activities in areas under assessment.
Sources of vibration, shocks due to construction are not allowed to exceed the degree stated in Table 1
Causes of vibration, shocks by production, trading, services activities shall not exceed the degree stipulated in Table 2.
Degree of vibration acceleration regulated in Table 1 and 2 is:
1) The degree which is measured in case of stable oscillation, or
2) The average degree of maximum values measured periodically or interruptedly, or
3) The average degree of 10 values measured every 5 seconds or the equivalent (L10) in case of unstable and accidental fluctuation.

| Degree of vibration acceleration, dB | 55 | 60 | 65 | 70 | 75 |
|---|---|---|---|---|---|
| Vibration acceleration, $m/s^2$ | 0,006 | 0,010 | 0,018 | 0,030 | 0,055 |

Source: QCVN 27:2010/BTNMT – National Technical Regulation on Vibration of Vietnam

5.55 On the other hand, VNRA has prepared vibration standards along railway lines in TCCS 04:2009/VNRA, which are applied to vibration levels during train operation and construction or upgrade/improve of national railways in public and residential areas. The permitted levels for vibration from train operation are set as shown in Table 5.3.2. However, since these standards are internal ones and have not been approved by MONRE, they are not strictly enforced and may not be directly applied to the HSR Projects.

**Table 5.3.2 Permitted Vibration Levels from Train Operation by VNRA**

| No | Areas | Permitted Levels and Application Time Range | | Note |
|---|---|---|---|---|
| | | 06:00 – 18:00 | 18:00 – 06:00 | |
| 1 | Areas requiring specially quiet environment | 60 | 55 | The vibration acceleration levels in this table are:<br>1) The level measured at stable oscillations<br>2) The average of the maximum values measured for each oscillations cycle or intermittently, or<br>3) The average value of the 10 largest values from 100 values measured every 5s or equivalent (L10) when the oscillations are irregular and sudden |
| 2 | Residential areas, hotels, guest houses, administrative bodies and the like. | 65 | 60 | |
| 3 | Residential areas in-between commercial and production areas | 70 | 65 | |

Source: TCCS 04:2009/VNRA

### 2) Proposed Provisional Target Level for Railway Vibration Control

5.56 The guideline value of vibration from Shinkansen is set as 70dB at peak level based on the above notification. This is the same value of normal zone in daytime of vibration standard of Vietnam. Thus, the target level for railway vibration control is proposed tentatively at a peak level of 70dB.

5.57 Regarding to the measurement point, since the measurement value is different based on building structures and at on-ground outdoor, the site boundary (road edge when there is a service road) is assumed to be a principle.

### 3) Recommended Mitigation Measures for Railway Vibration

5.58 Mitigation measures for vibration should be taken by various approaches, i.e., measures for the cars and structures, and measures to be adopted on vibration propagation paths and/or for vibration receiving points.

5.59 For the same reasons as noise, measures for the cars and structures are essential and considered first for the reduction of vibration impacts. Various measures on vibration for the cars and structures have been developed and applied in practice for Shinkansen in Japan. As a specific example of lightening the cars, the result of reducing axle load of Shinkansen from 16t to 11t is 3dB (when changing axle load from W1 to W2 $\triangle L(dB)=20\log_{10}(w1/w2)$).

5.60 Table 5.3.2 summarizes major mitigation measures to reduce vibration impacts from the cars and structures which are recommended to be adopted in the HSR in Vietnam considering expected results and costs.

**Table 5.3.2 Recommended Measures for Railway Vibration**

| Countermeasure method | | Characteristics | Advantages | Disadvantages | Workability | Expected Results | Cost |
|---|---|---|---|---|---|---|---|
| On the side of structure | Insert rail pads | Reducing the vibration by buffering between rail and track | It is possible to maintain the effect of reducing vibration. | No specific disadvantages | Installation can be done together with rail fastening devices. | Medium | Part of rail fastening devices |
| | Adopt long rail and EJ | The excitation power by the wheel is decreased by diminishing the | It is possible to reduce not only vibration but also | When replacing the rails, workability is | It requires professional and special hardware for | Big | Part of project |

| Countermeasure method | | Characteristics | Advantages | Disadvantages | Workability | Expected Results | Cost |
|---|---|---|---|---|---|---|---|
| | | differences. | noise. | relatively difficult. | the rail welding. | | costs |
| | Thorough maintenance of track such as grinding rail | Adjust the worn-out running surface of rail or the track part above the ground to reduce operation vibration. | It can be done as part of routine maintenance. | The effect of track-realignment is short, just in few months. | Special devices or skill for track realignment or rail grinding is required. | Medium | Part of mainte-nance costs |
| On the side of cars | Lighten axle load | By lightening the axle load, the excitation power is decreased and the vibration is reduced. | Not only the vibration is reduced but also the life cycle of cars and track structures could be prolonged. | It is required to lighten the whole train set. | As it is not easy after the operation, lightening of the whole train set needs to be considered from the planning and order stages. | Big | Relatively expensive (Part of car procureme nt costs) |
| | Thorough maintenance of cars | By maintaining the initial condition of the cars, vibration can be reduced | It can be done as part of routine maintenance. | Adjustment of train operation schedule or for maintenance | Relatively easy as it can be done as part of routine maintenance. | Medium | Part of mainte-nance costs |

Source: JICA Study Team

5.61 Thorough maintenance of the tracks is fundamental practices for safely and smooth operation of high speed trains, but also contribute to reduce vibration impacts.

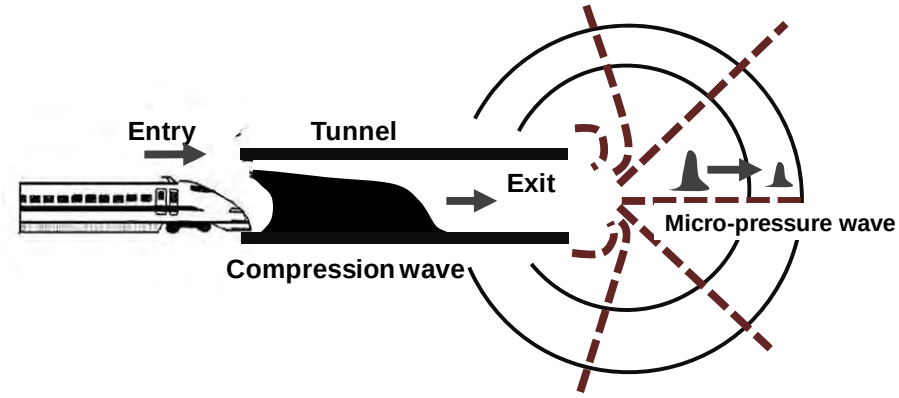
5.62 In addition to the above recommended mitigation measures, measures for the tracks, especially elevated structures or sections, could be considered such as sleeper pads and ballast mats. Moreover, relatively new technologies such as insert of low spring putt or elastic sleepers directly fastened to the tracks may be recommended if more stringent control is required although these measures are relatively expensive.

5.63 Regarding to vibration mitigation work through on-ground ditch and slurry wall, this is relatively difficult to adopt due to safety issues on-ground ditch. It could be considered for particular cases only.

## 5.4 Preliminary Study on Micro-pressure Wave (Tunnel Sonic Boom) from HSR

### 1) Mechanism of Generation of Tunnel Micro-Pressure Wave

5.64 When a train enters a tunnel at high speed, an impact sound (aerial vibration) is generated at the other side entrance hood, and there would be some shaking happening at windows of houses or buildings in the vicinity of the entrance hood. This phenomenon is so called “Tunnel Don”. This phenomenon is a characteristic of HSR which is produced by micro-pressure wave from tunnel portal of which frequency element is about few Hz–20Hz. This is caused when there will be a pressure wave (compression wave) at the entrance, and it will spread speed of sound in the tunnel, the compression wave from the other side entrance hood will be pulsed and then discharged as pulse-shaped pressure wave as shown in Figure 5.4.1.




Source: JICA Study Team

**Figure 5.4.1 Generation Mechanism of Tunnel Micro-Pressure Wave**

5.65 Generation of micro-pressure wave is depending on conditions such as running speed of the train, shape of the car, sectional area of the tunnel, length of tunnel and track structure.

### 2) Proposed Provisional Target Level for Micro-Pressure Wave Control

5.66 Although there is no environmental standard on micro-pressure wave, the standard values for Shinkansen have been proposed as the criteria to install the tunnel entrance hood as a mitigation cover in Japan. The unit of the wave is measured as Pascal (Pa). The standard values adopted for Shinkansen in Japan are 50 Pa at 20m point from the exit side of the tunnel and about 20 Pa near the residential houses which are located near the exit of the tunnel. Generally, it has been observed that there is no impact sound at the tunnel exit at about 50 Pa, and there is no shaking at houses’ windows when it is at about 20 Pa.

5.67 The target level of environment preservation is tentatively set as less than 50 Pa from the exit side tunnel pithead to 20m same as the standard value of Shinkansen. In order to achieve this provisional target level, it is required to install a tunnel entrance hood. However, it is also necessary to not allow new houses to be built in the vicinity of the tunnel pithead within 50m.

### 3) Recommended Measures for Micro-Pressure Wave

5.68 The magnitude of the micro-presser wave is in proportion to the maximum wave front presser gradient of the compression wave that has arrived at the exit side tunnel. Therefore, it makes the basic philosophy for the tunnel micro-pressure wave suppression measures to decrease the maximum wave front pressure gradient of the compression wave that has arrived at exit side of tunnel. Broadly speaking, measures can be considered on the structures (tunnels) and on the cars.

5.69 Corresponding with the target value, Table 5.4.1 summarizes major mitigation measures to reduce impacts by micro-pressure wave, which are recommended to be adopted in the HSR in Vietnam considering expected results and costs. Figures 5.4.1-5.4.3 show examples of each of recommended measures.

**Table 5.4.1 Recommended Measures for Micro-Pressure Wave**

| Countermeasure method | | Characteristics | Advantages | Disadvantages | Workability | Expected Results | Cost |
|---|---|---|---|---|---|---|---|
| On the side of structure | Tunnel entrance hood | By installing buffer at the entrance of the tunnel, it is possible to reduce the pressured wave at the exit of the tunnel. | The effect can be maintained. | The trial to reduce pressure is required. | Buffering work for both entrance and exit gate in case of going and returning line is required. | Big | Relatively expensive |
| On the side of cars | Adopt long nose head | By suppressing the change of rushing pressure, it is possible to mitigate the rapid pressure fluctuation. | The effect can be maintained. | The trial of obtaining a condition, which is not causing pressure change, will be required | As it is not easy after the operation, adopting of long nose head needs to be considered from the planning and order stages. | Medium | Relatively cheap (Part of car procurement costs) |
| | Streamlining of head shape | By suppressing the change of rushing pressure, it is possible to mitigate the rapid pressure fluctuation. | The effect can be maintained. | The trial of obtaining a condition, which is not causing pressure change, will be required | As it is not easy after the operation, streamlining of head shape needs to be considered from the planning and order stages. | Medium | Relatively cheap (Part of car procurement costs) |

Source: JICA Study Team

### (1) On the Side of Structure

- **Characteristics:** By installing buffer at the entrance of the tunnel, it is possible to reduce the pressured wave at the exit of the tunnel.
- **Advantages:** The effect can be maintained.
- **Disadvantages:** A trial to reduce pressure is required.
- **Workability:** Buffering work for both entrance and exit gate for going and returning lines is required.
- **Expected Results:** Big
- **Cost**: Relatively expensive

Source: JICA Study Team (Sample Photo from Internet)

**Figure 5.4.2 Example of Tunnel Entrance Hood**

### (2) On the Side of Cars

- **Characteristics:** By suppressing the change of rushing pressure, it is possible to mitigate the rapid pressure fluctuation.
- **Advantages:** The effect can be maintained.
- **Disadvantages:** The trial of obtaining a condition, which is not causing pressure change, will be required
- **Workability:** As it is not easy after the operation, adopting of long nose head needs to be considered from the planning and order stages
- **Expected Results**: Medium
- **Cost:** Relatively cheap (part of car procurement cost)

Source: JICA Study Team

**Figure 5.4.3 Example of Long Nose Head**

- **Characteristics:** By suppressing the change of rushing pressure, it is possible to mitigate the rapid pressure fluctuation.
- **Advantages:** The effect can be maintained.
- **Disadvantages:** The trial of obtaining a condition, which is not causing pressure change, will be required
- **Workability:** As it is not easy after the operation, streamlining of head shape needs to be considered from the planning and order stages.
- **Expected Results:** Medium
- **Cost:** Relatively cheap (part of car procurement cost)

Source: JICA Study Team

**Figure 5.4.4 Example of Streamlined Head Shape**

5.70 In addition to the above measures, ballast track could reduce the impact of the micro-pressure wave, but it is not considered in this study due to track maintenance reasons. Adoption of wider tunnel cross section and utilization of branches (inclined shaft, vertical shaft, adit) are not recommended in this study due to increase of construction cost[1]. However, according to some recent surveys, it is known that the micro-pressure wave could be decreased by atomization of water in the tunnel.

5.71 As for measures on the cars, head parts are made long nose and optimizing shape of head part of cars are recommended. These measures need to be considered from the planning and order stages so that such design can be reflected on the cars. However, reducing sectional area of the cars is not considered for the livability and securing capacity of the guest rooms.

### 4) Preliminary Study for Necessary Length of Tunnel Entrance Hood

5.72 Under the above conditions, since it can be said that rolling stocks to be used for HSR in Vietnam are expected to adopt long nose head and streamlined head shape as preinstalled ones, the necessary length of tunnel entrance hood was studied preliminarily.

5.73 In the preliminary study on the necessary length of tunnel entrance hood, the combination of number of patterns on tunnel extension etc. was examined. The following

[1] The preliminary study on tunnel cross section including effects of utilization branches are conducted by Railway Technical Research Institute (RTRI) in this study to examine technical viability of adoption of minimum tunnel cross section area equivalent to that of Shinkansen (63.4 $m^2$) for HSR in Vietnam. In this tunnel cross section study, it was found that by installation of enough length of a tunnel entrance hood at the entry side of the tunnel, the magnitude of the micro-pressure wave generated by the high speed train operation could be suppressed even tunnels having a cross-sectional area equivalent to that of Shinkansen (see Volume I Appendix 5B).

procedures were taken to examine the length of the buffer entrance hood to limit the magnitude of the micro-pressure wave at 50 Pa or less at a point 20 m distant from the tunnel when series E equivalent cars enter a tunnel (slab track) at a maximum entry speed of 350 km/h (see Volume I: Development of North-South Railways, Appendix 5B for moiré details);

(i) Calculation of the maximum pressure gradient at the exit side of tunnel ($P_{max}$) to limit the magnitude of the micro-pressure waves to 50 Pa at a 20 m distant from the tunnel by the following formula. As the value of the radiation solid angle Ω that expresses the spatial expanse in the vicinity of tunnel exit differs depending on the topography and track conditions, Ω = π, which is a typical value, was adopted.

$$P_{\max} = \frac{2A_{tun}}{\Omega cr}\left(\frac{\partial p}{\partial t}\right)_{\max,\mathrm{ext}}$$

Where:

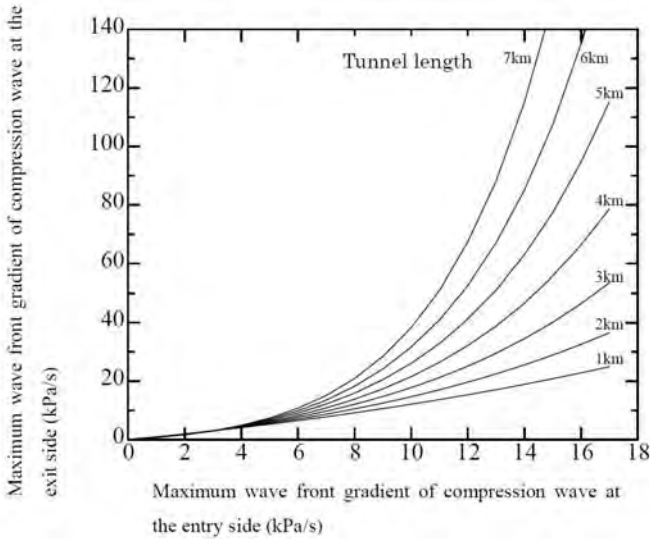
$A_{tun}$: Main tunnel cross-sectional area ($m^2$)

Ω: Radiation solid angle (spatial expanse toward the open section viewed from the tunnel portal)

r: Distance from the center of the portal to the measuring point (m)

$(\partial p/\partial t)_{max,\ ent}$: Maximum front pressure gradient of the compression wave that has arrived at the exit side portal (Pa)

(ii) Estimation of the maximum pressure gradient at the entry side corresponding to that at the exit side based on relation between the maximum pressure gradient of compression wave at the entry side and that at the exit side which is obtained at a slab track Shinkansen tunnel as shown in Figure 5.4.5.




Source: RTRI.

**Figure 5.4.5 Relation between the Maximum Pressure Gradient of Compression Waves at the Entry Side and that at the Exit Side (a Slab Track Shinkansen Tunnel)**

(iii) Calculation of the length of the buffer tunnel (L) to obtain the maximum pressure gradient at the entry side based on the following formula which gives maximum front pressure gradient of the compression wave in the vicinity of the entry side portal

when a train enters a tunnel.

$$\left(\frac{\partial p}{\partial t}\right)_{\max,ent} = \frac{1}{2}\frac{\rho V^3}{\kappa d}\frac{1-(1-R)^2}{(1-M)\{M+(1-R)^2\}}\alpha$$

Where:

ρ: Density of air (kg/m$^3$)

V: Speed of train (km/h)

κ: A parameter dependent on the profiles of train head and tunnel portals (1.7)

d: Tunnel diameter (m)

R: Ratio of cross-sectional areas of train to tunnel (= train cross-sectional area/tunnel cross-sectional area)

M: Train Mach number (= V/c, c: speed of sound in air)

α: D /(D+L), D: Attribute length(m)[2], D:Length of tunnel entrance hood(m)

5.74 As the results of the above calculations, in order to achieve the provisional target level of 50Pa at 20m from the exit of the tunnel, an entrance hood of about 60m–100m for sectional area of 63.4 m$^2$ would be required depending on the length of tunnel. The result of the preliminary study on length of tunnel entrance hood is shown in Table 5.4.2.

**Table 5.4.2 Required Length of Tunnel Entrance Hood**

| Length of Tunnel (km) | Required Length of Tunnel Entrance Hood |
|---|---|
| 1 | 57 m |
| 3 | 76 m |
| 5 | 90 m |
| 7 | 101 m |
| 8.15 | 107 m |

Source: JICA Study Team

5.75 The purpose of the tunnel entrance hood is to decrease the maximum wave front pressure gradient of the compression wave when a train enters the tunnel, thereby aiming at reducing the micro-pressure wave radiated from the tunnel exit side portal. In more concrete terms, installation of an entrance hood having a cross-sectional area 1.4 to 1.6 times that of the main tunnel at the train entry side portal (opposite to the exit side portal from where micro-pressure wave is radiated) with appropriate openings on the sides or at the ceilings is required so that compression air can be released at train entry side.

[2] In case of Sanyo Shinkanasen, the value of D is approximately 12m for the combination of the entrance hood and series 0 rolling stock.

## 5.5 Radio Wave Disturbance

5.76 There is a possibility of radio wave disturbance caused by high speed train operation as well as by some elevated structures such as elevated bridges and station buildings. When passing high speed train, it is possible that there is flutter or pulse disturbance happening.

5.77 In Japan, regarding to radio wave disturbance, there is a notification from Administrative Vice-Minister for Construction on “Burden of the Cost of Damage or Loss from Radio Wave Disturbance due to the Installation of the Public Facilities” which was issued on October 12, 1979 and amended on July 11, 2003. In accordance with this notification, if any damage or loss from radio wave disturbance by HSR (Shinkansen) is identified or predicted, necessary cost for countermeasures is borne by the project proponent. The countermeasures suggested in the notification are: i) installation of common reception facility, ii) installation of individual reception facility, and iii) relocation or improvement of reception facility and so on.

5.78 In Vietnam, there are now at least 9 television broadcasting stations as shown in Table 5.5.1. In addition, there are local televisions broadcasting stations in cities/provinces along the HSR alignment.

**Table 5.5.1 Major TV Broadcasting Station in Vietnam**

| Name of Television Station | Note |
|---|---|
| Vietnam Television (VTV) | - |
| Vietnamese multimedia Corporation (VTC) | Vietnam postal administration communication public corporation-affiliated |
| VTC news: Digital TV | Vietnam multimedia Corporation-affiliated |
| Hanoi Radio Television/Hanoi TV | Hanoi local state-run television station |
| Ho Chi Minh City Television (HTV) | Ho Chi Minh City state-run television station |
| VCTV | Hanoi Radio Television/Hanoi TV-affiliated Cable television station |
| Hanoi Cable Network television (HCaTV) | Hanoi Radio Television/Hanoi TV-affiliated Cable television station |
| Ho Chi Minh City Cable Television (HTVC) | Ho Chi Minh City Television-affiliated Cable television station |
| Saigon Tourist Cable Television Co. :SCTV | JV Cable television station of Vietnam Television and Saigon tourist |

Source: vietnam.all-guide.info/media/tv.htm

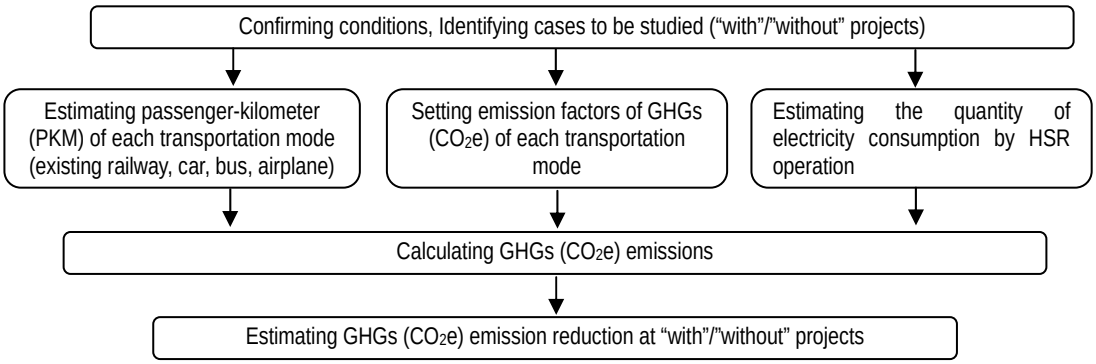
5.79 So far, even with other various development projects, electric wave disturbance by development project activities has not become a problem in Vietnam. However, people’s concerns and demands on better quality of TV pictures are expected to increase in the future with the changes in lifestyles and economic development. In addition, there is a possibility of some disturbances on electromagnetic waves especially around the facilities where AC feeding is adopted, such as the substations. Since there is no law, regulations and guidelines regarding radio wave disturbance available in Vietnam, it is recommended that necessary law, regulations and guidelines should be prepared for these potential problems. Specifically, a compensation framework or guidelines is recommended to be established.

# 6 PRELIMINARY STUDY ON THE REDUCTION OF GHGs EMISSION AND AIR POLLUTANTS BY HIGH SPEED RAILWAY

## 6.1 Preliminary Study on the Reduction of GHGs Emission by High Speed Railway

### 1) Procedure and Conditions

6.1 The amount of reduction of green house gases (GHGs) emission of the HSR projects was estimated by comparing two cases; i) "with" project (i.e., both the north and the south sections start operation from 2030), and ii) "without" project (i.e., both the north and south sections will not be implemented). In this preliminary study, carbon dioxide equivalent ($CO_2e$) was calculated as an indicator of GHGs since it is a universal unit of measurement that allows the global warming potential of different GHGs to be compared. The process of the estimation of GHGs emission reduction by HSR is shown in Figure 6.1.1.




Source: JICA Study Team

**Figure 6.1.1 Flowchart of Estimation of GHGs ($CO_2e$) Emission Reduction by HSR**

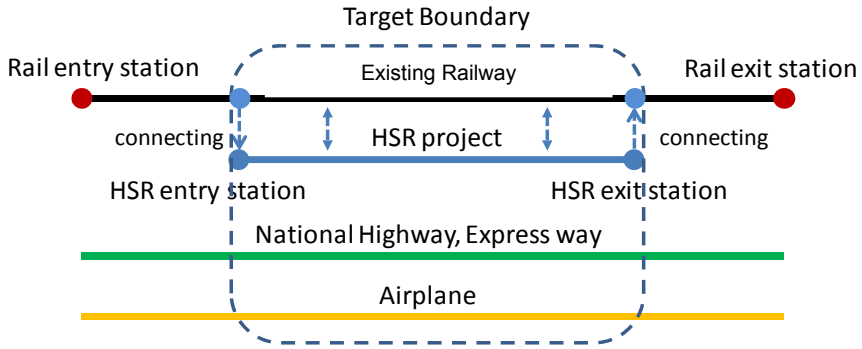
6.2 For the estimation of GHGs emissions, Clean Development Mechanism (CDM) methodologies defined in "AM0101 High Speed Passenger Rail Systems" (United Nations Framework Convention on Climate Change: UNFCCC) were referred to. Based on this, the following conditions were set in this study:

(i) Both the north (Hanoi – Vinh) section and the south (HCMC – Nha Trang) section start operation in 2030;

(ii) The target of the estimation of GHGs emissions is for inter-provincial/urban passenger transport only. The GHGs emissions associated with transportation of the passengers travelling in the HSR system between the HSR entry station and HSR exit station are defined as "direct project emissions". The HSR entry station refers to the station where a passenger enters into the new HSR system under the projects, while HSR exit station refers to the station where a passenger leaves the new HSR system under the projects;

(iii) The target boundary to be considered for the estimation of GHGs emissions is illustrated schematically as show in Figure 6.1.2. In order to simplify the estimation exercise, passengers using connecting railway (existing railway) are considered inside the boundary only, although "indirect project emissions" associated with passengers

using connecting railway from the rail entry station to the HSR entry station and from the HSR exit station to the rail exit station are recommended to be estimated as per the AM0101.




Source: JICA Study Team

**Figure 6.1.2 Target Boundary to be Considered for the Estimation of Emission Reduction by HSR**

(iv) The type of GHGs emission mitigation action is "energy efficiency", i.e., displacement of more GHGs intensive transport modes[1] (existing railway, road transport, and air transport) by less GHGs intensive mode (i.e., HSR) as per the AM0101. Thus, GHGs emission estimation targets only the case of inter-provincial/urban passengers shifting transport from existing transportation modes to HSR due to the implementation of the HSR projects;

(v) The GHGs emissions associated with the projects' life cycle activities such as construction/renewal of railway structures/facilities and production and disposal of rolling stocks were not considered; and

(vi) Only electricity and no liquid, gaseous or solid fuels are used for the propulsion of the HSR systems. Thus, GHGs emissions from power plant(s) connected physically to the electricity system that supplies power to the HSR systems are considered as "direct project emissions".

### 2) Estimation of Passenger-kilometer (PKM)

6.3 The traffic demand analysis was conducted for "with" project and "without" project in 2030 at the north and south sections. The analysis was conducted by estimating the number of passengers of each transportation mode covering the existing railway, HSR, road transport (personal cars and conventional buses using national highway and expressway), and air transport with eight combinations of transportation modes. The sub-sections were set for demand analysis at each of the north and south sections. The estimated number of passengers "with" and "without" projects in 2030 by sub-sections is shown in Tables 6.1.1 to 6.1.1.4 at the north and south sections, respectively.

**Table 6.1.1 Estimated Number of Passengers "With" Project at the North Section in 2030**

(Unit: Person/day)

| Transportation Mode | | Sub-Section | | |
|---|---|---|---|---|
| | | Hanoi-Phu Ly (46km) | Phy Ly-Thanh Hoa (108km) | Thanh Hoa-Vinh (130km) |
| Railway | CR_CR*1 | 27,090 | 22,547 | 20,894 |
| | CR_HSR*2 | 984 | 2,508 | 272 |

[1] As the usage of motorcycle transport for inter-provincial/city transport is limited and negligible, it was not considered in this preliminary study.

| Transportation Mode | | | Sub-Section | | |
|---|---|---|---|---|---|
| | | | Hanoi-Phu Ly (46km) | Phy Ly-Thanh Hoa (108km) | Thanh Hoa-Vinh (130km) |
| | HSR*3 | | 70,290 | 42,953 | 30,271 |
| | Sub-Total | | 98,364 | 68,008 | 51,437 |
| Road | National Highway | Car*4 | 32,267 | 1,066 | 2,509 |
| | | Bus*5 | 67,631 | 17,097 | 3,172 |
| | Express Way | Car*6 | 76,222 | 51,546 | 43,686 |
| | | Bus*7 | 79,651 | 54,176 | 42,062 |
| | Sub-Total | | 255,771 | 123,885 | 91,429 |
| Airplane*8 | | | 67,641 | 67,641 | 67,641 |
| Total | | | 421,776 | 259,534 | 210,507 |

Note: *1: Passengers who will use existing railway (CR).
*2: Passengers who will transfer from/to CR to/from HSR.
*3: Passengers who will use HSR only.
*4: Passengers who will use personal cars in the national highways.
*5: Passengers who will use conventional buses in the national highways.
*6: Passengers who will use personal cars in the national express ways.
*7: Passengers who will use conventional buses in the national express ways.
*8: Passengers who will use airplanes only.
Source: JICA Study Team

### Table 6.1.2 Estimated Number of Passengers "Without" Project at the North Section in 2030

(Unit: Person/day)

| Transportation Mode | | | Sub-Section | | |
|---|---|---|---|---|---|
| | | | Hanoi-Phu Ly (46km) | Phy Ly-Thanh Hoa (108km) | Thanh Hoa-Vinh (130km) |
| Railway | CR_CR | | 37,455 | 31,334 | 28,129 |
| | CR_HSR | | 0 | 0 | 0 |
| | HSR | | 0 | 0 | 0 |
| | Sub-Total | | 37,455 | 31,334 | 28,129 |
| Road | National Highway | Car | 30,746 | 2,477 | 2,970 |
| | | Bus | 69,756 | 19,580 | 4,500 |
| | Express Way | Car | 95,405 | 68,122 | 51,546 |
| | | Bus | 100,680 | 57,495 | 44,537 |
| | Sub-Total | | 296,586 | 147,674 | 103,552 |
| Airplane | | | 67,514 | 67,514 | 67,514 |
| Total | | | 401,555 | 246,522 | 199,195 |

Note: Combinations of transportation modes are same as Table 6.1.1.
Source: JICA Study Team

### Table 6.1.3 Estimated Number of Passengers "With" Project at the South Section in 2030

(Unit: Person/day)

| Transportation Mode | | | Sub-Section | | | |
|---|---|---|---|---|---|---|
| | | | Nha Trang-Thap Cham (83km) | Thap Cham-Phan Thiet (130km) | Phan Thiet-Long Thanh (117km) | Long Thanh-HCMC (36km) |
| Railway | CR_CR | | 26,818 | 25,864 | 29,562 | 28,172 |
| | CR_HSR | | 2,063 | 4,320 | 4,693 | 6,105 |
| | HSR | | 39,570 | 43,626 | 48,503 | 50,525 |
| | Sub-Total | | 68,451 | 73,810 | 82,758 | 84,802 |
| Road | National Highway | Car | 598 | 246 | 3,686 | 56,608 |
| | | Bus | 31,776 | 3,871 | 10,474 | 144,167 |
| | Express Way | Car | 42,038 | 21,413 | 24,560 | 90,522 |
| | | Bus | 20,326 | 14,898 | 27,571 | 192,117 |
| | Sub-Total | | 94,738 | 40,428 | 66,291 | 483,414 |
| Airplane | | | 86,794 | 86,794 | 86,794 | 86,794 |
| Total | | | 249,983 | 201,032 | 235,843 | 655,010 |

Note: Combinations of transportation modes are same as Table 6.1.1.
Source: JICA Study Team

**Table 6.1.4 Estimated Number of Passengers "Without" Project at the South Section in 2030**

(Unit: Person/day)

| Transportation Mode | | | Sub-Section | | | |
|---|---|---|---|---|---|---|
| | | | Nha Trang-Thap Cham (83km) | Thap Cham-Phan Thiet (130km) | Phan Thiet-Long Thanh (117km) | Long Thanh-HCMC (36km) |
| Railway | CR_CR | | 28,138 | 27,696 | 28,831 | 28,172 |
| | CR_HSR | | 0 | 0 | 0 | 0 |
| | HSR | | 0 | 0 | 0 | 0 |
| | Sub-Total | | 28,138 | 27,696 | 28,831 | 28,172 |
| Road | National Highway | Car | 2,077 | 429 | 7,296 | 60,938 |
| | | Bus | 40,390 | 6,893 | 22,883 | 157,298 |
| | Express Way | Car | 48,944 | 27,053 | 33,174 | 100,016 |
| | | Bus | 30,440 | 23,670 | 41,865 | 209,760 |
| | Sub-Total | | 121,851 | 58,044 | 105,219 | 528,011 |
| Airplane | | | 88,247 | 88,247 | 88,247 | 88,247 |
| Total | | | 238,236 | 173,987 | 222,297 | 644,430 |

Note: Combinations of transportation modes are same as Table 6.1.1.
Source: JICA Study Team

6.4 Based on the above results of traffic demand analysis, passenger-kilometer (PKM), which is defined as the average passenger trip distance multiplied by the number of passengers, was estimated for each transportation mode at the north and south sections, respectively as show in Table 6.1.5 and Table 6.1.6.

**Table 6.1.5 Estimated Passenger-kilometer (PKM) "With" and "Without" Project at the North Section in 2030**

(Unit: PKM/day)

| Transportation Mode | | | North Section | | PKM Reduction ("Without"-"With") |
|---|---|---|---|---|---|
| | | | "With" Project | "Without" Project | |
| Railway | CR_CR | | 6,397,436 | 8,763,772 | 2,366,336 |
| | CR_HSR | | 351,488 | 0 | -351,488 |
| | HSR | | 11,807,494 | 0 | -11,807,494 |
| | Sub-Total | | 18,556,418 | 8,763,772 | -9,792,646 |
| Road | National Highway | Car | 1,925,580 | 2,067,840 | 142,260 |
| | | Bus | 5,369,862 | 5,908,398 | 538,536 |
| | Express Way | Car | 14,752,360 | 18,446,682 | 3,694,322 |
| | | Bus | 14,983,014 | 16,630,536 | 1,647,522 |
| | Sub-Total | | 37,030,816 | 43,053,456 | 6,022,640 |
| Airplane | | | 19,210,044 | 19,173,976 | -36,068 |
| Total | | | 74,797,278 | 70,991,204 | -3,806,074 |

Note: Combinations of transportation modes are same as Table 6.1.1.
"-" means increase by the HSR project.
Source: JICA Study Team

**Table 6.1.6 Estimated Passenger-kilometer (PKM) "With" and "Without" Project at the South Section in 2030**

(Unit: PKM/day)

| Transportation Mode | | | South Section | | PKM Reduction ("Without"-"With") |
|---|---|---|---|---|---|
| | | | "With" Project | "Without" Project | |
| Railway | CR_CR | | 10,061,160 | 10,323,353 | 262,193 |
| | CR_HSR | | 1,501,690 | 0 | -1,501,690 |
| | HSR | | 16,449,441 | 0 | -16,449,441 |
| | Sub-Total | | 28,012,291 | 10,323,353 | -17,688,938 |
| Road | National Highway | Car | 2,550,764 | 3,275,504 | 724,740 |
| | | Bus | 9,556,108 | 12,588,482 | 3,032,374 |
| | Express Way | Car | 12,405,156 | 15,061,197 | 2,656,041 |
| | | Bus | 13,765,817 | 18,053,214 | 4,287,397 |
| | Sub-Total | | 38,277,845 | 48,978,397 | 10,700,552 |
| Airplane | | | 31,766,604 | 32,298,402 | 531,798 |

| Transportation Mode | South Section | | PKM Reduction ("Without"-"With") |
|---|---|---|---|
| | "With" Project | "Without" Project | |
| Total | 98,056,740 | 91,600,152 | -6,456,588 |

Note: Combinations of transportation modes are same as Table 6.1.1.
"-" means increase by the HSR project.
Source: JICA Study Team

6.5 It was estimated that the PKM of road transport would decrease by about 6 million PKM/day in the north section and by about 10 million PKM/day in the south section in 2030, when the HSR is in operation. However, it should be noted that the above results of traffic demand analysis for "with" project may include induced traffic (rebound effects) after the introduction of HSR. Due to additional traffic demands boosted by the improved traffic services by HSR, the number of passengers of air transport "with" and "without" projects shows little change. On the whole, the estimated total PKMs of "with" projects are estimated to be larger than the ones of "without" projects.

### 3) Setting of Emission Factors of GHGs ($CO_2e$)

#### (1) Emission Factors of GHGs of Existing Railway, Car, Bus and Air Transport

6.6 Firstly, emission factors of GHGs per PKM (g-$CO_2e$/PKM) of each transportation mode other than HSR, i.e., existing railway, car, bus and airplane, were set to estimate GHGs ($CO_2e$) emissions. Since such factors have not been developed yet in Vietnam, it was necessary to set the factors by referring to available data which have been developed for similar situations in Vietnam.

6.7 For setting the emission factors of GHGs of existing railway, car, bus and airplane, information from the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) of Japan and the Department for Environment, Food and Rural Affairs (DEFRA) of UK was reviewed. Table 6.1.7 shows available information on the emission factors of GHGs for each of the said transportation modes.

**Table 6.1.7 Available Emission Factors of GHGs of Each Transportation Mode**

| Transportation Mode | Emission Factor [g-$CO_2e$/PKM] | Source | Remarks |
|---|---|---|---|
| Existing Railway | 18.0 | 1) | There is no railway classification. |
| | 56.5 | 2) | This is the average in British Rail (BR). |
| Car | 169.0 | 1) | There is no classification of vehicle type. |
| | 211.9 | 2) | This is the average for gasoline-fueled vehicle (average of small, middle and large size cars). |
| | 174.1 | 2) | This is the average for gasoline-fueled vehicle (average of small size car). |
| | 196.7 | 2) | This is the average for diesel-fueled vehicle (average of small, middle and large size cars). |
| | 146.9 | 2) | This is the average for diesel-fueled vehicle (average of small size cars). |
| Bus | 49.0 | 1) | There is no classification of bus type. |
| | 89.1 | 2) | This is the city bus in London (the number of passengers is 16.6 persons on the average). |
| | 30.7 | 2) | This is the long-distance bus (the number of passengers is 16.2 persons on the average). |
| Airplane | 102.0 | 1) | There is no airplane classification. |
| | 164.8 | 2) | This is the domestic lines in UK. |

Note: 1) Unit of Environmental Politics, Department of General Politics in MLIT of Japan, 2010
2) DEFRA of UK, 2011/Energy and Carbon Conversion 2011 updated CARBON TRUST
Source: JICA Study Team based on the above sources

6.8 Among the above available information on the GHGs emission factors, the emission factors to be used in this study were selected as shown in Table 6.1.8.

**Table 6.1.8 Emission Factors of GHGs Used in the Study for Each Transportation Mode**

| Transportation Mode | Emission Factor [g-$CO_2$e/PKM] | Source | Reasons of Selection | Remarks |
|---|---|---|---|---|
| Existing Railway | 56.5 | 2) | Since electrification of British Railway (BR) is 40%, the situation of electrification of BR is relatively close to the future Vietnamese case than the Japanese case. Thus, the basic unit of BR was applied. | The same basic unit is also applied for passengers who transfer from CR to HSR or HSR to CR. |
| Car | 174.1 | 2) | Data by vehicle type is available. | Gasoline-fueled vehicle (average of small size car) |
| Bus | 59.9 | 2) | Number of passengers per bus is relatively close to the Vietnamese case. | Average of city bus and long-distance bus. |
| Airplane | 102.0 | 1) | The basic unit between UK and Japan was similar. Thus, Japanese unit was applied. | There is no classification of airplane type. |

Note: 1) Unit of Environmental Politics, Department of General Politics in MLIT of Japan, 2010
2) DEFRA of UK, 2010
Source: JICA Study Team based on the above sources

### (2) GHGs ($CO_2$e) Emission of HSR

6.9 With respect to the emission factor of GHGs of HSR, available referential information is summarized in Table 6.1.9.

**Table 6.1.9 Available Emission Factors of GHGs of HSR in Various Countries**

| Transportation Mode | Emission Factor [g-$CO_2$e/PKM] | Source | Remarks |
|---|---|---|---|
| HSR | 12.3 | 1) | The actual value of Series N700 rolling stock reported by Central Japan Railway Company. |
| | 11.0 | 2) | The actual value between London and Paris (return) by Eurostar. |
| | 24.3 | 2) | The actual value between London and Brussels (return) by Eurostar. |
| | 17.0 | 3) | Average in Europe based on the Alstom AGV case. |

Note: 1) Annual Report of Central Japan Railway Company, 2012
2) Website of EUROSTAR available from the URL below;
http://www.eurostar.com/UK/uk/leisure/travel_information/before_you_go/Green_Eurostar.jsp
3) High Speed Rail and Sustainability, International Union of Railways, November 2011
Source: JICA Study Team based on the above sources

6.10 In the HSR projects, the electricity is planned to be purchased from the grid only. GHGs ($CO_2$e) emission from electricity consumption for the HSR operation was calculated as “direct project emissions” based on the quantity of electricity consumed. Thus, an emission factor which is developed based on the similar structure of power sources in Vietnam is needed. However, as the emission factors shown in Table 6.1.9 are considered to be developed based on the different structure of power sources from the one in Vietnam, they are not used in this study.

6.11 Therefore, GHGs ($CO_2$e) emission of HSR was estimated in line with the CDM methodologies defined in “Tool to Calculate Baseline, Project and/or Leakage Emissions from Electricity Consumption” which is referred in “AM0101 High Speed Passenger Rail Systems”. It is assumed that either no captive power plant is installed at the site of electricity consumption or if any on-site captive power exits, it is not operating or it can physically not provide electricity to the source of electricity consumption.[2]

6.12 The application of an emission factor for electricity generation and a factor to

[2] This is an acceptable scenario for the application of the estimation as described in AM0101 methodology.

account for transmission and distribution losses is as follows:

PEc=EC x EFc x (1+TDL)

Where:

PEc: Emission from electricity consumption (t-$CO_2$e/year)

EC: Quantity of electricity consumed by the HSR operation (MWh/year)

EFc: Emission factor for electricity generation for source (t-$CO_2$e/MWh)

TDL: Average technical transmission and distribution losses for providing electricity

6.13 The quantity of electricity consumed by the operation of HSR was estimated at 31.7kWh/train-km by the JICA Study Team based on the assumed HSR train type to be introduced in Vietnam, etc. The official emission factor for electricity generation source has been calculated by the Department of Meteorology, Hydrology and Climate Change, Ministry of Natural Resources and Environment (MONRE) under the framework of UNFCCC. The calculated official emission factor for electricity grid for the year 2010 is 0.5408 ton of $CO_2$e per MWh (Combined Emission [CM] factor) according to No.109/KTTVBDKH Viet Nam National Electric Grid Emission Factor (Respectfully attention: CDM project developers) dated March 5, 2012[3]. As for the electric power transmission and distribution losses (TDL: % of output) in Vietnam, it was estimated at 9.6% in 2009 according to the data of International Energy Agency (IEA). The TDL includes losses in transmission between sources of supply and points of distribution and in the distribution to consumers including pilferage. Although TDL is expected to be improved in future according to Decision No.1208/QD-TTg on "Approval of the National Master Plan for Power Development for the 2011-2020 Period with the Vision to 2030 (Power Master Plan VII)" dated July 21, 2011, same level of TDL was used in this study because there is no concrete target in the decision.

6.14 Based on the above, GHGs ($CO_2$e) emissions from the operation of HSR per year in 2030 were estimated as shown in Table 6.1.10.

**Table 6.1.10 Estimate of GHGs ($CO_2$e) Emission of HSR Operation**

| Items | North (Hanoi-Vinh) Section | South (HCMC-NhaTang) Section | Remarks |
|---|---|---|---|
| Electricity consumption per train-kilometer | 31.7 [kWh/train-km] | 31.7 [kWh/train-km] | Estimated by JICA Study Team |
| Electricity consumption per train-trip (one way) | 9.0 [MWh/train-trip] | 11.6 [MWh/trip] | |
| Number of train operation per day | 138 [train-trip/day] | 118 [train-trip/day] | In 2030 |
| Electricity consumption per year (EC) | 453x$10^3$ [MWh/year] | 500x$10^3$ [MWh/year] | 365 days operation/year |
| Emission factor (EFc) | 0.5408 [t-$CO_2$e/MWh] | 0.5408 [t-$CO_2$e/MWh] | No.109/KTTVBDKH |
| Technical transmission and distribution losses (TDL) | 9.6% | 9.6% | Assumed same as 2009 |
| GHGs emission per year (PEc) | 269 x$10^3$ [t-$CO_2$e/year] | 296 x$10^3$ [t-$CO_2$e/year] | |

Source: JICA Study Team

### 4) Calculation of GHGs ($CO_2$e) Emissions

6.15 The GHGs ($CO_2$e) emissions of two cases, i.e., "with" project and "without" project cases, were calculated multiplying the estimated PKM and the GHGs ($CO_2$e) emission factor for each transportation mode. The results of calculation of both "with" project and

[3] Operating Margin (OM) emission factor has been calculated at 0.6095t-$CO_2$e/MWh, while Build Margin (BM) emission factor has been calculated at 0.4722 t-$CO_2$e/MWh. CM factor has been calculated as the weighted average of OM and BM emission factors.

"without" project cases are shown in Table 6.1.11 for the north section and Table 6.1.12 for the south section.

**Table 6.1.11 Comparison of GHGs ($CO_2e$) Emissions for "With" and "Without" Project at the North Section**

(Unit: kt-$CO_2e$/year)

| Transportation Mode | | | "With" Project | "Without" Project | GHGs Emission Reduction ("Without"-"With") |
|---|---|---|---|---|---|
| Railway | CR_CR | | 132 | 181 | 49 |
| | CR_HSR | | 7 | 0 | -7 |
| | HSR | | 269 | 0 | -269 |
| | Sub-Total | | 408 | 181 | -227 |
| Road | National Highway | Car | 122 | 131 | 9 |
| | | Bus | 117 | 129 | 12 |
| | Express Way | Car | 938 | 1,172 | 234 |
| | | Bus | 328 | 364 | 36 |
| | Sub-Total | | 1,505 | 1,796 | 291 |
| Airplane | | | 715 | 714 | -1 |
| Total | | | 2,628 | 2,691 | 63 |

Note: "-" means increase by the HSR project.
Source: JICA Study Team

**Table 6.1.12 Comparison of GHGs ($CO_2e$) Emissions for "With" and "Without" Project at the South Section**

(Unit: kt-$CO_2e$/year)

| Transportation Mode | | | "With" Project | "Without" Project | GHGs Emission Reduction ("Without"-"With") |
|---|---|---|---|---|---|
| Railway | CR_CR | | 208 | 212 | 4 |
| | CR_HSR | | 31 | 0 | -31 |
| | HSR | | 296 | 0 | -296 |
| | Sub-Total | | 535 | 212 | -323 |
| Road | National Highway | Car | 162 | 208 | 46 |
| | | Bus | 209 | 275 | 66 |
| | Express Way | Car | 788 | 957 | 169 |
| | | Bus | 301 | 395 | 94 |
| | Sub-Total | | 1,460 | 1,835 | 375 |
| Airplane | | | 1,183 | 1,203 | 20 |
| Total | | | 3,178 | 3,250 | 72 |

Note: "-" means increase by the HSR project.
Source: JICA Study Team

### 5) Evaluation of GHGs Emission

6.16 From the above calculations in Table 6.1.11 and Table 6.1.12, 63 kt-$CO_2e$/year and 72 kt-$CO_2e$/year of GHGs emissions (total of 135 kt-$CO_2e$/year) are expected to be decreased at the north and the south sections, respectively in 2030, due to the shifting of the inter-provincial/urban passengers from existing transportation modes to HSR even if the analyzed traffic demand "with" projects may include induced traffic (rebound effects).

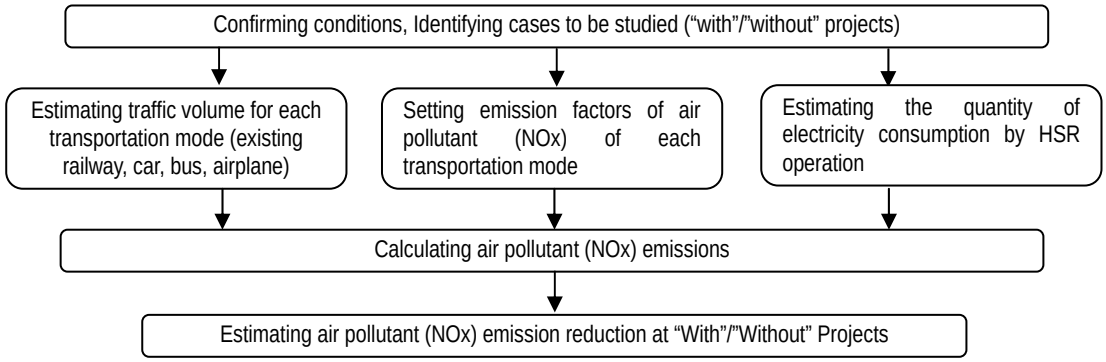
6.17 According to the CDM methodologies defined in "AM0101 High Speed Passenger Rail Systems", no "leakage emissions" shall be accounted for. This means that it is not required to estimate emissions due to changes in the load factors of existing transportation modes as well as due to congestion change including change in vehicle speed and induced traffic (rebound effects), etc. However, the estimated PKM "with" projects includes induced traffic (rebound effects) because of the limitation of established model for traffic demand analysis and available secondary information. It is likely that the estimated GHGs ($CO_2e$) emissions "with" projects in this study will be more than the expected GHGs ($CO_2e$) emissions which should have been estimated in accordance with said CDM methodologies. In other words, if the estimation is conducted rather strictly

following the CDM methodologies, more GHGs emission reduction could be expected. Since this is a preliminary estimation, it is recommended that a detailed estimation be conducted in accordance with the CDM methodologies defined/approved under the framework of UNFCCC and an updating of the basic unit data be done once this has been established.

## 6.2 Preliminary Study on the Reduction of Air Pollutant Emission by HSR

### 1) Procedure and Conditions

6.18 Estimation of air pollutant emission reduction in this study focuses on nitrogen oxides (NOx) as a representative of various air pollutants. NOx is one of the important air pollution indicators. Like the case of GHGs emission, possible reduction of NOx emission is also studied by comparing two cases; i) "with" project (when both the north and south sections start operation from 2030), and ii) "without" project (both the north and the south sections are not implemented) as shown in Figure 6.2.1.




Source: JICA Study Team

**Figure 6.2.1 Flowchart of Estimation of Air Pollutant (NOx) Emission Reduction by HSR**

6.19 The conditions set to estimate NOx emission reduction are the same as the ones for GHGs. Estimation was done by setting: i) the estimated traffic volume (i.e., existing railway, car, bus and airplane), and ii) the emission factor of NOx of each transportation mode. As for the NOx emission by the HSR operation, it was estimated based on the quantity of electricity consumption.

### 2) Estimation of Traffic Volume

6.20 The traffic volume of trains of the existing railway in 2030 was estimated as train-kilometer per day based on the PKM given in Tables 6.1.5 and 6.1.6 and the average number of passengers per train, which was set at 1,000 persons based on the information from VR. The estimated train-kilometers at the north and south sections "with" and "without" projects are shown in Table 6.2.1.

**Table 6.2.1 Estimated Train-kilometer of the Existing Railway at the North and South Sections in 2030**

(Unit: train-kilometer/day)

| Transportation Mode | | North Section | | South Section | |
|---|---|---|---|---|---|
| | | "With" Project | "Without" Project | "With" Project | "Without" Project |
| Railway | CR_CR | 6,397 | 8,764 | 10,061 | 10,323 |
| | CR_HSR | 351 | 0 | 1,502 | 0 |
| | Total | 6,748 | 8,764 | 11,563 | 10,323 |

Source: JICA Study Team

6.21 The traffic volumes of road transport (personal cars and conventional buses) in 2030 were estimated as car-kilometer per day also based on the PKM given in Tables 6.1.5 and 6.1.6 and the average numbers of passengers per car and bus, which were set at 3.2 persons/car and 20.5 persons/bus based on the results of the traffic survey by the JICA Study Team conducted in November 2011. The estimated traffic volume of road

transport as car-kilometers at the north and south sections "with" and "without" projects are shown in Table 6.2.2.

**Table 6.2.2 Estimated Car-kilometer of Road Transport at the North and South Sections in 2030**

(Unit: car-kilometer/day)

| Transportation Mode | | | North Section | | South Section | |
|---|---|---|---|---|---|---|
| | | | "With" Project | "Without" Project | "With" Project | "Without" Project |
| Road | National Highway | Car | 601,744 | 646,200 | 797,114 | 1,023,595 |
| | | Bus | 261,944 | 288,215 | 466,152 | 614,072 |
| | Express Way | Car | 4,610,113 | 5,764,588 | 3,876,611 | 4,706,624 |
| | | Bus | 730,879 | 811,246 | 671,503 | 880,645 |
| | Total | | 6,204,680 | 7,510,249 | 5,811,380 | 7,224,936 |

Note: The average number of passenger is assumed at 3.2 persons/car and 20.5 persons/bus.
Source: JICA Study Team

6.22 As for the traffic volume of airplanes in 2030, the number of landing and takeoff (LTO) per day was estimated based on the passenger volume given in Tables 6.1.1 to 6.1.4 and average number of passenger per airplane since the emission factors of NOx for airplane are available as one LTO. The estimated LTO at the north and south sections "with" and "without" projects are shown in Table 6.2.3.

**Table 6.2.3 Estimated Number of Air Transport at North and South Sections in 2030**

| Transportation Mode | North Section | | South Section | |
|---|---|---|---|---|
| | "With" Project | "Without" Project | "With" Project | "Without" Project |
| Passenger per day (persons/day) | 67,641 | 67,514 | 86,794 | 88,247 |
| Number of landing and takeoff (LTO) per day | 268 | 268 | 344 | 350 |

Note: The average number of passenger was assumed at 126 persons/airplane by referring to 180 seats of a major airplane (Airbus 320) and 70% loading factor in average.
Source: JICA Study Team

### 3) Setting of Emission Factor of NOx

#### (1) Emission Factors of NOx of Existing Railway, Car, Bus and Air Transport

6.23 Firstly, emission factors of NOx of each transportation mode other than HSR, i.e., existing railway, car, bus and airplane were set to estimate NOx emissions. Since such factors have not been developed yet in Vietnam, it was necessary to set the factors by referring to available data which have been developed for the similar situations in Vietnam.

6.24 The emission factor of NOx (g-NOx/km) of the existing railway was set based on the data in UK because the electrification situation of the British Railway (BR) is considered to be close to the future Vietnam case. For the emission factors of the cars and buses, the Euro standards are currently applied for vehicle emission gas control in Vietnam. As such, Tier 2 emission factors for passenger cars and buses defined in "EMEP/EEA Emission Inventory Guidebook 2009, updated May 2012" were used. For the airplanes, emission factor estimated for Airbus 320 was applied considering the type of aircrafts operated by Vietnam Airlines. The emission factors applied in this study are tabulated in Table 6.2.4.

**Table 6.2.4 Emission Factors of NOx Applied in this Study**

| Transportation Mode | Emission Factor | | Source | Remarks |
|---|---|---|---|---|
| CR | 12 | g-NOx/km | 1) | It was estimated for a diesel train per one train. |
| Car | 0.242 | g-$NO_X$/km | 2) | It came from a gasoline-fueled car (PC Euro 2-94/12/EEC) |
| Bus | 10.7 | g-$NO_X$/km | 2) | It came from a diesel-fueled bus (HD Euro 2-91/542/EEC II) |
| Airplane | 11,000 | g-$NO_X$/LTO | 3) | It came from one takeoff and landing (LTO) of Airbus A320 |

Note:
1) Transport Analysis Guidance (TAG), Department of Transport, UK, 2012
2) EMEP/EEA Emission Inventory Guidebook 2009, updated May 2012
3) IPCC Guidelines on National Greenhouse Gas Inventories. Reference Manual
Source: JICA Study Team based on the above sources

### (2) NOx Emission of HSR

6.25 In like manner as the case of GHGs, NOx emission from electricity consumption for the operation of HSR was estimated based on the quantity of electricity consumed. The application of an emission factor for electricity generation and a factor to account for transmission and distribution losses is as follows:

$PE_N = EC \times EF_N \times (1+TDL)$

Where:

$PE_N$: Emission from electricity consumption (t-NOx/year)

EC: Quantity of electricity consumed by the HSR operation (MWh/year)

$EF_N$: Emission factor for electricity generation for source (t-NOx/MWh)

TDL: Average technical transmission and distribution losses for providing electricity

6.26 The EC and TDL were set following the estimates mentioned for the GHGs ($CO_2e$) emission as shown in Table 6.1.10. On the other hand, emission factor of NOx from electricity generation for source has not been developed yet in Vietnam. It was, therefore, calculated based on the structure of power sources in Vietnam in 2030 and available emission factors for each type of power source. The future structure of power sources in Vietnam in 2030 is available from Decision No.1208/QD-TTg on "Approval of the National Master Plan for Power Development for the 2011-2020 Period with the Vision to 2030 (Power Master Plan VII)" dated July 21, 2011 as shown in Table 6.2.5.

**Table 6.2.5 Future Structure of Power Sources in 2030 in Vietnam**

| Power Sources | Targeted Capacity (unit: MW) | Targeted Electricity Output (unit: billion kWh) |
|---|---|---|
| Hydropower including energy storage hydropower | 230,476 (15.7%) | 64.6 (9.3%) |
| Coal thermal power | 757,488 (51.6%) | 392.0 (56.4%) |
| Gas thermal power including LNG | 173,224 (11.8%) | 100.1 (14.4%) |
| Renewable energy power | 137,992 (9.4%) | 41.7 (6.0%) |
| Nuclear power | 96,888 (6.6%) | 70.2 (10.1%) |
| Import | 71,932 (4.9%) | 26.4 (3.8%) |
| Total | 146,800 (100.0%) | 695 (100.0%) |

Source: Decision No.1208/QD-TTg (Power Master Plan VII)

6.27 Among the major compositions of power sources, NOx is emitted mainly from coal thermal power and gas thermal power. The emission data of NOx from coal thermal power in various countries are available from the OECD Environmental Data Compendium 2006/2007. According to a provisional calculation by Tokyo Electric Power Company on the emission factor of NOx from coal thermal power based on the OECD data etc., the

emission factor is 1.2g-NOx/kWh as the average of six nations (Canada, France, Germany, Italia, UK, and The United States of America). For the emission factor of NOx from gas (LNG) thermal power, it was set at 0.08g-NOx/kWh based on the data from Chubu Electric Power Company. For the emission factor of imported electricity, NOx emission was not considered because the Government of Vietnam has an intention to import the electricity mainly generated by hydropower.

6.28 The NOx emission factor per electric power consumption (kWh) for the HSR operation in 2030 was set as shown in Table 6.2.6, which was estimated at 0.69g-NOx/kWh after a weighted ratio of the structure of the power source.

**Table 6.2.6 Emission Factor of NOx of HSR Set in this Study**

| Power Sources | Structure of Power Source in 2030(%) | Emission Factors (g-NOx/kWh) |
|---|---|---|
| Hydropower | 9.3 | 0 |
| Coal thermal power | 56.4 | 1.2 |
| Gas thermal power (LNG) | 14.4 | 0.08 |
| Renewable energy power | 6.0 | 0 |
| Nuclear power | 10.1 | 0 |
| Import | 3.8 | 0 |
| Total/Average | 100.0 | 0.69 (weighted) |

Source: JICA Study Team

6.29 Based on the above, NOx emission from the operation of HSR per year in 2030 was estimated as shown in Table 6.2.7.

**Table 6.2.7 Estimate of NOx Emission of HSR**

| Items | North (Hanoi-Vinh) Section | South (HCMC-NhaTang) Section | Remarks |
|---|---|---|---|
| Electricity consumption per train-kilometer | 31.7 [kWh/train-km] | 31.7 [kWh/train-km] | Estimated by JICA Study Team |
| Electricity consumption per train-trip(one way) | 9.0 [MWh/train-trip] | 11.6 [MWh/trip] | |
| Number of train operation per day | 138 [train-trip/day] | 118 [train-trip/day] | In 2030 |
| Electricity consumption per year (EC) | $453x10^3$ [MWh/year] | $500x10^3$ [MWh/year] | 365 days operation/year |
| Emission factor ($EF_N$) | 0.0007 [t-NOx/MWh] | 0.0007 [t-NOx/MWh] | See table 6.2.6 |
| Technical transmission and distribution losses (TDL) | 9.6% | 9.6% | Assumed same as 2009 |
| NOx emission per year ($PE_N$) | 334 [t-NOx/year] | 384 [t-NOx/year] | |

Source: JICA Study Team

### 4) Calculation of Air Pollutant (NOx) Emissions

6.30 The air pollutant (NOx) emissions of two cases, i.e., “with” project and “without” project cases, were calculated multiplying the estimated traffic volumes and the NOx emission factor for each transportation mode. The results of calculation of both “with” project and “without” project cases are shown in Table 6.2.5 for the north section and Table 6.2.6 for the south section.

**Table 6.2.5 Comparison of NOx Emission for “With” and “Without” Projects at the North Section**

(Unit: t-$NO_x$/year)

| Transportation Mode | | “With” Project | “Without” Project | NOx Emission Reduction (“Without”-“With”) |
|---|---|---|---|---|
| Railway | CR_CR | 28 | 38 | 10 |
| | CR_HSR | 2 | 0 | -2 |
| | HSR | 334 | 0 | -334 |

| Transportation Mode | | | "With" Project | "Without" Project | NOx Emission Reduction ("Without"-"With") |
|---|---|---|---|---|---|
| | Sub-Total | | 364 | 38 | -326 |
| Road | National Highway | Car | 53 | 57 | 4 |
| | | Bus | 1,023 | 1,125 | 102 |
| | Express Way | Car | 407 | 509 | 102 |
| | | Bus | 2,854 | 3,168 | 314 |
| | Sub-Total | | 4,337 | 4,859 | 522 |
| Airplane | | | 1,076 | 1,076 | 0 |
| Total | | | 5,777 | 5,973 | 196 |

Source: JICA Study Team

**Table 6.2.6 Comparison of NOx Emission for "With" and "Without" Projects at the South Section**

(Unit: t-$NO_x$/year)

| Transportation Mode | | | "With" Project | "Without" Project | NOx Emission Reduction ("Without"-"With") |
|---|---|---|---|---|---|
| Railway | CR_CR | | 44 | 45 | 1 |
| | CR_HSR | | 7 | 0 | -7 |
| | HSR | | 384 | 0 | -384 |
| | Sub-Total | | 435 | 45 | -390 |
| Road | National Highway | Car | 70 | 90 | 20 |
| | | Bus | 1,820 | 2,398 | 578 |
| | Express Way | Car | 342 | 416 | 74 |
| | | Bus | 2,623 | 3,439 | 816 |
| | Sub-Total | | 4,855 | 6,343 | 1,488 |
| Airplane | | | 1,381 | 1,405 | 24 |
| Total | | | 6,671 | 7,793 | 1,122 |

Source: JICA Study Team

### 5) Evaluation of NOx Emission

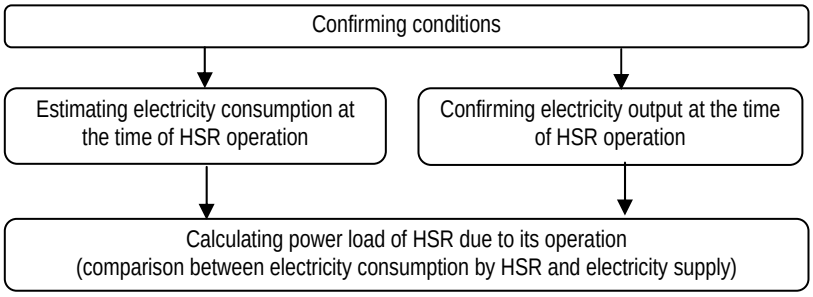
6.31 From the above calculation in Tables 6.2.5 and 6.2.6, it was found that 196 t-NOx/year and 1,122 t-NOx/year (total of 1,318 t-NOx/year) are expected to be decreased at the north and south sections, respectively in 2030 due to the shifting of the inter-provincial/urban passengers from existing transportation modes to HSR even if the analyzed traffic demand "with" projects may include induced traffic (rebound effects).

6.32 On the other hand, in general, when the air pollutants emission reduction by the railway projects is estimated, the emissions from power plant(s) connected physically to the electricity system are not taken into account. This is because air pollution is normally discussed in certain areas (mainly around project areas) but the locations of emissions from power plant(s) are relatively far from these areas in most cases. If the amount of NOx emission reduction is calculated in this manner, 532 t-NOx/year and 1,513 t-NOx/year (total of 2,045 t-NOx/year) are expected to be decreased at the north and south sections, respectively around each of the project areas. The HSR projects are expected to contribute to improve air pollution situations around each of the project areas.

## 6.3 Study on HSR Power Load on the Electricity Supply in Vietnam

### 1) Procedure and Conditions

6.33 The HSR power load on the electricity supply in Vietnam was calculated based on the procedure shown in Figure 6.3.1.




Source: JICA Study Team

**Figure 6.3.1 Flowchart of Estimation of Electricity Load of HSR**

6.34 The basic conditions set to examine loads of the HSR on the electricity supply are the same as the ones used for the estimation of GHGs emission.

6.35 In addition, some conditions such as balance between demand and supply of electricity area-wise or during the peak period of electricity consumption (e.g., drought period, the peak time zone of electricity consumption, and the peak time zone of number of trains) are not considered in this study.

### 2) Electricity Consumption of the HSR Operation

6.36 Electricity consumption of the HSR operation per year was estimated at about 453x$10^3$ MWh for the north section and 500 x$10^3$ MWh for the south section, as shown in Table 6.1.10 (total of 953 x$10^3$ MWh/year).

### 3) Future Electricity Output in Vietnam

6.37 As discussed in 6.1, “the National Master Plan for Power Development for the 2011-2020 Period with the Vision to 2030 (Power Master Plan VII)” was approved by the Prime Minister of Vietnam on July 21, 2011 under Decision No.1208/QD-TTg. Development perspectives include that development of the electricity sector in conjunction with the national socio-economic development strategies, and ensure adequate supply of electricity for national economy and social life. One of specific objectives of the Power Master Plan VII is to provide adequate electricity for the domestic demand by increasing the aggregate output of produced and imported electricity from 194-210x$10^6$ MWh by 2015 to 330-362x$10^6$ MWh by 2020 and 695-834 x$10^6$ MWh by 2030. The Power Master Plan VII also envisages that the aggregate power generation capacity of all the power plants in Vietnam is targeted to increase to about 146,800 MW by 2030.

### 4) Electricity Load to Future Electricity Output in Vietnam of the HSR Operation

6.38 Comparing the quantities of the estimated electricity consumption of the HSR operation and the planned aggregate electricity output of Vietnam in 2030, the electricity consumption of the HSR operation was estimated at around 0.14% of the electricity output of Vietnam in 2030 (lower case) as shown in Table 6.3.3.

**Table 6.3.3 Comparison between Electricity Output and Electricity Consumption of the HSR in Vietnam**

(Unit: MWh/year)

| Year | Aggregate Electricity Output in Vietnam*1 | Annual Electricity Consumption of the HSR Operation | Percentage |
|---|---|---|---|
| 2030 | $695 \times 10^6$ (lower case) | $953 \times 10^3$ | 0.14% |

Note *1: Power Master Plan VII
Source: JICA Study Team

6.39 In the case of Japan, it is estimated that electricity consumption of the railway sector in 2011 accounts for about 2.4% of total electricity supply as shown in Table 6.3.4. Even taking into account the fact that the case in Vietnam in this preliminary study is counting HSR only, the percentage of electricity consumption of the HSR operation to the total electricity supply in Vietnam in 2030 is much smaller than the case in Japan. It is evaluated that this percentage is not at a scale where it becomes necessary to develop additional power supply for the HSR projects.

**Table 6.3.4 Comparison between Electricity Supply and Electricity Consumption of Railway Sector in Japan**

(Unit: MWh)

| Year | Annual Electricity Supply (10 electricity companies)*1 | Annual Electricity Consumption of Railway Sector*2 | Percentage |
|---|---|---|---|
| 2010 | $906.4 \times 10^6$ | $21.6 \times 10^6$ | 2.38% |
| 2011 | $859.8 \times 10^6$ | $20.6 \times 10^6$ | 2.40% |

Source: *1- Federation of Electric Power Companies in Japan
*2-JR EAST Group Sustainability Report, 2011, East Japan Railway Company ($3.5 \times 10^6$ MWh generated by East Japan Railway Company is added)

6.40 The increase of GHGs emission brought about by the increase of electricity consumption of the HSR operation was estimated as shown in Table 6.1.10. However, as discussed in section 6.1, by the modal shift of inter-province/urban passengers from existing transportation modes to HSR, GHGs ($CO_2e$) emission is expected to decrease as a whole.

# 7 STUDY ON THE PREPARATION OF RESETTLEMENT AND REHABILITATION POLICY FRAMEWORK

## 7.1 Objectives of the Projects and Reasons for the Resettlement

7.1 The prime objective of the North-South High Speed Railway Projects is to promote further economic development in Vietnam as well as to be a symbol of the successful growth of the country. Based on several previous studies, two sections have been recommended as initial development sections, namely, the north section and the south section (hereafter referred to as the projects). These sections are where the highest economic impact is expected.

7.2 In the case of a transportation development project, land acquisition and resettlement is generally inevitable but it can be minimized. As for the projects, an optimal route was selected for each section through the comparison exercise of alternatives as explained in previous chapters. In addition, the minimum distance between two track centerlines was adopted in order to minimize land acquisition area and the number of project affected persons (PAPs)[1]. Although the optimal route carries less environmental and social impacts as compared to other options, acquiring privately used land (i.e., agriculture land, residential land, and commercial land) is necessary in order to make the route technically viable and financially feasible as well as convenient for users. Thus, resettlement is inevitable and necessary measures to compensate loss caused by land acquisition/resettlement and to secure livelihood after land acquisition/resettlement are necessary.

## 7.2 Reasons Not to Prepare a Resettlement Action Plan (RAP)

7.3 Resettlement Action Plan (RAP)[2] is generally prepared for a fixed Right-of-Way (ROW) of a project since it contains a specific plan of compensation and assistance targeting PAPs in a project area. In general, RAP is prepared based on examination of characteristics of the PAPs, which is obtained through a household survey (i.e., census, inventory of loss and socio-economic survey) at field as shown in Figure 7.6.1. However, the projects are not at a stage to conduct such survey since it is in the planning stage and technical designs of the project area remain preliminary. Thus, Resettlement and Rehabilitation Policy Framework (RRPF) is prepared for the optimal route as the framework for land acquisition and compensation for the projects as well as the guideline for preparing a RAP and Compensation, Support and Resettlement (CSR) Plan[3] in the future project stage.

1 Project Affected Persons (PAPs) means any persons, household, firm, private or public institution that lose land, a home or business interests because of land acquisition.

2 According to the Handbook on Resettlement A Guide to Good Practice (ADB, 1998), RAP is " a time-bound action plan with budget setting out resettlement strategy, objectives, entitlement, actions, responsibilities, monitoring and evaluation". It generally contains; i) project description, ii) potential impact, iii) objectives, iv) socio-economic study, v) legal framework, vi) institutional framework, vii) eligibility, viii) estimation of loss, ix) resettlement measures, x) relocation sits, xi) grievance mechanism, xii) implementation schedule and xiii) budget.

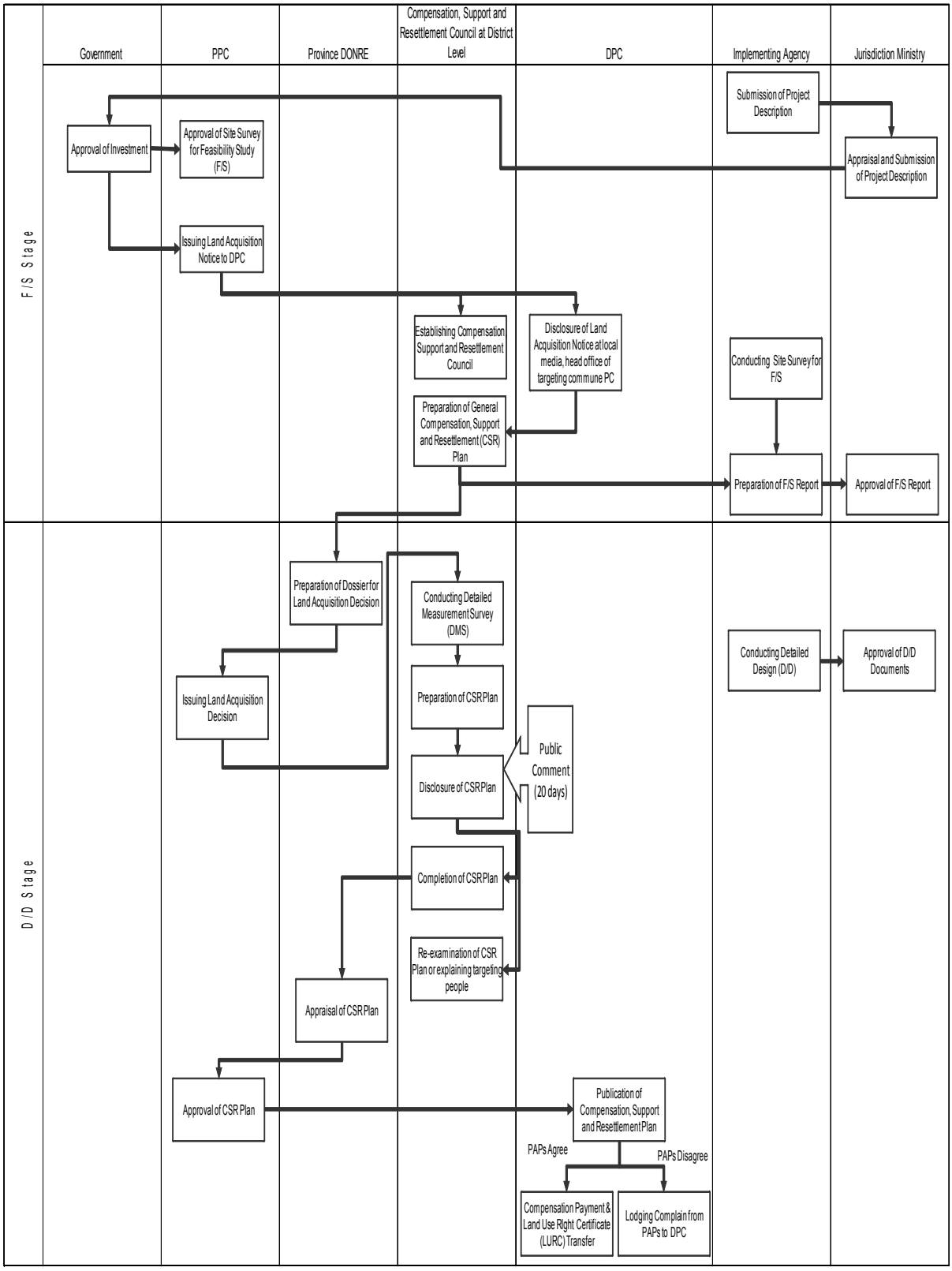
3 Compensation, Support and Resettlement (CSR) Plan is the plan containing land acquisition impact and compensation amount, which is prepared at two stages (i.e., before approval of feasibility study and after approval of feasibility study). See Sections 7.3 and 7.6 for more details.

## 7.3 Land Acquisition Procedure in Vietnamese Legislation

7.4 Among several regulations related to land acquisition and resettlement, Decree No. 197/2004/ND-CP, Decree No. 181/2004/ND-CP, Decree No. 84/2007/ND-CP and Decree No. 69/2009/ND-CP are the main regulations for land acquisition and resettlement.

7.5 Land acquisition procedure is divided into two stages, namely, (i) Feasibility Study (F/S) stage, and (ii) after the F/S stage (i.e., D/D stage). Figure 7.3.1 shows land acquisition procedure in the case of a state budget project encompassing more than two provinces. Land acquisition procedure begins when the investment for the project is approved by the Government. First of all, land acquisition notice is issued by the Provincial People's Committee (PPC) to the District People's Committee (DPC), which is also publicly disclosed in designated places. Then, the council for compensation, support and resettlement is established in a district[4]. The council prepares a general CSR plan consisting of a compensation policy, potential land acquisition impact and estimated budget. When the F/S, including the general CSR plan, is approved by the jurisdiction ministry, land acquisition decision is issued by the PPC based on the land acquisition dossiers prepared by the provincial Department of Natural Resources and Environments (DONRE) and the general CSR plan. After the land acquisition decision is issued, Detailed Measurement Survey (DMS) is conducted by the council in order to measure and examine the affected area and to determine the compensation amount. Based on the DMS result, the CSR plan containing land acquisition impact and estimated compensation amount is prepared and disclosed for public comment. In case there is no significant comment from public, CSR plan is finalized and approved by PPC. In case there is significant comment, CSR plan is re-examined or its contents explained to target PAPs directly. If the target PAPs agree with the contents of the detailed CSR plan, Land Use Right Certificate (LURC) is transferred. In case the PAPs disagree, complaints are filed with the DPC.

[4] It is organized headed by a leader of DPC and a head of the Finance Department; the DONRE; Transport Department; Agriculture Department; a representative of commune people's committee, a representative of affected communes and a project implementing agency. Furthermore, other members such as representative of the provincial Farmers' Association or Women's Union can be added as a member, if necessary.




Source: JICA Study Team based on Decree No. 69/2009/ND-CP

**Figure 7.3.1 Legal Procedure of Land Acquisition**

## 7.4 Land Acquisition Scope

### 1) Land Acquisition Area

7.6 Land acquisition area of the optimal route in the north section and south section was calculated based on a set of conditions. Table 7.4.1 shows the definition of land acquisition area in accordance with the following conditions:

(i) Land acquisition area for the alignment (i.e., embankment, cutting, bridges, viaduct and tunnel), depot and workshop, access route to depot and workshop, stations, electric facilities, station plaza was estimated based on available data in this study level. Land acquisition area for other facilities, if required, shall be examined at the next project stage when they are designed.

(ii) Embankment and cutting were designed based on three typical standards. Thus, land acquisition area was calculated according to these three standards.

(iii) Land acquisition for the tunnel section was calculated on the premise that the area of the entire tunnel will be acquired.

(iv) Protection scope is the area to secure the safety of the alignment and land acquisition of this area is necessary. In the case of the projects, the protection scope was defined to be 5m from the outer edge of embankment and cutting based on the project scope and previous railway projects in Vietnam and Japan. As for bridge, viaduct and tunnel; protection scope was also defined to be 5m from the outer edge of a structure.

(v) As for station, station structure and 1m for elevated or ground station and station structure plus 3m for half-underground station were regarded for the land acquisition area.

**Table 7.4.1 Definition of Land Acquisition Area/Width to be Acquired**

| Facility | ROW (m) | Protection Scope*1 (m) | Safety Corridor*2(m) | Total*3 (m) |
|---|---|---|---|---|
| Embankment, Type 1 | 24 | 5x 2sides | 10x2sides | 34 |
| Embankment, Type 2 | 34 | 5 x 2sides | 10x2sides | 44 |
| Embankment, Type 3 | 51 | 5 x 2sides | 10x2sides | 61 |
| Cutting, Type 1 | 24 | 5 x 2sides | 10x2sides | 34 |
| Cutting, Type 2 | 34 | 5 x 2sides | 10x2sides | 44 |
| Cutting, Type 3 | 47 | 5 x 2sides | 10x2sides | 57 |
| Bridges | 12 | 5 x 2sides | - | 22 |
| Viaducts | 12 | 5 x 2sides | - | 22 |
| Tunnels | 12 | 5m at each side | - | - |
| Stations (Elevated) | *4 | 1m at each side | - | - |
| Station (Ground) | *4 | 1m at each side | - | - |
| Station (Half-Underground) | *4 | 3m at each side | - | - |

Source: JICA Study Team

Note

*1: Width is defined based on the preliminary feasibility study report (Establishing Report on Construction Investment of High Speed Railway Line Hanoi – Ho Chi Minh City prepared by Vietnam Railways on February, 2009), other railway projects in Vietnam and Japanese example.

*2: This is 10m each side from the edge of the protection scope.

*3: Total means total width of land acquisition (i.e., ROW and protection scope).

*4: It refers to each tunnel and station.

(vi) The safety corridor is the area where land use is limited though land acquisition is not necessary according to the Railway Law (No. 35/2005/QH11) and the practical operation of previous railway projects in Vietnam. The safety corridor was defined to be 15m from the outer edge of the embankment/cutting. Since 5m from the edge of the embankment/cutting was defined as the protection scope and was included in land

acquisition area, the remaining 10m was regarded as the safety corridor.

### 2) Approach to Examine Land Acquisition Impact

7.7 Potential land acquisition and resettlement impact was examined based on the available data such as topographic map produced from the satellite imagery taken between October 8, 2009 and February 16, 2011 and data of land use map collected from each city/province. The list of land use map data collected from each city/province is presented in Table 7.4.2. The information was overlaid on Arc GIS format to define the land acquisition area, as given in Table 7.4.1, as well as to calculate the physical assets within ROW for the projects.

**Table 7.4.2 Collected Data of Land Use Map from Each City/Province**

| City/Province | Collected Data |
|---|---|
| 1. North Section | |
| Hanoi | Current Landuse Map up to 2010 |
| Ha Nam | Landuse Plan Map up to 2010 |
| Nam Dinh | Landuse Plan Map up to 2020 |
| Ninh Binh | Landuse Plan Map up to 2010 |
| Thanh Hoa | Landuse Plan Map up to 2020 |
| Nghe An | Current Landuse Map up to 2010 |
| 2. South Section | |
| HCMC | Landuse Plan Map up to 2020 |
| Dong Nai | Landuse Plan Map up to 2010 |
| Binh Thuan | Landuse Plan Map up to 2020 |
| Ninh Thuan | Landuse Plan Map up to 2010 |
| Khanh Hoa | Landuse Plan Map up to 2020 |

Source: JICA Study Team

7.8 Land use was classified into three categories (i.e., agriculture, forest and residential area) based on the land use data and existing RAP reports of donor agency funding projects in the transportations sector such as Ben – Luc – Long Thanh Expressway Project (ADB, July 2010) and HCM – LT – DG Expressway Project Portion An Phu – Ring Road 2 and Ring Road 2 I.C (ADB, November 2010). In this study, there were additional land use categories such as commercial land, vacant land, public land, religious land, national defense security land according to land use data collected from each city/province.

7.9 The types and the number of crops and trees, and category of affected houses were not obtainable from the topographic map and provincial land use data. Thus, following approaches were applied:

- Crops were classified into three categories (i.e., rice, aquaculture and other crops) automatically according to land use, and affected crops were estimated as per the affected area.
- Trees were classified into two categories (i.e., forest tree and fruit tree) according to land use, and affected trees were estimated by multiplying affected land (i.e., forest land or fruit tree cultivated land) by tree density stipulated in the provincial decision. If information of tree density was not available in some provinces, available tree density information at a province of similar natural condition was used.

- The number of affected structures was inventoried. Even if only a portion of the structure was found to be inside the ROW, it was counted as one regardless of the affected area of a structure.
- The number of affected structures was counted as house and shop. In addition, the number of affected structures was counted on the premise that 30% of the affected structure was shop and the remaining structure was house. As for house, it was classified into three types (i.e., temporary house, 1st floor house and 2nd floor house). The number of affected houses of each category was estimated from the distribution rate of each house type at each province obtained from provincial statistic year books.
- Inasmuch as the total area of the grave sites was available, information on the number of graves was not available from existing data. Thus, the number of graves was estimated by referring to the estimated number in the existing RAP reports in the transportation sector.

### (1) North Section

7.10 Total land acquisition area at the north section was estimated at 1,125 ha. Among them, the affected land and land use at three major land use by province and section is shown in Table 7.4.3 and Table 7.4.4, respectively.

**Table 7.4.3 Preliminary Estimate of Affected Land Area by Province at North Section**

| Province | Land Use Category (Unit: Ha) | | |
|---|---|---|---|
| | Agriculture | Forest | Residence |
| Hanoi | 108 | 0 | 7 |
| Ha Nam | 76 | 0 | 16 |
| Nam Dinh | 81 | 0 | 15 |
| Ninh Binh | 60 | 7 | 8 |
| Thanh Hoa | 218 | 46 | 83 |
| Nghe An | 239 | 18 | 52 |
| Total | 782 | 71 | 181 |

Source: JICA Study Team

**Table 7.4.4 Preliminary Estimate of Affected Land Area by Section at North Section**

| Section | Land Use Category (Unit: Ha) | | |
|---|---|---|---|
| | Agriculture | Forest | Residence |
| Ngoc Hoi Sta. | 3 | 0 | 0 |
| Km 0.308 – 45.215 | 148 | 0 | 14 |
| Phu Ly Sta. | 2 | 0 | 0 |
| Km 45.865 – 67.339 | 35 | 0 | 14 |
| Nam Dinh Sta. | 2 | 0 | 0.4 |
| Km 67.989 – 103.056 | 95 | 0 | 14 |
| Ninh Bih Sta. | 4 | 0 | 0.4 |
| Km 103.706 – 153.326 | 119 | 29 | 32 |
| Thanh Hoa Sta. | 1 | 0 | 2 |
| Km 154.326 – 282.970 | 359 | 42 | 83 |
| Vinh Sta. | 14 | 0 | 21 |
| Total | 782 | 71 | 181 |

Source: JICA Study Team

7.11 Table 7.4.5 and Table 7.4.6 show the number of affected structures by province and section of the north section, respectively.

**Table 7.4.5 Preliminary Estimate of Affected Structures by Province at North Section**

| Province | Hanoi | Ha Nam | Nam Dinh | Ninh Binh | Thanh Hoa | Nghe An | Total |
|---|---|---|---|---|---|---|---|
| Number of Affected Structures (Unit: No.) | 56 | 57 | 76 | 64 | 520 | 518 | 1,291 |

Source: JICA Study Team

**Table 7.4.6 Preliminary Estimate of Affected Structures by Section at North Section**

| Section | Ngoc Hoi Sta. | Km 0.308 – 45.215 | Phu Ly Sta. | Km 45.865 – 67.339 | Nam Dinh Sta. | Km 67.989 – 103.056 |
|---|---|---|---|---|---|---|
| Number of Affected Structures (Unit: No.) | 0 | 74 | 0 | 66 | 5 | 81 |
| | Ninh Bih Sta. | Km 103.706 – 153.326 | Than Hoa Sta. | Km 154.326 – 282.970 | Vinh Sta. | Total |
| | 2 | 340 | 0 | 517 | 206 | 1,291 |

Source: JICA Study Team

7.12 Table 7.4.7 and Table 7.4.8 show the number of affected trees in the forest area (excluding the affected fruit trees) by province and section of the north section, respectively.

**Table 7.4.7 Preliminary Estimate of Affected Trees[1] in the Forest Area by Province at North Section**

| Province | Hanoi | Ha Nam | Nam Dinh | Ninh Binh | Thanh Hoa | Nghe An | Total |
|---|---|---|---|---|---|---|---|
| Number of Affected Trees (Unit: No.) | - | - | - | 1,200 | 93,380 | 21,200 | 115,780 |

[1] Excluding fruit trees.
Source: JICA Study Team

**Table 7.4.8 Preliminary Estimate of Affected Trees[1] in the Forest Area by Section at North Section**

| Section | Ngoc Hoi Sta. | Km 0.308 – 45.215 | Phu Ly Sta. | Km 45.865 – 67.339 | Nam Dinh Sta. | Km 67.989 – 103.056 |
|---|---|---|---|---|---|---|
| Number of Affected Trees (Unit: No.) | 0 | 0 | 0 | 0 | 0 | 0 |
| | Ninh Bih Sta. | Km 103.706 – 153.326 | Than Hoa Sta. | Km 154.326 – 282.970 | Vinh Sta. | Total |
| | 0 | 46,000 | 0 | 69,780 | 0 | 115,780 |

[1] Excluding fruit trees.
Source: JICA Study Team

7.13 Table 7.4.9 and Table 7.4.10 show the affected number of households by province and section, respectively.

**Table 7.4.9 Preliminary Estimate of Affected Households by Province at North Section**

| Province | Hanoi | Ha Nam | Nam Dinh | Ninh Binh | Thanh Hoa | Nghe An | Total |
|---|---|---|---|---|---|---|---|
| Number of Affected Households (HHs) (Unit: No.) | 493 | 360 | 400 | 303 | 1,398 | 1,477 | 4,431 |

Source: JICA Study Team

**Table 7.4.10 Preliminary Estimate of Affected Households by Section at North Section**

| Section | Ngoc Hoi Sta. | Km 0.308 – 45.215 | Phu Ly Sta. | Km 45.865 – 67.339 | Nam Dinh Sta. | Km 67.989 – 103.056 |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| Number of Affected Households (HHs) (Unit: No.) | 13 | 668 | 10 | 207 | 15 | 462 |
| | Ninh Bih Sta. | Km 103.706 – 153.326 | Than Hoa Sta. | Km 154.326 – 282.970 | Vinh Sta. | Total |
| | 17 | 816 | 4 | 1,954 | 265 | 4,431 |

Source: JICA Study Team

### (2) South Section

7.14 Total land acquisition area at the South section was estimated at 1,681 ha. Among them, land acquisition at three major land use is shown in Table 7.4.11 and Table 7.4.12.

**Table 7.4.11 Preliminary Estimate of Affected Land Area by Province at South Section**

| Province | Land Use Category (Unit: Ha) | | |
|---|---|---|---|
| | Agriculture | Forest | Residence |
| HCMC | 64 | 0 | 17 |
| Dong Nai | 265 | 26 | 17 |
| Binh Thuan | 558 | 56 | 36 |
| Ninh Thuan | 178 | 20 | 5 |
| Khan Hoa | 154 | 53 | 32 |
| Total | 1,219 | 155 | 107 |

Source: JICA Study Team

**Table 7.4.12 Preliminary Estimate of Affected Land Area by Section at South Section**

| Section | Land Use Category (Unit: Ha) | | |
|---|---|---|---|
| | Agriculture | Forest | Residence |
| Thu Thiem Sta | 0 | 0 | 7 |
| Km 0.250 – 35.8 | 105 | 8 | 14 |
| Long Thanh Sta | 0 | 0 | 0 |
| Km 36.3 - 152.95 | 455 | 30 | 17 |
| Phan Thiet Sta | 2 | 0 | 1 |
| Km 153.45 – 220.20 | 240 | 13 | 18 |
| Tuy Phong Sta | 2 | 0 | 2 |
| Km 220.70 – 283.35 | 158 | 42 | 12 |
| Thap Cham Sta | 0 | 0 | 1 |
| Km 283.85 – 361.85 | 215 | 57 | 31 |
| Nha Trang Sta | 42 | 5 | 4 |
| Total | 1,219 | 155 | 107 |

Source: JICA Study Team

7.15 Table 7.4.13 and Table 7.4.14 show the number of affected structures by province and section, respectively.

**Table 7.4.13 Preliminary Estimate of Affected Structures by Province at South Section**

| Province | HCMC | Dong Nai | Binh Thuan | Ninh Thuan | Khan Hoa | Total |
|---|---|---|---|---|---|---|
| Number of Affected Structures (Unit: No.) | 90 | 102 | 483 | 214 | 360 | 1,249 |

Source: JICA Study Team

**Table 7.4.14 Preliminary Estimate of Affected Structures by Section at South Section**

| Section | Thu Thiem Sta | Km 0.250 – 35.8 | Long Thanh Sta | Km 36.3 - 152.95 | Phan Thiet Sta | Km 153.45 – 220.20 |
|---|---|---|---|---|---|---|
| Number of Affected Structures (Unit: No.) | 4 | 108 | 0 | 260 | 52 | 222 |
| | Tuy Phong Sta | Km 220.70 – 283.35 | Thap Cham Sta | Km 283.85 – 361.85 | Nha Trang Sta | Total |
| | 17 | 193 | 13 | 222 | 158 | 1,249 |

Source: JICA Study Team

7.16 Table 7.4.15 and Table 7.4.16 show the affected trees in the forest area (excluding the affected fruit trees) by province and section, respectively.

**Table 7.4.15 Preliminary Estimate of Affected Trees[1] in the Forest Area by Province at South Section**

| Province | HCMC | Dong Nai | Binh Thuan | Ninh Thuan | Khan Hoa | Total |
|---|---|---|---|---|---|---|
| Number of Affected Trees (Unit: No.) | - | 47,340 | 10,980 | 8,820 | 47,340 | 114,480 |

[1] Excluding fruit trees.
Source: JICA Study Team

**Table 7.4.16 Preliminary Estimate of Affected Trees[1] in the Forest Area by Section at South Section**

| Section | Thu Thiem Sta | Km 0.250 – 35.8 | Long Thanh Sta | Km 36.3 - 152.95 | Phan Thiet Sta | Km 153.45 – 220.20 |
|---|---|---|---|---|---|---|
| Number of Affected Trees (Unit: No.) | 0 | 14,940 | 0 | 34,920 | 0 | 8,460 |
| | Tuy Phong Sta | Km 220.70 – 283.35 | Thap Cham Sta | Km 283.85 – 361.85 | Nha Trang Sta | Total |
| | 0 | 0 | 0 | 47,340 | 8,820 | 114,480 |

[1] Excluding fruit trees.
Source: JICA Study Team

7.17 Table 7.4.17 and Table 7.4.18 show the number of affected households by province and section, respectively.

**Table 7.4.17 Preliminary Estimate of Affected Households by Province at South Section**

| Province | HCMC | Dong Nai | Binh Thuan | Ninh Thuan | Khan Hoa | Total |
|---|---|---|---|---|---|---|
| Number of Affected HHs (Unit: No.) | 348 | 1,167 | 2,715 | 928 | 973 | 6,125 |

Source: JICA Study Team

**Table 7.4.18 Preliminary Estimate of Affected Households by Section at South Section**

| Section | Thu Thiem Sta | Km 0.250 – 35.8 | Long Thanh Sta | Km 36.3 - 152.95 | Phan Thiet Sta | Km 153.45 – 220.20 |
|---|---|---|---|---|---|---|
| Number of Affected HHs (Unit: No.) | 4 | 528 | 0 | 2,080 | 61 | 1,183 |
| | Tuy Phong Sta | Km 220.70 – 283.35 | Thap Cham Sta | Km 283.85 – 361.85 | Nha Trang Sta | Total |
| | 25 | 824 | 13 | 1,083 | 324 | 6,125 |

Source: JICA Study Team

## 7.5 Eligibility and Entitlement for Compensation and Rehabilitation Assistance

### 1) Consistency between Donor Policy and Vietnamese Regulations

7.18 Recently, Vietnamese regulations have tendencies to follow the concept of a donor policy on land acquisition and compensation. However, there are still some gaps between these two. Table 7.5.1 shows the gaps identified between major regulations such as Decree No. 197/2004/ND-CP, Decree No. 181/2004/ND-CP, Decree No. 84/2007/ND-CP and Decree No. 69/2009/ND-CP and the JICA Guidelines for Environmental and Social Considerations (April, 2010, hereafter referred as JICA Guidelines). A Policy on land acquisition and compensation among donor agencies such as the World Bank, ADB and JICA reflect similar understandings. An examination of differences between the Vietnamese regulations and the JICA Guidelines, representing here a donor policy, was done. Resultant differences are shown in Table 7.5.1. Once the implementation scheme of the projects is decided upon, examination of differences between the policy of a nominated funding agency and the latest Vietnamese regulations is indispensable.

**Table 7.5.1 Differences between Vietnamese Regulations and JICA Guidelines**

| Items | Vietnamese Regulations | JICA Guidelines | Gaps | Measure to Differences |
|---|---|---|---|---|
| 1. Entitlement | The land users should satisfy the following conditions (Art. 9 of Decree No.197/2004/ND-CP, Art. 44, 45 & 46 of Decree No. 84/2007/ND-CP, Article 14 of Decree No.69/2009/ND-DP)<br>- Those who have a certificate of land use or equivalent documents<br>- Those who are not illegal squatters, not have a certificate of land use or equivalent documents, but having documents on occupied land issued by commune level People's Committee<br>- Owners of structures established on land to be affected by a project<br>As for the eligibility of non-title holders, PPC shall consider to provide support for non-title holders (Decree 69/2009, Art.14). | People who will be requested resettlement or whose livelihood means will be affected by a project. (JICA Guidelines p30) | There is no significant difference. | - |
| 2. Support for socially vulnerable people | There is no clear description about specific support for socially vulnerable people, but necessary support is provided by considering local situation in addition to livelihood rehabilitation. (Decree 69/2009, Art. 23) | Appropriate consideration must be given to vulnerable social groups, such as women, children, the elderly, the poor, and ethnic minorities. (JICA Guidelines p29) | There is no significant difference. | - |

| Items | Vietnamese Regulations | JICA Guidelines | Gaps | Measure to Differences |
|---|---|---|---|---|
| 3. Assistance for restoration and improvement of living standard | a) Support for life and production stabilization, job-change training and job creation are provided in case of agriculture land acquisition (Decree 69/2009, Art.17).<br>b) PPC shall decide other supports to persons whose land will be acquired based on the local custom (Decree 69/2009, Art. 23). | Host countries must make efforts to enable people affected by projects and to improve their standard of living, income opportunities, and production levels or at least restore these to pre-project level. (JICA Guidelines p30) | There is no significant difference. | - |
| 4. Compensation based on full replacement cost | a) When land price for compensation stipulated in a provincial decision is not close to the market price, a PPC shall re-examine appropriate land price (Decree No. 69/2009 Art. 11).<br>b)Compensation for land is basically provided by substitute land with same land use. In case substitute land is not available, compensation equal to the value of land use rights calculated based on land prices at the time of land recovery decision will be paid (Decree No. 69/2009, Art.14). | Prior compensation, at full replacement cost, must be provided as much as possible. (JICA Guidelines p30) | There is a possibility of gap even though land price is re-examined by referring to the latest market price. | Market price survey is necessary to be conducted in order to evaluate the market price of land and structure in the project area for appropriate compensation estimation. Market price survey shall be conducted by referring to the Vietnamese regulation and the policy of the donor agency. |
| 5. Public participation into planning and implementation of resettlement plan | There is no clear description about public participation into planning and implementation of resettlement plan. However, it is stipulated to ask public opinion to the prepared resettlement plan at each stage (Decree 69/2009, Section 4). | Appropriate participation by the people affected and their communities must be promoted in planning, implementation and monitoring of involuntary resettlement plans and measures against the loss of their means of livelihood. (JICA Guidelines p30) | Although approach of public participation is different, public participation is ensured. | Public consultation meeting by targeting all PAPs in order to have opinion from PAPs on land acquisition and compensation is necessary to be held in the process of RAP preparation. |
| 6. Grievance redress mechanism | The following procedure is applied (Decree No. 84/2007/ND-CP, Art.163)[5]<br>a)In case land acquisition decision is issued by DPC, grievance can be raised to DPC within 90 days after decision issued and shall be settled within 45 days after lodging grievance. If lodged grievance is not solved within 45 days, it can be appealed to PPC or the court.<br>b)In case land acquisition decision is issued by PPC, grievance shall be | Appropriate and accessible grievance mechanisms must be established for the affected people and their communities. (JICA Guidelines p30) | There is no significant gap. | For more convenient access to PAPs, first contact/venue to lodge grievance shall be with the commune people's committee. |

[5] In case that provincial People's Committee issues land acquisition

| Items | Vietnamese Regulations | JICA Guidelines | Gaps | Measure to Differences |
|---|---|---|---|---|
| | lodged to PPC within 30 days of decision issued, and the lodged grievance shall be settled within the due duration. | | | |
| 7. Monitoring | Monitoring is not clearly requested. | Appropriate follow-up plans and systems, such as monitoring plans and environmental management plans, must be prepared; and costs of implementing such plans and systems, and financial methods to fund such costs, must be determined. (JICA Guidelines, p13 - 14) | Establishment of clear monitoring system is different. | Establishing practical monitoring system is necessary. |
| 8. Contents of RAP[6] | - Name and address of affected people<br>- Area and category of acquired land<br>- Justification of compensation calculation<br>- Compensation amount<br>- Resettlement<br>- Necessary arrangement for resettlement<br>- Resettlement implementation | - Project description<br>- Potential impacts<br>- Objectives<br>- Socioeconomic studies<br>- Legal framework<br>- Institutional framework<br>- Eligibility<br>- Valuation of and compensation for losses<br>- Resettlement measures<br>- Site selection, site preparation, and relocation<br>- Housing, infrastructure, and social services<br>- Environmental protection and management<br>- Community participation<br>- Integration with host populations<br>- Grievance procedures<br>- Organizational responsibilities<br>- Implementation schedule<br>- Cost and budget<br>- Monitoring and evaluation | Significant differences are the description of:<br>a)compensation policy;<br>b)grievance procedures;<br>c)monitoring system; and<br>d)socioeconomic study. | Preparation of RAP to satisfy donor requirements is necessary. |

Source: JICA Study Team

### 2) General Principles

7.19 Based on the identified differences between Vietnamese regulations and JICA Guidelines, as a representative donor policy, shown in Table 7.5.1, the following principles are proposed by JICA Study Team as the basis for land acquisition and compensation in the projects to supplement items which are not mandatory in Vietnamese legislation on land acquisition:

(a) Land and property acquisition shall be avoided or minimized, as much as possible, by examining all possible alternatives from engineering as well as environmental and social viewpoints.

(b) PAPs shall be meaningfully consulted in appropriate timing in order to reflect their

[6] Decree No. 69/2009 for the Vietnamese regulation and World Bank Safeguard Policy OP4.12 Annex A for JICA Guidelines are referred.

opinions and preferences on resettlement plans and options, whereby their participation for planning and implementing of resettlement plan shall be promoted.

(c) Compensation shall be provided in a timely manner based on the agreement with PAPs, and will be completed before the date of evacuation.

(d) Compensation on loss of assets shall be provided with replacement cost in order to compensate for their livelihoods, standards of living, or income opportunities, or at least to restore them to their pre-project levels.

(e) All PAPs living, working, doing business in the projects area at the time of the census will be entitled to compensation and/or assistance.

(f) All PAPs will be eligible for compensation and rehabilitation assistance, irrespective of tenure status.

(g) Necessary institutional arrangement shall be ensured for preparation and implementation of resettlement in a timely manner.

(h) Adequate financial arrangement shall be ensured and enforced within the time frame to cover the cost of land acquisition, resettlement, and rehabilitation.

(i) Appropriate mechanisms for monitoring, reporting, and evaluation shall be developed and ensured within the resettlement management system.

(j) Appropriate mechanism for grievance redress shall be established.

### 3) Eligibility for Compensation and/or Assistance

7.20 People who are living or whose assets are locating in the projects area[7] at the time of the cut-off date[8] are eligible for compensation and/or assistance to their loss to be caused by the project implementation. However, those who arrive after the cut-off date are not entitled. Based on the definition of cut-off date by the World Bank, cut-off date for the projects is proposed to be set at: i) the day of provincial decisions on land acquisition is officially publicized, or ii) the first day of census if it is conducted prior to announcement of land acquisition decisions by PPC. Identified PAPs are basically classified into categories according to the World Bank Safeguard Policy, OP4.12 for Involuntary Resettlement, and are entitled compensation and/or assistance based on the legal status. The same categorization for eligibility are also applied for these projects:

(i) Those who have formal legal rights to land (including customary and traditional rights recognized under the laws of the country);

(ii) Those who do not have formal legal rights to land at the time census begins, but have a claim to such land or assets, provided that such claims are recognized under the law of the country (i.e., Decree No. 197/2004/ND-CP, Decree No. 181/2004/ND-CP, Decree No. 84/2007/ND-CP and Decree No. 69/2009/ND-CP in the case of these projects) or become recognized through a process identified in RAP; and

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

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7 Project area is the target area of land acquisition. Target area of land acquisition in the project is composed of ROW and protection scope as shown in Table 7.4.1.

8 According to the definition in the Involuntary Resettlement Sourcebook (World Bank, 2004), "cut-off date is the date of census begins. The cut-off date could also be the date the project area was delineated, prior to the census, provided that there has been an affected public dissemination of information on the area delineated, and systematic and continuous dissemination subsequent to the delineation to prevent further population influx". In the case of projects in Vietnam, cut-off date is also defined as the date when a local authority such as PPC or DPC officially announces land acquisition by a decision.

## 7.6 Procedure of Compensation at Full Replacement Cost

7.21 In the case of compensation at full replacement cost, studies in Table 7.6.1 which are not requested in the Vietnamese legal framework, are necessary to be conducted in the process of RAP preparation.

**Table 7.6.1 Necessary Study Items and Contents for Compensation at Full Replacement Cost**

| | Study Item | Purpose | Contents | Study Target | Implementing Timing |
|---|---|---|---|---|---|
| 1 | Census | • Confirmation of number of PAPs | • Confirmation of name of PAPs<br>• Confirmation of family size of each PAPs<br>• Confirmation of main income source<br>• Confirmation of perception on rehabilitation program | All PAPs | After projects approval and delineating the projects area |
| 2 | Inventory of Loss | • Confirmation of affected land and structures in the projects area | • Confirmation of affected land/property of each PAPs<br>• Confirmation of affected community land/property loss | All PAPs | After projects approval and delineating the projects area |
| 3 | Socio-Economic Survey | • Confirmation of socio-economic condition of PAPs | • Confirmation of properties<br>• Confirmation of household income | 25% of PAPs | After projects approval and delineating the projects area |
| 4 | Replacement Cost Survey | • Confirmation of the latest market price of land and structure in the projects area | • Confirming the latest official rate at provinces<br>• Confirming the market price in the projects area based on the evaluation methods defined by TDGVN of MOF | All district and/or communes in the projects area | After projects approval and delineating the projects area |
| 5 | Preparation of RAP | • Preparing appropriate land acquisition and resettlement plan by enhancing participation of PAPs | • Land acquisition impacts based on the results of survey at 1 to 4 above<br>• Eligibility and entitlement<br>• Grievance redress mechanism<br>• Institutional framework<br>• Implementation schedule and budget[9] | PAPs | After projects approval and delineating the projects area |
| 6 | Public Consultation Meetings | • Disclosing projects information including potential impacts<br>• Explaining compensation policy and entitlement | • Projects description<br>• Potential impacts<br>• Compensation policy<br>• Grievance redress mechanism | PAPs, Local Authorities | At the time of Draft RAP |

Source: JICA Study Team

7.22 There are several financial aid schemes with different procedures in a donor agency. Among them, procedure of compensation at full replacement cost is prepared on the premise that RAP is prepared at the time of the loan agreement between a donor agency and the Government of Vietnam.

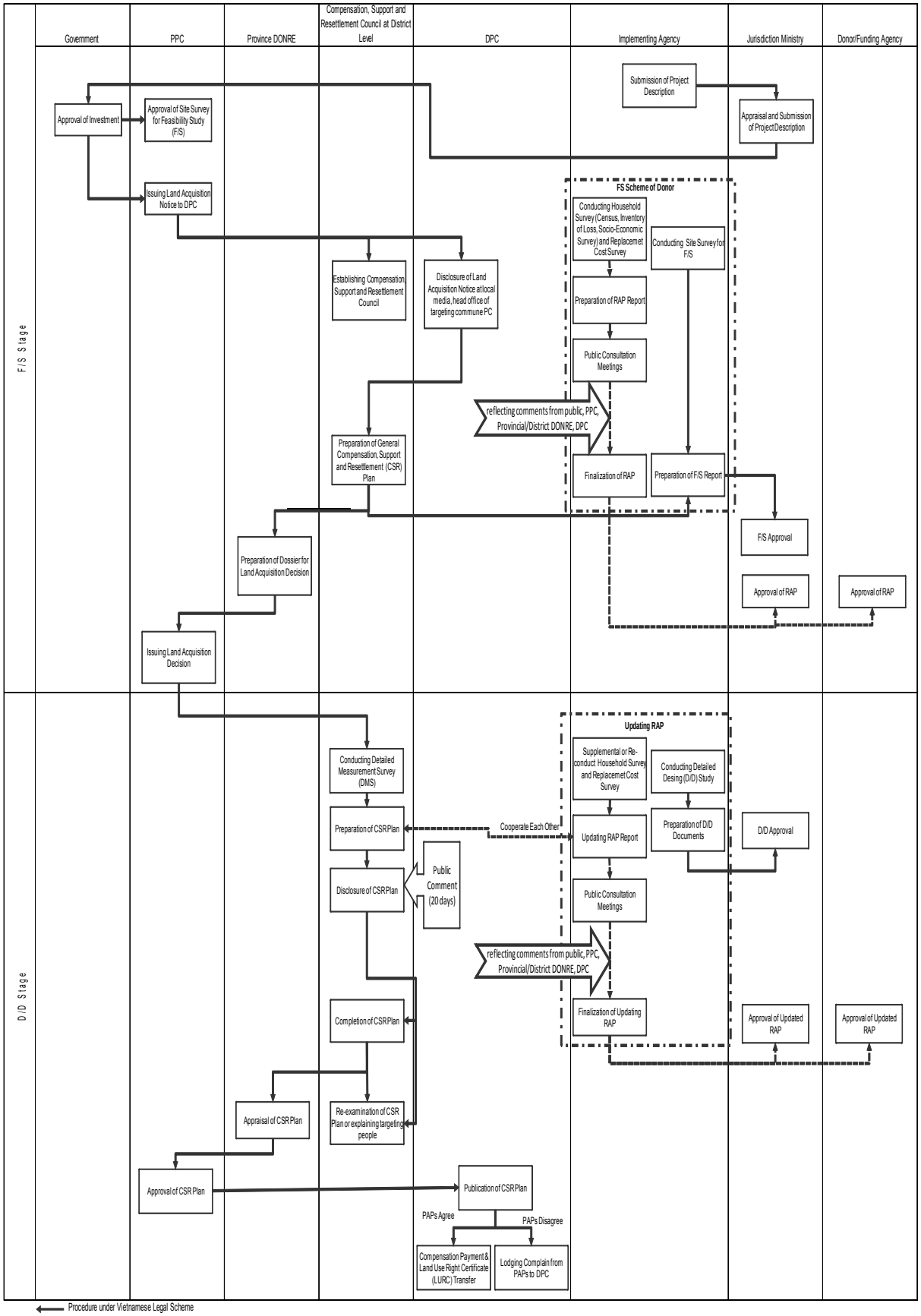
[9] Contents to be covered in RAP shall be in accordance with Annex A of OP 4.12 for Involuntary Resettlement

7.23 Procedure of compensation at full replacement cost in the Vietnamese legal framework is shown in Figure 7.6.1. General procedure is same as the flow shown in Figure 7.3.1, and additional works are necessary to be done by a project implementing agency.

7.24 The official land acquisition procedure begins when a land acquisition notice is issued. In parallel with an official land acquisition procedure, an implementing agency conducts household survey (i.e., census, inventory of loss and socio-economic survey) at field and replacement cost survey at the time of F/S. RAP is prepared based on these survey results and public consultation meetings are organized to explain the overall RAP to the PAPs and concerned local authorities. The RAP is finalized by reflecting comments at consultation meetings and is approved by a donor agency and a jurisdiction ministry. When D/D starts, an implementing agency updates the RAP which is prepared at the time of F/S, if there is modification of the engineering design. In the process of RAP updating, supplemental household survey to the modified parts is necessary if modified parts are small and time lag between F/S and D/D is short (i.e., less than 2 years)[10]. However, if design modification is significant and/or time lag between F/S and D/D is more than 2 years, re-conducting household survey is necessary to obtain fresh information. As for the methodology of supplemental or re-conducting household interview survey, the scheme of DMS to be conducted by the compensation, support and resettlement council is utilized (see Section 7.3). The project implementing agency has the responsibility to collect necessary information to update the RAP, which is not requested under Vietnamese regulations. Through a series process, the finalized updated RAP is approved by the donor agency and the jurisdiction ministry.

7.25 Land acquisition decisions are issued by PPC at the time of D/D stage, and CSR plan containing land acquisition area, compensation amount, resettlement arrangement, relocation of graves, etc stipulated in the Decree No. 69/2009/ND-CP is prepared by the Compensation, Support and Resettlement Council based on the result of DMS. CSR plan is disclosed at a public hearing, and is finalized by reflecting public comments. The final CSR plan is approved by PPC, which is disclosed to the public, and its outline informed to the PAPs in an official letter. If the PAPs agree with the contents of the CSR plan, LURC is transferred. In the case where PAPs disagree, complaints are to be filed with the DPC.

[10] The World Bank Involuntary Resettlement Sourcebook (World Bank, 2004) says “If acquisition of land does not occur for at least 2 years after gathering of baseline date, the date can usually be updated.” From this description, it is considered that gathered census data is valid for 2 years.




Source: JICA Study Team based on Decree No. 69/2009/ND-CP and Previous Donor Funding Projects

**Figure 7.6.1 Land Acquisition Procedure in Replacement Cost Compensation**

## 7.7 Policy/Measures for Improvement or Rehabilitation of Livelihood of PAPs at Pre-Project Level

7.26 An appropriate policy or framework to rehabilitate livelihood of PAPs who might be adversely impacted shall be examined carefully as a part of compensation/assistance. In the case of a state budget project, a job training and job change plan is prepared in addition to CSR plan for PAPs who lose agriculture land. As for a donor agency funding project, an income restoration plan is presented in the RAP. The purpose of each plan is for improving or stabilizing PAP's livelihood after land acquisition though a plan of state budge project is limited only to those who lose agriculture land.

7.27 In general, an income restoration plan is able to be prepared by confirming demands and characteristics of PAPs through the socio-economic or prospect studies to be conducted at the next project stage. Such approach may also be applied for a job training and job change plan. Then, general principles for preparing an income restoration plan and a job training and job change plan are proposed as follows:

(a) Improvement or rehabilitation of livelihood shall be at least secured by providing appropriate compensation such as land for land or cash in replacement cost as per the compensation policy;

(b) Vocational training in the national or provincial educational scheme shall be provided as per the request of PAPs;

(c) Employment opportunities related to the projects shall be preferentially provided to PAPs according to their capability;

(d) Employment opportunities at the existing or newly planned industrial area near the projects area shall be enhanced through support from provincial or district people's committees in case income source will be lost;

(e) Technical advice and financial support for establishing small or middle scale business scheme shall be provided;

(f) Technical advice and financial support for systemtic/effective agricultural management shall be provided; and

(g) Technical advice and financial support for increasing productivity in the remaining land.

## 7.8 Responsibility of Relevant Authorities and Procedure of Grievance Redress

### 1) Institutional Arrangement

7.28 Overall responsibility of land acquisition and resettlement activity is on DPC or PPC though land acquisition and resettlement involve several levels of entities. In addition to these authorities, a council, as a practical resettlement implementing entity, is established at the concerned district. This is initiated by DPC in cooperation with a project implementing agency, according to Decree No. 197/2004/ND-CP and Decree No. 69/2009/ND-CP. Table 7.8.1 summarizes responsibilities of each entity on land acquisition and resettlement.

**Table 7.8.1 Responsibility of Each Entity on Land Acquisition and Resettlement**

| | Entity | Responsibility |
|---|---|---|
| 1 | Project Implementing Agency | [General]<br>• Overall responsibility for implementing the projects as the project executing agency<br>• Employer's responsibility such as approval of detailed design, procurement activities, procedure of loan agreement with the donor agency<br>• Coordinate with relevant agencies, local authorities and the donor agency<br>[Land Acquisition]<br>• Prepare RAP by conducing household survey (i.e., census, inventory of loss and socio-economic survey) and replacement cost survey according to donor requirements<br>• Coordinate with relevant agencies and local authorities for implementing rehabilitation program<br>• Prepare necessary amount of budget for compensation<br>• Supervise land acquisition progress through internal and independent monitoring<br>• Prepare land acquisition progress report quarterly and submit to relevant authorities and the donor agency<br>• Implement further measures, if required<br>• Prepare relocation site |
| 2 | Jurisdiction Ministry | • Supervise the project as the jurisdiction ministry |
| 3 | City/Provincial People's Committee | [General]<br>• Overall responsibility for implementing the project including land acquisition<br>[Land Acquisition]<br>• Issue the land acquisition decision<br>• Approve CSR Plan under Vietnamese regulation<br>• Evaluate and approve compensation amount<br>• Settle raised grievances within defined duration<br>• Support to prepare relocation site |
| 4 | District People's Committee | [Land Acquisition]<br>• Establish Compensation, Support and Resettlement Council<br>• Supervise the activities of Compensation, Support and Resettlement Council<br>• Instruct and supervise relevant departments in a district to prepare necessary documents for transferring land ownership and moving to new relocation sites<br>• Payment of compensation amount<br>• Support to prepare relocation site<br>• Settle raised grievances within defined duration at the district level |
| 5 | District Compensation, Support and Resettlement Council | [Land Acquisition]<br>• Conduct DMS and prepare compensation, support and |

| | Entity | Responsibility |
|---|---|---|
| | | resettlement plan<br>• Disclose compensation, support and resettlement plan at designated places<br>• Implement the approved compensation, support and resettlement plan or RAP<br>• Payment of compensation and assistance amount |
| 6 | Commune People's Committee | [Land Acquisition]<br>• Prepare and implement compensation, support and resettlement plan or RAP at daily basis<br>• Organize a team to support the compensation, support and resettlement council |
| 7 | Project Supervision Consultant including International Consultant for Resettlement and Domestic Consultant for Resettlement | [Land Acquisition]<br>• Support the project implementing agency and local authorities (PPC, DPC and District Compensation Support and Resettlement Council) to prepare RAP and implement land acquisition<br>• Evaluate capability of the project implementing agency concerning land acquisition and compensation under a donor policy and provide necessary trainings |
| 8 | Independent Monitoring Institution | • Conduct regular monitoring through interviewing relevant authorities, and PAPs, and reviewing relevant documents such as monitoring progress report to be submitted by DPC to the implementing agency regularly<br>• Examine further measures, if necessary |

Source: JICA Study Team

### 2) Grievance Redress

7.29 All PAPs are able to enjoy their right to complain and express their grievances about the result of land acquisition and resettlement (including compensation, if it is not agreeable). In addition, it is also important that the grievance redress mechanism covers the entire procedure of land acquisition and resettlement including compensation payment. Decree No. 84/2007/ND-CP ensures that PAPs are given grievance rights as follows:

(i) PAPs who have any objections to the decision of land acquisition issued by DPC can raise their grievance to DPC within 90 days after the district decision of land acquisition is issued.

(ii) Raised grievance is settled within a time stipulated in the Law of Complaints and Denunciation (No. 09/1998/QH10 of December 2, 1998). The solution is disclosed as well as informed to a person who raised the grievance in writing.

(iii) In case the grievance is not settled within 45 day, it is handed over to PPC or to the court.

(iv) A solution is informed to a person who raised the grievance in writing, if a grievance is handled by PPC.

(v) PAPs who have any objections to the decision of land acquisition issued by PPC can raise their grievance to PPC within 30 days after the provincial decision of land acquisition is issued.

(vi) Raised grievance is settled within a time stipulated in the Law of Complaints and Denunciation. The solution is disclosed as well as informed to a person who raised the grievance in writing.

(vii) A grievance is handed over to the court in case it is not settled within 45days after issuing the provincial decision.

7.30 In order to secure the accessibility of the grievance redress procedure for PAPs, contacting the nearest local authority is considered to be practical rather than lodging to DPC or PPC. Thus, it is proposed that Commune People's Committee (CPC) is the contact window throughout the projects implementation. Although CPC does not have the mandate as a contact window of grievance under the Vietnamese legal framework, Commune People's Committee is expected to convey the lodged complaints to the DPC or the PPC, in addition to the stipulated procedure.

## 7.9 Provisional Implementation Schedule

7.31 The projects are planned to implement the Ngoc Hoi–Phu Ly section in the north section or Thu Thiem – Long Thain section in the south section as the initial sections. Then, Phu Ly–Vinh and Long Thain - Nha Trang sections are developed as the prioritized sections.

7.32 Premises of implemeting schedule at each section are explained below.

(i) All sections are implemented as donor agency funding projects.

(ii) RAP is prepared before D/D and the prepared RAP is updated during D/D, if necessary. However, if RAP or equivalent to RAP is not prepared in the previous stage of D/D, RAP is newly prepared in D/D. Since study items and procedure are common for RAP and updating prepared RAP, necessary duration for both studies is regarded as same.

(iii) Consturction starts from the part in a section where land acquisition is complete (i.e., land acquisition is started part by part rather than implementing all parts in one time).

(iv) The initial section at the north and south section is implemented at the same schedule in the same project period. The remaining section in the north and south setion is also be implmented in the same scheule in the sample project period.

7.33 Land acquisition schedule which is common for all sections (i.e., not only for the initial section but also the remaining section in the north and south section) is explained in the following procedure. Table 7.9.1 shows a provisional schedule of land acquisition in the case of a donor-funded project, and is commonly usable for the north and south sections. However, it should be reminded that necessary period for the household survey such as census, inventory of loss, socio-economic surve, replacement cost survey is depending on the length of a target section to be acquired and local conditions.

(i) F/S is commenced when the projects is approved by the Government of Vietnam. When ROW is almost delineated at F/S level, household survey (i.e., census, inventory of loss and socio-economic survey) is started by the project implementing agency in a process to prepare RAP.

(ii) Each section at the initial sections encompasses more than two provinces, and therefore, it is preferable to arrange separate household survey team at each province since conducting household survey will need permissions from local authorties.

(iii) In parallel with the household survey, a replacement cost survey is also necessary to be conducted by authorized valuators according to national regulations such as TDGVNs issued by Ministry of Finance and also according to the Involuntary Resettlement Sourcebook of the World Bank, 2004. This is to collect necessary information for estimating compensation cost in replacement cost.

(iv) Collected survey data is used for establishing compensation policy and estimating compensation cost, which is compiled in the RAP. The framework of RAP is disclosed to PAPs through public consultation meeting. The RAP is then finalized by reflecting public comments. Final RAP needs to be approved by the concerned Vietnamese authorities and by the donor agency.

(v) The RAP prepared at the time of F/S is updated in the same timing of official land acquisition procedure during D/D phase.

(vi) Household survey and replacment cost survey are implemented in collaboration with DMS when land acquisition decision is issued, if profile of PAPs is necessary to be renewed or project design is changed.

(vii) When compensation assessment is to be dislosed, the holding of a public consultation meeting is necessary in order to explain the updated RAP.

(viii) Internal and independent monitoring is started when an official procedure of land acquisition is commenced. As for internal monitoring, it is finished when land acquisition is completed. In terms of independent monitoring, it is continued even after land acquisition is complete in order to monitor livelihood stabilization of PAPs.

**Table 7.9.1 Provisional Schedule of Land Acquisition**

| | | Responsibility | Year 1 | | | | Year 2 | | | | Year 3 | | | | Year 4 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1st | 2nd | 3rd | 4th | 1st | 2nd | 3rd | 4th | 1st | 2nd | 3rd | 4th | 1st | 2nd | 3rd | 4th |
| | **<Project Implementation>** | | | | | | | | | | | | | | | | | |
| 1 | Project Approval | | | | | | | | | | | | | | | | | |
| 2 | Feasibility Study | | | | | | | | | | | | | | | | | |
| 3 | Detailed Design | | | | | | | | | | | | | | | | | |
| 4 | Construction Work | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | **<Land Acquisition & Resettlement>** | | | | | | | | | | | | | | | | | |
| **1** | **Preparation of RAP** | | | | | | | | | | | | | | | | | |
| 1-1 | Census | Project Implementing Agency | | | | | | | | | | | | | | | | |
| 1-2 | Inventory of Loss | Project Implementing Agency | | | | | | | | | | | | | | | | |
| 1-3 | Socio-Economic Survey | Project Implementing Agency | | | | | | | | | | | | | | | | |
| 1-4 | Replacement Cost Survey | Project Implementing Agency | | | | | | | | | | | | | | | | |
| 1-5 | Data Analysis and Report Preparation | Project Implementing Agency | | | | | | | | | | | | | | | | |
| 1-6 | Public Consultation Meeting | Project Implementing Agency | | | | | | | | | | | | | | | | |
| 1-7 | Finalize RAP | Project Implementing Agency | | | | | | | | | | | | | | | | |
| **2** | **Update of RAP** | | | | | | | | | | | | | | | | | |
| 2-1 | Supplemental/Re-Conduct Household Survey | Project Implementing Agency | | | | | | | | | | | | | | | | |
| 2-4 | Supplemental/Re-Conduct Replacement Cost Survey | Project Implementing Agency | | | | | | | | | | | | | | | | |
| 2-5 | Update RAP Report | Project Implementing Agency | | | | | | | | | | | | | | | | |
| 2-6 | Public Consultation Meeting | Project Implementing Agency | | | | | | | | | | | | | | | | |
| 2-7 | Finalize Updated RAP | Project Implementing Agency | | | | | | | | | | | | | | | | |
| **3** | **Offical Procedure under Vietnamese Regulation (Update RAP)** | | | | | | | | | | | | | | | | | |
| 3-1 | Issuing a Land Acquisition Decision (cut-off date) | Provincial People's Committee | | | | | | | | | | | | | | | | |
| 3-2 | Conducting DMS | District People's Committee | | | | | | | | | | | | | | | | |
| 3-3 | Assessment of Compensation | District People's Committee | | | | | | | | | | | | | | | | |
| 3-4 | Prepare CSR Plan | District People's Committee | | | | | | | | | | | | | | | | |
| 3-5 | Disclosure of CSR Plan | District People's Committee | | | | | | | | | | | | | | | | |
| 3-6 | Compensation Payment | District People's Committee | | | | | | | | | | | | | | | | |
| **4** | **Transferring Ownership & Evacuation** | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | **<Monitoring>** | | | | | | | | | | | | | | | | | |
| | Internal Monitoring | Project Implementing Agency | | | | | | | | | | | | | | | | |
| | Independent Monitoring | Project Implementing Agency | | | | | | | | | | | | | | | | |

Note: Necessary period for the household survey such as census, inventory of loss, socio-economic survey, replacement cost survey is depending on the length of the target section to be acquired and local conditions.

Source: JICA Study Team

## 7.10 Budget

7.34 Based on the preliminary assessment on land acquisition and resettlement, compensation cost for land acquisition and resettlement was estimated with the following conditions:

(i) Compensation and assistance cost was estimated at full replacement cost as a requirement by a donor agency funding project.

(ii) Compenation for land targeted only private use land (i.e., agriculture land, residential land, commercial land and vacant land). In this study, land use categories such as forest land (i.e., protection forest and production forest), public land, national defense security land, religious land on land use map data from cit/province were regarded as public land, and compensation for these land categories was not included.

(iii) Compensation for structures and assistance for households locating or living both of private and public land use were considerd since a donor policy requested to provide necessary compensation/assitance to structures despite of tenure status.

(iv) Compensation for trees and crops were considered despite of private or public land use since an asset was necessary to be compensated according to a donor policy.

(v) Market price of typical land use in the projects area (i.e., agriculture land, residential land and forest land) at the time of July 2012 was collected from a real estate source at each district in the projects area. Collected data of market price is enclosed in Appendix 7A.

(vi) Market price was collected from three areas at each land use, and the average amount was used as the unit cost for compensation and assistance calculation.

(vii) Administration cost and contingency were set as 5% and 10% of the total cost of compensation/assistance, respectively, based on the examples of donor agency funding projects in the transportation sector.

(viii) Cost for arrangement of relocation site was not included. All necessary compensation was premised to be provided in replacement cost (i.e., not providing land for land).

(ix) Necessary cost for reloction of public utilities was not included since examining impact to public utilities is difficult at this study level. Examination of such impact and cost is necessary in the course of RAP preparation.

(x) Necessary compensation cost for domestic animal was not included since examining such impact from available data (i.e., city/provincial land use data or statistical data) was difficult. Such impact is necessary to be studied through household survey (i.e., census, inventory of loss and socio-economic survey) in the process of RAP preparation, and necessary compensation/assistance cost shall be examined if impact is identified.

7.35 Compensation cost for the north and south sections was estimated at provincial and section levels as summarized in Table 7.10.1 to Table 7.10.4. Breakdown of each compensation cost is enclosed in Appendix 7B. From the collected provincial official rate and unit price of compensation cost estimated at other projects conducted in same provinces, it was found that unit price of agriculture and residential land in the north section was higher than the south. Since the provincial official rate was set based on the market price, the tendency of unit price difference between the north and south section

was also found in the collected market price of this study. It is considered that difference of unit price might bring difference of compensation cost between the north and the south though total length and construction contents at each section is different.

**Table 7.10.1 Preliminary Estimation of Compensation Cost by Province in the North Section**

(Unit: million VND)

| No | Province | Total (VND) |
|---|---|---|
| 1 | Hanoi | 2,053,683 |
| 2 | Ha Nam | 1,377,721 |
| 3 | Nam Dinh | 1,443,264 |
| 4 | Nin Binh | 856,018 |
| 5 | Thanh Hoa | 9,138,512 |
| 6 | Nghe An | 6,553,626 |
| Total for North Section | | 21,422,824 |

Note: Cost for RAP preparation, independent monitoring, administration (5% of total cost) and contingency (10% of total cost) is included at total cost in each province.

Source: JICA Study Team

**Table 7.10.2 Preliminary Estimation of Compensation Cost by Section in the North Section**

(Unit: million VND)

| No | KM Post | Total (VND) |
|---|---|---|
| 1 | Ngoc Hoi Station | 131,181 |
| 2 | Km 0.308 – 45.215 | 2,670,278 |
| 3 | Phu Ly Station | 10,649 |
| 4 | Km 45.865 – 67.339 | 861,989 |
| 5 | Nam Dinh Station | 35,355 |
| 6 | Km 67.989 – 103.056 | 1,658,363 |
| 7 | Ninh Binh Station | 27,192 |
| 8 | Km 103.706 – 153.326 | 6,124,306 |
| 9 | Thanh Hoa Station | 152,227 |
| 10 | Km 154.326 – 282.970 | 6,318,603 |
| 11 | Vinh Station | 3,432,681 |
| Total for North Section | | 21,422,824 |

Note: Cost for RAP preparation, independent monitoring, administration (5% of total cost) and contingency (10% of total cost) is included at total cost in each section.

Source: JICA Study Team

**Table 7.10.3 Preliminary Estimation of Compensation Cost by Province in the South Section**

(Unit: million VND)

| No | Province | Total (VND) |
|---|---|---|
| 1 | HCMC | 5,664,363 |
| 2 | Dong Nai | 806,855 |
| 3 | Binh Thuan | 2,461,435 |
| 4 | Ninh Thuan | 719,592 |

| | | |
|---|---|---|
| 5 | Khan Hoa | 4,738,381 |
| Total for South Section | | 14,390,626 |

Note: Cost for RAP preparation, independent monitoring, administration (5% of total cost) and contingency (10% of total cost) is included at total cost in each province.

Source: JICA Study Team

**Table 7.10.4 Preliminary Estimation of Compensation Cost by Section in the South Section**

(Unit: million VND)

| No | KM Post | Total (VND) |
|---|---|---|
| 1 | Thu Thiem Station | 3,192,214 |
| 2 | Km 0.250 – 35.8 | 2,683,538 |
| 3 | Long Thanh Station | 2,574 |
| 4 | Km 36.3 - 152.95 | 1,213,701 |
| 5 | Phan Thiet Station | 87,095 |
| 6 | Km 153.45 – 220.20 | 1,304,402 |
| 7 | Tuy Phong Station | 32,014 |
| 8 | Km 220.70 – 283.35 | 797,495 |
| 9 | Thap Cham Station | 41,067 |
| 10 | Km 283.85 – 361.85 | 4,049,819 |
| 11 | Nha Trang Station | 986,707 |
| Total for South Section | | 14,390,626 |

Note: Cost for RAP preparation, independent monitoring, administration (5% of total cost) and contingency (10% of total cost) is included at total cost in each section.

Source: JICA Study Team

## 7.11 Monitoring System by a Project Proponent and Independent Parties

7.36 Monitoring is done during and after land acquisition and resettlement to confirm whether land acquisition as well as resettlement is properly implemented and completed according to a prepared RAP with the following objectives:

(i) verification of proposed activities in RAP;

(ii) evaluation of implementation situation and the effectiveness of the mitigation measures proposed; and

(iii) confirmation of any unforeseeable situation at the time of preparation of RAP.

7.37 Monitoring is proposed to be done by an implementing agency as internal monitoring and independent monitoring organization hired by an implementing agency.

### 1) Internal Monitoring

7.38 Internal monitoring is the activity that an implementing agency confirms the monthly progress of implementation of resettlement in accordance to the prepared plan from the available data to be provided by the commune/district people's committees.

#### (1) Monitoring Indicators

7.39 An implementing agency collects necessary information on the following indicators every month from concerned people's committees:

(i) Identification of entitlement about project affected people;

(ii) Implementation of compensation payment in various categories and resettlement in a timely manner;

(iii) Restoration or relocation of affected public facilities;

(iv) Following the procedures of compensation payment, information disclosure/public consultation and grievance proposed in RAP;

(v) Implementation of rehabilitation assistance to PAPs; and

(vi) Confirmation of completion of compensation payment and resettlement as well as commencement of civil works.

**(2) Monitoring Methodology**

7.40 An implementing agency collects information and data of resettlement progress and any concerned issues monthly from concerned people's committees. The collected information and data of resettlement progress and any concerned issues is compiled in the developed database system, and will also be reported to an implementing agency monthly. The proposed monitoring structure is shown in Figure 7.11.1.

### 2) Independent Monitoring

7.41 The general objective of independent monitoring is: (i) to provide an independent periodic review and assessment, (ii) to assess achievement of resettlement objectives, (iii) to assess changes in living standards and livelihoods, (iv) to assess restoration and/or improvement of economic and social base of the affected people, (v) to assess effectiveness and sustainability of entitlement, (vi) to identify the need for further mitigation measures, and (vii) to identify strategic lessons for future policy formulation and planning. Independent monitoring is conducted quarterly from the commencement of the official procedure of land acquisition until six months after completion of property ownership transferring. Monitoring result will be reported to the implementing agency.

**(1) Monitoring Indicators**

7.42 The main indicators of independent monitoring are enumerated below.

(i) Reviewing of existing baseline data obtained through site investigation and population census;

(ii) Assessment of effectiveness, impact and sustainability of entitlement;

(iii) Assessment of appropriateness of compensation amount;

(iv) Assessment of discrepancy among donor polices, RAP and actual implementation;

(v) Assessment of further mitigation measurements and recommendation for improvement of resettlement;

(vi) Monitoring and assessment of grievance redress mechanism;

(vii) Assessment of livelihood restoration;

(viii) Assessment of awareness of PAPs on compensation policy; and

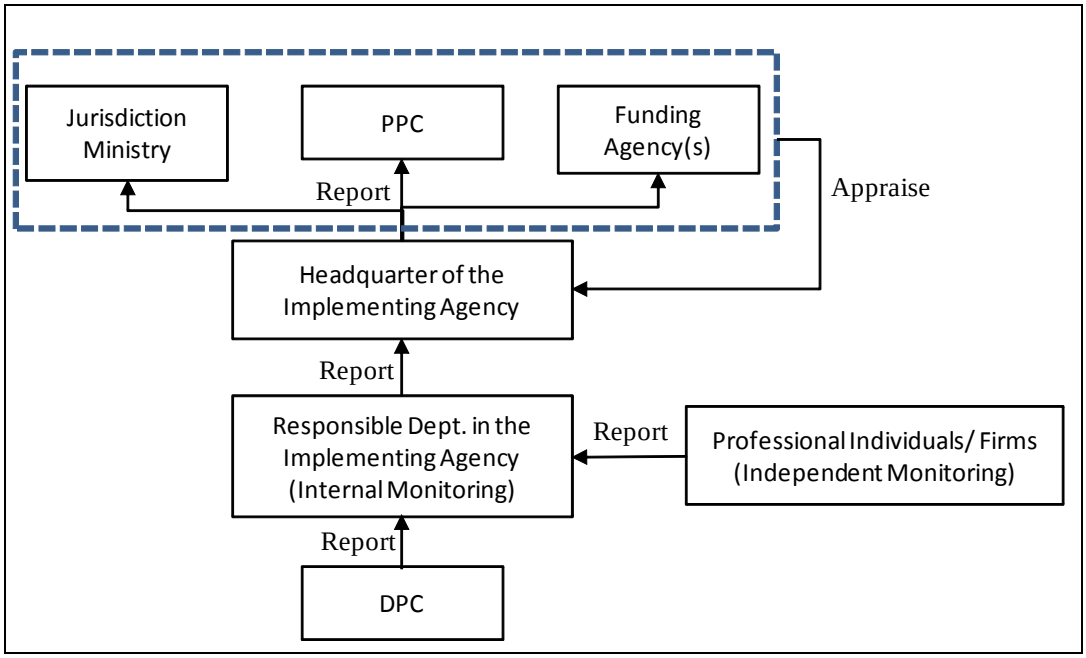
(ix) Confirmation of appropriateness about temporal land acquisition and compensation conducted by a contractor.

**(2) Monitoring Methodology**

7.43 An implementing agency hires professional personnel or firms as a third party to conduct an independent monitoring. The monitoring is conducted through review of the collected information and data such as internal monitoring report, direct interviews to PAPs at field survey, and meeting with several concerned ministries and local offices.

### 3) Monitoring Structure

7.44 Internal and independent monitoring results is compiled by a responsible department in an implementing agency. The compiled report of monitoring result is submitted to a headquarter of an implementing agency. The monitoring report is submitted quarterly from a headquarter of an implementing agency to a jurisdiction ministry, PPC and a donor agency for their appraisal. The overall monitoring structure is shown in Figure 7.11.1.




Source: JICA Study Team

**Figure 7.11.1 Monitoring Structure**

## 7.12 Strategies to Enhance Public Participation in the Preparation of RAP

7.45 Successful land acquisition may be achieved through the supportive attitude of PAPs. Thus, public participation in the process of RAP preparation is indispensable since the RAP is prepared for implementing an appropriate compensation and restoration program not to degrade the living standards of PAPs but to avoid hardship caused by land acquisition. In terms of a donor policy on land acquisition and compensation, an implementing agency is requested to conduct meaningful consultations and to provide opportunities for PAPs and relevant parties to participate in planning and implementing a resettlement program.

7.46 As is often the case with development projects, land acquisition is implemented unilaterally without enough consultations with PAPs. As for the cases in Vietnam, however, asking public for their comments is mandatory through disclosing the CSR plan or organizing meetings among project executing agencies, relevant local authorities and PAPs.

7.47 Although the Vietnamese regulations secure public participation, it is realized at the later part of project formulation. Therefore, in addition to information disclosure stipulated in the Vietnamese regulations, enhancement of public participation from the early stage of project formulation is necessary. Since it is presumed that public consultations, which are not requested in relevant regulations, are difficult to be organized, utilizing opportunities in the relevant studies within a project shown below are proposed:

**(a) Collaboration with EIA Consultation Meetings:** Consultations with a wide range of stakeholders in the process of EIA are required in a donor policy. Consultations tend to be generally and practically organized at the beginning (i.e., scoping phase) and later parts of project formulation (i.e., draft EIA report preparation phase). Thus, it is propose that participation of potential PAPs be encouraged at the beginning of the consultations to explain the overall project as well as potential social impacts. In this manner, comments obtained in the meeting could be reflected in the RAP.

**(b) Utilizing Household Interview Survey:** Conducting household survey (i.e., census, inventory of loss and socio-economic survey) of all PAPs is necessary in the course of RAP preparation under donor policy. Participation or providing opinion during large scale meetings might be difficult for PAPs in some social categories. Such inconvenience for PAPs on providing their opinion on the project and land acquisition could be solved by organizing focus group discussion at each affected commune during the household survey.

## 7.13 Provisional Entitlement Matrix

7.48 The entitlement for compensation and assistance for the stabilization of livelihood is defined according to Vietnamese regulations in compliance with a donor policy. An entitlement of compensation/assistance is basically categorized based on the defined eligibility to the type of loss/impact. As for the projects, eligibility is proposed by JICA Study Team as shown in Section 7.5 considering JICA Guidelines as a representative donor policy and also considering projects in the transportation sector implemented in Vietnam so far. Table 7.13.1 provides the provisional entitlement matrix as a part of the RRPF for the potential loss/impact caused by project implementation.

**Table 7.13.1 Provisional Entitlement Matrix**

| Loss Type | Application | Entitled Person | Compensation Policy | Implementation Issues |
|---|---|---|---|---|
| 1. Loss of Productive Land | | | | |
| Permanent Marginal Loss | • Land on ROW<br>• Land is still economically viable for use or meets the expected personal yield | • Owners with LURC,<br>• Those who are in the process of acquiring LURC,<br>• Those who are eligible to acquire LURC,<br>• Those who are without LURC but regarded as customary owner regardless of tenure status | • Cash compensation for acquired land at full replacement cost, OR<br>• Land-for-land of similar attributes with secure tenure. | • Classification and measurement will be determined by District Compensation Committee (DCC) and concurred with by the affected household during DMS.<br>• Affected households to be notified at least 4 months prior to the date that the land will actually be acquired by the project |
| | | • People without LURC (i.e., squatters or encroachers) | • Cash compensation for structures or land improvement in a acquired land in full replacement cost | |
| Permanent Severe Loss | • Land on ROW<br>• Land is no longer viable for continued use or does not meet the expected personal yield, therefore the entire property to be acquired. | • Owners with LURC,<br>• Those who are in the process of acquiring LURC,<br>• Those who are eligible to acquire LURC<br>• Those who are without LURC but regarded as customary owner regardless of tenure status | • Cash compensation at replacement cost (free from transaction costs) for the entire land, or land-for-land of equivalent productive value and with secure tenure, OR<br>• Land-for-land of similar attributes with secure tenure, AND<br>• Entitled to take part in the income restoration program | • Classification and measurement will be determined by DCC and concurred with by the affected household during DMS.<br>• Affected households to be notified at least 4 months prior to the date that the land will actually be acquired by the project |
| | | • People without LURC (i.e., squatters or encroachers) | • Cash compensation for structures or land improvement in an acquired land in full replacement cost | |
| 2. Loss of Residential/Commercial Land | | | | |
| Permanent Marginal Loss | • Land on ROW<br>• Land is still viable for use and house not requiring relocation | • Owners with LURC,<br>• Those who are in the process of acquiring LURC,<br>• Those who are eligible to acquire LURC<br>• Those who are without LURC but regarded as customary owner regardless of tenure status | • Cash compensation at replacement cost (100% value- no deduction for depreciation or salvageable materials), OR<br>• Land-for-land of similar attributes with secure tenure. | • Classification and measurement will be determined by DCC and concurred with by the affected household during DMS |
| | | • People without LURC (i.e., squatters or encroachers) | • Cash compensation for structures or land improvement in an acquired land at full replacement cost | |
| Permanent Severe Loss | • No or insufficient remaining land for viable use | • Owners with LURC,<br>• Those who are in the process of acquiring LURC,<br>• Those who are eligible to acquire LURC | • Cash compensation at replacement cost (free from taxes and transaction costs) for the entire land, OR<br>• Land-for-land of similar attributes with secure tenure.<br>• In case of cash compensation, affected households have the option to (i) purchase a land plot in resettlement sites by paying land use levies but not to pay for infrastructure fees, OR (ii) receive resettlement allowance (equals to the infrastructure fees) if they do not | • Classification and measurement will be determined by DCC and concurred with by the affected household during DMS<br>• Affected household to be notified at least 6 months prior to the date that the land will actually be acquired by the projects |

| Loss Type | Application | Entitled Person | Compensation Policy | Implementation Issues |
|---|---|---|---|---|
| | | | want to move to resettlement sites. | |
| Permanent Marginal or Severe Loss | | Households living with relatives/friends on same land or were permitted to build houses by local officials on commune land.<br><br>(Note: assumption is that these households are landless. The type of assistance will be determined during DMS.) | • For marginal loss, for the portion to be acquired permanently no compensation for land but will be allowed to use remaining land.<br>• For severe loss, for landless households, assistance thru provision of land-for-land of similar attributes with secure tenure at no cost to landless households. The size of land will not be less than 40 $m^2$ | • Affected household to be notified at least 6 months prior to the date that the land will actually be acquired by the project |
| 3. Loss of Structures (Residential/Commercial) | | | | |
| Permanent Marginal Loss | • Affected structures on ROW<br>• Unaffected portion of the structure is still viable for use and require no relocation | • Owners of the structures with or without acceptable proof of ownership over the land; with or without building permit | • Cash compensation at replacement cost (i.e., no depreciation and no deduction for salvage materials) for the affected portion, OR<br>• Repair allowance not less than 20% of replacement cost of the affected portion or equivalent to the actual cost of repair. | • Classification and measurement will be determined by DCC and concurred with by the affected household during DMS |
| Permanent Severe Loss | • Affected structures on ROW<br>• A structure is no longer viable for continued use and the entire structure is to be acquired | • Owners of the structures with or without acceptable proof of ownership over the land; with or without building permit | • Cash compensation based on current market prices of materials and labor without depreciation or deductions for salvaged building materials for the entire structure, AND<br>• Materials transport allowance as per regulation of PPCs, AND<br>• For relocating households, renting house allowance for 6 months will be provided. | • Classification and measurement will be determined by DCC and concurred with by the affected household during DMS |
| 4. Loss of Secondary Structures (kitchen, latrine, etc) | | | | |
| Loss of, or damage to, assets | Affected structures on ROW | Owners of the structures with or without acceptable proof of ownership over the land; with or without building permit | Cash compensation based on current market prices of materials and labor without depreciation or deductions for salvaged building materials | Classification and measurement will be determined by DCC and concurred with by the affected household during DMS |
| 5. Loss of Cultivated Products (Crops, trees, aquaculture products, livestock) | | | | |
| Loss of, or damage to, products (Crops and Trees) | Cultivated products in ROW | Owners regardless of tenure status and beneficiaries of the land | • Annual crops equivalent to current market value of crops at the time of compensation;<br>• For perennial crops trees, cash compensation at replacement cost equivalent to current market value given the type, age and productive value (future production) at the time of compensation.<br>• Timber trees based on diameter at breast height at current market value | Classification and measurement will be determined by DCC and concurred with by the affected household during DMS |
| Loss of, or damage to, products (Aquaculture Projects and Livestock) | | Owner of aquaculture projects or livestock regardless of tenure status | • For aquaculture products and livestock of no commercial usage or no commercial value, cash compensation at equivalent to current market value at the time of compensation<br>• For aquaculture projects and livestock with commercial use or commercial value, providing allowance for moving and registration fee for relocation | |
| 6. Affected Public Properties | | | | |
| Loss of, or damage to, properties | Affected public structures (i.e., infrastructure, social service, etc) | Owners of affected properties | Cash compensation to cover the cost of restoring the facilities | Classification and measurement will be determined by DCC and concurred with by the affected organization during DMS |
| 7. Affected Community Properties | | | | |

| Loss Type | Application | Entitled Person | Compensation Policy | Implementation Issues |
|---|---|---|---|---|
| Loss of, or damage to, assets | Affected community structures (i.e. community buildings, community irrigation system, etc) | Affected Communities | Cash compensation to cover the cost of restoring the facilities | Classification and measurement will be determined by DCC and concurred with by the affected organization during DMS |
| 8. Affected Religious Structures | | | | |
| Loss of, or damage to, assets | Affected graves | Grave owners | • Substitute graves will be build in a similar location, OR<br>• All costs of excavation, relocation and reburial will be reimbursed in cash to the affected grave owners | Classification and measurement will be determined by DCC and concurred with by the affected commune during DMS |
| | Affected pagodas | Religious organization which manages affected pagoda | • Substitute pagodas will be build in a similar location, OR<br>• All costs of relocation and reburial will be reimbursed in cash to the affected religious organization | |
| 9. Loss of Livelihood[11] | | | | |
| Loss of Income/ Livelihood | Marginal impacts due to loss of 20% to 70% of their total productive land and income sources | • Owners with LURC,<br>• Those who are in the process of acquiring LURC,<br>• Those who are eligible to acquire LURC,<br>• Those who are without LURC but regarded as customary owner regardless of tenure status<br>• Affected households with lease agreement over the affected land<br>• People without LURC (i.e., squatters or encroachers)<br>• Share croppers, agricultural labors and employees | • Transition subsistence allowance in cash equivalent to 30 kg of rice per person per month for 6 months in case of displacement within a province, for 12 months in case of displacement outside of a province and for 24 months in case of economic difficulty, AND<br>• Affected households are eligible to take part in the income restoration program conducted by local authorities, AND<br>• Every displaced households affected by loss of productive land, irrespective of the degree of impact, will be provided with additional assistance equivalent to 1.5 times the compensation amount. | The eligible households will be determined by DCC |
| | Severe impacts due to loss of 70% or more of their total productive land and income sources | • Owners with LURC,<br>• Those who are in the process of acquiring LURC,<br>• Those who are eligible to acquire LURC,<br>• Those who are without LURC but regarded as customary owner regardless of tenure status<br>• Affected households with lease agreement over the affected land<br>• People without LURC (i.e., squatters or encroachers)<br>• Share croppers, agricultural labors and employees | • Transition subsistence allowance in cash equivalent to 30 kg of rice per person per month for 12 months in case of displacement within a province, for 24 months in case of displacement outside of a province and for 36 months in case of economic difficulty, AND<br>• Affected households are eligible to take part in the income restoration program conducted by local authorities, AND<br>• Every displaced households affected by loss of productive land, irrespective of the degree of impact, will be provided with additional assistance equivalent to 1.5 times the compensation amount. | |

[11] Detailed livelihood restoration program shall be examined based on the prospect of PAPs which will be studied in the next study stage.

| Loss Type | Application | Entitled Person | Compensation Policy | Implementation Issues |
|---|---|---|---|---|
| | Severe impacts on shops | Relocating shop (owners) regardless of tenure status and employees | • For registered businesses, the business disruption allowances equivalent to 30% of annual net income will be applied.<br>• For non-registered business owners, the business disruption allowances equivalent to 50% of business disruption allowances of registered businesses will be applied.<br>• If stand-alone shops (commercial only, not house-cum-shops), materials transport allowance equivalent to the actual cost of relocation expenses (labor, transport)<br>• Employees who are affected by residential/commercial land acquisition, public land or land of enterprises: Allowance equivalent to the minimum salary as per the provincial regulations to affected employees during the transition period for a maximum of 6 months | The eligible households will be determined by DPC |
| 10. Temporal Loss during the Construction[12] | | | | |
| Loss of land and structure | Temporal Loss due to construction activities | Owners of land and structures | • Compensation for rental fee for the area of the temporal use duration but this rental fee shall be more than net income that can be generated by this temporal use land, AND<br>• Restoration of the land within 3 months after use. The project owner will request the contractors if they fails to restore the affected land within 3 months after end of use, AND<br>• Affected non-land assets cause during construction will be paid at replacement cost by the Contractor, AND<br>• The project owner will request the contractors to pay full replacement cost if contractor fails to pay affected non-land assets and does not restore the affected land within 3 months after end of use. | • Classification and measurement will be determined by DCC and concurred with by the affected household during DMS |
| 11. Additional Support to Vulnerable Groups[13] | | | | |
| Loss of Land and Non-Land Assets | | • Households living or working in the project Right of Way<br>• Affected households categorized as: (i) female headed households with dependents, (ii) households with disabled persons, (iii) households falling under the current MOLISA benchmark poverty line, (iv) children and elderly households who are with no other means of support, (v) landless households, are regarded as vulnerable groups, (vi) ethnic minority groups in case they are discriminated | • Social protection beneficiary groups defined in the Decree No. 67/2007/ND-CP of April 13, 2007 (i.e. orphans, elderly people in poor households, people aged over 85, people without pension or social insurance allowance, seriously disabled persons in poor household, mental disease patients, HIV/AIDS infected persons in poor households, families/individuals adopting orphans or abandoned children, households with serious disabled persons, women/men-headed households in the poor household raising child(ren) under 16 years old) and heroic mothers, wounded, dead soldiers: Cash allowance from 10 Million to 20 Million per household depending specific cases. | |

[12] The Contractor is the sole responsible party on this compensation.

[13] Detailed additional assistance needs to be studied based on the results of census and socio-economic survey to be conducted in the next study stage

| Loss Type | Application | Entitled Person | Compensation Policy | Implementation Issues |
|---|---|---|---|---|
| | | | • For other vulnerable households who are identified by DPC: cash allowance of 10 million per household.<br>• Entitled to take part the income restoration program | |

Source: JICA Study Team.

# 8 RESULTS OF STAKEHOLDER MEETINGS

## 8.1 Overall Plan of Stakeholder Meetings

### 1) Background

8.1 At the onset of the HSR study, it is already clear that stakeholders' involvement is a vital part of the planning process. It is a process that will have to comply with the social and environmental considerations ingrained in Vietnam's laws and guidelines. In addition, the process will also have to ensure JICA's policies and guidelines are adhered to requiring consultations/discussions with local stakeholders in the effort of instituting social and environmental safeguards for the HSR projects, among others.

8.2 In this connection, reaching the stakeholders was carried out through various ways within the social and environmental framework of the study. The initiatives included: (a) consultation meetings with key persons from national and provincial/city government agencies; (b) participatory workshops/meetings with broad participation of stakeholders at each affected province/city; (c) information dissemination through newsletter/brochure; (d) panel board displays about the HSR projects at localities; (e) structured questionnaire survey with key informants. The details on the conduct for these processes are presented in the attached appendix for the stakeholder meetings.

8.3 On the whole, there a number of meetings held for consultation on various aspects of the study. However, for the social and environmental aspect, the participatory activities for the HSR projects in terms of the stakeholders' meetings held, so far, are as follows:

(i) 1st Stakeholders' Meeting: This was done during the early part of the study, on December 9, 2011, at Hanoi spearheaded by the Vietnam Railways and the JICA Study Team. It had the participation of 65 representatives from relevant national and provincial government agencies, NGOs, experts and the media.

(ii) 2nd Stakeholders' Meeting: This was held for each of the 11 provinces affected by the HSR projects from July 9, 2012 to August 10, 2012 as arranged by Vietnam Railways. There were 198 participants from the southern provinces section of HSR (i.e., Ho Chi Minh – Nha Trang) and 242 participants for the northern provinces section of the HSR (i.e. Hanoi – Vinh). 2 plenary meetings were held on September 14 and 17, 2012 in Hanoi and HCMC, respectively, (1) to build consensus among the provinces located along the route to select the alignment and station location of the north-south high-speed railway, and (2) to share understanding on the above issue among other stakeholders including Central Government, academia, donors, among others.

8.4 In addition to the above, further stakeholder meetings shall be held in the future after this study in the course of the finalization of scoping and formulation of Environmental Impact Assessment (EIA) and Resettlement Action Plan (RAP).

### 2) Objectives of the Stakeholder Meetings

8.5 Basically, the underlying objectives of all stakeholder meetings are to increase project awareness and cooperation through the sharing of information, to gain vital inputs for the planning and environmental and social considerations of the HSR, and to gain consensus for the HSR for ease of implementation. The specific objectives of the meetings would relate to the phases of project planning and environmental and social considerations

as shown in Table 8.1.1.

**Table 8.1.1 Objectives of the Stakeholder Meetings**

| Planning Stage | Participants | Objectives |
|---|---|---|
| Planning Outputs during Interim Phase (Planning of Environmental and Social Considerations Study) | National, Provincial, Local Government Officials, Academe, Experts, and the Media | • To increase awareness of the projects;<br>• To explain and discuss scope of environmental and social considerations.(i.e., issues and approach); and<br>• To obtain cooperation for the activities of the HSR projects. |
| Planning Outputs for Draft Final Report (Alternative Comparison Phase) | Provincial and Local Officials, Academe, Experts, NGOs and the Media | • To conduct the comparison of alternatives for selection of optimal option among alternatives of alignments and stations, with sufficient provision of information on both the positive (satisfaction of large traffic demand in the future, satisfaction of increasing needs of high-speed transport at reasonable fare levels, strengthening of connectivity of cities along the north-south corridor to promote socio-economic activities, etc.) and negative (financial burden of investment to the country, etc.) impacts expected due to the projects; and<br>• To solicit views and recommendations from stakeholders for environment and social considerations. |

Source: JICA Study Team, 2012

## 8.2 Results of the 1st Stakeholder Meeting

### (a) Overview

8.6 As a part of environmental and social considerations of the study, the 1st stakeholder meeting was conducted on December 9, 2011 in Hanoi. The profile of participants included representatives from relevant national and local governments as well as from experts from planning institutions, representatives from various media related organizations, a representative from a professional associations, JICA officials and members of the JICA Study Team (see Table 8.2.1).

**Table 8.2.1 Summary of Participants to 1st Stakeholder Meeting**

| Type of Participants | Number |
|---|---|
| 1. Central Government Officials and Line Agencies | 30 |
| 2. Local Government Officials | 18 |
| 3. Professional Associations | 5 |
| 4. Mass Media | 12 |
| 5. JICA Officials | 2 |
| 6. JICA Study Team | 9 |
| Total No. of Participants | 76 |

Source: JICA Study Team, 2012.

8.7 The program consisted of the welcome address and introduction of speakers, keynote speeches from the Vice Minister of MOT and Deputy Chief Representative of JICA, a 2-part presentation from the JICA Study Team, summary of the contents of the meeting, and a closing speech by the Deputy General Director of VR (refer to Appendix 8A for the minutes). The presentations were as follows:

Part I Outline of the Study on Plans for the Development of the North-South Railway Line

Part II The Environmental and Social Considerations for the North-South Railway Line

8.8 Part I of the presentation gave a short run down on the progress of the study. It then presented an assessment on the existing north-south railway and provided the improvement options with comparative criteria-based analogy for improving said existing railway. The improvement options presented are: (a) Option A1: Baseline, minimal improvement to ensure safe operation; (b) Option A2: Maximization of existing single track transportation capacity; (c) Option B1: Strengthening of transportation capacity through double tracking and increase in maximum operating speed to 120 kph; (d) Option B2: Double tracking and increase of maximum operating speed to 150 kph or more (semi high-speed). The development initiative was then linked to the current national development orientations and the results of the VITRANSS2 study. Main points for consideration in the study were, then, shown. The final slide of the presentation outlined the next steps of the study.

8.9 Part II focused on the environmental and social considerations approach for the study and presented the plan for the stakeholder meetings. Information was also provided on the study team's scope for the preparation of a resettlement policy framework.

### (b) Discussions held in 1st Stakeholder Meeting

8.10 The comments and views raised by the participants of the meeting are varied. They are summarized by area of concern with corresponding response from the study in Table 8.2.2.

**Table 8.2.2 Summary of Discussion at the 1st Stakeholder Meeting**

| Open Forum | | Response from the Study |
|---|---|---|
| Concern | Issues / Comments Raised | |
| Technology Transfer | It was mentioned that with Vietnam coming into the high-speed railway technology, it would be beneficial if the Vietnamese can master the technology so that they don't have to always rely on Japan for future lines. | The extent by which Vietnam could absorb the technology depends on the country's policy or type of technology to be embraced by the Vietnam Government. It was emphasized that technology, human resource development (operation and maintenance) and integration of development of railway and surrounding urban areas need further study and discussion for specific answer on technology transfer. |
| Technical Aspect | • Clarifications were requested on the calculation methods and formula for the operation capacity according to operation of single type of train (passenger train or freight train only) or mix operation of both types of trains.<br>• Also a question as to whether the improvement of alignment and level crossings were conducted according to a selected plan (A2) would translate to attainment of operation capacity of 25 pairs of trains per day.<br>• There should be detailed calculation basis and formula for each modal split to support the data provided by the JICA Study Team/ VR. It is important to decide whether the improvement of existing lines is enough or new line is needed to be constructed.<br>• The number of level crossing provided by JICA Study Team/ VR is lacking. There are other crossings to be considered on top of the official crossings such as the residential level crossings and unpermitted level crossings. | All calculation methods and formula would be presented in the study and transferred to the Vietnamese side. Copies of the summary of Interim Report will be distributed to the participants in the next meeting, which could be used as basis for further detailed discussion. |
| Cost Aspects | • A re-calculation was requested for the cost Options A1 and A2. Investment cost should be much higher because the rough cost for land acquisition was even higher than what was presented by the JICA Study Team/ VR.<br>• Cost for restoring railway safety corridor and constructing frontage roads has already exceeded the given costs.<br>• Option B2 has to include both the construction of new line and the cost for the removal of existing 1000mm gauge single track. | JICA Study Team/ VR will incorporate comments on Options A1, A2, B1 and B2 into the study. VR and TRICC were requested to provide help with regard to improvement of existing railway lines. |
| Environmental and Social Considerations | • In Options A1 and A2, all level crossings were still at-grade. It was suggested that JICA Study Team/ VR should study railroad right-of-way encroachment situation and incorporate the impact of climate change and floods prior to choosing an optimal plan.<br>• It was recommended to conduct further study on double track plan in terms of social and environmental impacts, land acquisition and resettlement because even the existing single track project failed to ensure right-of-way.<br>• It was suggested that JICA Study Team/ VR refer to approved Inland Container Depot (ICD) planning in | JICA Study Team/ VR will look into the suggestions given and also consider the issue of the ICD. IEE Study was an integral part of planning, which played an important part in the determination of alignment and station location. Hence, JICA Study Team/ VR would take this into consideration during the choice of the most optimal plan.<br><br>When detailed alignment and station location options were drawn up, JICA Study Team/ VR would make thorough comparisons regarding social and environmental impacts. The |

| Open Forum | | Response from the Study |
|---|---|---|
| Concern | Issues / Comments Raised | |
| | order to choose the optimal alignment.<br>• To implement IEE Study, JICA Study Team/ VR has to clearly provide indicators to study, expected outputs and, methods to study indicators. Documents and materials will be transferred by Dr. Khuat Viet Hung to Vietnam Union of Science and Technology Associations (VUSTA) environmental group for their study. | documents offered by Dr. Hung were highly appreciated. |
| Other Relevant information | • Information on the NS railway line development was provided. In summary, the Hanoi-Vinh and Ho Chi Minh-Nha Trang sections will be double track line while the Vinh-Nha Trang section would be kept single track line for the next 10-15 years. | Further information on ongoing projects at these sections will be provided by TRICC to JICA Study Team/ VR. |

Source: JICA Study Team.

## 8.3 Results of the 2nd Stakeholder Meeting

### (a) Overview

8.11 Pursuant to the approach for strongly involving stakeholders in the planning of the HSR alignment and station locations (comparison of alternatives), the 2nd Stakeholder Meeting was held for each affected province in the northern and southern sections of the project. Visits to each province for meetings and consultations were conducted in a series of 3 occasions. One meeting would be for preliminary discussions with key persons basically about technical matters of the HSR projects (including alignment and stations), another would be on a broad participatory workshop to present alternative alignments and locations of stations for assessment and selection (i.e., 2nd Stakeholder Meeting) and a third meeting would be a plenary meeting as a follow up to present outputs incorporating comments of the stakeholders in the previous meetings.

8.12 VR organized the various meetings and mapped out the stakeholders to participate. Table 7.3.1 gives the profile of the participants in the 2nd Stakeholder Meetings while those in the follow up plenary meetings are given in the explanation (d) of this section. The presentation materials of the meetings-cum-workshops, which basically followed the same format for all provinces, are shown in Appendix 8B. The full blown workshop consisted of a 2-part presentation, a questionnaire survey for key informants (see Appendix 8C), large-sized panel board displays of maps per province (i.e., showing alignments, location of stations, and environmental sensitivities), and distribution of project information materials (i.e., newsletter, brochure and workshop presentations).

**Table 8.3.1 Participants in the 2nd Stakeholder Meeting**

| Provinces | Date / Time and Venue | Number and Categories of Participants | | | | |
|---|---|---|---|---|---|---|
| | | Total | GOV | Private Sector/ Others | Total | |
| | | | | | Male | Female |
| Southern Section: Ho Chi Minh–Nha Trang | | | | | | |
| 1. Khanh Hoa | 7/9/12, 14:00-17:30 Que Hong Hotel | 54 | 27 | 27 | 48 | 6 |
| 2. Ninh Thuan | 7/11/12, 14:00-17:00 Ninh Thuan, PPC | 43 | 34 | 9 | 39 | 4 |
| 3. Binh Thuan | 7/12/12, 1400-17:30 Binh thuan PPC | 23 | 20 | 3 | 23 | 0 |
| 4. Dong Nai | 7/13/12, 8:00-12:00 Dong Nai. DOT | 29 | 24 | 5 | 23 | 6 |
| 5. Ho Chi Minh City | 8/10/12, 14:00-17:00, DOTCS, HCMC | 49 | 9 | 40 | 47 | 2 |
| Northern Section: Hanoi–Vinh | | | | | | |
| 6. Nghe An | 7/23/12 14:30-17:30 Nghe An, DOT | 52 | 35 | 17 | 50 | 2 |
| 7. Thanh Hoa | 7/24/12 8:00-12:00 Thanh Hoa, DOT | 36 | 16 | 20 | 36 | 0 |
| 8. Ninh Binh | 7/25/12 8:00-12:00 Hoang Son Hotel | 21 | 19 | 3 | 19 | 2 |
| 9. Nam Dinh | 7/26/12, 8:00-12:00 Nam Dinh DOT | 55 | 41 | 14 | 44 | 11 |
| 10. Ha Nam | 7/27/12, 8:00-12:00 Ha Nam PPC | 34 | 23 | 11 | 30 | 4 |
| 11. Ha Noi | 7/30/12; 13:30-17:30 Railways Trade union's Center for Culture, Sports and Tourism | 44 | 10 | 34 | 38 | 6 |

Source: JICA Study Team, 2012

8.13 The flow of the presentations was as follows:

Part I Seminar on the North-South Railway Development

Part II Comparison of Alternatives for Alignment and Station Location

8.14 Part I of the presentation contained explanations on the outline of the study. It discussed the overall study flow and progress up till that point in time. The approach of the study was also presented jumping off from the 6 improvement options of the existing

line and new line already discussed in the National Assembly. An assessment of the existing railways was presented in terms of its capacities and operating speed. This was followed by a discussion on the plan for upgrading of existing railway to HSR standards and the difficulties to hurdle. Taking cue from these difficulties, improvement options on existing railway was offered for further verification, which were also previously discussed in the 1st Stakeholder Meeting.

8.15 Still in Part 1, aspects for development of the North-South Railway were explained consisting of the future demand along the corridor for high-speed quality service and reasonable fare, the role of railway transport along the corridor, and existing railway development. The discussion then turned to the high-speed railway development showing the concept and preliminary road map for its development. Expected benefits were, likewise, pointed out. Finally, the ongoing works within the study for the priority sections of the North-South High Speed Railway (HSR) was divulged.

8.16 Part II focused on presenting the alternative alignments for the HSR for discussion and soliciting inputs from the participants for establishing the optimal alternative. The discussion was guided as follows:

(i) Environmental and social considerations under the study were explained starting with the study's basic principle on this matter, the important law and guidelines for reference and the flow of activities of the study. The approach for alternative comparison of the study was then presented in terms of the objective, the target sections, alternatives formulated, and the aspects to be considered. An overview of the sections was shown on maps. Then, the characteristics of the HSR Plan were explained.

(ii) The process in the setting of alternatives was discussed with due consideration of previous studies, present conditions of the areas and applicable structures. The finer alternatives relating to the section within the province were done presented and explained. There are basically 3 section alternatives presented as to alignment and the station location. Comparison of the presented alternatives were discussed in terms of both positive and negative impacts, i.e. under a 4-aspects approach, which includes convenience and integrated development; environmental and social considerations (e.g. impacts on protected areas and forest, noise and vibration impacts, scale of involuntary resettlement), high-speed serviceability; and economical efficiency.

(iii) In addition to the alternatives for HSR development, a Zero Option was presented.

(iv) Lastly, discussion points were raised for the participants to consider covering the weighting based on importance as well as their comments on planning and environmental and social considerations.

**(b) Discussions held in 2nd Stakeholder Meetings**

8.17 Enormous amount of significant comments and responses was scoped from the 11 provinces during the open forum of the meetings. These are summarized by HSR section and by province as shown in Table 8.3.2 and Table 8.3.3 for the North Section and South Section, respectively.

**Table 8.3.2 Summary of Discussions in the 2nd Stakeholder Meeting (North Section Provinces)**

| Open Forum | | Response from the Study |
|---|---|---|
| North Section Provinces | Summary of Comments Raised | |
| Hanoi City | The general agreement from the participants was that there is a necessity for the development of a HSR. However, there will be a number of difficulties to hurdle. The participants provided the following comments and inputs for consideration:<br>• Alternative 1 is the most suitable option because of its low construction cost and low impact on the environment.<br>• The location at Ngoc Hoi is very suitable with the approved plan and transport connectivity. Likewise, the alignment running on the west side is suitable.<br>• At present, there is a railway line from Ngoc Hoi to the West and then to Lao Cai. At Yen Vien station, there is line leading to Lang Son. There is a sub-region Mekong project sponsored by ADB, and in this project, there is a Hanoi – Lao Cai railway line. Possibly, the line will be from Ha Dong to Noi Bai airport, to Vinh Phuc, Yen Bai and then to Lao Cai. So, the HSR can strategically run from Lao Cai to Hanoi, then to HCMC. That's the reason why Ha Dong is a good location for connecting Hanoi and Lao Cai in the future if the high speed railway will be developed towards the further Northern part.<br>• It is imperative that the high speed railway should not destroy the orientation and the approved development plans of the city.<br>• Hanoi City is now studying the transportation development plan which concretizes the transportation sectoral plan of the Hanoi Master plan such as terminals of national railway, urban railway and land fund for railway in general..<br>• Regarding the technical design of urban railway line 1, there should be no competition between the urban railway and high speed railway, that's the reason why there ought to be a collaboration with the transport sector.<br>• It is suggested to pay more attention to the approved plans. The alignment should avoid the power station by 500m, Thuong Tin Town, Phu Thuong Industrial Zone, Dau Pagoda, Phu Xuyen Town.<br>• The implementation of the HSR projects depend on the government and local funds. The study on the alignment and safety corridors should include the scale of land required in order to avoid land encroachment and for land to be secured.<br>• In selecting the best alignment, it is suggested that the study team should consider other plans such as land use plan, tourism development plan and transportation plan.<br>• Regarding environmental effects of the HSR, it is required to conduct Environmental Impact Assessment (EIA) report for these HSR projects that will show impact assessment on the alignment and station location for each alternative. | The JICA Study Team/ VR confirmed that collaboration between the study team and the city planners and local officials will be done.<br><br>The study team explained that when the HSR projects are approved, EIA will be conducted by the Vietnamese side. |
| Ha Nam Province | There was a unanimous agreement from the provincial departments and district heads that there is a need for the development of the HSR. The following feedbacks were gathered:<br>• An overview of the Provincial plan was presented to brief the participants, using the provincial development map, indicating the areas for current and planned development. The plan was formulated by VIAP from 2030 and Vision 2050.<br>• In the Alternatives 1 and 2, the high speed railway is located in the West of the NH1A, which will destroy all the plans of the province. Land fund has already been allocated for the development of HSR on the East side of the existing expressway in harmony with the district and provincial plan.<br>• It was recommended that the study team should consider Alternative 3. It was further suggested that the line should be modified or realigned so that it will not cross the expressway twice. The land area between the expressway and high speed railway should be as little as possible. It is also recommended that the new station should be located in Liem Tuyen area. | The recommendation of the province will be incorporated in the redesigning of the alignment based on the provincial development plan. Ha Nam has set an example of a well illustrated development plan, which includes the HSR. |

| Open Forum | | Response from the Study |
|---|---|---|
| North Section Provinces | Summary of Comments Raised | |
| | • In Binh Luc, it is suggested that the existing railway will be connected with the new station of the high speed railway. | |
| Nam Dinh Province | There was agreement with the road map and the assessment for the development HSR which is suitable with the financial conditions of Vietnam.In parallel, it was found necessary to fix and upgrade the existing railway to satisfy the increasing demands of the people and formulate the HSR plan at the same time. Comments and inputs raised are as follows:<br>• It is very necessary to upgrade the existing railway (A1) in order to reduce the number of intersection crossings because Nam Dinh is a province which has the most number of crossings in the country. So to minimize the number of crossings, it is necessary to construct a feeder road. Only by doing so, can we increase the train's speed and improve traffic safety.<br>• Alternative 1 was selected by participants. The other alternatives are close to densely populated areas so compensation cost and social impacts would be high. There was agreement that the station location at Dang Xa area is appropriate and in accordance with the plan of Nam Dinh for 2025, as approved by the Prime Minister. Dang Xa station will be a development area in the future.<br>• There was also the agreement to combine the upgrading alternative A2 and B1 for some sections as recommended by the JICA Study Team/ VR.<br>• Regarding the existing railway crossing the city center, it is impossible to develop the station due to limited land area. Surrounding the station are built-up areas and there are many intersection crossings so the traffic safety is at high risk. It is a good idea to realign in the suggested area.<br>• There was interest in the social impacts in the development of the HSR since it will trigger several social issues. Among the three alternatives, Alternative 1 will result to least negative impacts on social environment. It was suggested that the study team should further explain the social impacts of the various alternatives.<br>• If Alternative 2 is chosen, it will affect a lot of people. It should be noted that in Nam Dinh, there are 495 intersection crossings and a lot of feeder roads. The North-South railway runs parallel with National Highway 10 and 21. The intersection crossings do not satisfy the technical standards. So when we implement the A.2, it is necessary to consider the safety on intersection crossings and it is suggested to construct viaducts or feeder roads.<br>• Overall, for the structure of the HSR. It is suggested to construct viaduct because it will have less impact on environment and land acquisition | With regards to social impact, JICA Study Team/ VR considered to minimize resettlement as much as possible. From the viewpoint of land use, passing through industrial areas and cemeteries was avoided. This is the interim stage of preparation. We are going to the scoping stage. And we will identify more important issues.<br>A social assessment will be conducted on how this will affect the living condition of the people.<br>With the HSR, the appropriate fare will be considered so that it can benefit the people. JICA Study Team/ VR has conducted a survey on the willingness to pay by ordinary people, so the results will be looked again into detail.<br>Important information was given in this meeting, which the JICA Study Team/ VR will consider in the adjusting the alignment. At the same time JICA Study Team/ VR's main concern is how the existing railway can be integrated with the HSR. |
| Ninh Binh Province | It was confirmed this is the second meeting in Ninh Binh. As much as there was agreement on the 4 criteria for the selection of the alignment, there was a request for VR to send an official request to collect the comments from the provincial department officially. The following comments and suggestions were given by the participants:<br>• The proposed alternatives should be in line with the provincial plans. Ninh Binh Socioeconomic Development Plan (SEDP) was approved by the Prime Minister in 2011. This plan should be considered and updated in the JICA study and should include other sectoral plans that were revised, including transport development plan and land use plan. The proposed HSR should show how it is integrated with the provincial sectoral development plan.<br>• Alignment: The overall length of HSR in Ninh Binh province is about 20 km. Alternative 1 cuts through Khanh An commune of Yen Khanh District while Alternative 2 and Alternative 3 will traverse through Ninh An commune of Hoa Lu Town, Tan Binh ward, Bao Son ward, Quang Son commune and a part of Tay Son ward of Tam Diep City. Under this condition, both Alternatives 2 and 3 will trigger impacts on highly populated areas. As such the proposed Alternative 1 is more appropriate. as it will have less impact on the localities and the technical aspects are more feasible. | JICA Study Team and VR will send the official document to collect opinions from the related agencies. However, comments on the issues presented above are highly appreciated.<br><br>JICA Study Team/ VR will continue to work with the province and collaborate for further planning works. The JICA Study Team/ VR will make best effort to incorporate the issues and suggestions raised such as network connectivity, alignment and location of stations. |

| Open Forum | | Response from the Study |
|---|---|---|
| North Section Provinces | Summary of Comments Raised | |
| | • On station location: the province expects that the station should be to the east of the city, this is specified in all documents of the city, which is most similar to Alternative 1. In Ninh Binh transportation plan (2020) the area is planned specifically for this.<br>• Land use: The JICA Study Team/ VR has not considered the socio-economic development and land use plan in HSR assessment. If the HSR projects are approved, land acquisition will be a critical issue. MOT and VR shall approve the HSR and so the province will examine the direction within the framework of the provincial and sectoral plans.<br>• It is proposed that the study team shall cooperate with DONRE to prepare EIA in compliance with the Environment Protection Law, Decree No. 29 and Circular No. 26.<br>• Alignment: Agreement was given for Alternative 1 where the starting point is at eastern industrial parks on the province. This is considered as convenient in terms of accessibility of the workers from the industrial parks. It is expected that Khanh Phu industrial park will attract 10,000–15,000 workers. The end point of alternative 1 which lies in Quan Son area is also proposed to be an industrial park in the future and this would facilitate easy access for the workers.<br>• The three railway stations (Ninh Binh, Cau Yen and Dong Giao) need to be taken into consideration to ensure the connectivity between the existing railway and the high speed railway.<br>• Alternative 1 is supposed to be a straight line but the development of Ninh Binh airport shall also be taken into account properly. The province considers development of Cat Xi airport, covering 400 ha, which will complement the high speed railway.<br>• Although the plan for HSR is a long-term vision, it is suggested that the road map shall be implemented earlier.<br>• There are three proposals from 3 different teams and two alternatives (red and blue) from two consultants who had worked with the province. The process was systematic and professional, while the approach by JICA was based on satellite maps without proper consultation with the local authorities, so there are considerable gaps when it comes to local realities and conditions. It is suggested that the JICA Study Team/ VR works closely with the local units to resolve the differences.<br>• The intersection with existing railway is almost overlapping with the future crossing of the expressway. This area is also an industrial area of Mai Son district.<br>• The section through Tam Diep crosses almost entirely through an urban area and site clearance will be a problem. | |
| Thanh Hoa Province | It was requested that VR and the JICA Study Team shall send the official explanation on the proposed alternative to Thanh Hoa Province so based on that, related departments will comment officially.<br><br>The following comments were given:<br>• It was proposed that alternatives 2 and 3 for the alignment be combined. Alternative 2 for the northern Ham Rong section and Alternative 3 for the southern Ham Rong section<br>• It is proposed that the Study Team will further clarify the selection of Alternative 1 in terms of (1) impacts of Hanoi – Vinh expressway to HSR; (2) viaduct development at densely populated areas, especially ROW, elevation and safety corridor which will affect urban development in the province; and (3) impacts on Thanh Hoa new towns, especially Bim Son Town (urban class III), Ha Trung Town (Urban class IV) and Thanh Hoa City (urban class I) as well as some areas in Bim Son where the high speed railway traverses.<br>• Regarding station locations: Alternative 3 is the most appropriate since the location is near the North-South expressway which will facilitate easy access to Thanh Hoa City center, which is only 4 km. It is also connected appropriately to the main urban corridor (Le Loi Street) which will be expanded to planned station location. In addition, it is proposed that | JICA Study Team and VR will send the official document to collect opinions from the related agencies.<br><br>In JICA study, the alignment is considered to ensure the most convenient conditions for passenger accessing the HSR. The alignment was studied carefully to meet the minimum curve radius of 6,000 m for high speed train operation as well as to avoid mountain crossing which would require tunnel and longer bridge.<br><br>JICA Study Team/ VR |

| Open Forum | | Response from the Study |
|---|---|---|
| North Section Provinces | Summary of Comments Raised | |
| | another station be constructed at Truong Lam to improve connectivity to Nghi Son and Hoang Mai Industrial Parks.<br>• HSR will be developed in long-period after 2020. The locality shall save land for the implementation of HSR projects in the future. It is proposed that the JICA Study Team/ VR shall update related plans of the province properly.<br>• Regarding station location, the Prime Minister approved the Thanh Hoa City construction plan up to 2020 and Vision to 2025 based on Decision 84/2009. Thanh Hoa City will be developed towards the east, merging to Sam Son Town along Ma River, stretching 19 km long. The 3 proposed locations are not in the city center. It is noted that the connectivity with the city center of three alternatives are similar. However, Alternative 3 will not affect the city plans. Alternative 2 and Alternative 1 will break the city plans and existing facilities, especially the city construction plan up to 2020. Alternative 3 connectivity should be updated to further improve the people's accessibility to the station, including western ring road, NH47 and eastern road among others.<br>• HSR Alignment: It is suggested that the study shall compare the expressway development, the high speed railway development and the airway development scenarios appropriately to clearly clarify the necessity of the high speed railway development.<br>• For the upgrading of existing railways, it should be better to consider "Option B2" to promote both passengers and freight transport.<br>• The study shall consider the economic viability of the project. B2 Option costs US$ 27.7 billion while the preliminarily cost of the high speed railway development is US$ 38 billion, excluding locomotives and car cost.<br>• The operation cost shall be taken into account besides the construction cost.<br>• The study team emphasizes the importance of the connectivity of the existing railway with the high speed railway. In fact, the existing railway shares only 7-8% travelling demand in Vietnam so the demand is not significant as compared to demand on road, expressway and airway. | explained that the station locations are considered to provide the best convenience for the passengers. The existing railway will function as feeder of the high speed railway as well as serving the short travelling requirement. Future demand was analyzed. Convenience and accessibility were considered as the most advantage of the high speed railway compared to airway so the station is proposed near the city center. The HSR projects are long-term which is proposed to commence after 2020 so the province has time to secure the land.<br>The final report will provide an estimated cost for each improvement option to make comparison.<br>JICA Study Team/ VR will further consider the investment cost and share in GDP at the construction implementation time appropriately. |
| Nghe An Province | An extensive discussion took place regarding the alignment of the HSR. It was mentioned that the provincial government thoroughly discussed the matter with MOT to incorporate HSR plan into the provincial development plans. Overall, the alignment through a mountainous area does not affect the existing plans of the province. Some sections on the west side of the existing railway runs through low lying rice fields. The following comments were raised on the alignment:<br>• The province suggested that HSR should run on the west side of the expressway and existing railway<br>• It may traverse both residential and industrial zone which are highly populated.<br>• It may destroy historical sites (i.e., An Duong Vuong Temple) and may require substantial land acquisition.<br>• HSR should be elevated considering the crossing with roads and impact to communities.<br>• Alternative 3 has much lower land acquisition cost because the land to be acquired is mostly hilly.<br>• The analysis of variables on slide 25 (Preliminary Comparison of Alternatives) requires revision as it does not reflect the local condition. It is suggested that further site survey is required in order to come up with a good analysis of the site.<br>• JICA Study Team highly values social and environmental aspects and Alternative 3 is the best option reflecting these aspects, why is alternative 3 not recommended then? Ii is suggested that Alternative 1 and Alternative 3 can both be combined.<br>• There should be comparative information between HSR vis-a-vis, airway or waterway.<br>• With regards to climate change, sea levels will rise by 0.5m. The JICA | The most important criteria when the JICA Study Team/ VR selected the alignment alternatives are the connectivity to existing railway. The study team also went by car along the Hanoi Vinh railway line to investigate and studied maps to analyze the conditions. Residential areas, cemeteries, industrial zones and the need for a tunnel were avoided to arrive at the alignment proposed.<br>All the criteria of the local province will be considered when we select the station location. Then, JICA Study Team/ VR requested for industrial development plans.<br>Regarding land acquisition or environmental concerns, JICA Study Team/ VR will try to minimize them.<br>On modal comparison, JICA Study Team/ VR provided |

| Open Forum | | Response from the Study |
|---|---|---|
| North Section Provinces | Summary of Comments Raised | |
| | Study Team/ VR has to consider this.<br>• The alignment should go to the West side of the existing railway so it would not require complication. Whereas it if runs to the East side of the existing railway, it would create a lot of crossings and land acquisition and will have to deal more with social concerns.<br>• The connectivity between North-South expressway and HSR has to be considered so that land acquisition and interconnectivity can be considered appropriately. Prioritization of project needs also to be considered because HSR will take considerable time requiring human resources, technologies and more fund.( VND 38 billion) It would be difficult to implement both at the same time, so it is recommended that the North-South expressway should be given priority.<br><br>Regarding the location of station, it was mentioned that the station planned in Alternative 3 is only 4-5km away from existing station and 2 stations will be connected by a wide road. Alternative 3 location is appropriate for the extension of the HSR to the southern direction. Moreover, it was suggested that another station should be considered between Thanh Hoa and Vinh (i.e., Hoang Mai) to enable industrial workers to gain access to the HSR. The construction of a station on this area could speed up the conversion of this area into a new town. | Study Team/ VR provided an analysis pertaining to transport demand by various modes in the future on the North – South railway, besides HRS, the improvement of other modes are also needed.<br>The JICA Study Team/ VR explained that the 3 alternatives used satellite images to see how many buildings are affected and counted those to select the best option.<br>The alignment was considered by taking into account many aspects, not only terrain. The selection of a station is not only on location based but also on how it is interconnected with the whole transport system as well. The JICA Study Team/ VR will take note of the suggestion of combining two alternatives.<br>JICA Study Team/ VR will consider the suggestions regarding Hoang Mai and study further to select the best option |

Source: JICA Study Team

### Table 8.3.3 Summary of Discussions in the 2nd Stakeholder Meeting (South Section Provinces)

| Open Forum | | Response from the Study |
|---|---|---|
| South Section Provinces | Summary of Comments Raised | |
| Ho Chi Minh City (HCMC) | The significance of the development of HSR was recognized among participants. It was explained that the National Assembly in 2010 did not exactly reject the HSR project itself but requested the MOT to further conduct a study on it due to the lack of sufficient explanation about the necessity and the timing of the project. JICA Study Team/ VR was requested to clarify the roadmap for HSR development in detail upon finalizing the study. Participants suggested that the fare level is important for attracting passengers for the HSR.<br>Comments on the alignment were provided as follows:<br>• Construction time should be 2040.<br>• It was suggested that JICA Study Team/ VR should consider the extension of HSR to Can Tho section, Trang Bom-Hoa Hung railway upgrading plan and detailed plan of railway terminal in HCMC.<br>• By 2020, A1 and A2 should be finished, and after 2020, B1 would be upgraded. He suggested that after the improvement of existing railway, the new HSR would be constructed.<br>• The number of passenger from Nha Trang to Ho Chi Minh is high, so this railway section should be given priority to upgrade to the speed of 170 km/h.<br>• The existing railway section from Nha Trang to Sai Gon can be upgraded | The JICA Study Team/ VR will review the existing plan and will incorporate recommendations in the final report. |

| Open Forum | | Response from the Study |
|---|---|---|
| South Section Provinces | Summary of Comments Raised | |
| | to B1 and B2. The railroad from Sai Gon to Can Tho will be upgraded to the speed of 200 Km/h for both passenger and freights, which was approved by the Prime Minister.<br>• The railway terminal plan will be submitted to the Government by the MOT.<br>• There was agreement on the crossing through Long Thanh airport.<br>• On the section from Long Thanh to Phan Thiet, it is suggested that there should be one station located here because the distance form Long Thanh to Phan Thiet is quite long.<br><br>On the location of the station, it was generally agreed among participants that the station will be located in Thu Thiem as this is in compliance with the approved plan for the city. However, coments were made that the initially reserved land of 25 ha is becoming smaller. As such this available land should be studied if it is still sufficient. | |
| Dong Nai Province | It is recognized that HSR play and important role in urban development. The proposed implementation of the HSR (2020) is viewed as suitable and in line with the planned development of Dong Nai Province. The development of an airport in Long Thany is expected to raise transport demand by about 100 million passengers. The HSR is perceived as the most appropriate mode to meet this demand. There was support for the idea to connect HSR with the airport.<br>Discussion on the alignment raised the following comments:<br>• Alternative 2 and Alternative 3 run through the residential area. Alternative 1 which runs through the airport center is considered appropriate as passengers arriving/departing at the airport could access the HSR conveniently. The sub-sections of HCMC–Long Thanh should be developed first as this would support the airport demand and activities. The expressway HCMC to Dau Giay is expected to operate by end of 2013. The HSR plan should reflect connectivity to the expressway. Overall, Alternative 1 is considered appropriate as it crosses through the center of the airport. However, main issues to be addressed include: (1) Security requirement of airport and passengers; (2) Pressure on airport management; and (3) Design of the station and alignment.<br>• Apart from NH51, there will be another expressway (new NH51) running parallel to the existing NH51, and another expressway under construction. With another horizontal line for HSR, development plan for the intersection and connectivity to these roads has to be updated by the JICA Study Team/ VR in order to integrate the HSR with all these roads.<br>• Alternative 1 crossings should be made clear. MOT supports the idea of crossing right through the center of the airport but needs to consider security measures.<br><br>On the location of the station, an additional station is proposed between Long Thanh–Phan Thiet in Long Khanh area, near NH56 which can be connected with Ba Ria and Lam Dong.<br><br>It was mentioned that the expressway HCMC to Dau Giay is expected to start operation by end of 2013. This plan should be updated and reflected in the HSR plan, which include other connectivity such as the Dau Giay – Phan Thiet expressway which will also be developed under PPP scheme. | The JICA Study Team/ VR concluded that the inputs from the participants would enable the study to assess the alignment and the stations accordingly. The JICA Study Team/ VR will continue to coordinate with the province for specific information before finalizing the study report.<br><br>The Dau Giay – PhanThiet expressway plan has been updated, and in fact the Alternative 1 runs parallel to Dau Giay – Phan Thiet Expressway. |
| Binh Thuan Province | There is generally high support for the HSR. The demand is based on the strategic location of Phan Thiet as a tourist destination. It is expected that a faster mode of transport could reduce travel time significantly and is expected to boost the tourism industry in Phan Thiet which will contribute to the socioeconomic development of the city. The planned expressway plus the HSR is perceived to lessen the traffic volume on NH1A in the future.<br><br>Comments on alignment are as follows:<br>• The alignment from Dong Nai to Phan Thiet should run to the western side of the NH1A so that it will not split several urban areas, especially Tan Nghia and Thuan Nam Town. It is also recommended that the | One of the critical issues is location of the stations. The JICA Study Team/ VR explained that there might be some misunderstanding with regard to the comments on the alignment. The alignment was already modified, in accordance with the comments of the province in the pre-meeting, to the |

| Open Forum | | Response from the Study |
|---|---|---|
| South Section Provinces | Summary of Comments Raised | |
| | alignment should minimize the crossing with NH1A.<br>• The alignment toward Phuong Long area should be planned at the western side of NH1A not to affect Ham Thuan Nam District.<br>• It is proposed that the alignment should be running through the west of the existing as well as future National Highway for the following reasons: (i) it will avoid major residential areas; (ii) compensation cost is lesser; (iii) it will benefit the farmers whose land will not be acquired; (iv) avoid protected areas and religious heritage areas; (v) people are already familiar with the existing railway on the east; (vi) alignment should avoid crossing the industrial parks; (vii) it should cross Phu Long and Phu Hai residential areas; and (viii) alignment should be straight.<br>• For the alignment from Dong Nai to Phan Thiet, either Alternative (1 or 2) could be selected. For the section from Phan Thiet to the boundary of Binh Thuan, Alternative 1 is recommended.<br><br>Comments on the location of stations include:<br>• Station locations shall be convenient for the people accessing it. However, the impacts on existing urban areas shall be minimized. The study proposed the stations location at Phan Thiet and Tuy Phong, where Phan Thiet station is near the new existing railway station. It is suggested to move the station in Phan Thiet towards Muong Man station. In addition, taking the interval between stations into account, one more station shall be considered at Tan Nghia where various new towns are being developed. However, the impacts on existing urban areas shall be minimized.<br>• Regarding Phan Thiet station, although there is new station there, the availability of land for expansion in the future is limited. It is suggested that it should be shifted closer to the proposed National Highway. The bypass road will be developed not until 2020, so in the meantime the province will develop new road (Le Duan Road) to connect to this area. With this new road and the bypass road of Phan Thiet City in the future, the people will have better connection. As such, the HSR alignment (towards the station) should not be along the existing railway and located on the west side but rather on the eastern side of NH1A. | western side of the NH1A.<br><br>With regard to the alignment between PhanThiet and Tuy Phong, the sandy area will not be appropriate for HSR alignment, due to the difficulties of construction and maintenance, with high risk of land degradation and change of topography. Since safety of the HSR is very important, the alignment going through the sandy area is not suggested.<br><br>The JICA Study Team/ VR explained that the connectivity and convenience is the key for the success of HSR and proposed that the new Phan Thiet station should be the location where the HSR station be developed. |
| Ninh Thuan Province | There is generally an expressed need and demand for the HSR in the province of Ninh Thuan, coupled by an expressed desire to have it implemented soon.<br><br>• The following considerations for the selection of the alignment are recommended by the stakeholders of the province: (i) proper measures on urban drainage where the alignment crosses major residential areas; (ii) connectivity and convenience; (iii) appropriate design for viaduct or embankment such as height, aesthetics, impact during occurrence of flood particularly on the lower west side; (iv) occurrence on flooding on the west section is prevalent and this will trigger more flood affecting poor households in coastal areas; (v) the elevation from east to west is made up of considerable slopes which will trigger performance of HSR if 350 km/hr is to be achieved, as such slopes must be avoided; (vi) surface and ground water will most likely be affected; and (vii) re-adjustment on land use.<br>• There were mixed responses on alternative alignments. The Vice Chairman preferred Alternative 2 while the Department of Construction preferred Alternative 1 for urban development, but Alternative 3 in the future for better connectivity with the Expressway. Alternative 3 was seen to have the least impact on resettlement.<br>• The following perspectives were recommended for the JICA Study Team/ VR to consider: (i) ensure standard measurement of 15 m on corridor of impact; (ii) stations should be along major roads with a distance of between 30–70 km between stations; (iii) for logistical requirement (service waiting areas, cargoes) Alternative 1 is preferred instead of Alternative 3; (iv) for long term requirement (2020), the stations locations of three alternatives should be planned close to the expressway and other roads for connectivity and convenience; and (v) the location of | The JICA Study Team/ VR explained that to address flooding, the structure of Alternative 1 is the viaduct in the city section, thus the urban drainage issue will not occur. In the suburban area where the embankment is applied, the design of the embankment includes culverts for water drainage and crossing roads. Hydrology study will be conducted in the coming EIA study.<br>Green House Gas: GHG emission for the HSR will be much less than other modes of transportation. The results of analysis will be shown in the Draft Final Report and Final Report.<br>The consultation process is strategic and requires compliance to the laws of the country. So all comments are documented. Among important issues are the location of the stations to maximize connectivity with the HSR and the benefits of the |

| Open Forum | | Response from the Study |
|---|---|---|
| South Section Provinces | Summary of Comments Raised | |
| | station in Thap Cham will trigger impact on major residential areas and there is limited land for the proposed station. It is suggested to shift the station to the north instead of east side. It is more advantageous as connectivity between the existing railway / HSR and other transport is more convenient and viable, and it is only 300 m away from the proposed station which merges with Alternatives 1 and 2.<br>• Land acquisition is a major issue if embankment will be designed. While the use of viaduct is considered as more expensive, the cost should not be used to justify in favour of the potential risks that may results to any adverse social impact. Productive land is limited in the province and land acquisition of productive land will result to lower productivity that may lead to poverty among affected households. Hence viaduct is preferred considering (i) the impact on hydrology, (ii) exposure of radioactive elements distributed during the war, and (iii) segregation of land use and communities. Since the cost of HSR is quite high, it was suggested that JICA Study Team/ VR defines the detailed cost and make suggestions on how the HSR will be funded.<br>• Regarding greenhouse gas emission, the HSR will be powered by electricity which means no greenhouse gas. However, the need for electricity will be more and land will be needed to develop power plant. | location where the HSR passes through. There are 2 additional criteria for choosing: Proximity of HSR to the urban cities to be integrated. And how best to connect to other urban transport.<br>The JICA Study Team/ VR will provide the best combination for embankment and viaducts as it relates to land acquisition and natural disasters. The cost is also a very important aspect, which we have to present to the national assembly. |
| Khanh Hoa Province | There was a general agreement that the development of HSR should be accelerated.<br>The need for more clarification pertaining to the proper alignment, location of station, the target design speed of 350km/h and cost was also expressed from the province.<br>Comments on the alignment were offered as follows:<br>• In the area around Cam Duc, many residential communities are located on the east of National Highway 1A. Alternative 1 is running in the eastern side of NH1A while Alternatives 2 and 3 are running in the western side. It was recommended that the study should clarify the assessment method of alternative routes as the presented results do not correspond to the local condition.<br>• In the city area, in order to reduce construction cost, it is suggested to construct viaduct rather than embankment. How to acquire the land for such long-term projects in the urban and urbanizing areas while the construction is still uncertain must be considered.<br><br>As for station locations, all stations were found to be planned considering the present conditions, but for the long-term, the city area may be developed and the station location should be planned considering the future development plan. | The JICA Study Team/ VR explained that the alignment and the station location were revised according to the comments by the Chairman and Vice Chairman of PPC in the previous meeting. Also, Alternative 1 in the city section will be constructed by viaduct considering the social impact. With regard to the land acquisition, JICA Study Team/ VR suggested that the landuse plan should incorporate the future land area to be allocated for HSR after the official commitment.<br>Comments such as on the schedule and the design speed will be reflected and/or answered in the Draft Final Report and Stakeholder Meetings to be held later. |

Source: JICA Study Team

### (c) Results of the Questionnaire Survey

8.18 For each meeting, a rapid questionnaire survey was conducted to gather insights from key informants on the HSR projects covering the following: (i) level of awareness of the HSR projects; (ii) perceived benefits and impacts; (iii) issues and concerns; (iv) assessment of the alternatives presented; and (v) considerations of factors for the planning of HSR. A total of 154 key informants answered the questionnaire from the northern section provinces and 143 from the southern section provinces.

8.19 A summary of the findings are presented in Table 8.3.4.

**Table 8.3.4 Summary of Findings from the Key Informants' Questionnaire Survey**

| Questionnaire Item | Northern HSR Section Provinces[1/] | Southern HSR Section Provinces[2/] |
|---|---|---|
| 1) Project Awareness | • Overall awareness rate indicator is 96%;<br>• Generally favors implementation in the short term | • Overall awareness rate indicator is 95%;<br>• Generally favors implementation in the short term |
| 2) Perception of Positive Impact and Benefits | • Perceived *travel speed and time savings* as most significant benefit.<br>• Most significant impact perceived to be on the *increase tourism* and *urban development.* | • Perceived *safe transport service* as most significant benefit.<br>• Likewise, most significant impact perceived to be on the *increase tourism* followed closely by *urban development*. |
| 3) Issues and Concerns | • Majority of the provinces perceived less impact concerns on *natural environment and pollution* but limited impact indicated for *nature reserve and protected area*s by Ninh Dinh, Hanoi and Ha Nam.<br>• There is perceived high impact concerns on *land acquisition and resettlement* especially in Thanh Hoa, Ha Nam, Nam Dinh, and Ninh Binh. | • There is perceived less impact concerns on *natural environment and pollution* but limited impact indicated for *nature reserve and protected area*s by Ho Chi Minh and Khanh Hoa. Also, Dong Nai and Ho Chi Minh showed some concern for *pollution, noise and vibration*.<br>• There is perceived high impact concerns on *land acquisition and resettlement* especially in Khanh Hoa, Ninh Thuan, Binh Thuan, Dong Nai and Ho Chi Minh. In like manner, the same provinces showed concern for *displacement of residential and business communities*. |
| 4) Assessment of 3 Alternative Routes | • Alternative 1 alignment was found highly appropriate by majority of the provinces in terms of *convenience and integrated development.* However, the provinces of Ha Nam and Nghe An showed preference for Alternative 3 in terms of *availability of land for integrated development*.<br>• In terms of *environmental and social considerations*, Alternative 1 alignment was found to have the favorable cumulative assessment ratings. But careful investigation is needed for provinces that gave low ratings such as Ha Nam, Thanh Hoa and Nghe An. | • Alternative 1 alignment was found highly appropriate by majority of the provinces in terms of *connectivity to other transport.*.<br>• In terms of *environmental and social considerations*, Alternative 1 alignment was found to have the favorable cumulative assessment ratings for the southern provinces as well. But careful investigation is needed for province of Binh Thuan in terms of *impact to natural environment.* |
| 5) Planning Concerns | • For location planning, the top concern is *connectivity with other transport modes.* This is followed by *distance to the city center.*<br>• For alignment, the most important factor for all the provinces *is transport performance*. | • For location planning, the top concern is *connectivity with other transport modes.* This is followed by *distance to the city center.*<br>• For alignment, the most important factor for all the provinces *is transport performance*. |

1/ The northern HSR section provinces are comprised of Hanoi, Ha Nam, Nam Dinh, Ninh Binh, Thanh Hoa, and Nghe An.
2/ The southern HSR section provinces are comprised of Ho Chi Minh, Dong Nai, Binh Thuan, Ninh Thuan and Khanh Hoa.
Source: JICA Study Team, 2012

### (d) Plenary Meetings

8.20 A plenary meeting was held with main objectives as follows: (1) to build consensus among the provinces located along the route to select the alignment and station location of the north-south high-speed railway, and (2) to share understanding on the above issue among other stakeholders including Central Government, academia, donors, among others. For the north section, this was held on September 14th, 2012 in Hanoi City and for the south section on September 17th in HCMC. The participants to this plenary meeting are summarized in Table 8.3.5.

**Table 8.3.5 Summary of Participants to Plenary Meeting**

| Type of Participants | North Section | South Section |
|---|---|---|
| 1. Central Government | 17 | 15 |
| 2. Local Government | 49 | 33 |
| 3. Professional Associations | 7 | 0 |
| 4. Business Associations | 10 | 10 |
| 5. Social Associations/ NGOs | 13 | 15 |
| 6. Academic Society | 0 | 13 |
| 7. Mass Media | 3 | 5 |
| 8. Others | 4 | 7 |
| 9. JICA Study Team | 7 | 7 |
| Total No. of Participants | 110 | 105 |

Source: JICA Study Team, 2012.

8.21 The program was consisted of 3 parts, as follows:

Part I Overall Explanation of the Study

Part II Summary of 2nd SHM in Cities/ Provinces and Reflection of Comments from Participants

Part III In-depth Study on Common Topics for the Selection of Optimal Alternative

Optimum Alternative for Alignment and Station Locations

8.22 Part I gave an overall view of the outline and progress of the study, with emphasis on why the HSR is needed referring to alternative scenarios discussed in the National Assembly, constraints and opportunities of the existing railway, demand analysis and results of economic and financial analysis. Information was provided on both the positive (satisfaction of large traffic demand in the future, satisfaction of increasing needs of high-speed transport at reasonable fare levels, strengthening of connectivity of cities along the north-south corridor to promote socio-economic activities, etc.) and negative (financial burden of investment to the country, etc.) impacts expected due to the HSR projects including potential risks inherent in the HSR projects. The future roadmap and possible funding options were presented as well. (see Appendix 8B, materials from provincial meetings and overall Plenary Meetings for further details on these points).

8.23 Part II began with an explanation on the comparison and selection of alternatives, followed by the report on provincial stakeholder meetings. The response to comments from provinces which were raised during the provincial stakeholder meetings were shared after this, with explanation on how these comments were reflected to the revised alignment and station location.

8.24 Part III consisted of 3 sections. The first section explained the common topics for both north and south sections on the selection of the optimal alternative. It focused on the main concept for alignment and station location plan, i.e. importance of connectivity, integrated development, and concept of setting stations. The other 2 parts were for the north and south sections respectively, explaining in detail the response to the comments given from the provinces and detailed studies and discussions especially on points that the JICA Study Team and the provinces had different views on.

### (1) Discussions held in Plenary Meeting for North Section

8.25 Comments were raised from each province in detail, summarized as follows:

(i) **Ha Nam Province:** The province expressed their general agreement with Alternative 1, especially for the section running through Ha Nam Province and the location of the station. However, the province suggested that the alignment from Hanoi to Ha Nam should follow Alternative 3.

(ii) **Nam Dinh Province:** The province expressed their full agreement with Alternative 1. The representative provided views that Nam Dinh Station will serve not only for Nam Dinh Province but also for Thai Binh Province and its vicinities.

(iii) **Ninh Binh Province:** The province expressed their general agreement with Alternative 1. However, the province noted that the study result shall be reported to competent authorities for approval of Alternative 1 as soon as possible so that the provinces could adjust their local plans accordingly. As for the station location, although it was agreed that the connectivity with the existing line is important, the province requested further study on the proposed location.

(iv) **Thanh Hoa Province:** The province expressed their general agreement with Alternative 1, on the section north of Ma River and the section south of the city. However, the province requested to revise the section from the south of Ma River to the end of Nong Cong District and also expressed their preference the station location shown in Alternative 3.

(v) **Nghe An Province:** The province expressed their general agreement with Alternative 1, but however requested to revise the alignment so that it would run the west side of the existing railway. He agreed with the JICA Study Team's views that a new station should be developed in Hoang Mai Town.

8.26 Other significant comments include those from an expert from the Construction and Traffic Work Quality Management Department of MOT, suggesting the necessity of further study about the connectivity of various transportation modes in order to take the full advantage of HSR.

8.27 The JICA Study Team thanked all the participants for providing the comments and noted that the team will revise as much as possible, and for areas which still have room for further discussion will be taken up in the Draft Final Report to be reported to the Central Government for their final decision.

### (2) Discussions held in Plenary Meeting for South Section

8.28 Comments were raised from each province in detail, summarized as follows:

(i) **HCMC:** The city expressed their full agreement with Alternative 1. The representative from the city shared his experience about the HSR in Taiwan, and showed his support for the study that the location of the station in consideration to the people's convenience is important. It was noted that the fare should be considered so that the HSR will be affordable to the people.

(ii) **Dong Nai Province:** The province expressed that their comments were not reflected to Alternative 1, i.e. that the HSR alignment should be on the same corridor with the expressway of HCMC – Dau Giay, Bien Hoa – Phan Thiet in order to minimize land acquisition. It was requested to update the intersecting points of HSR and local roads, especially the expressway.

(iii) **Binh Thuan Province:** The province expressed their general agreement with Alternative 1. It was requested to shift the station location towards the west side, as this would reduce the impacts to industrial zones and residential zones.

(iv) **Ninh Thuan Province:** The province expressed their full agreement with Alternative 1, and also agreed with the construction of viaducts for residential zones. It was noted to continuously consider the flood drainage which is a major issue for the province.

(v) **Khanh Hoa Province:** The province expressed their general agreement with Alternative 1. It was requested that the alignment running on the east side of the existing railway should be revised, as land fund in this area is very limited. The province noted that the study result shall be reported to competent authorities for approval of Alternative 1 as soon as possible so that the provinces could adjust their local plans accordingly. The province noted that the location of the depot is a flood prone area and hence shall be reconsidered.

8.29 Other significant comments include those from an expert from the Association of Science and Technology of HCMC, noting the following:

(i) The report has reflected many comments from the previous meeting;

(ii) The city has sent a letter to MOT explaining that Thu Thiem Station will be the terminal station and no plan for extension to Can Tho (rather Tank Kien Station will be extended to Can Tho);

(iii) Alternative 1 is generally agreed;

(iv) An additional station is needed between Long Thanh and Phan Thiet Station;

(v) Submission of the National Assembly in 2013 is not feasible given the economic difficulties in Vietnam.

8.30 Representatives from the HCMC University of Transportation noted that the north-south corridor has more potential for growth, and that the HSR development should be considered both from demands and financial feasibility.

8.31 The JICA Study Team thanked all the participants for providing the comments and noted that the team will revise as much as possible, and for areas which still have room for further discussion will be taken up in the Draft Final Report to be reported to the Central Government for their final decision.

# 9 FURTHER STEPS AND RECOMMENDATIONS

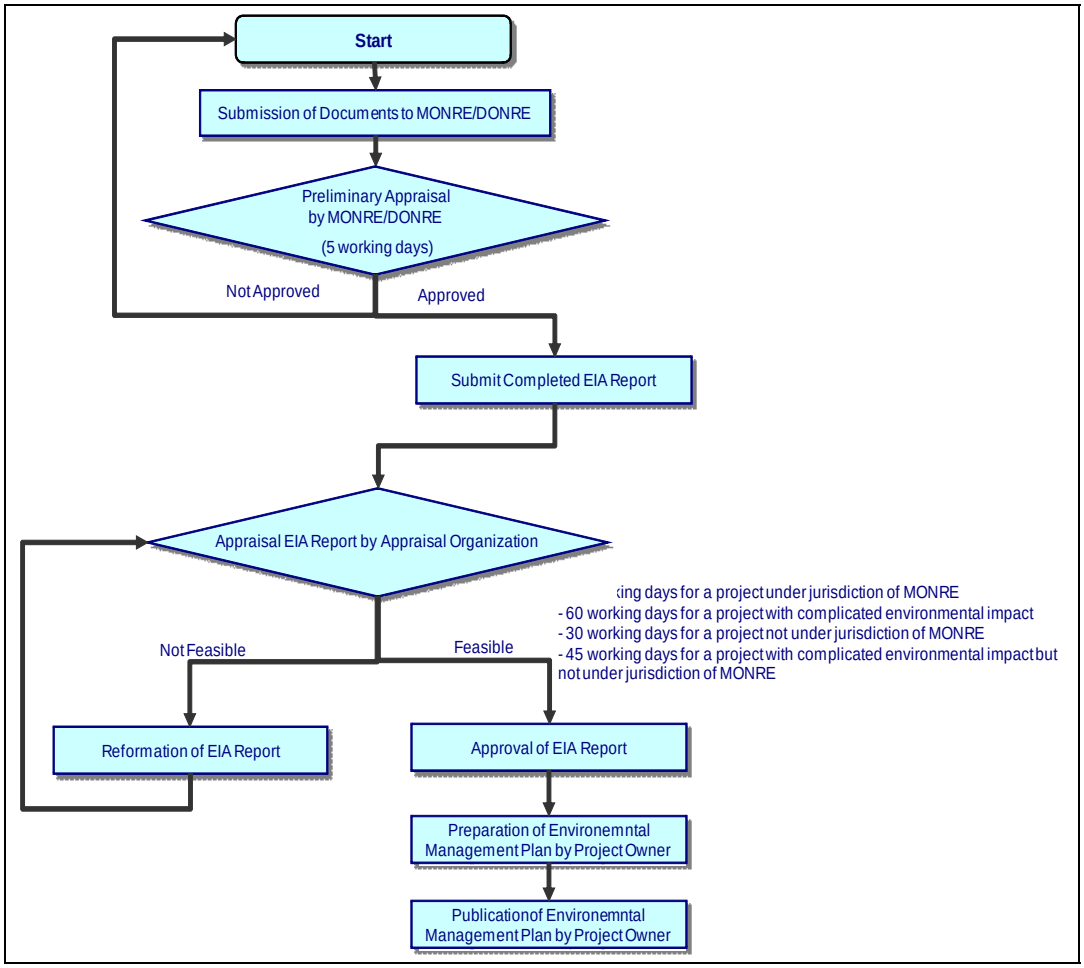
9.1 In this study, a comparative analysis of alternatives of the HSR alignments and station locations, was carried out in accordance with the JICA Guidelines for Environmental and Social Considerations of 2004 and 2010. Four aspects (i.e., convenience and integrated development, environmental and social considerations, high-speed serviceability and economical efficiency) were taken into consideration for the comparison of the alternatives which include “Zero option” or without the HSR projects case. During the course of the comparison of alternatives, a series of stakeholder meetings was held at each city and province where the HSR alignment is proposed. Plenary sessions were also conducted in order to provide opportunities to exchange information and opinions on the alternatives. Finally, through the above exercises, comments, opinions and ideas received from stakeholders were consolidated and reflected on the HSR alignment and station location plan. The optimal alternative was then determined and selected. After that, provisional scoping was carried out on the selected optimal alternative and the corresponding provisional environmental mitigation measures and monitoring framework were proposed. In the following sections, further steps and recommendations on environmental and social considerations are discussed in order to go forward with the HSR projects in an environmentally sound and socially acceptable manner.

## 9.1 Further Steps

### 1) Implementation of a Full-Scale Environmental Impact Assessment (EIA) Study

9.2 In Vietnam, the Law on Environmental Protection was promulgated on November 29, 2005 (enacted in 2006). In accordance with this law, Decree No 29/2011/ND-CP on Provisions of Strategic Environmental Assessment, Environmental Impact Assessment and Environmental Protection Commitment was also issued on April 18, 2011. The Decree stipulates the target projects with which an EIA is required in “Chapter III Environmental Impact Assessment, Article 12 Projects Subject to Environmental Impact Assessment Reporting and Responsibility of Project Proponent for Environmental Impact Assessment”. Since all investment projects decided upon by the National Assembly or the Prime Minister are subject to an EIA reporting (as per Appendix II of the decree), the HSR projects will require an EIA report. In this connection, an EIA report shall be made concurrently with the formulation of the investment project, i.e., during the preparation of a feasibility study.

9.3 Typical flow-chart of the EIA process in Vietnam is shown in Figure 9.1.1. Since the HSR projects need the decision of the National Assembly, MONRE will be in charge of the appraisal of the EIA report as per Article 18 of Decree No.29/2011/ND-CP. The project proponent should submit the necessary document to MONRE based on Circular No.26 /2011/TT-BTNMT of July 18, 2011, detailing a number of articles of the Government’s Decree No.29/2011/ND-CP.




Source: Decree No. 29/2011/ND-CP

**Figure 9.1.1 EIA Appraisal Process in Vietnam**

9.4 On the other hand, JICA, Japan Bank for International Cooperation (JBIC), other donor agencies and various agencies and organizations which are envisioned to be funding sources of the HSR projects, have their respective guidelines or policies on environmental and social considerations or safeguards. If the HSR projects will strive to receive funds or any other support from these agencies and organizations, a detail and comprehensive environmental and social considerations study including a preparation of an EIA report, which meets their requirements in terms of content, quality, and process, will be essential.

9.5 In this study, based on the 2004 and 2010 JICA Guidelines for Environmental and Social Considerations, provisional scoping has been carried out for the selected optimal alternative as part of the IEE study in order to clarify a range of significant and potentially significant environmental and social impacts which need to be assessed in detail in the subsequent detail EIA study. Provisional scope of the EIA study for the technical requirements such as survey, prediction and evaluation methods has also been proposed. As a next step, it is necessary that the scoping and scope of the EIA study should be updated and finalized based on the updated and elaborated projects plan. At such time, the depth and level of the EIA study need to be examined taking into consideration the requirements of JICA and other potential funding sources.

9.6 MOT also issued a document on “Procedure on Environmental Impact

Assessment upon Preparing Feasibility Study Projects and Construction Design on Railway, Road and Port Facility" in 1997. This document contains EIA guidelines for railway construction projects. Inasmuch as said guidelines may not be directly applied to the HSR projects, the contents and technical requirements discussed in the guidelines should be referred to for the EIA study.

9.7 Considering the above requirements, the contents of the EIA report covering the requirements of both JICA Guidelines for Environmental and Social Considerations 2010 and Decree No.29/2011/ND-CP are proposed as shown in Table 9.1.1.

**Table 9.1.1 Proposed Contents of EIA Report**

| Items | Contents |
|---|---|
| Introduction | Description of background, purpose, target and owner of the Projects |
| Project policy and plan | Describe policy/ plan of the Projects including future socio-economic situations, alignment and list of structures and activities which would likely have adverse environmental and social impacts. |
| Alternative analysis to document the purpose of the Projects | Description of alternatives (alignment and station locations) analysis to document the purpose of the Projects |
| Institutions and organizations for environmental and social considerations in Vietnam | Summary of institutions and organizations related to environmental and social considerations including public participation and information disclosure<br>• Outlines of relating laws, decrees, circulars and standards<br>• Outlines of relating agencies and its organizations |
| Environmental and social conditions (baseline conditions) | Summary of environmental and social baseline conditions covering topography, geological features, land use, natural environment, cultural/historical heritages and valuable landscape, indigenous people, environmental pollution, socio economic condition, etc. |
| Scoping | Summary of result of scoping |
| Methodology of impact prediction/evaluation | Methodologies of impact prediction and evaluation |
| Impact prediction and evaluation | Results of prediction and evaluation of impacts of each item at project planning (pre-construction), construction and operation stages, referring to similar projects in Japan or other countries. The following items should be assessed with due considerations:<br>• Natural environment (ecosystem, flora and fauna, biodiversity, etc.)<br>• Living environment (noise, vibration, soil contamination, low frequency noise/ micro-pressure wave around the tunnel sections, radio wave interference, etc.)<br>• Social environment (involuntary resettlement, social infrastructures and social services, unequal distribution of benefits and damages, cultural/historical heritages, etc.)*<br>• Others (climate change, etc.) |
| Stakeholder meetings/public consultation meetings | Results of stakeholder meetings and/or public consultation meetings including a record of consultation meetings (date, venue, participants, procedures, opinions of major local stakeholders and responses to them, and other items). |
| Environmental and social management plan | Proposed environmental and social management plan (ESMP) including impact mitigation measures to be taken during project pre-construction, construction, and operation in order to eliminate adverse impacts, offset them or reduce them to acceptable levels. |
| Environmental and social monitoring plan | Proposed environmental and social monitoring plan (ESMoP) to be conducted during pre-construction, construction, and operation. This includes estimated costs for construction of environmental protection works in the project's total cost. |
| Conclusion and Recommendations | Conclusion of EIA study as the commitment of the projects owner and recommendations for the next stage of the Projects. |

Source: Prepared by JICA Study Team based on the JICA Guidelines (2010) and Decree No. 29/2011/ND-CP
Note: * Social environment should be assessed as Social Impact Assessment (SIA) study as discussed below.

9.8 In addition, in preparing an EIA report, consultations with local stakeholders, such as affected individuals or groups (including illegal dwellers) and local NGOs, should take place after sufficient information has been disclosed and records of such consultations

should be prepared. The holding of consultations is required, especially when the items to be considered in the EIA are being selected (finalization of scoping) and when the draft EIA report is being prepared.

### 2) Necessary Actions for Land Acquisition, Resettlement and Rehabilitation

9.9 There is a fundamental law on land acquisition in Vietnam, namely the Law on Land, which was promulgated on November 26, 2003. Under this law, several derivative decrees and circulars have been issued. Among these, Decree No.197/2004/ND-CP, Decree No.181/2004/ND-CP, Decree No.84/2007/ND-CP and Decree No.69/2009/ND-CP are main regulations of land acquisition and resettlement relating to the HSR projects. In accordance with these laws and decrees, a Compensation, Support and Resettlement (CSR) plan needs to be prepared and approved for land acquisition. There are two stages in the CSR plan preparation and approval processes, i.e., before F/S approval and after F/S approval by jurisdiction ministry.

9.10 In the case of the after F/S approval, Detail Measurement Survey (DMS) will be conducted for preparation of CSR plan by Compensation, Support and Resettlement Council at district level. In addition, a replacement cost survey is to be conducted by authorized valuators or appraisers for understanding the latest market price and for evaluating appropriate compensation amount since there is a possibility that provincial compensation rate does not always properly reflect the real market price. If there is a difference in the replacement costs between the survey results and provincial compensation results, the local authorities are requested to review and update their valuations for the appropriate compensation rate by examining the latest market price. In the course of the preparation of a CSR plan, public comments will be received through disclosure of the draft CSR plan.

9.11 On the other hand, similar to the case of the EIA mentioned above, JICA, JBIC, other donor agencies and various agencies and organizations, which are envisioned to be funding sources of the HSR projects, have their respective guidelines or policies on environmental and social considerations or safeguards. Should the HSR projects strive to procure funds or any other supports from these agencies and organizations, then a detailed and comprehensive resettlement action plan (RAP) will be essential. Such RAP should meet the funder’s requirements in terms of its contents, quality, and process. In the case of JICA, it is desirable that the RAP should include elements laid out in the World Bank Safeguard Policy, OP 4.12.

9.12 Since the HSR projects are now in the planning stage and are expected to be decided upon by the National Assembly in the near future, it is not the right time to conduct an official household survey (i.e., census, inventory of asset loss, socio-economic survey) on the potential project affected people (PAP) to prepare a RAP. Thus, in accordance with the JICA Guidelines, a resettlement and rehabilitation policy framework (RRPF) has been drafted in this study containing the basic idea and direction for the resettlement and rehabilitation which is expected to be utilized for the preparation of a CSR plan and RAP. When preparations for these plans are underway it is recommended that the contents of the RRPF are complied with. In particular, the CSR plan should meet the requirements of the potential funding agency so that the CSR plan can be regarded as a satisfactory RAP.

### 3) Necessary Actions for Change of Forest Use Purposes for the HSR Projects

9.13 In Vietnam, the Law of Forest Protection was promulgated on December 3, 2004. In accordance with this law, No.23/2006/ND-CP on the Implementation of the Law of Forest Protection and Development was also issued on March 3, 2006. The selected optimal alternative (alignment and station locations) has avoided, as much as possible, passing through or locating in special-use forest areas. However, there are instances that the alignment needs to pass through some protection and production forest areas. For such cases, Decree No.23/2006/ND-CP stipulates necessary procedures of change of forest use purposes in addition to forest protection and development planning and plans, etc. In its Article 29, change of forest use purpose into non-forestry purpose is stipulated as shown in Table 9.1.2.

9.14 In addition to this decree, the HSR projects shall follow Circular No. 38/2007/TT-BNN stipulating forest recovery procedure, Circular No. 35/2011/TT-BNNPTNT stipulating the exploitation of the forest in conversion of the forest land to non-forestry land use, and Circular No. 46/2007/QD-BNN stipulating the condition of the replacement afforestation which the project proponent needs to achieve before the handing over.

**Table 9.1.2 Change of Forest Use Purpose into Non-Forest Purposes**

| |
|---|
| Kinds of forest permitted for the change of forest use purposes into non-forestry purposes must comply with the provisions of land law and forest protection and development law, be compatible with forest protection and development planning already approved by competent state agencies as well as the following provisions:<br>(i) The competence to decide on the change of forest use purposes shall comply with the provisions of Clause 2, Article 28 of this Decree.<br>(ii) There is an investment project on the forest area subject to use purpose change, which has already been approved by a competent state agency.<br>(iii) There is a report on assessment of environmental impacts of the change of forest use purposes.<br>(iv) There is a scheme on compensation for forest ground clearance, approved by a competent state agency.<br>(v) The agency permitting the change of forest use purposes into other purposes must ensure investment in planting new forests to replace the forest area subject to such use purpose change. |

Source: Decree No.23/2006/ND-CP

9.15 It is therefore that the project proponent of the HSR projects should take necessary actions to comply with Article 29 above including preparation of a report on assessment of environmental impacts of the change of forest use purposes which would be covered by the EIA report based on Decree No.29/2011/ND-CP.

## 9.2 Recommendations

### 1) Establishment of Institutional and Legal Systems on Railway Noise and Vibration by the HSR Projects

9.16 The HSR projects, especially operation of trains/rolling stock cars at a high speed, generate specific and relatively higher levels railway noise and vibration. The past various researches and surveys revealed that railway noise and vibration levels are considered to be increased as the running speed of trains is faster. In this study, the preliminary examinations on railway noise and vibration pollution from operation of high speed trains were conducted with the assumption of running speed of 320 km/h as an operating speed and various possible mitigation measures were discussed. As part of the preliminary examinations, tentative noise and vibration target levels on HSR to be archived were set because the existing noise and vibration standards in Vietnam (QCVN 26:2010/BTNMT, QCVN 27:2010/BTNMT) are not considered to be the ones set specific for railway noise and vibration and environmental and regulatory standards on HSR noise and vibration have not been established yet. Actually, VNRA has prepared noise and vibration standards along railway line as TCCS 03:2009/VNRA and TCCS 04:2009/VNRA respectively, which are applied to noise and vibration levels during train operation and construction or upgrade/improve of national railways in public and residential areas. However, since these standards are internal ones and have not been approved by MONRE, they are not strictly enforced and may not be directly applied to the HSR projects.

9.17 In Vietnam, the people's concerns on noise and vibration are not considered so high at this moment. However, as experienced by most of the developed countries, the people's concerns on noise and vibration are expected to increase in accordance with improvements in public awareness on the environment, changes in lifestyles, etc. It is necessary to take into consideration this potential problem in advance in the project planning. In order to promote appropriate mitigation measures by the project proponent, it is necessary to clarify and define the responsibilities of the proponent of the HSR projects on railway noise and vibration. It is therefore, recommended to legally establish national railway noise and vibration standards/regulations on HSR together with its monitoring/measurement and evaluation methods. At the same time, it is also recommended that improvement of the capacities of the regulatory authorities such as MONRE and DONRE are strengthened in order to secure the appropriate mitigation measures by the project proponent.

### 2) Establishment of Compensation Framework or Guideline for Electric Wave Interference and Sunshine Obstruction by the HSR Projects

9.18 There is a possibility of radio wave reception interference caused by high-speed train operation and by elevated structures such as viaducts and station buildings. In particular, the flutter or pulse phenomena on TV pictures would be caused when trains are operating at a high speed. So far, even with other various development projects, electric wave interference by development project activities has not become a problem in Vietnam. However, similar to railway noise and vibration, people's concerns and demands on better quality of TV pictures are expected to increase in the future with the changes in lifestyles and economic development. In addition, there is a possibility of some disturbances on electromagnetic waves especially around the facilities where AC feeding is adopted, such as the substations. Since there is no law, regulations and guidelines regarding radio wave interference available in Vietnam, it is recommended that necessary law, regulations and

guidelines should be prepared for these potential problems. Specifically, a compensation framework or guidelines should be established in advance or in parallel with the detail study in EIA.

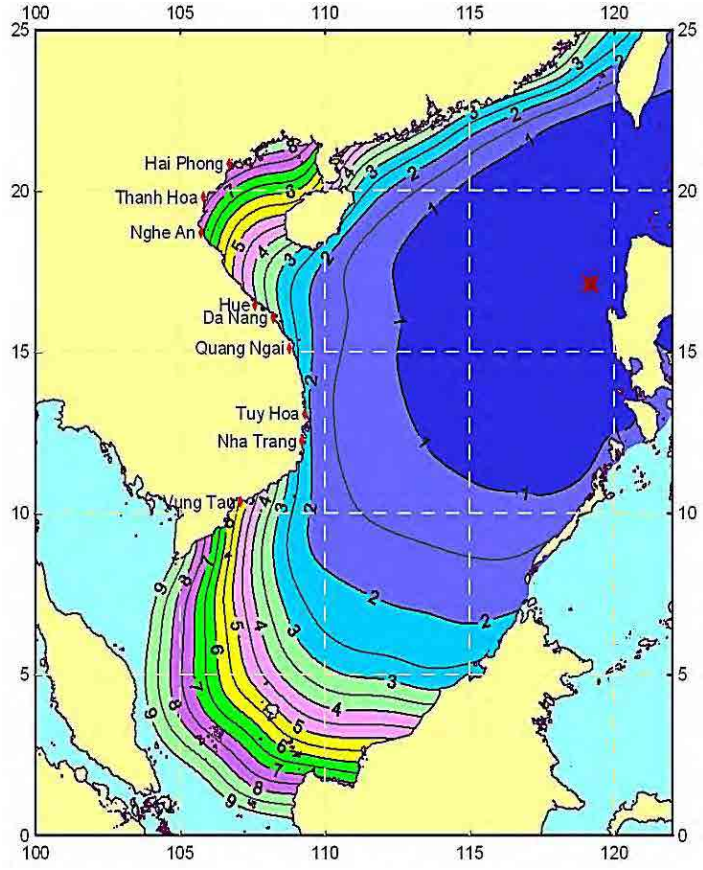
9.19 As for sunshine obstruction, although it has not been a problem so far in Vietnam, special considerations should also be given on this issue. Especially in agricultural areas, there is a possibility that an issue on shade created by the elevated structures would cause some negative impacts on agricultural products. This should be addressed for farmers who own a farm land besides the elevated structures of the HSR projects. Therefore, it is recommended that a framework or guidelines should be established together with the preparation of necessary law and regulations.

### 3) Careful Considerations of Potential Impacts by Natural Disaster in the HSR Projects Planning

9.20 According to UN-Vietnam Factsheet on Earthquakes and Tsunamis in Vietnam which was issued on March 24, 2011, Vietnam is not located on the edge of any plates. Hence, the occurrence of earthquakes in Vietnam is much less compared to the neighboring countries. However, there are some fault systems in the northern region of Vietnam. These fault lines are likely to have lengths of several hundred kilometers which can potentially generate earthquakes with a magnitude of 5.7 to 7 according to the above factsheet. Historically, from 1900 till 1995, two large scale earthquakes with magnitude 6.7-6.8 occurred.

9.21 As for tsunamis, although a damaging tsunami has so far not yet been registered since records started, some coastal provinces can potentially be affected by a tsunami. Three most likely sources of earthquakes have been defined that could trigger tsunamis reaching the Vietnamese coast. These are earthquakes measuring 8 on the Richter scale along the Manila fault, earthquakes over 8 occurring North of the Luzon Island of the Philippines and those originating south of Taiwan and earthquakes over magnitude 8.8 along the Ryukyu fault of Japan. The central coast from Đong Ha (Quang Trị) to Phan Rang (Ninh Thuan) could potentially be the most affected by a tsunami. It is anticipated that it would take about two to three hours for tsunami waves generated by a very strong earthquake along the Manila fault to reach the Vietnamese coastline as shown in Figure 9.2.1.

9.22 Although the areas where the HSR projects are planned may not be vulnerable to earthquakes and are not expected to be affected seriously by tsunamis, further studies need to be conducted for the projects plan and structures design as well as EIA so that potential impacts by earthquakes and tsunamis can be adequately taken into consideration.




Source: UN-Vietnam Factsheet on Earthquakes and Tsunamis in Vietnam March 24, 2011

**Figure 9.2.1 Anticipated Time for Tsunami Waves Caused by a Very Strong Earthquake along the Manila Fault**

9.23 Other natural disasters such as flood, landslide and typhoons are common in Vietnam. The flood prone areas and/or flood affected areas, landslide prone areas and/or landslide affected areas, and typhoon prone areas and/or typhoon affected areas have been recorded in Vietnam as transcribed in the Environmental Sensitivity Maps (see Technical Report No.4). Although these areas have been avoided as much as possible in the alignment planning including comparison of alternatives, there are still a few of such areas in the alignment. In the next study stage, the projects plan and design of structures should be made with due consideration of eliminating or minimizing the risks of these natural disasters.

### 4) Consideration of Results of other EIA Studies

9.24 The terminal station of the north section of HSR is planned to be located at Ngoc Hoi connecting with the Line 1 of Hanoi City Urban Railway. EIA studies on this project have been conducted including a supplemental EIA study which covers the Ngoc Hoi station area. In south section, the HSR alignment is planned to pass through the center of the planned Long Thanh International Airport (LTIA). The feasibility study including environmental impact studies for the LTIA has been conducted with support from JICA. Therefore, when the EIA study on the HSR project will be conducted, the results of these

EIA studies should be taken into consideration in the baseline data, environmental impacts prediction and evaluation, and examination of EMP, etc.

**5) Establishment of Strategic Schemes to Secure the Projects Land**

9.25 For smooth implementation of the HSR projects, it is essential that the land for the project should be secured on time. However, major concerns from each local government at the stakeholder meetings held at each city and province revealed that it would be not easy to acquire the land, especially for projects which require a continuous long strip of land. In fact, there have been many cases recently that implementation of the development projects were delayed mainly due to setbacks in land acquisition and resettlement in Vietnam, especially in the urban areas. In order to cope with these issues, it is recommended that actions for land acquisition be taken at an early stage as much as possible to ensure the land in advance in accordance with the RAP and/or CSR plan as approved by concerned entities. As part of the advance land acquisition activities especially in urban areas, it is recommended that new strategic schemes such as land readjustment be established and adopted. Even with the land acquired or reserved in advance for the projects, the project is still expected to be implemented over a long period of time. It is then necessary to prevent the influx of new residents or business activities including illegal ones, during the project implementation period. Thus, a legal system should also be developed so that the status quo of the acquired or arranged project lands can remain secure for an extended period of the project time.

**6) Further Considerations for Minimization of Involuntary Resettlement**

9.26 Involuntary resettlement and loss of means of livelihood are to be avoided by exploring all viable alternatives. In this study, the alignment and station locations are planned minimizing the number of project affected buildings as much as possible through the comparison of alternatives and adopting the minimum distance of between track centers to minimize the area of the land to be acquired. However, the total estimated number of PAPs, which was calculated based on the estimated number of project affected buildings etc. are still relatively large compared with other development projects in Vietnam. It is therefore necessary that further measures be undertaken to minimize the number of PAPs. Moreover, the number for involuntary resettlement should be re-examined and validated during the next planning stage of the projects, the EIA study and the RAP preparation. At such time, a more accurate number and distribution of PAPs and involuntary resettlement should be confirmed so that more concrete measures can be drawn up.

**7) Sufficient Compensation for Resettlement and Rehabilitation**

9.27 For the confirmed PAPs, effective measures to minimize impact and to compensate for losses must be agreed upon by all the affected parties. The affected persons to be resettled involuntarily and those whose means of livelihood will be hindered or lost must be provided with support and sufficient compensation in a timely manner. Proper compensation at full replacement cost should be given as much as possible. It is necessary to enable the PAPs to improve their standard of living, income opportunities, and production levels, or at least to restore these to pre-project levels. Measures to achieve these may include providing land and monetary compensation for losses (to cover land and property losses), supporting means for an alternative sustainable livelihood, and providing for the costs necessary for the relocation and re-establishment of communities

at resettlement sites. These measures should be in place in accordance with the RAP and/or CSR plan, which are expected to be developed based on the contents of the RRPF.

9.28 There is some discrepancies identified between the Vietnamese law and decree and the potential funding agencies' policies and guidelines (e.g., the JICA Guidelines). In particular, among the discrepancies, compensation based on full replacement cost is one of the crucial issues to be addressed. In principle, it is recommended that compensation should be carried out in accordance with the RAP which is approved by concerned entities. On the other hand, as discussed above, if there is a difference in the replacement costs between the market price survey result and the provincial compensation rate, local authorities are requested to review and appropriately update their compensation rate by examining the latest market price. If these procedures are carried out properly and timely, the replacement cost in the CSR plan could be at the same level as the RAP. It is recommended that the local authorities should coordinate with the expected funding agency or agencies on the level of replacement cost so that the PAPs will be able to receive sufficient compensation.

### 8) Careful Considerations for Ingenious People/Ethnic Minority

9.29 Generally, the ethnic minorities living in the mountainous areas are referred to as indigenous people in Vietnam. As such, the term "ethnic minorities" is often used interchangeably with indigenous people. As a multi-ethnic country, Vietnam has 54 recognized ethnic groups; the Kinh represents the majority comprising 86% of total population while the remaining 53 groups are ethnic minorities accounting for around 14% of the total population. Each ethnic group has its own distinct culture and tradition. All ethnic minorities have Vietnamese citizenship and they are scattered throughout the country, inhabiting the midland, coastal and mountain areas.

9.30 Any adverse impacts on ethnic minority are to be avoided when feasible by exploring all viable alternatives. In this study, the alignment and station locations are planned so as to avoid adverse impacts on ethnic minority as long as the alignment plan allows. However, the alignment of both north and south sections still need to pass several communes where ethnic minority groups live. Since it is not clear at this study stage whether there are ethnic minority groups that will be affected by the HSR projects, detailed information as to their distribution along the alignment need to be surveyed during the next study stage. At such time, it is necessary that their culture, life, means of livelihood, religion etc. should be examined with the cooperation of local experts.

9.31 If and when there is no recourse to avoid affecting the ethnic minorities, then effective measures must be taken to minimize impacts and to compensate them for their losses. In the event that the HSR projects may have adverse impacts on the ethnic minorities, all their rights in relation to land and resources must be respected in accordance with the spirit of relevant international declarations and treaties, including the United Nations Declaration on the Rights of Indigenous Peoples.

9.32 Measures for the affected ethnic minority groups should be prepared as an indigenous peoples plan (IPP) which may constitute a part of other documents for environmental and social considerations and must be made public in compliance with the relevant laws and ordinances in Vietnam. In preparing the IPP, consultations must be made with the affected ethnic minority people based on sufficient information made available to them in advance. It is desirable that the IPP should include the elements laid

out in the World Bank Safeguard Policy, OP4.10, Annex B.

**9) Implementation of Social Impact Assessment (SIA) Study**

9.33 Along the HSR alignment, some impacts on social infrastructures such as irrigation system, water supply facilities and roads, social services such as education and health care, and local economy and livelihood are expected. In particular, the HSR projects will likely cause an unequal distribution of benefits and damages between those residents living near the HSR station and those residents living near the HSR alignment but far away from the HSR station. Thus, special attention should also be given to social considerations for them especially for the sections where the embankment is planned. Accordingly, the embankment will be designed installing appropriate number of box culverts and/or other similar facilities in order not to disrupt people's mobility and to minimize impacts on the cohesiveness of the community. The installed box culverts are also expected to play important roles for the smooth flow of water and the movement of animals in the area. In consideration to these potential impacts on local communities, it is recommended that a social impact assessment (SIA) study be conducted including a detailed survey of local communities as well as social infrastructures and services as part of the environmental and social considerations. The detail and concrete mitigation measures for social impacts should be developed based on the SIA study while measures for the affected ethnic minorities should be prepared as an IPP as discussed above. These documents should be presented to the local stakeholders so that the HSR projects may be accepted in a manner that is socially appropriate to the country and locally where the project is planned.

**10) Continuous and Sufficient Consultations with Local Stakeholders and Vulnerable Social Groups**

9.34 During the study, a series of SHMs was conducted for the HSR projects planning as well as environmental and social considerations (IEE study) including the comparison of the alternatives on alignment and station locations. Once the HSR projects are decided upon by the National Assembly, a feasibility study together with detailed EIA study will be carried out. A series of surveys to prepare the RAP will also be carried out. During these surveys and studies, more site specific consultations with local stakeholders such as affected individuals or groups (including illegal dwellers) and local NGOs and local residents at least at commune level will be required. In addition to these official consultations, it is recommended that continuous and sufficient communications and dialogues with local stakeholders along the HSR alignment should be carried out via disclosure of sufficient information from an early stage of the projects. Outcomes of such consultations should be incorporated into the contents of the project plans. In the consultations, both positive and negative impacts by the HSR projects including increase public financial burden as well as spillover effects for regional development should also be explained.

9.35 To organize the consultations, it is necessary that appropriate considerations should be given to especially vulnerable social groups, such as women, children, the elderly, the poor, indigenous people or ethnic minorities, and all other members which are susceptible to environmental and social impacts and may have little access to the decision-making processes within society. When consultations are held, it is also desirable that explanations be given in a form, manner, and language that are understandable to the people concerned.

### 11) Implementation of Environmental Monitoring and Utilization of its Results

9.36 The HSR projects would generate noise and vibration, and micro-pressure wave (tunnel sonic boom) etc. peculiar to high speed train operation. In Japan, these adverse impacts by the HSR (Shinkansen) have been overcome by taking various measures. These measures have been developed and established by trial and error taking into consideration the results of environmental monitoring.

9.37 As this is the first HSR undertaking in Vietnam, in general, unforeseeable situations could happen relating to environmental impacts after the start of the projects, even with appropriate measures already in place. Therefore, environmental monitoring is required to check whether any unforeseeable situations occur and whether the performance and effectiveness of mitigation measures are consistent with the EIA. In this study, provisional environmental monitoring frameworks have been prepared for both the north and the south sections. These frameworks should be finalized in the EIA considering updated projects information as well as actual environmental and social conditions. In fact, as sufficient monitoring is deemed essential for appropriate environmental and social considerations, like the HSR projects for which mitigation measures should be implemented while monitoring their effectiveness, a feasible environmental monitoring plan must be ensured. Based on the results of such monitoring, appropriate mitigation measures then need to be developed and taken.

9.38 It is also recommended that the process and results of the monitoring should be available to local stakeholders. When third parties point out, in concrete terms, that environmental and social considerations are not being fully undertaken, forums for discussion and examination of countermeasures are established based on sufficient information disclosure, including local stakeholders' participation. The HSR projects should make efforts to reach an agreement on procedures to be adopted with a view to resolving problems.

# APPENDIX 1A

# Laws and Regulations related to Environmental and Social Considerations (National Level)

National regulations on environmenal and social considerations are listed in Table 1A.1.

**Table 1A.1 Laws and Regulations related to Environmental and Social Considerations (National Level)**

| No. | Laws and Regulations | Description |
|---|---|---|
| 1 | Law on Environmental Protection | It went to effect in 2006 as a replacement of the former Law of Environmental Protection. Stipulating environmental protection, policies, rights and obligation for all stakeholders to environmental protection. |
| 2 | Law on Construction | Stipulating construction activities, rights and obligation of individuals/organizations which invest for construction or conduct construction activities. |
| 3 | Law on Biodiversity | Stipulating conservation and sustainable development of biodiversity. |
| 4 | Law on Forest Protection and Development | Stipulating management, protection, development, and use of forest as well as rights and obligation of forest owners. |
| 5 | Law on historical, cultural heritage and landscapes No. 14-LCT/HDNN7 dated 4 April 1984 | Stipulating issues on historical, cultural heritage and landscapes |
| 6 | Law on radio wave frequency No.49/2009/QH12 | Stipulating issues on radio wave |
| 7 | Cultural heritage law 2011 No. 28/2001/QH10 | Stipulating management of cultural heritage |
| 8 | Law No 32/2009/QH12 on amendment of some articles of cultural heritage law 28/2001/QH10 | Amendment on management of cultural heritage |
| 9 | Law on gender equality No.73/2006/QH11 dated 29/11/2006 | Stipulating issues on gender equiality |
| 10 | Law on protection, taking care and education of children No.25/2004/QH11 dated 25/6/2004 | Stipulating issues on children's right |
| 11 | Law on public health protection No. 21-LCT/HĐNN8 dated June 30, 1989 | Stipulating issues on public health |
| 12 | Law on HIV/AIDS prevention No. 64/ 2006/QH11 dated June 29, 2006 | Stipulating issues on HIV/AIDS prevention |
| 13 | Law on labor protection | Stipulating issues on labor protection |
| 14 | Law on social insurance No.71/2006/QH11 dated June 29, 2006 | Stipulating issues on labor protection on social insurance |
| 15 | Decree No. 80/2006/ND-CP issued in August 9, 2006 | Stipulating guidance of implementing Law on Environmental Protection. |
| 16 | Decree No. 81/2006/ND-CP of August 9, 2006 | Stipulating administrative violation in the domain of environmental protection. |
| 17 | Decree No. 140/2006/ND-CP of November 22, 2006 | Providing environmental protection at stages of elaboration, evaluation, approval and implementation of development strategies, planning, plans, programs, and projects. |
| 18 | Decree No. 21/2008/ND-CP dated February 28, 2008 | Stipulating amendment and supplement a number of articles in Decree No. 80/2006/ND-CP. |
| 19 | Decree No. 29/2011/ND-CP of April | Providing the strategic environmental assessment, environmental impact |

| No. | Laws and Regulations | Description |
|---|---|---|
| | 18, 2011 | assessment, environmental protection commitment. This is the latest regulation on SEA and EIA. |
| 20 | Decree No. 16/2005/ND-CP of February 7, 2005 | Stipulating guidance of implementing Construction law and necessity of analysis of environmental impact attributable to project. |
| 21 | Decree No.112/2006/ND-CP of September 29, 2006 | Stipulating amendment and supplement a number of articles in Decree No. 16/2005/ND-CP on management of investment projects on the construction of works. |
| 22 | Decree No. 65/2010/ND-CP of June 11, 2010 | Providing detailing and guiding a number of articles of Law on Biodiversity. |
| 23 | Decree No. 109/2003/ND-CP of September 23, 2003 | Regulating conservation of ecosystem in wetland and development. |
| 24 | Decree No. 32/2006/ND-CP of March 30, 2006 | Regulating flora and fauna which are necessary to be protected. |
| 25 | Decree No. 23/2006/ND-CP of March 3, 2006 | Regulating forest protection and development. |
| 26 | Decree No. 288/HDBT dated December 31, 1985 | Stipulating protection and use of historical, cultural heritages and landscapes |
| 27 | Decree No. 98/2010/ND-CP dated September 21, 2010 | Detailing a number of Articles of the Law on Cultural Heritage and the Law amending and supplementing a number of Articles of the Law on Cultural Heritage |
| 28 | Decree No. 172/1999/ND-CP | Article 25, requiring that sites currently recognized for cultural and historical preservation and that are situated within the boundaries of waterway safety corridors, should be kept intact according to current legal regulations |
| 29 | Decree No. 86/2005/ND-CP of July 8, 2005 | Stipulating management and protection of underwater cultural heritage. |
| 30 | Decree No. 59/2007/N-CP of April 9, 2007 | Stipulating solid waste management. |
| 31 | Decree No.70/2008/ND-CP dated June 4, 2008 of GoV | Detailing regulations on some articles of gender equality law |
| 32 | Decree No.71/2001/ND-CP dated August 22, 2011 | Stipulating and guiding for implementing the Law on protection, taking care and education of children No.25/2004/QH11 |
| 33 | Decree No.108/2007/ND-CP dated 26 June 2007 | Detailing regulations on some articles of HIV/AIDS prevention law |
| 34 | Decree No.69/2011/ND-CP dated August 8, 2011 | Stipulating fine of administration violation on standby medical activities, medical environment and HIV/AIDS prevention |
| 35 | Decree No.06/CP dated January 20, 1995 | Detailing regulation on some articles of work safety law, regarding work safety and work sanitation. |
| 36 | Decree No.110/2002/ND-CP dated December 27, 2002 | Stipulating adjustment of some articles of Decree No.06/CP on detailed regulation on some articles of work safety law, regarding work safety and work sanitation. |
| 37 | Decree No.47/2010/ND-CP dated May 6, 2010 | Stipulating administrative fine for violation on labor law |
| 38 | Decision No. 96/2006/QĐ-TTG | Stipulating the management and peformatnce of the task of sweeping bomb, mine and explosive objects |
| 39 | Decision No. 395/QD-BLDTBXH dated March 30, 2012 | Stipulating issues plan of information disclosure, law propagation about gender equality |
| 40 | Decision No.199/QD-BGTVT dated January 26, 2011 | Stipulating approval of action plan against to climate change of MOT in the stage of 2011-2015 |
| 41 | Decision No.543/QD-MNN-KHCN dated March 23, 2011 | Stipulating approval of action plan against to climate change of agriculture sector in the stage of 2011-2015 and vision until 2050 |
| 42 | Circular No. 05/2008/TT-BTNMT of December 8, 2008 | Providing environmental protection at stages of elaboration, evaluation, approval and implementation of development strategies, planning, plans, programs, and projects. This is the replacement of Circulars No. 08/2006/TT-BTNMT. |
| 43 | Circular No. 26/2011/TT-BTNMT of July 18, 2011 | Providing environmental protection at stages of elaboration, evaluation, approval and implementation of development strategies, planning, plans, programs, and projects. This is the replacement of Circulars No. 05/2008/TT-BTNMT. This is the latest circular on SEA and EIA. |
| 44 | Circular No.146/2007/TT-BQP | Stipulating the implementation of Decision No.96/2006/QD-TTG on sweeping bomb, mine and explosive objects |

| No. | Laws and Regulations | Description |
|---|---|---|
| 45 | Circular No. 38/2007/TT-BNN | Stipulating forest recovery procedure. |
| 46 | Circular No. 35/2011/TT-BNNPTNT | Stipulating the exploitation of the forest in conversion of the forest land to non-forestry landuse. |
| 47 | Circular No. 46/2007/QD-BNN | Stipulating the condition of the replacement afforestation which the project proponent needs to achieve before the handing over. |
| 48 | Circular No. 12/2011/TT-BTNMT dated April 14, 2011 | Stipulating management of hazardous waste |
| 49 | Circular No.12/2006/QD-TTg dated December 26, 2006 of MONRE | Guiding condition of profession and procedure of record preparation, registration, granting permits of profession, code of hazardous waste management |
| 50 | Circular No. 40/TTLT-BLDTBXH-BYT dated December 28, 2011 | Stipulating harmful work conditions and some works which are not allowed to use women labors, pregnant women labors and women labors with children under 12 months |
| 51 | Circular No.01/2010 dated 6 January 6, 2010 | Stipulating responsibility, procedures of informing positive HIV testing result |
| 52 | Circular No.48/2010/TT-BYT dated December 31, 2010 | Guiding announcement, information, reporting for sexual transmitted illness |
| 53 | Circular No. 20/2008/ TTLT - BTTTT – BYT dated August 20, 2010 of MOH | Guiding the priority on time, duration for emission in radio, television, capacity and location on newspaper, magazines for information, education and communication about HIV/AIDS prevention |
| 54 | Circular No. 09/2012/BYT dated May 24, 2012 of MOH | Guiding supervising HIV/AIDS epidemiology and STI infection |
| 55 | Circular No. 12/2012/TTLT-BLDTBXH-BYT dated May 21, 2012 | Guiding announcement, investigation and reporting work accidents |
| 56 | Environmental Standard (QCVN) | Examples are as follows:<br>Air Quality Standard (QCVN 05: 2009/BTNMT, QCVN 06: 2009/BTNMT)<br>Water Quality Standard (QCVN 08: 2008/BTNMT, QCVN 09: 2008/BTNMT)<br>Noise Standard (QCVN 26: 2010/BTNMT)<br>Vibration Standard(QCVN 27: 2010/BTNMT) |
| 57 | Environmental Standard (TCVN) | 1) Noise<br>- TCVN 7878 - 1: 2008: Acoustic. Part 1: Basic quantities and assessment procedures (Equivalent to ISO 1996 - 1:2003)<br>- TCVN 7878 - 2: 2010: Acoustic. Part 2: Measurement of acoustic pressure level (Equivalent to ISO 1996 - 2:2003)<br>2) Vibration<br>- TCVN 6963:2001, Measurement procedure of vibration and quake caused by construction and industrial activities.<br>- TCVN 7210:2002, Environmental allowable limit in public and residential areas by road trafic<br>- TCVN7378:2004, Vibration of buildings - Limits of vibration levels and method for evaluation. |
| 58 | TCCS 03:2009/VNRA | Stipulating noise level during train operation and construction or upgrade/improve of national railways in public and residential areas. |
| 59 | TCCS 04:2009/VNRA | Stipulating vibration level during train operation and construction or upgrade/improve of national railways in public and residential areas. |

Source: JICA Study Team

# APPENDIX 1B

# Laws and Regulations Related to Land Acquisition/Compensation (National Level)

National regulations on land acquisition and compensation are listed in Table 1B.1.

**Table 1B.1 Laws and Regulations Related to Land Acquisition / Compensation at National Level**

| No. | Laws and Regulations | Description |
|---|---|---|
| I. Land Acquisition/ Compensation | | |
| 1 | Law on Land | This is the upper law on regulating land use and land use right. |
| 2 | Decree No. 79/2003/ND-CP | This stipulates the regulation on the exercise of democracy in communes, including requirements for consultation with and participation of people in communes |
| 3 | Decree No. 181/2004/ND-CP of October 29, 2004 | This stipulates the regulation of utilization of Law on Land. |
| 4 | Decree No. 188/2004/ND-CP of November 16, 2004 | This specifies methods for land pricing and issuance of land price framework for land categories. |
| 5 | Decree No. 197/2004/ND-CP of December 3, 2004 | This stipulates the land acquisition and compensation. |
| 6 | Decree No.17/2006/ND-CP of January 27, 2006 | This is the amendment of some provisions of some Decrees guiding implementation of the Law of Land and the Decree No.197/2004/ND-CP. |
| 7 | Decree No.84/2007/ND-CP of May 25, 2007 | This stipulates the procedure on resettlement. |
| 8 | Decree No.123/2007/ND-CP of July 27, 2007 | This stipulates the decision methods of land price. |
| 9 | Decree No. 44/2008/ND-CP of April 9, 2008 | Amending and supplementing a number of articles of Decree No. 198/2004/ND-CP on the collection of land use levies |
| 10 | Decree No. 34/2009/QH12 of June 18, 2009 | Amending and supplementing Article 126 of the Housing Law and Article 121 of the Land Law |
| 11 | Decree No. 69/2009/ND-CP of May 13, 2009 | Additionally providing for land use planning, land prices, land recovery, compensation, support and resettlement |
| 12 | Decree No. 11/2010/ND-CP of February 24, 2010 | Prescribing the management and protection of road infrastructure facilities |
| 13 | Decree No. 120/2010/ND-CP of December 30, 2010 | Amending Decree No. 198/2004/ND-CP |
| 14 | Decree No. 121/2010/ND-CP of December 30, 2010 | Amending and Supplementing a number of articles in Decree No. 142/2005/ND-CP |
| 15 | Circular No. 114/2004/TT-BTC by MOF | This provides the guideline for implementation of the Decree No.188/2004/ND-CP. |
| 16 | Circular No. 116/2004/TT-BTC | Guiding implementation of Decree No. 197/2004/ND-CP of December 3, 2004 |
| 17 | Circular No. 06/2007/TT-BTNMT of July 2, 2007 | Guiding the implementation of number of articles of the Decree No. 84/2007/ND-CP |
| 18 | Circular No. 145/2007/TT-BTC of December 6 2007 by MOF | Guiding to execute Decree No. 123/2007/ND-CP of July 27, 2007 |
| 19 | Circular No. 14/2009/TT-BTNMT of October 1, 2008 | Detailing the compensation, support and resettlement, and order of any procedure for land recovery allowance and lease |
| 20 | Correction No. 181/DC-CP dated on October 23, 2009 | Correcting the Decree No. 69/2009/ND-CP |
| II. Ethnic Minority Groups | | |
| 1 | Joint Circular No. 819/2004/ TTLT-UBDT-KHDT-TC-XD-NNPTNT on November 10, 204 | Guiding the implementation of the Prime Minister's Decision No. 134/2004/QD-TTg on July 20, 2004 on a number of policies to provide support in terms of production land, residential land, dwelling houses and daily-life water to poor ethnic minority households meeting with difficulties |

Source: JICA Study Team

# APPENDIX 1C

# Relevant Regulations on Land Acquisition and Compensation (City/Provincial Level)

City/Provincial decision on land acquisition and compensation are shown below.

**(1) Hanoi – Vinh Section (North Section)**

(a) Ha Noi City:

- Decision No. 108/2009/QD-UBND dated 29/9/2009 - Promulgation of regulation on promulgating regulations on compensation, rehabilitation and resettlement in case of land recovery by the state in Ha Noi.
- Decision No. 108/2009/QD-UBND dated 29/9/2009 –Promulgation of regulation on compensation, support and resettlement upon land recovery by the State in Hanoi area.
- Decision No. 48/2011/QD-UBND dated 26/12/2011 – Amending and supplementing some articles of the regulation issued with Decision 02/2010/QD-UBND dated 18/01/2010 of HPC on land recovery, land allocation, land leasing and change in land use purpose to implement investment projects and build rural houses in rural residential zones in Hanoi area.
- Decision No. 02/2010/QD-UBND dated 18/01/2010 – Promulgation of regulation on land recovery, land allocation, land lease and change in land use purpose to implement investment projects and build rural houses in rural residential zones in Hanoi area.
- Decision No. 45/1999/QD-UB dated 04/6/1999 – Promulgation of "Temporary regulations on construction, conservation and improvement management of Hanoi's ancient quarter".
- Decision No. 35/2011/QD-UBND dated 05/12/2011 – Promulgation of construction prices for new houses, temporary houses and architectural structures as a basis for valuation of compensation and support when the State recovers land in Hanoi area;
- Decision No. 50/2011/QD-UBND dated 30/12/2011 – Promulgation regulation on prices of lands in Hanoi area.
- Notification No. 6323/STV-BG dated 29/12/2011 of Hanoi Department of Finance – Promulgation of unit prices in compensation and support for trees, crops and livestock on land with water surface to serve land clearance works in Hanoi area in 2012.

(b) Ha Nam Province

- Decision No. 30/2009/QD-UBND dated 26/10/2009 - Promulgating regulations on some details of compensation, supports and resettlement for land acquired by the State in Ha Nam Province.
- Decision No. 33/2011/QD-UBND dated 30/12/2011 - Promulgating regulations on issuing unit price for compensating houses, architectural works and moving graves when land is acquired by the State.
- Decision No. 18/2011/NQ-HDND dated 15/12/2011 – Promulgation regulation on prices of lands in Ha Nam province.

(c) Nam Dinh Province

- Dicision No. 33/2010/QD-UBND dated 21/12/2010 - Promulgation regulation on implementing compensation and resettlement in Nam Dinh province.
- Dicision No. 24/2011/NQ-HDND dated 08/12/2011 - Promulgation regulation on prices of land in Nam Dinh province.
- Decision No. 25/2009/QD-UBND dated - Promulgation On amending and supplementing some Articles of/ into The March 7th 2008 Decision No.02/2008/QD-UNBD of The Provincial People's Committee (regarding to promulgating the catalogue of compensation and supporting price units for the affected houses, facilities, architectural structures when the government acquires land).
- Decision No. 15/2008 dated - on promulgating the compensation, support price rate for affected houses, works and architectural structures when the government acquires land.
- Decision No. 02/2008/QD-UBND - on promulgating the compensation, support price rate for affected houses, works and architectural structures when the government acquires land.

(d) Ninh Binh Province

- Decision No. 27/2009/QD-UBND dated 16/10/2009 - Promulgating the Regulation on issuing policies for land compensation, support and resettlement when the state acquires land in Ninh Binh province.
- Decision No. 1226/2011/QD-UBND dated 31/12/2010 – Promulgation regulation on prices of lands in Ninh Binh province.
- Decision No. 06/2011/QĐ-UBND dated 21/7/2011 - Promulgating on the price units of houses, architectural structures, plants, livestock within Ninh Binh.
- Decision No. 15/2010/QD-UBND dated 12/7/2010 - Promulgating on the price units of houses, architectural structures, plants, livestock within Ninh Binh.

(e) Thanh Hoa Province

- Decision No. 2072/2010/QD-UBND dated 11/6/2010 -Regulating on procedure of land acquisition, changed land-use purpose, land allocation, land leasing for implementing the investment project within Thanh Hoa.
- Decision No. 4293/2011/QĐ-UBND dated 21/12/2011 - Promulgating on prices of lands in Thanh Hoa province in 2012.
- Decision No. 3644/2011/QĐ-UBND dated 04/11/2011 - Promulgating on the price units of houses, architectural structures in Thanh Hoa province.
- No. 3788/2009/QD-UBND dated 23/10/2009 - Promulgating on support and resettlement policy for land acquired by the state in Thanh Hoa province.

(f) Nghe An Province

- Decision No. 04/2010/QD-UBND - Regulating on compensation, support and resettlement when the government acquires land within Nghe An.
- Decision No 107/2010/QD-UBND dated 23/12/2010 - Regulating on the price units of newly built houses/ architectural structures for compensation, support and resettlement when the government acquires land within Nghe An.
- Decision No. 30/2011/NQ-HDND dated 09/12/2011 - Promulgating on prices of lands

in Nghe An province in 2012.

**(2) HCHC – Nha Trang Section**

(a) Ho Chi Minh City:

- Decision No. 35/2010/QD-UBND dated 28/5/2010 - Promulgation of regulation on compensation, support and resettlement upon land recovery by the State in Ho Chi Minh area.
- Decision No. 51/2011/QD-UBND dated 12/7/2011 - Promulgating the regulation on organization and operation of the evaluation Council compensation Ho Chi Minh City.
- Decision No. 82/2011/QD-UBND dated 18/12/2011 - Regulating on the land-price within Ho Chi Minh city.
- Decision No. 43/2011/QD-UBND dated 30/6/2011 - On adjusting the price of urban residential land of district.
- Decision No. 12/2008/QD-UBND dated 20/3/2008 - Promulgated standard on investment rate for contructions in territory of Ho Chi Minh city.

(b) Dong Nai Province

- Decision No. 25/2012/QD-UBND dated 3/4/2012 - On the issue of formalities of compensation, rehabilitation, resettlement and land acquisition, allocation, land lease in Dong Nai province.
- Decision No. 12/2012/QD-UBND dated 23/2/2012 - Promulgating regulations on compensation, support price for assets in case of land acquisition by the state.
- Decision No. 13/2012/QD-UBND dated 24/22/2012 - Promulgating regulations on difference subsidies land prices in case of land acquisition by the state for relocate households.
- Decision No. 72/2011/QD-UBND dated 22/02/2011 - on the land price by-type within Dong Nai in 2012.
- Decision No. 20/2010/QD-UBND dated 5/4/2010 - On the of regulations on rehabilitation policies and standards and formalities of resettlement consideration in case of land acquisition in Dong Nai province.

(c) Binh Thuan Province

- Decision No. 54/2010/QĐ-UBND dated 24/12/2010 - Issuing regulations on pricing types of land in 2011 in Binh Thuan Province.
- Decision No. 14/2008/QD-UBND - on principles and price units compensating for damages when the government acquires lands to develop facilities within Binh Thuan.
- Decision No. 38/2011/QD-UBND dated 23/12/2011 - Regulating on the land-price within Binh Thuan province.

(d) Ninh Thuan Province

- Decision No. 2380/2010/QD-UBND dated 21/12/2010 - Promulgating the Regulation on Compensation, Support and Resettlement when the government acquires lands for implementing the investment projects within Ninh Thuan province.
- Decision No. 69/2011/QD-UBND dated 22/12/2012 - On land price by-type in 2012 within Ninh Thuan.
- Decision No. 33/2011/QD-UBND dated 15/8/2011 - On stipulating the price table of

houses, buildings, architectural structures in Ninh Thuan province.

(e) Khanh Hoa Province

- Decision No. 101/2009/QD-UBND dated 21/12/2009 by Khanh Hoa Provincial People's Committee on the promulgation of the regulations for compensation, support and reallocation upon land acquisition by the Government in Khanh Hoa province.
- Decision No. 46/2011/QD-UBND Khanh Hoa provincial PC dated 30/12/2011 on unit price of contruction works, architectural objects and compensation price and support for construction works on land in Khanh Hoa province.
- Decision No. 31/2011/QD-UBND dated 26/10/2011 - Promulgating regulations on the valuation of trees, crops, livestock in case of land acquisition in Khanh Hoa provine.
- Decision No. 2575/2009/QD-UBND dated 20/11/2011 by Khanh Hoa Provincial People's Committee on the promulgation of the regulations for price adjustment method on construction and structure.
- Decision No. 44/2011/QD-UBND dated 30/12/2011 - Promulgating regulations on order up, evaluation and approval of general plan, compensation details and assistance when the land acquisition in Khanh Hoa Province.

(f) Binh Duong Province

- Decision No. 66/2011/QD-UBND dated 20/12/2011 - Promulgating regulations on land unit price in 2012 in Binh Duong province.
- Decision No. 67/2011/QD-UBND dated 20/12/2011 - Promulgating regulations on land adjustment coefficient price (K) in 2012 the province of Binh Duong.
- Decision No. 58/2011/QD-UBND dated 19/12/2011 - Promulgating regulations on compensation, support unit price for houses, architectural works, fruit trees and crops on land in case of land acquisition by the state.
- Decision No. 12/2012/QD-UBND dated 06/4/2012 - Promulgating regulations on modification and additional on compensation unit price, housing assistance, structures, fruit tree and crop on land in case of land acquisition by Binh Duong Province was issued together with DecisionNo. 58/2011/QD-UBND on 19/12/2011.
- Decision No. 55/2011/QD-UBND dated 09/12/2012 - On land price by-type in 2012 in Binh Duong province.

# APPENDIX 2A

# Socio-Economic Baseline Data

Socio-economic baseline data in the project area is shown below.

## (1) Hanoi – Vinh Section (North Section)

### 1) Land Use

Table 2A.1 shows total land use of each province in the project area. Although tendency of land use at each province differs, agricultural land is prominent in the city/provinces of red river delta while forestry land is prominent in the north central coastal provinces.

**Table 2A.1 Land Use in the Project Areas**

(unit: 1,000ha)

| Region/province | Unit | Total | Agricultural land | Forestry land | Special use land | Residential land |
|---|---|---|---|---|---|---|
| Whole Country | Area | 33,105.1 | 9,598.8 | 14,757.8 | 1,629.5 | 633.9 |
| *Red River Delta* | Area | *2,106.3* | *794.7* | *461.2* | *291.0* | *132.9* |
| Ha Noi | Area | 334.5 | 153.2 | 24.1 | 68.6 | 34.9 |
| | % | 100.0 | 45.8 | 7.2 | 20.5 | 10.4 |
| Ha Nam | Area | 86.0 | 45.5 | 6.8 | 13.7 | 5.3 |
| | % | 100.0 | 52.9 | 7.9 | 15.9 | 6.2 |
| Nam Dịnh | Area | 165.3 | 96.2 | 4.4 | 24.1 | 10.4 |
| | % | 100.0 | 58.2 | 2.7 | 14.6 | 6.3 |
| Ninh Binh | Area | 138.9 | 61.9 | 28.9 | 17.9 | 5.9 |
| | % | 100.0 | 44.6 | 20.8 | 12.9 | 4.2 |
| *North Central coastal area* | | *9,588.6* | *1,765.9* | *5,154.0* | *463.6* | *174.2* |
| Thanh Hoa | Area | 1,113.3 | 245.7 | 566.0 | 67.3 | 50.2 |
| | % | 100.0 | 22.1 | 50.8 | 6.0 | 4.5 |
| Nghe An | Area | 1,649.1 | 250.1 | 915.9 | 53.2 | 20.2 |
| | % | 100.0 | 15.2 | 55.5 | 3.2 | 1.2 |

Source: Decision No. 2097b/QĐ-BTNMT dated 29th October, 2009 of Ministry of Natural resource and Environment.

### 2) Population

There are more than 22 million households in whole country with average 3.89 person per household (3.8 in urban area and 3.92 in rural area) though household size is decreasing (it was 4.44 persons in 2002, 4.36 persons in 2004, 4.24 persons in 2006 and 4.12 in 2008).

Average household size in almost provinces in the project area is higher than the country average size accounting for 4.0 to 4.5, except 3 provinces such as Ha Nam, Nam Dinh and Ninh Binh provinces.

**Table 2A.2 Population, Natural Increase Rate and Household in Project Area**

| No. | Province | District | Population (person) | | | Natural increase rate (%) | Total HH | Average HH size |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Urban | Rural | | | |
| Whole Country | | | 87,840,000 | 27.888.200 | 59.951.800 | 9,70 | | 3,89 |

| No. | Province | District | Population (person) | | | Natural increase rate (%) | Total HH | Average HH size |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Urban | Rural | | | |
| Red River Delta | | | 19,999,300 | 6,179,000 | 13,820,300 | 9.20 | | 3.65 |
| North Central and Central Coastal Areas | | | 19,046,500 | 4,999,600 | 14,046,900 | 9.10 | | 3.94 |
| 1 | Hanoi | Total | 5,948,026 | 2,893,500 | 3,806,100 | 13.45 | 1,612,784 | 3.9 |
| | | Thuong Tin | 219,248 | 6,800 | 212,448 | 13.32 | 56,881 | |
| | | Phu Xuyen | 182,008 | 14,800 | 167,208 | 10.92 | 53,687 | |
| | | Ung Hoa | 182,008 | 13,000 | 169,008 | 10.27 | 50,873 | |
| 2 | Ha Nam | Total | 1,486,204 | 82,400 | 704,500 | 7.00 | 445,966 | 3.6 |
| | | Duy Tien | 125,983 | 9,825 | 116,158 | 8.46 | 39,331 | |
| | | Thanh Lien | 128,111 | 9,332 | 118,779 | 9.29 | 38,709 | |
| | | Binh Luc | 145,718 | 5,250 | 140,468 | 8.43 | 43,036 | |
| 3 | Nam Dinh | Total | 1,828,111 | 329,500 | 1,504,000 | 7.40 | 555,605 | 3.4 |
| | | Nam Dinh city | 243,186 | 198,437 | 44,749 | 5.60 | 78,864 | |
| | | My Loc | 69,143 | 4,792 | 64,351 | 12.00 | 20,357 | |
| | | Vu Ban | 129,669 | 6,619 | 123,050 | 10.00 | 38,120 | |
| | | Y Yen | 227,160 | 9,945 | 217,215 | 15.00 | 66,019 | |
| 4 | Ninh Binh | Total | 898,999 | 181,900 | 725,000 | 4.70 | 257,088 | 3.5 |
| | | Ninh Binh City | 110,541 | 93,030 | 17,511 | - | 33,484 | |
| | | Tam Diep town | 55,021 | 34,783 | 20,238 | - | 17,006 | |
| | | Hoa Lu | 66,187 | 3,076 | 63,111 | - | 20,139 | |
| | | Yen Khanh | 133,420 | 12,601 | 120,819 | - | 37,878 | |
| | | Yen Mo | 110,304 | 3,436 | 106,868 | - | 32,337 | |
| 5 | Thanh Hoa | Total | 2,912,588 | 380,500 | 3,032,100 | 11.31 | 759,478 | 4.0 |
| | | Bim Son Town | 53,442 | 46,800 | 6,642 | 11.09 | 16,160 | |
| | | Ha Trung | 108,049 | 5,850 | 102,199 | 6.79 | 30,945 | |
| | | Hoang Hoa | 246,626 | 9,620 | 237,006 | 8.00 | 62,797 | |
| | | Hau Loc | 165,742 | 3,480 | 162,262 | 6.68 | 42,216 | |
| | | Nong Cong | 182,898 | 3,590 | 179,308 | 6.45 | 45,871 | |
| | | Dong Son | 102,783 | 8,850 | 93,933 | 6.49 | 28,666 | |
| | | Quang Xuong | 256,931 | 2,820 | 254,111 | 12.05 | 68,524 | |
| | | Tinh Gai | 214,665 | 4,620 | 210,045 | 10.66 | 56,400 | |
| | | Thieu Hoa | 176,747 | 7,600 | 169,400 | 10.55 | 46,794 | |
| | | Thanh Hoa city | 210,551 | 150,300 | 60,500 | 11.20 | 63,846 | |
| 6 | Nghe An | Total | 2,306,050 | 392,200 | 2,550,700 | 11.60 | 607,296 | 3.9 |
| | | Vinh City | 303,714 | 216,325 | 87,389 | 0.89 | 94,309 | |
| | | Quynh Luu | 346,030 | 14,818 | 331,212 | 1.30 | 84,263 | |
| | | Dien Chau | 266,447 | 5,392 | 261,055 | 1.21 | 68,693 | |
| | | Nghi Loc | 184,148 | 4,780 | 179,368 | 1.32 | 46,356 | |
| | | Hung Nguyen | 110,451 | 7,876 | 102,575 | 0.87 | 27,988 | |

Source: JICA Study Team based on Statistical Handbook of Vietnam, 2011, Statistical Year Book Provinces and District, 2011, Viet Nam Household Living Standards Survey, 2010 and some data provided by Statistics office at District level, 2011

### 3) Poverty

Poverty rate among city/provinces in the project area is under national rate excluding two provinces (i.e. Thanh Hoa and Nghe An) in the Central Coast Region.

**Table 2A.3 Poverty Rate by Provinces**

(Unit: %)

| No | Provinces | Poverty Rate by Provinces (%) | | | | |
|---|---|---|---|---|---|---|
| | | 2004 | 2006 | 2008 | 2010 | 2011 |
| Whole Country | | 18.1 | 15.5 | 13.4 | 14.2 | 11.76 |
| | Red River Region | - | - | - | - | 6.50 |
| | Central Coast Area | | - | - | - | 14.49 |
| 1 | Ha Noi | - | - | 6.6 | 5.3 | 3.14 |
| 2 | Ha Nam | - | 12,8 | 11.6 | 12.0 | 10.68 |
| 3 | Nam Dinh | - | 12 | 10.6 | 10.0 | 8.30 |
| 4 | Ninh Binh | - | 14,3 | 13.0 | 12.2 | 9.85 |
| 5 | Thanh Hoa | - | 27,5 | 24.9 | 25.4 | 20.37 |
| 6 | Nghe An | - | 26 | 22.5 | 24.8 | 18.79 |

*Note: Poverty Rate in 2010 by the Government' poverty lines for period 2011-2015 are 400 thousand dongs per month for the rural and 500 thousand dongs per capital per month for the urban area.*

Source: JICA Study Team based on Statistical Handbook of Vietnam, 2011, Statistical Year Book Provinces and District, 2011, Viet Nam Household Living Standards Survey, 2010 and some data provided by Statistics office at District level, 2011

### 4) Housing

At the country level, according to result of the Vietnam household living standard survey, the share of households having permanent houses was 49.2%; semi-permanent houses is 37.8%, less-permanent houses is 7.5% and simple houses is 5.6%.

In the project area the share of households having permanent houses varies from 78.4% to 97.0%; semi-permanent houses is from 3.6% to 12.0%, less-permanent houses is 0.1% to 5.8% and temporary houses is 0.1% to 5.9%.

**Table 2A.4 Percentage of households having house by type of house and province**

(Unit: %)

| No. | **Province** | **Total** | **Permanent House** | **Semi-Permanent House** | **Less-Temporary House** | **Temporary House and other house** |
|---|---|---|---|---|---|---|
| 1 | Ha Noi | 100 | 94.0 | 6.0 | 0.1 | - |
| 2 | Ha Nam | 100 | 97.0 | 2.8 | 0.2 | - |
| 3 | Nam Dinh | 100 | 95.1 | 4.4 | 0.4 | 0.1 |
| 4 | Ninh Binh | 100 | 95.8 | 3.6 | 0.5 | 0.1 |
| 5 | Thanh Hoa | 100 | 79.1 | 10.2 | 4.8 | 5.9 |
| 6 | Nghe An | 100 | 78.4 | 12.0 | 5.8 | 3.8 |

Source: Viet Nam Household Living Standards Survey, 2010

**Table 2A.5 Living area per capital by type of house and province**

(Unit: m2)

| No | Provinces | Total | Permanent House | Semi-Permanent House | Less-Temporary House | Temporary House and other house |
|---|---|---|---|---|---|---|
| 1 | Ha Noi | 21.5 | 21.8 | 16.3 | 8.3 | - |
| 2 | Ha Nam | 17.0 | 17.2 | 12.9 | 10.0 | - |
| 3 | Nam Dinh | 17.4 | 17.7 | 11.5 | 19.5 | 7.5 |
| 4 | Ninh Binh | 17.1 | 17.2 | 11.4 | 33.0 | 20.0 |
| 5 | Thanh Hoa | 16.0 | 17.3 | 12.8 | 11.2 | 10.0 |
| 6 | Nghe An | 16.4 | 17.4 | 13.7 | 12.6 | 12.4 |

Source: Viet Nam Household Living Standards Survey, 2010

**Table 2A.6 Durable goods per 100 households by region**

(Unit: No.)

| Items | Whole Country | Red River Delta | North Central Coast |
|---|---|---|---|
| Car | 1.3 | 1.8 | 1.0 |
| Motorbike | 96.1 | 91.9 | 87.6 |
| Telephone | 128.4 | 138.9 | 113.3 |
| Refrigerator | 39.7 | 49.8 | 30.1 |
| Video | 54.2 | 53.6 | 46.8 |
| Color TV | 85.9 | 93.7 | 80.3 |
| Computer | 17.0 | 20.1 | 12.5 |
| Air conditioner | 9.4 | 17.7 | 4.0 |
| Washing machine | 17.6 | 23.7 | 10.6 |

Source: Viet Nam Household Living Standards Survey, 2010

### 5) Education

The 2009 Viet Nam Population and Housing Census indicates that the dropout rate in northern provinces among those of school age (5-18 years) is lower than in the southern provinces. This rate of Vietnamese population aged 15 years and older is illiterate is higher in several provinces in project areas such as Nam Dinh, Thanh Hoa and Nghe An.

**Table 2A.7: Illiterate Rate (over 15 year old)**

(Unit: %)

| No. | Province | Illiterate Rate (over 15 year old) |
|---|---|---|
| 1 | Hanoi | 1.06 |
| 2 | Ha Nam | 0 |
| 3 | Nam Dinh | 1.92 |
| 4 | Ninh Binh | 0.6 |
| 5 | Thanh Hoa | 2.41 |
| 6 | Nghe An | 1.62 |

Source: Viet Nam Household Living Standards Survey, 2010

### 6) Employment and Income

Employment is the most important factor which directly impacts living standards of the population through its role in household income generation. The unemployment rate among Vietnam's work force is 2.88% in 2010 and 2.6% estimated in 2011, and the rate at urban area is 4.43% and 2.27% at rural area. The unemployment rate in some city/province/districts in the project area is

higher than the national average rate.

In 2010, monthly average income per capita across the country in current prices becomes 1,387 thousand dong increasing 39.4% compared to 2008, an average increase of 18.1% per year in the period 2008-2010. Out of total income, income from wages and salary accounts for 44.9%, income from agricultural, forestry, fishery sectors accounts for 20.1%, income from industry and construction accounts for 5.7%, income from services accounts for 17.9% and other income accounts for 11.4%

**Table 2A.8 Average monthly income, labor population, employment rate**

| No. | Province | District | Labor population | Employment (%) | Unemployment (%) |
|---|---|---|---|---|---|
| 1 | Hanoi | Total | 5,117,229 | 72.80 | 27.20 |
| | | Thuong Tin | 171,347 | 72.80 | 27.20 |
| | | Phu Xuyen | 138,587 | 72.70 | 27.30 |
| | | Ung Hoa | 139,719 | 72.60 | 27.40 |
| 2 | Ha Nam | Total | 471,662 | 75.10 | 1.04 |
| | | Duy Tien | 76,168 | 75.00 | 0.94 |
| | | Thanh Lien | 76,911 | 73.80 | 0.51 |
| | | Binh Luc | 87,174 | 76.20 | 0.36 |
| 3 | Nam Dinh | Total | 1,222,333 | 96.47 | 3.53 |
| | | Nam Dinh city | 160,742 | 97.36 | 2.64 |
| | | My Loc | 41,785 | 94.65 | 5.35 |
| | | Vu Ban | 79,626 | 97.09 | 2.91 |
| | | Y Yen | 136,650 | 96.19 | 3.81 |
| 4 | Ninh Binh | Total | 160,742 | - | - |
| | | Ninh Binh City | 19,912 | - | - |
| | | Tam Diep town | 9,911 | - | - |
| | | Hoa Lu | 11,913 | - | - |
| | | Yen Khanh | 24,015 | - | - |
| | | Yen Mo | 19,851 | - | - |
| 5 | Thanh Hoa | Total | 2,526,000 | 93.9 | 6.1 |
| | | Bim Son Town | 37,711 | 93.8 | 6.2 |
| | | Ha Trung | 37,711 | 94.0 | 6.0 |
| | | Hoang Hoa | 37,711 | 94.1 | 5.9 |
| | | Hau Loc | 37,711 | 93.6 | 6.4 |
| | | Nong Cong | 37,711 | 93.2 | 6.8 |
| | | Dong Son | 37,711 | 93.3 | 6.7 |
| | | Quang Xuong | 37,711 | 93.9 | 6.1 |
| | | Tinh Gai | 37,711 | 93.1 | 6.9 |
| | | Thieu Hoa | 31,006 | 92.96 | 94.37 |
| | | Thanh Hoa city | 45,142 | 7.04 | 5.63 |
| 6 | Nghe An | Total | - | - | - |
| | | Vinh City | 230,072 | 94.1 | 5.9 |
| | | Quynh Luu | 228,646 | 95.2 | 4.8 |
| | | Dien Chau | 173,664 | 95.2 | 4.8 |
| | | Nghi Loc | 123,928 | 95.7 | 4.3 |
| | | Hung Nguyen | 75,673 | 95.9 | 4.1 |

Source: Statistics Data at District level, Province Level 2011

**Table 2A.9 Monthly Income per Capital by Income Sources**

| Province | Unit | Total | Salary | Agriculture, Forest and fishery | Non - Agriculture, Forestry and Fishery | Other |
|---|---|---|---|---|---|---|
| Ha Noi | 1000 VND | 2,012.9 | 1,164.7 | 108.5 | 466.5 | 273.2 |
| | % | 100 | 57.9 | 5.4 | 23.2 | 13.6 |
| Ha Nam | 1000 VND | 1,150.2 | 470.0 | 264.4 | 247.7 | 168.2 |
| | % | 100.0 | 40,9 | 23.0 | 21.5 | 14.6 |
| Nam Dinh | 1000 VND | 1,237.4 | 477.4 | 285.6 | 321.7 | 152.8 |
| | % | 100.0 | 38.6 | 23.1 | 26.0 | 12.4 |
| Ninh Binh | 1000 VND | 1,202.4 | 498.4 | 264.3 | 279.8 | 159.9 |
| | % | 100.0 | 41.5 | 22.0 | 23.3 | 13.3 |
| Thanh Hoa | 1000 VND | 839.7 | 363.6 | 244.6 | 150.8 | 80.7 |
| | % | 100.0 | 43.3 | 29,1 | 18.0 | 9.6 |
| Nghe An | 1000 VND | 919.6 | 390.8 | 246.2 | 135.9 | 146.7 |
| | % | 100.0 | 42.5 | 26.8 | 14.8 | 16.0 |

Source: Statistics Data at District level, Province Level 2011

### 7) Ethnic Groups

Vietnam is a multi-ethnic country with 54 ethnic groups, and each has its own language, lifestyle and cultural heritage. The most dominant group is called “Viet” or “Kinh” accounting for 86 % of the entire population.

As for the project area, population of the Kinh is more than 97% at most of towns and districts except Thanh Hoa and Nghe An provinces, according to the latest Population and Housing Census data in 2011.

**Table 2A.10 Gender and Ethnic Minority**

| No. | Province | District | Population | | | Ethnic Group (%) | |
|---|---|---|---|---|---|---|---|
| | | | Male | Female | Total | Kinh | Ethnic Minority |
| Whole Country | | | 43,444,800 | 44,395,200 | 87,840,000 | - | - |
| Red River Delta | | | 9,872,300 | 10,127,000 | 19,999,300 | - | - |
| North Central and Central Coastal Areas | | | 9,425,500 | 9,621,000 | 19,046,500 | - | - |
| 1 | Hanoi | Total | 3,314,400 | 2,633,626 | 5,948,026 | 98.69 | 1.31 |
| | | Thuong Tin | 108,205 | 111,043 | 219,248 | 99.84 | 0.16 |
| | | Phu Xuyen | 89,105 | 93,673 | 182,008 | 99.56 | 0.44 |
| | | Ung Hoa | 88,335 | 93,673 | 182,008 | 99.87 | 0.13 |
| 2 | Ha Nam | Total | 384,300 | 1,101,904 | 1,486,204 | 99.82 | 0.18 |
| | | Duy Tien | 61,713 | 64,270 | 125,983 | 99.83 | 0.17 |
| | | Thanh Lien | 62,512 | 65,599 | 128,111 | 99.83 | 0.17 |
| | | Binh Luc | 71,176 | 74,542 | 145,718 | 99.87 | 0.13 |
| 3 | Nam Dinh | Total | 897,200 | 930,911 | 1,828,111 | 99.76 | 0.24 |
| | | Nam Dinh city | 115,561 | 127,625 | 243,186 | 99.68 | 0.32 |
| | | My Loc | 33,576 | 35,567 | 69,143 | 99.78 | 0.22 |
| | | Vu Ban | 62,519 | 67,150 | 129,669 | 99.79 | 0.21 |
| | | Y Yen | 111,215 | 115,945 | 227,160 | 99.76 | 0.24 |

| No. | Province | District | Population | | | Ethnic Group (%) | |
|---|---|---|---|---|---|---|---|
| | | | Male | Female | Total | Kinh | Ethnic Minority |
| 4 | Ninh Binh | Total | 451,500 | 447,499 | 898,999 | 97.39 | 2.61 |
| | | Ninh Binh City | 55,267 | 55,274 | 110541 | 99.76 | 0.24 |
| | | Tam Diep town | 28,547 | 26,474 | 55,021 | 98.94 | 1.06 |
| | | Hoa Ly | 32,073 | 34,114 | 66,187 | 99.76 | 0.24 |
| | | Yen Khanh | 65,875 | 67,545 | 133,420 | 99.86 | 0.14 |
| | | Yen Mo | 54,087 | 56,217 | 110,304 | 99.86 | 0.14 |
| 5 | Thanh Hoa | Total | 1,686300 | 1226,288 | 2,912,588 | 70.64 | 29.36 |
| | | Bim Son Town | 27,047 | 26,395 | 53,442 | 99.14 | 0.86 |
| | | Ha Trung | 52,701 | 55,348 | 108,049 | 98.67 | 1.33 |
| | | Hoang Hoa | 121,201 | 125,425 | 246,626 | - | - |
| | | Hau Loc | 81,385 | 84,357 | 165,742 | - | - |
| | | Nong Cong | 92,413 | 90,485 | 182,898 | 99.50 | 0.50 |
| | | Dong Son | 50,756 | 52,027 | 102,783 | 99.75 | 0.25 |
| | | Quang Xuong | 126,054 | 130,877 | 256,931 | 99.71 | 0.29 |
| | | Tinh Gai | 106,583 | 108,082 | 214,665 | 99.53 | 0.47 |
| | | Thieu Hoa | 176,747 | 87,504 | 89,243 | 99.88 | 0.12 |
| | | Thanh Hoa city | 210,551 | 102,048 | 108,503 | 99.89 | 0.11 |
| 6 | Nghe An | Total | 1,460,600 | 845,450 | 2,306,050 | 84.74 | 15.26 |
| | | Vinh City | 147,796 | 155,918 | 303,714 | 99.15 | 0.85 |
| | | Quynh Luu | 172,626 | 173,404 | 346,030 | 99.44 | 0.56 |
| | | Dien Chau | 130,587 | 135,860 | 266,447 | 99.93 | 0.07 |
| | | Nghi Loc | 91,440 | 92,708 | 184,148 | 99.90 | 0.10 |
| | | Hung Nguyen | 54,903 | 55,548 | 110,451 | 99.94 | 0.06 |

Source: Statistics Data at District level, Province Level 2011

Distribution of ethnic groups at each city/province in the project area is shown in the following tables.

**Table 2A.11 Ethnic Distribution at Hanoi City**

(unit: persons)

| Town/District / Ethnicity | Thuong Tin | Phu Xuyen | Ung Hoa |
|---|---|---|---|
| Kinh | 218,889 | 181,208 | 181,764 |
| Tay | 114 | 63 | 40 |
| Thai | 47 | 11 | 13 |
| Muong | 113 | 61 | 159 |
| Kho Me | 0 | 0 | 1 |
| Chinese | 5 | 4 | 12 |
| Nung | 51 | 24 | 5 |
| Hmong | 7 | 5 | 0 |
| Dao | 7 | 6 | 7 |
| Gia rai | 0 | 0 | 2 |
| E De | 4 | 0 | 0 |
| Ba Na | 1 | 0 | 0 |
| San Chay | 5 | 2 | 5 |
| Cham | 0 | 0 | 0 |

| | | | |
|---|---|---|---|
| Co Ho | 9 | 0 | 0 |
| Xo Dang | 0 | 0 | 0 |
| San Dieu | 3 | 1 | 0 |
| Hre | 0 | 0 | 0 |
| Ra Glai | 0 | 0 | 0 |
| Mnong | 0 | 1 | 0 |
| Tho (4) | 0 | 1 | 0 |
| Xitieng | 0 | 0 | 0 |
| Kho Mu | 0 | 0 | 0 |
| Bru Van Kieu | 0 | 0 | 0 |
| Co Tu | 0 | 0 | 0 |
| Giay | 0 | 1 | 0 |
| Ta Oi | 0 | 0 | 0 |

Source: Statistics Data at District level, Province Level 2011

**Table 2A.12 Ethnic Distribution at Ha Nam Province**

(unit: persons)

| Town/District / Ethnicity | Duy Tien | Thanh Liem | Binh Luc |
|---|---|---|---|
| Kinh | 125,772 | 127,894 | 145,529 |
| Tay | 26 | 44 | 42 |
| Thai | 68 | 58 | 69 |
| Muong | 44 | 42 | 25 |
| Kho Me | 0 | 0 | 2 |
| Chinese | 7 | 8 | 2 |
| Nung | 9 | 11 | 11 |
| Hmong | 33 | 32 | 25 |
| Dao | 7 | 10 | 3 |
| Gia rai | 0 | 0 | 1 |
| E De | 0 | 0 | 1 |
| Ba Na | 0 | 0 | 0 |
| San Chay | 5 | 4 | 3 |
| Cham | 0 | 0 | 0 |
| Co Ho | 0 | 0 | 0 |
| Xo Dang | 0 | 0 | 0 |
| San Dieu | 1 | 0 | 0 |
| Hre | 0 | 0 | 0 |
| Ra Glai | 0 | 0 | 0 |
| Mnong | 0 | 0 | 1 |
| Tho (4) | 4 | 5 | 0 |
| Xitieng | 0 | 0 | 0 |
| Kho Mu | 2 | 2 | 2 |
| Bru Van Kieu | 0 | 0 | 0 |
| Co Tu | 0 | 0 | 0 |
| Giay | 0 | 0 | 0 |
| Ta Oi | 0 | 0 | 0 |

Source: Statistics Data at District level, Province Level 2011

**Table 2A.13 Ethnic Distribution at Nam Dinh Province**

(unit: persons)

| Town/District / Ethnicity | Nam Dinh | My Loc | Vu Ban | Y Yen |
|---|---|---|---|---|
| Kinh | 242,408 | 68,991 | 129,396 | 226,620 |
| Tay | 144 | 11 | 23 | 44 |
| Thai | 217 | 81 | 140 | 274 |
| Muong | 111 | 22 | 47 | 78 |

| Town/District / Ethnicity | Nam Dinh | My Loc | Vu Ban | Y Yen |
|---|---|---|---|---|
| Kho Me | 5 | 0 | 0 | 3 |
| Chinese | 134 | 1 | 0 | 1 |
| Nung | 47 | 6 | 8 | 23 |
| Hmong | 67 | 23 | 33 | 81 |
| Dao | 19 | 5 | 1 | 11 |
| GiaRrai | 0 | 0 | 0 | 0 |
| E De | 1 | 1 | 0 | 0 |
| Ba Na | 0 | 0 | 0 | 0 |
| San Chay | 2 | 0 | 0 | 0 |
| Cham | 0 | 0 | 0 | 0 |
| Co Ho | 0 | 0 | 0 | 0 |
| Xo Dang | 0 | 0 | 0 | 0 |
| San Dieu | 0 | 0 | 0 | 0 |
| Hre | 0 | 0 | 0 | 0 |
| Ra Glai | 0 | 0 | 0 | 0 |
| Mnong | 0 | 0 | 0 | 0 |
| Tho (4) | 6 | 0 | 1 | 1 |
| Xitieng | 0 | 0 | 0 | 0 |
| Kho Mu | 0 | 0 | 2 | 2 |
| Bru Van Kieu | 0 | 0 | 0 | 0 |
| Co Tu | 0 | 0 | 0 | 0 |
| Giay | 12 | 0 | 0 | 3 |
| Ta Oi | 0 | 0 | 0 | 0 |

Source: Statistics Data at District level, Province Level 2011

**Table 2A.14 Ethnic Distribution at Ninh Binh Province**

(unit: persons)

| Town/District / Ethnicity | Ninh Binh | Tam Diep | Hoa Lu | Yen Khanh | Yen Mo |
|---|---|---|---|---|---|
| Kinh | 110,278 | 54,439 | 66,029 | 133,230 | 110,149 |
| Tay | 23 | 34 | 45 | 59 | 37 |
| Thai | 31 | 11 | 0 | 0 | 0 |
| Muong | 164 | 502 | 75 | 97 | 94 |
| Kho Me | 0 | 0 | 0 | 0 | 0 |
| Chinese | 1 | 4 | 0 | 3 | 1 |
| Nung | 1 | 4 | 9 | 1 | 3 |
| Hmong | 5 | 1 | 4 | 3 | 1 |
| Dao | 4 | 7 | 0 | 5 | 5 |
| GiaRrai | 1 | 0 | 0 | 0 | 0 |
| E De | 0 | 3 | 0 | 0 | 0 |
| Ba Na | 0 | 0 | 0 | 0 | 0 |
| San Chay | 5 | 4 | 0 | 1 | 0 |
| Cham | 0 | 0 | 1 | 0 | 0 |
| Co Ho | 0 | 0 | 0 | 0 | 0 |
| Xo Dang | 0 | 1 | 0 | 0 | 0 |
| San Dieu | 0 | 1 | 3 | 0 | 0 |
| Hre | 0 | 0 | 0 | 0 | 0 |
| Ra Glai | 0 | 0 | 0 | 0 | 0 |
| Mnong | 0 | 0 | 0 | 0 | 1 |
| Tho (4) | 3 | 2 | 1 | 1 | 0 |
| Xitieng | 0 | 0 | 0 | 0 | 0 |
| Kho Mu | 0 | 0 | 0 | 0 | 0 |
| Bru Van Kieu | 0 | 0 | 0 | 0 | 5 |

| | | | | | |
|---|---|---|---|---|---|
| Co Tu | 0 | 0 | 0 | 0 | 0 |
| Giay | 2 | 0 | 0 | 0 | 0 |
| Ta Oi | 3 | 1 | 0 | 0 | 0 |

Source: Statistics Data at District level, Province Level 2011

**Table 2A.15 Ethnic Distribution at Than Hoa Province**

(unit: persons)

| Town/ District / Ethnicity | Than Hoa | Bim Son | Ha Trung | Thieu Hoa | Hoang Hoa | Hau Loc | Nong Cong | Dong Son | Quang Xuong | Tinh Gia |
|---|---|---|---|---|---|---|---|---|---|---|
| Kinh | 205,382 | 52,984 | 106,614 | 176,777 | 246,626 | 165,742 | 181.985 | 102,529 | 256,181 | 213,663 |
| Tay | 62 | 95 | 9 | 17 | 0 | 0 | 47 | 15 | 30 | 2 |
| Thai | 777 | 73 | 36 | 55 | 0 | 0 | 348 | 90 | 316 | 16 |
| Muong | 1,328 | 185 | 1,384 | 113 | 0 | 0 | 372 | 114 | 358 | 878 |
| Kho Me | 1 | 1 | 1 | 3 | 0 | 0 | 4 | 2 | 2 | 84 |
| Chinese | 29 | 1 | 0 | 2 | 0 | 0 | 4 | 5 | 3 | 2 |
| Nung | 10 | 24 | 1 | 6 | 0 | 0 | 18 | 10 | 12 | 1 |
| Hmong | 23 | 7 | 2 | 0 | 0 | 0 | 64 | 8 | 3 | 4 |
| Dao | 22 | 7 | 0 | 3 | 0 | 0 | 22 | 6 | 6 | 2 |
| GiaRrai | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| E De | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ba Na | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| San Chay | 2 | 1 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 1 |
| Cham | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| Co Ho | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Xo Dang | 0 | 9 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| San Dieu | 2 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 |
| Hre | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ra Glai | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Mnong | 4 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 |
| Tho (4) | 46 | 5 | 2 | 2 | 0 | 0 | 19 | 2 | 11 | 5 |
| Xitieng | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Kho Mu | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Bru Van Kieu | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Co Tu | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Giay | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ta Oi | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Source: Statistics Data at District level, Province Level 2011

**Table 2A.16 Ethnic Distribution at Nghe An Province**

(unit: persons)

| Town/District / Ethnicity | Vinh | Quynh Luu | Dien Chau | Nghi Loc | Hung Nguyen |
|---|---|---|---|---|---|
| Kinh | 301,120 | 344,083 | 266,257 | 183,955 | 110,388 |
| Tay | 110 | 33 | 23 | 25 | 6 |
| Thai | 1,849 | 1,816 | 109 | 125 | 38 |
| Muong | 162 | 37 | 15 | 12 | 7 |
| Kho Me | 6 | 1 | 0 | 0 | 1 |
| Chinese | 24 | 1 | 2 | 0 | 0 |
| Nung | 19 | 12 | 1 | 6 | 1 |
| Hmong | 85 | 4 | 4 | 1 | 0 |
| Dao | 11 | 4 | 2 | 1 | 0 |
| GiaRrai | 0 | 0 | 0 | 0 | 1 |
| E De | 1 | 0 | 0 | 0 | 0 |

| Town/District / Ethnicity | Vinh | Quynh Luu | Dien Chau | Nghi Loc | Hung Nguyen |
|---|---|---|---|---|---|
| Ba Na | 0 | 0 | 0 | 0 | 0 |
| San Chay | 2 | 1 | 0 | 0 | 0 |
| Cham | 2 | 1 | 1 | 0 | 0 |
| Co Ho | 0 | 0 | 0 | 0 | 0 |
| Xo Dang | 2 | 0 | 0 | 0 | 0 |
| San Dieu | 3 | 0 | 0 | 2 | 0 |
| Hre | 1 | 1 | 0 | 2 | 0 |
| Ra Glai | 3 | 0 | 0 | 0 | 0 |
| Mnong | 1 | 0 | 0 | 0 | 0 |
| Tho (4) | 241 | 19 | 25 | 17 | 8 |
| Xitieng | 0 | 0 | 0 | 0 | 0 |
| Kho Mu | 31 | 0 | 6 | 2 | 0 |
| Bru Van Kieu | 4 | 1 | 1 | 0 | 0 |
| Co Tu | 5 | 3 | 0 | 0 | 0 |
| Giay | 1 | 0 | 0 | 0 | 0 |
| Ta Oi | 16 | 0 | 0 | 0 | 0 |

Source: Statistics Data at District level, Province Level 2011

### (2) HCHC – Nha Trang Section (South Section)

#### 1) Land Use

Table 2A.17 shows total land use at each city/province in the project area. Although tendency of land use at each city/province differs, forestry land is prominent in the south central coast provinces while agriculture land is prominent in the south east provinces.

**Table 2A.17 Land Use in the Project Areas**

(unit: 1,000ha)

| Region/city/province | Unit | Total | Agricultural land | Forestry land | Special use land | Residential land |
|---|---|---|---|---|---|---|
| Whole Country | Area | 33,105.1 | 9,598.8 | 14,757.8 | 1,629.5 | 633.9 |
| *South Central Coast* | Area | *9,588.6* | *1,765.9* | *5,154.0* | *463.6* | *174.2* |
| Khanh Hoa | Area | 521.8 | 88.6 | 211.4 | 82.8 | 6.2 |
| | % | *100.0* | *17.0* | *40.5* | *15.9* | *1.2* |
| Ninh Thuan | Area | 335.8 | 69.7 | 186.0 | 16.1 | 3.8 |
| | % | *100.0* | *20.8* | *55.4* | *4.8* | *1.1* |
| Binh Thuan | Area | 781.0 | 282.9 | 390.7 | 23.3 | 7.7 |
| | % | *100.0* | *36.2* | *50.0* | *3.0* | *1.0* |
| *South East* | | *2,360.5* | *1,393.6* | *509.3* | *202.8* | *63.1* |
| Binh Duong | Area | 269.5 | 201.2 | 12.5 | 33.8 | 8.1 |
| | % | *100.0* | *74.7* | *4.6* | *12.5* | *3.0* |
| Dong Nai | Area | 590.3 | 287.5 | 179.2 | 45.2 | 14.5 |
| | % | *100.0* | *48.7* | *30.4* | *7.7* | *2.5* |
| HCMC | Area | 209.6 | 75.3 | 34.4 | 30.6 | 21.2 |
| | % | *100.0* | *35.9* | - | - | - |

Source: No. 2097b/QĐ-BTNMT dated 29 th October, 2009 of Ministry of Natural resource and Environment

#### 2) Population

There are more than 22 million households in whole country with average 3.89 person per household (3.8 in urban area and 3.92in rural area) though household size is decreasing (i.e. it

was 4.44 persons in 2002, 4.36 persons in 2004, 4.24 persons in 2006 and 4.12 in 2008). This trend was seen in both urban and rural areas.

Average household size in almost provinces in the project area is higher than country average accounting for 4.0 to 4.5, except HCM.

**Table 2A.18 Population, Natural Increase Rate and Household in Project Area**

| No. | Province | District | Population (person) | | | Natural Increase rate (‰) | Total HH | Average house hold size |
|---|---|---|---|---|---|---|---|---|
| | | | Urban | Rural | Total | | | |
| Whole country | | | 27,888,200 | 59,951,800 | 87,840,000 | 1.05 | 22,839,100 | 3.89 |
| Central Coastal Region | | | - | - | 18,935,500 | - | - | 4.00 |
| South East Region | | | 9,065,800 | 5,825,00 | 14,890,800 | - | - | 3.70 |
| 1 | Khanh Hoa | Total province | 584,200 | 589,900 | 1,174,100 | 8.50 | 286,240 | 4.1 |
| | | NhaTrang city | 75,388 | 24,845 | 392,279 | 10.99 | 98,931 | |
| | | Cam Ranh | 22,574 | 8,815 | 121,050 | 10.14 | 31,327 | |
| | | Cam Lam | 3,788 | 20,807 | 100,850 | 11.28 | 25,726 | |
| 2 | Ninh Thuan | Total province | 205,200 | 363,800 | 569,000 | 12.10 | 135,987 | 4.5 |
| | | Phan Rang-Tháp Chàm city | 40,633 | 2,233 | 161,730 | 11.31 | 41,689 | |
| | | Ninh Haidistict | 3,836 | 18,512 | 89,420 | 12.31 | 21,674 | |
| | | Ninh Phuoc | 6,371 | 24,447 | 180,338 | 12.29 | 41,227 | |
| | | Thuan Bac | - | 8,890 | 37,769 | 13.76 | 8,557 | |
| 3 | Binh Thuan | Total province | 463,900 | 716,400 | 1,180,300 | 10.60 | 135,987 | 4.4 |
| | | PhanThiet | 46,996 | 6,691 | 216,327 | 14.60 | 53,670 | |
| | | Tuy Phong | 14,838 | 17,353 | 140,708 | 16.40 | 31,655 | |
| | | BacBinh | 6,630 | 21,910 | 116,901 | 15.1 | 27,841 | |
| | | Ham ThuanBac | 7,414 | 34,287 | 167,646 | 18.2 | 41,582 | |
| | | Ham Thuan Nam | 3,100 | 20,403 | 98,632 | 18.2 | 23,059 | |
| | | Ham Tan | 4,347 | 12,562 | 96,487 | 18.0 | 16,965 | |
| 4 | Dong Nai | Total province | 897,600 | 1,767,500 | 2,665,100 | 12,00 | 642,772 | 4.0 |
| | | Long Khanh town | 13,555 | 20,565 | 130,704 | 10.85 | 33.031 | |
| | | Cam My | - | 34,476 | 137,870 | 11.81 | 32,257 | |
| | | Long Thanh | 7,306 | 48,117 | 287,744 | 10.13 | 77,588 | |
| | | Xuan Loc | 3,968 | 50,377 | 205,547 | 11.21 | 50,069 | |
| | | Nhon Trach | - | 49,659 | 158,256 | 10.59 | 44,084 | |
| 6 | HCMC | Total city | 6,250,700 | 1,270,400 | 7,521,100 | 7.40 | 1,824,822 | 3.6 |
| | | District 2 | 24,392 | 12,196 | 147,490 | 9.52 | 37,864 | |
| | | District 9 | 48,082 | 24,041 | 256,257 | 9.50 | 70,503 | |

Source: JICA Study Team based on Statistical Handbook of Vietnam, 2011, Statistical Year Book Provinces and District, 2011, Viet Nam Household Living Standards Survey, 2010 and some data provided by Statistics office at District level

**3) Poverty**

Poverty rates among provinces in the project area also vary considerably, ranging from 0.3% in HCMC to 19% in Ninh Thuan province based on the latest official poverty rate in 2010. Poverty rate was improved in period of 2004 to 2010 at most provinces, however there is still very small increase of poverty rate in Binh Duong between 2008 and 2010 which could be explained as a very clear picture of economic crisis in the most active provinces of Vietnam.

**Table 2A.19 Poverty Rate by Provinces**

| No | Provinces | Poverty Rate by Provinces (%) | | | |
|---|---|---|---|---|---|
| | | 2004 | 2006 | 2008 | 2010 |
| Whole Country | | 18.1 | 15.5 | 13.4 | 14.2 |
| 1 | Khanh Hoa | - | 11.0 | 9.1 | 9.5 |
| 2 | Ninh Thuan | - | 22.3 | 19.3 | 1.9 |
| 3 | Binh Thuan | - | 11.0 | 9.2 | 10.1 |
| 4 | Dong Nai | - | 5.0 | 4.3 | 3.7 |
| 5 | Binh Duong | - | 0.5 | 0.4 | 0.5 |
| 6 | HCMC | - | 0.5 | 0.3 | 0.3 |

Source: Viet Nam Household Living Standards Survey, 2010

**4) Housing**

At the country level, according to result of the Vietnam household living standard survey, the share of households having permanent houses is 49.2%; semi-permanent houses is 37.8%, less-permanent houses is 7.5% and simple houses is 5.6%.

In the project area the share of households having permanent houses varies from 9.3% to 45.6%; semi-permanent houses is from 47.0% to 81.9%, less-permanent houses is 0.9% to 4.4% and temporary houses is 0.6% to 3.1%.

**Table 2A.20 Percentage of households having house by type of house and city/province**

(Unit: %)

| No. | Provinces | Total | Permanent House | Semi-Permanent House | Less-Temporary House | Temporary House and other house |
|---|---|---|---|---|---|---|
| 1 | Khanh Hoa | 100 | 45.6 | 47.0 | 4.4 | 3.1 |
| 2 | Ninh Thuan | 100 | 21.9 | 69.3 | 3.8 | 5.0 |
| 3 | Binh Thuan | 100 | 25.2 | 69.2 | 1.8 | 3.8 |
| 4 | Dong Nai | 100 | 9.3 | 81.9 | 3.4 | 5.5 |
| 5 | Binh Duong | 100 | 16.7 | 80.9 | 0.9 | 1.5 |
| 6 | HCMC | 100 | 23.0 | 75.3 | 1.2 | 0.6 |

Source: Viet Nam Household Living Standards Survey, 2010

**Table 2A.21 Living area per capital by type of house and city/province**

(Unit: m2)

| No. | Provinces | Total | Permanent House | Semi-Permanent House | Less-Temporary House | Temporary House and other house |
|---|---|---|---|---|---|---|
| 1 | Khanh Hoa | 16.8 | 18.0 | 16.5 | 9.6 | 9.7 |
| 2 | Ninh Thuan | 13.0 | 15.9 | 12.7 | 9.8 | 6.2 |
| 3 | Binh Thuan | 14.8 | 16.3 | 14.8 | 9.7 | 7.5 |
| 4 | Dong Nai | 16.4 | 22.4 | 16.2 | 13.1 | 12.0 |
| 5 | Binh Duong | 19.3 | 24.8 | 18.2 | 8.2 | 11.8 |
| 6 | HCMC | 19.2 | 27.6 | 16.7 | 14.0 | 13.0 |

Source: Viet Nam Household Living Standards Survey, 2010

**Table 2A.22 Durable goods per 100 households by region**

(Unit: No.)

| Items | Whole Country | South Central Coast | South East |
|---|---|---|---|
| Car | 1.3 | 0.6 | 2.2 |
| Motorbike | 96.1 | 98.8 | 130.9 |
| Telephone | 128.4 | 121.5 | 160.5 |
| Refrigerator | 39.7 | 37.3 | 55.8 |
| Video | 54.2 | 49.1 | 58.1 |
| Color TV | 85.9 | 79.4 | 92.8 |
| Computer | 17.0 | 15.9 | 30.8 |
| Air conditioner | 9.4 | 5.0 | 16.3 |
| Washing machine | 17.6 | 13.4 | 32.9 |

Source: Viet Nam Household Living Standards Survey, 2010

### 5) Education

The literacy rate of the Vietnamese population aged 15 years and over is 93.5%, increasing 3.2% since 1999. Even though the national literacy rate is very high, the rate is still rather low among Thai, Khmer, and Hmong ethnic groups compared to the Kinh majority.

There has been a sharp decline in the gender gap between literate males and females aged 15 years and above, falling from 10% in 1989 to 4.4% in 2009. This illiterate rate of Vietnamese population aged 15 years and older is still high in several provinces in project areas such as Khanh Hoa, Ninh Thuan and Binh Thuan.

**Table 2A.23 Illiterate Rate (over 15 year old)**

(Unit: %)

| No. | Province | District | Illiterate (over 15 year old) |
|---|---|---|---|
| 1 | Khanh Hoa | Province Average | 5.10 |
| | | Nha Trang City | 5.01 |
| | | Cam Ranh Town | 5.15 |
| | | Cam Lâm District | 5.20 |
| 2 | Ninh Thuan | Province Average | 19.50 |
| | | Phan Rang-Tháp Chàm City | 19.97 |
| | | Ninh Hải District | 19.85 |
| | | Ninh Phước District | 18.99 |
| | | Thuận Bắc District | 18.83 |
| 3 | Binh Thuan | Province Average | - |
| | | Phan Thiết City | 5.50 |
| | | Tuy Phong District | 12.62 |
| | | Bắc Bình District | 10.76 |
| | | Hàm Thuận Bắc District | 6.72 |
| | | Hàm Thuận Nam District | 6.30 |
| | | Hàm Tân District | 5.73 |
| 4 | Dong Nai | Province Average | 1.01 |
| | | Long Khánh Town | 0.75 |
| | | Cẩm Mỹ District | 1.00 |
| | | Long Thành District | 1.03 |
| | | Xuân Lộc District | 0.95 |
| | | Nhơn Trạch District | 1.02 |

| No. | Province | District | Illiterate (over 15 year old) |
|---|---|---|---|
| 5 | HCMC | City Average | 2.33 |
| | | District 2 | 2.40 |
| | | District 9 | 2.29 |

Source: Statistics Data at District level, Province Level 2011

### 6) Employment and Income

Employment is the most important factor which directly impacts living standards of the population through its role in household income generation. The unemployment rate among Vietnam's work force was 2.88 percent in 2010, and 2.6% estimated in 2011, that the rate at urban area was 4.43 percent and rural area, 2.27 percent. The unemployment rate in some city/province/districts in the project area is still higher than average rate.

In 2010, monthly average income per capita across the country in current prices becomes 1,387 thousand dong increasing 39.4% compared to 2008, an average increase of 18.1% per year in the period 2008-2010. Out of total income, income from wages and salary accounts for 44.9%, income from agricultural, forestry, fishery sectors accounts for 20.1%, income from industry and construction accounts for 5.7%, income from services accounts for 17.9% and other income accounts for 11.4%.

**Table 2A.24 Average monthly income, labor population, employment rate**

| Province | District | Average monthly income (GDP/person (million VND) | Labor population | Employment (%) | Unemployment (%) |
|---|---|---|---|---|---|
| Khanh Hoa | Total province | 2,489.00 | 62,904 | 77.80 | 2.00 |
| | NhaTrang city | - | 21,412 | 78.00 | 1.90 |
| | Cam Ranh town | - | 6,646 | 77.90 | 2.10 |
| | Cam Lam | - | 5,541 | 77.50 | 2.60 |
| Ninh Thuan | Total province | 1,071.50 | 317,200 | - | - |
| | Phan Rang – Thap Cham | 1,021.50 | 107,043 | 96.60 | 3.40 |
| | Ninh Hai | 1,071.62 | 56,082 | 96.40 | 3.60 |
| | Ninh Phuoc | 1,146.50 | 77,307 | 96.80 | 3.20 |
| Binh Thuan | Total province | 2,068.00 | 664,400 | - | - |
| | PhanThiet | 2,048.00 | 148,259 | 94.56 | 5.44 |
| | Tuy Phong | 2,078.00 | 92,995 | 94.85 | 5.15 |
| | Bac Binh | 2,053.00 | 76,083 | 95.81 | 4.19 |
| | Ham Thuan Bac | 1,993.00 | 109,657 | 95.40 | 4.60 |
| | Ham Thuan Nam | 2,033.00 | 64,952 | 97.24 | 2.76 |
| | Ham Tan | 2,078.00 | 44,765 | 96.99 | 3.01 |
| Dong Nai | Total province | 2,209.10 | 1,786,136 | 98.60 | 1.40 |
| | Long Khanh town | 2,159.22 | 90,938 | 97.37 | 2.63 |
| | Cam My | 2,184.22 | 93,992 | 98.02 | 1.98 |
| | Long Thanh | 2.109.22 | 211,800 | 98.40 | 1.60 |
| | Xuan Loc | 2,159.10 | 136,132 | 98.40 | 1.60 |
| | Nhon Trach | 2,088.22 | 119,661 | 97.20 | 2.80 |
| HCMC | Total city | 3,011.00 | 6,049,290 | 73.40 | 2.10 |
| | District 2 | 2,986.00 | 109,785 | 73.44 | 2.14 |

| Province | District | Average monthly income (GDP/person (million VND) | Labor population | Employment (%) | Unemployment (%) |
|---|---|---|---|---|---|
| | District 9 | 3,061.00 | 216,412 | 73.24 | 1.94 |

Source: Statistics Data at District level, Province Level 2011

### 7) Ethnic Groups

Vietnam is a multi-ethnic country with 54 ethnic groups, and each has its own language, lifestyle and cultural heritage. The most dominant group is called “Viet” or “Kinh” accounting for 86 % of the entire population.

As for the project area, population of the Kinh is more than 90% at most of towns and districts except some districts according to the latest Population and Housing Census data in 2011.

**Table 2A.25 Gender and Ethnic Minority**

| No. | Province | District | Population | | | Ethnic Group (%) | |
|---|---|---|---|---|---|---|---|
| | | | Male | Female | Total | Kinh | Ethnic Minority |
| 1 | Khanh Hoa | Total province | 585,972 | 571,632 | 1,157,604 | 94.68 | 5.32 |
| | | Nha Trang city | 202,542 | 189,737 | 392,279 | 99.22 | 0.78 |
| | | Cam Ranh town | 60,968 | 60,082 | 121,050 | 93.14 | 6.86 |
| | | Cam Lam | 50,979 | 49,871 | 100,850 | 94.98 | 5.02 |
| 2 | Ninh Thuan | Total province | 281,579 | 283,414 | 564,993 | 77.00 | 23.00 |
| | | Phan Rang – Thap | 79,657 | 82,073 | 161,730 | 98.00 | 2.00 |
| | | Ninh Hai distict | 44,680 | 44,740 | 89,420 | 91.00 | 9.00 |
| | | Ninh Phuoc district | 90,453 | 89,885 | 180,338 | 68.00 | 32.00 |
| | | Thuan Bac district | 18,871 | 18,898 | 37,769 | 33.00 | 67.00 |
| 3 | Binh Thuan | Total province | 281,579 | 283,414 | 564,993 | 91.00 | 9.00 |
| | | Phan Thiet district | 105,729 | 110,598 | 216,327 | 99.00 | 1.00 |
| | | Tuy Phong district | 70,398 | 70,310 | 140,708 | 95.00 | 5.00 |
| | | Bac Binh district | 59,070 | 57,831 | 116,901 | 66.00 | 34.00 |
| | | Ham ThuanBac district | 84,026 | 83,620 | 167,646 | 92.00 | 8.00 |
| | | Ham Thuan Nam district | 49,918 | 48,714 | 98,632 | 95.00 | 5.00 |
| | | Ham Tan district | 35,140 | 61,347 | 96,487 | 68.00 | 32.00 |
| 4 | Dong Nai | Total province | 1,231,279 | 1,254,875 | 2,486,154 | 93.00 | 7.00 |
| | | Long Khanh town | 64,774 | 65,930 | 130,704 | 91.00 | 9.00 |
| | | Cam My district | 69,584 | 68,286 | 137,870 | 83.00 | 17.00 |
| | | Long Thanh district | 143,950 | 143,794 | 287,744 | 97.00 | 3.00 |
| | | Xuan Loc district | 105,340 | 100,207 | 205,547 | 92.00 | 8.00 |
| | | Nhon Trach district | 78,307 | 79,949 | 158,256 | 99.00 | 1.00 |
| 5 | HCMC | Total city | 3,435,734 | 3,727,130 | 7,162,864 | 94.00 | 6.00 |
| | | District 2 | 72,661 | 74,829 | 147,490 | 99.00 | 1.00 |
| | | District 9 | 127,387 | 128,870 | 256,257 | 99.00 | 1.00 |

Source: Statistics Data at District level, Province Level 2011

Distribution of ethnic groups at each province in the project area is shown in the following tables.

**Table 2A.26 Ethnic Distribution at Khanh Hoa Province**

(unit: persons)

| Town/District / Ethnicity | Nha Trang | Cam Ranh | Cam Lam |
|---|---|---|---|
| Kinh | 389,279 | 112,740 | 95,785 |
| Tay | 304 | 49 | 26 |
| Thai | 65 | 11 | 0 |
| Muong | 102 | 10 | 29 |
| Kho Me | 54 | 6 | 5 |
| Chinese | 1,424 | 238 | 182 |
| Nung | 264 | 40 | 18 |
| Hmong | 2 | 0 | 0 |
| Dao | 20 | 7 | 0 |
| Gia rai | 47 | 2 | 0 |
| E De | 146 | 2 | 4 |
| Ba Na | 2 | 0 | 0 |
| San Chay | 3 | 0 | 0 |
| Cham | 191 | 38 | 7 |
| Co Ho | 63 | 3 | 0 |
| Xo Dang | 10 | 0 | 0 |
| Hre | 3 | 2 | 0 |
| Ra Glai | 12 | 0 | 0 |
| Mnong | 225 | 7,894 | 4,730 |
| Tho (4) | 13 | 1 | 0 |
| Xitieng | 15 | 0 | 33 |
| Kho Mu | 0 | 0 | 0 |
| Bru Van Kieu | 0 | 0 | 0 |
| Co Tu | 3 | 0 | 0 |
| Giay | 10 | 0 | 0 |

Source: Statistics Data at District level, Province Level 2011

**Table 2A.27 Ethnic Distribution at Ninh Thuan Province**

(unit: persons)

| Town/District / Ethnicity | Phan Ran Thap Cham | Ninh Hai | Ninh Phuoc | Thuan Bac |
|---|---|---|---|---|
| Kinh | 158,121 | 81,334 | 123,184 | 12,530 |
| Tay | 42 | 12 | 7 | 1 |
| Thai | 8 | 7 | 7 | 1 |
| Muong | 26 | 28 | 24 | 19 |
| Kho Me | 10 | 6 | 4 | 4 |
| Chinese | 1,053 | 37 | 369 | 14 |
| Nung | 42 | 4 | 3 | 5 |
| Hmong | 0 | 0 | 2 | 1 |
| Dao | 2 | 0 | 0 | 1 |
| Gia rai | 8 | 5 | 6 | 2 |
| E De | 7 | 1 | 20 | 14 |
| Ba Na | 0 | 1 | 1 | 0 |
| San Chay | 1 | 0 | 15 | 1 |
| Cham | 2,075 | 7,407 | 51,527 | 3,094 |
| Co Ho | 23 | 1 | 8 | 0 |
| Xo Dang | 7 | 0 | 12 | 3 |
| San Dieu | 0 | 9 | 0 | 2 |
| Hre | 5 | 0 | 2 | 6 |
| Ra Glai | 284 | 560 | 5,126 | 22,067 |
| Mnong | 0 | 0 | 1 | 0 |
| Tho (4) | 0 | 0 | 0 | 0 |

| Town/District / Ethnicity | Phan Ran Thap Cham | Ninh Hai | Ninh Phuoc | Thuan Bac |
|---|---|---|---|---|
| Xitieng | 0 | 0 | 0 | 0 |
| Kho Mu | 0 | 0 | 0 | 0 |
| Bru Van Kieu | 3 | 1 | 2 | 0 |
| Co Tu | 0 | 0 | 0 | 0 |
| Giay | 1 | 1 | 0 | 1 |
| Ta Oi | 0 | 0 | 0 | 0 |

**Table 2A.28 Ethnic Distribution at Binh Thuan Province**

(unit: persons)

| Town/District / Ethnicity | Phan Thiet | Tuy Phong | Bac Binh | Ham Thuan Bac | Ham Thuan Nam | Ham Tan |
|---|---|---|---|---|---|---|
| Kinh | 214,625 | 133,934 | 77,4445 | 153,830 | 94,169 | 65,790 |
| Tay | 81 | 16 | 4,319 | 320 | 37 | 43 |
| Thai | 14 | 6 | 16 | 26 | 21 | 14 |
| Muong | 57 | 4 | 99 | 108 | 51 | 142 |
| Kho Me | 62 | 22 | 48 | 63 | 35 | 115 |
| Chinese | 1,021 | 513 | 7,775 | 246 | 176 | 148 |
| Nung | 36 | 79 | 1,249 | 149 | 37 | 102 |
| Hmong | 1 | 0 | 0 | 0 | 1 | 2 |
| Dao | 1 | 6 | 4 | 10 | 2 | 5 |
| GiaRrai | 47 | 34 | 128 | 114 | 42 | 37 |
| E De | 8 | 8 | 21 | 11 | 3 | 7 |
| Ba Na | 14 | 11 | 22 | 21 | 19 | 8 |
| San Chay | 0 | 0 | 21 | 6 | 2 | 0 |
| Cham | 301 | 5,088 | 20,044 | 5,068 | 983 | 1,296 |
| Co Ho | 21 | 2 | 1,918 | 6,105 | 10 | 3 |
| Xo Dang | 3 | 1 | 2 | 3 | 2 | 0 |
| San Dieu | 1 | 0 | 14 | 2 | 6 | 7 |
| Hre | 0 | 0 | 1 | 1 | 78 | 7 |
| Ra Glai | 16 | 980 | 3,608 | 1,488 | 2,952 | 1,557 |
| Mnong | 3 | 0 | 7 | 7 | 0 | 0 |
| Tho (4) | 3 | 0 | 1 | 6 | 0 | 0 |
| Xitieng | 2 | 0 | 0 | 0 | 0 | 0 |
| Kho Mu | 0 | 0 | 0 | 0 | 0 | 0 |
| Bru Van Kieu | 0 | 0 | 0 | 0 | 0 | 0 |
| Co Tu | 0 | 1 | 0 | 0 | 0 | 5 |
| Giay | 0 | 0 | 0 | 0 | 0 | 0 |
| Ta Oi | 0 | 0 | 0 | 0 | 0 | 0 |

Source: Statistics Data at District level, Province Level 2011

**Table 2A.29 Ethnic Distribution at Dong Nai Province**

(unit: persons)

| Town/District / Ethnicity | Long Khanh | Cam My | Long Thanh | Xuan Loc | Nhon Trach |
|---|---|---|---|---|---|
| Kinh | 118,354 | 114,262 | 280,334 | 188,118 | 155,939 |
| Tay | 631 | 1,694 | 1,429 | 1,627 | 215 |
| Thai | 48 | 28 | 149 | 30 | 136 |
| Muong | 50 | 86 | 467 | 312 | 206 |
| Kho Me | 324 | 380 | 1,135 | 679 | 504 |
| Chinese | 7,339 | 15,317 | 2,144 | 5,236 | 897 |
| Nung | 791 | 4,937 | 667 | 1,500 | 102 |
| Hmong | 2 | 6 | 3 | 9 | 2 |
| Dao | 4 | 46 | 63 | 688 | 29 |
| GiaRrai | 0 | 3 | 0 | 3 | 0 |

| Town/District / Ethnicity | Long Khanh | Cam My | Long Thanh | Xuan Loc | Nhon Trach |
|---|---|---|---|---|---|
| E De | 44 | 1 | 9 | 8 | 11 |
| Ba Na | 0 | 0 | 3 | 2 | 0 |
| San Chay | 1 | 2 | 81 | 17 | 18 |
| Cham | 131 | 29 | 391 | 2,119 | 17 |
| Co Ho | 81 | 28 | 7 | 2 | 11 |
| Xo Dang | 1 | 0 | 1 | 0 | 0 |
| San Dieu | 7 | 26 | 49 | 32 | 111 |
| Hre | 0 | 0 | 3 | 77 | 6 |
| Ra Glai | 1 | 0 | 1 | 0 | 0 |
| Mnong | 0 | 0 | 1 | 2 | 0 |
| Tho (4) | 17 | 43 | 21 | 39 | 19 |
| Xitieng | 1 | 0 | 202 | 519 | 1 |
| Kho Mu | 0 | 0 | 2 | 0 | 0 |
| Bru Van Kieu | 0 | 0 | 0 | 0 | 1 |
| Co Tu | 0 | 0 | 1 | 0 | 2 |
| Giay | 0 | 1 | 0 | 0 | 0 |
| Ta Oi | 4 | 0 | 2 | 0 | 1 |

Source: Statistics Data at District level, Province Level 2011

**Table 2A.30 Ethnic Distribution at HCMC**

(unit: persons)

| Town/District / Ethnicity | District 2 | District 9 |
|---|---|---|
| Kinh | 146,003 | 253,829 |
| Tay | 98 | 140 |
| Thai | 25 | 24 |
| Muong | 59 | 134 |
| Kho Me | 381 | 969 |
| Chinese | 675 | 661 |
| Nung | 36 | 49 |
| Hmong | 0 | 8 |
| Dao | 4 | 27 |
| GiaRrai | 4 | 1 |
| E De | 15 | 20 |
| Ba Na | 2 | 4 |
| San Chay | 2 | 3 |
| Cham | 94 | 268 |
| Co Ho | 10 | 247 |
| Xo Dang | 9 | 53 |
| San Dieu | 7 | 224 |
| Hre | 5 | 78 |
| Ra Glai | 3 | 75 |
| Mnong | 8 | 79 |
| Tho (4) | 3 | 362 |
| Xitieng | 5 | 58 |
| Kho Mu | 0 | 60 |
| Bru Van Kieu | 0 | 26 |
| Co Tu | 9 | 54 |
| Giay | 1 | 19 |
| Ta Oi | 0 | 27 |

Source: Statistics Data at District level, Province Level 2011

# APPENDIX 3A

# Selection of Environmental and Social Considerations Items for Alternative Comparison in the IEE Study

### Table 3A.1 Selection of Items for Alternative Comparison in the IEE Study

| Category | Item | Potential Impact | | | Selection of Comparison Items for IEE Study (the shaded are the selected items) | | |
|---|---|---|---|---|---|---|---|
| | | Const-ruction | Oper-ation | Description | Selection Result | Items for Comparison of Station & Alignment alternatives | Reason for Selection |
| Natural Environment | Climate | D | D | No significant impact is expected by HSR construction. | n/a | n/a | Significant negative impact is not expected. |
| | Topography | B- | D | Some change in topography may be required by cutting/embankment, but not at large scale. | + | Slope, necessity of tunnels, curves | To avoid the difficult sections for civil works. This factor is basically considered in the civil engineering part in accordance with the target speed and the required technical standards to be set by the HSR study. |
| | Geology | D | D | No significant impact is expected by HSR construction. | + | Fault, soft ground, difficulty of tunnel construction | To minimize the risk and to avoid the difficult sections for civil works. Especially, the sections quartz sand areas in Phan Thiet. Areas in the south section are considered to be sensitive area since these soil type are regard to be inappropriate for cutting and mounding. Besides that, the geology information can also be utilized to consider the structure design and construction method since it will affect the necessary cost. |
| | Hydrology | C- | D | By digging of tunnels, mounding and changing topography, there may be a potential for the change of hydrological conditions. The careful monitoring would be required. Especially in the drier areas such as in Ninh Thuan Province and other local areas, people depend on the well water and other source of river-bed water for home consumption and irrigation. | + | Extent of the impact on surface water, river-bed water, and spring water | To avoid or minimize the negative impact on the water utilization in the lower stream and ecosystem by the changes and/or decrease of the flow of the surface water, river-bed water and spring water. |
| | Natural Hazard | C- | C- | By the civil structures, hydrological change may cause flooding. Cutting may trigger erosion and landslide. | ++ | Flood, landslide and other hazard prone areas | To minimize the risk and to avoid the difficult sections for civil works. In Viet Nam, the hazard area mapping is started recently and limited data are available, but considering the world climate trend in the south-east Asia, there is potential to have bigger and more typhoons and heavy rainfall which cause flood and landslide. |
| | Biodiversity | C- | C- | The project may cause impact on the habitat of flora/fauna depending on the alignment. Though it is considered that the protected areas would be avoided for the alignment in the target two sections, there is little data available for the flora and fauna outside the protected areas and further survey would be required at the full-scale EIA stage. | n/a | n/a (as part of Protected Areas) | At IEE study stage, one of the itmes to evaluate biodiversity could be “protected area” and detail is to be considered at scoping and/or full scale EIA for the selected optimal alignment. Since the secondary information on the biodiversity is limited especially outside the designated protected areas in most of the provinces, at IEE stage, it is better to be considered together with the protected areas. If there is available information on biodiversity, it may be utilized for the assessment item. |

| Category | Item | Potential Impact | | | Selection of Comparison Items for IEE Study (the shaded are the selected items) | | |
|---|---|---|---|---|---|---|---|
| | | Const-ruction | Oper-ation | Description | Selection Result | Items for Comparison of Station & Alignment alternatives | Reason for Selection |
| | Protected Area | C- | C- | The impact should be avoided by the alignment planning. If the alignment goes inside the protected areas, a negative impact will be expected. Currently, it is considered that it is possible to plan the alignment so that it would not affect the protected areas. | ++/+ | Special use forest (national parks, nature reserves, landscape protection area), marine protected areas, and protection forest. | To avoid and/or minimize impact on the important natural environment (including ecosystem, flora, fauna and landscape) is required. Special-use forest is regarded as the protected areas in Vietnam legal context, so that the importance is ++, while the protection forest can be regarded as + considering its objectives (ex. prevention of soil erosion, wind break etc.). Thus, the alignment should be planned so that the protected areas is not affected, while the affect on the protection forest will be considered to be minimized. |
| | Landscape | C- | C- | The civil work and structures may cause impact on landscapes. - Though the alignment would not affect the landscape protection areas, impact on the landscape should be considered after the alignment is selected. - The area of importance for considering landscapes may include: Ninh Binh Area with ancient city area and Tam-coc tourism areas, Khanh Hoa and Phan Thiet Area with coastal ocean resorts. | n/a | n/a (As part of Protected Area) | Secondary information on landscape is limited in Vietnam, while it can be evaluated from landscape protection area under the category of “protected area” and popular tourism areas at IEE study stage. Detail is to be considered at scoping and/or full scale EIA for the selected optimal alignment. |
| Pollution | Air | B- | B+ | During constructions, heavy vehicles may temporally cause impact on air quality. During operation, the project would not cause negative impact on air quality. The modal shift from cars to trains can contribute for reducing air pollution. | n/a | n/a | To be considered at EIA scoping and/or full scale EIA for the selected optimal alignment since air quality will not be affected much by the alignment options. |
| | Water | B- | D | The project would not cause major impact on water quality except the limited period for the construction of bridges over the rivers. Since HSR has to run across many rivers, due considerations on the design of the bridge and construction method is required. | n/a | n/a | To be considered at EIA scoping and/or full scale EIA for the selected optimal alignment |
| | Noise/Vibration | B- | A- | Noise and vibration can be generated during construction by the heavy vehicles and during operation by the trains. | ++ | Estimated affected people(household), and distribution of sensitive buildings (ex. school, hospital, religious buildings, high-tech factories) | To minimize the number of affected people is important since large impact could be expected on noise and vibration by the HSR. |
| | Ground Subsidence | D | D | The project would not cause major impact on ground subsidence since the alignment will avoid the soft ground area, | n/a | n/a | Significant negative impact is not expected. Ground subsidence in the soft ground will be considered in “geology”. |
| | Odor | D | D | The project would not cause major impact on offensive odor. | n/a | n/a | Significant negative impact is not expected. |

| Category | Item | Potential Impact | | | Selection of Comparison Items for IEE Study (the shaded are the selected items) | | |
|---|---|---|---|---|---|---|---|
| | | Const-ruction | Oper-ation | Description | Selection Result | Items for Comparison of Station & Alignment alternatives | Reason for Selection |
| | Low Frequency Noise | D | A- | Especially near the exit of the tunnels, low frequency noise problems can be significant. | n/a | n/a | To be considered at EIA scoping and/or full scale EIA for the selected optimal alignment |
| | Sunshine Obstruction | B- | B- | Civil structure such as elevated bridges and noise barriers may cause sunshine obstruction. | n/a | n/a | To be considered at EIA scoping and/or full scale EIA for the selected optimal alignment |
| | Wave Obstruction | B- | B- | Civil structure such as elevated bridges and noise barriers may cause wave obstruction. Also there is possibility that the AC feeding system may cause wave obstruction. | n/a | n/a | To be considered at EIA scoping and/or full scale EIA for the selected optimal alignment |
| | Waste | D | B- | Waste will be generated from the construction sites during construction. It will be also generated from trains and stations during operation. | n/a | n/a | To be considered at EIA scoping and/or full scale EIA for the selected optimal alignment |
| Social Environment | Land use | A- | D | The project may affect some important areas (industrial area, where interventions should be avoided. | ++/+<br><br>+ | Various development plan, army land, cemetery, religious land, water reservoirs<br><br>Connection with existing railway and other transportation modes | To avoid and/or mitigate the land acquisition in the difficult and sensitive areas<br>This will be assessed in “Social Environment”<br><br>For the sake of improving the positive impact by the project, connection with existing railway and other transportation modes are important.<br>This will be assessed in “Convenience and Integrated Development” |
| | City Plan | A+- | D | The project should be considered together with the city plans. Before construction, the HSR plan and City plan must refer to each other. (the impact is neither positive nor negative) | ++ | Harmonization with existing city plans | Station location and alignment should be considered in line with the city plan<br>- to maximize its economic benefit<br>- to maximize the connectivity with other transportation mode<br>- to minimize the conflict with residential areas<br><br>This will be assessed in “Convenience and Integrated Development” |
| | Residential Area/Developed Area | A- | B+ | The project will cause impact on residential areas especially around the station locations. | ++ | Resettlement, and potential of splitting the community | The location of railway should be planned considering the location of development area<br>- to minimize resettlement of houses, shops and factories<br>- to avoid the impact on community cohesion<br>- to minimize noise and vibration issue<br>- to be convenient for the access from the populated areas |
| | Local Economy | B-/B+ | B-/B+ | The project can cause both positive and negative significant impact on local economy. | n/a | n/a | To be considered at EIA scoping and/or full scale EIA for the selected optimal alignment |

| Category | Item | Potential Impact | | | Selection of Comparison Items for IEE Study (the shaded are the selected items) | | |
|---|---|---|---|---|---|---|---|
| | | Const-ruction | Oper-ation | Description | Selection Result | Items for Comparison of Station & Alignment alternatives | Reason for Selection |
| | Livelihood | B-/B+ | B+ | During construction phase, the project will cause negative impact on local economy such as the land acquisition in the agricultural areas and resettlement of shops and businesses, while work. while economic development in the area is expected by the improved transportation system. | n/a | n/a | To be considered at EIA scoping and/or full scale EIA for the selected optimal alignment |
| | Cultural and Historical Heritages | A- | D | The project may cause significant impact in cultural and historical heritages depending on alignment. Especially in the area like Cities of Hanoi/HCMC, ancient capital in Ninh Binh, Cham Relics in Khan Hoa, Ninh Thuan and Binh Thuan may be affected. | ++ | Registered Heritages of National and Provincial Level | To avoid the negative impact on cultural, historical heritages. Since history of Vietnam is diverse with various ethnic people and foreign interference, there are a lot of cultural and historical heritages. It is worth considering this issue to maintain the potential of the tourism in Vietnam, however, some experts in provincial governments mentioned that the reliable study result on cultural and historical heritages are rare because of the lack of surveys. |
| | Ethnic Minorities | B- | D | The project may cause impact on the ethnic minority communities depending on the alignment. | ++ | Residential area of ethnic minorities | To avoid and/or mitigate the impact on ethnic minorities and their culture and way of living. Though many ethnic minorities which keep their tradition and identity live in the mountainous region of Vietnam, while in the areas like Binh Thuan and Ninh Thuan Province, there are villages of ethnic minorities (ex. Cham people) are practicing traditional agriculture, and also the craft villages producing traditional pottery and weaving. |
| | Public Health | B- | C- | The project may cause impact on the public health and transmission diseases through the movement of construction workers during construction and potentially also through the passengers during operation. | n/a | n/a | To be considered at EIA scoping and/or full scale EIA for the selected optimal alignment since public health is not the important item in selecting the optimal alignment. |
| Other | Climate Change | D<br>B- | D<br>A+ | Adaptation (flood/sea level rise):<br>Mitigation (Greenhouse gasses emission) | n/a<br>+ | Adaptation (flood/sea level rise)<br>Mitigation (Greenhouse gasses emission) | Adaptation: To be considered together with "hazard" at IEE study stage and detail is to be considered at scoping and/or full scale EIA for the selected optimal alignment.<br>Mitigation: It may be considered for the comparison with zero-option. |

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

++: most important items for the comparison at the stage of IEE study
+: important items for the comparison at the stage of IEE study
n/a: not applied for the comparison at the stage of IEE study

# APPENDIX 3B

## Scoring Method of Convenience and Integrated Development

Connectivity of HSR with other transport modes is also important, as HSR will face the competition against air and road soon after its operation. Therefore, HSR should maximize the advantageous points of HSR (e.g. short access time, punctuality, high frequency of operation, etc.) by considering a strategic station location.

Successful urban development has been achieved with feeder railway network (that is to say, if there is better connectivity, the ridership will increase and thus promote economic viability). Without convenient railway connection, many cities have failed in integrated development (e.g. in Taiwan, Korea, and etc.)

Hence the station location has been evaluated and selected with regards to the following factors assessing the convenience of the people:

(i) Connectivity with other transportation mode

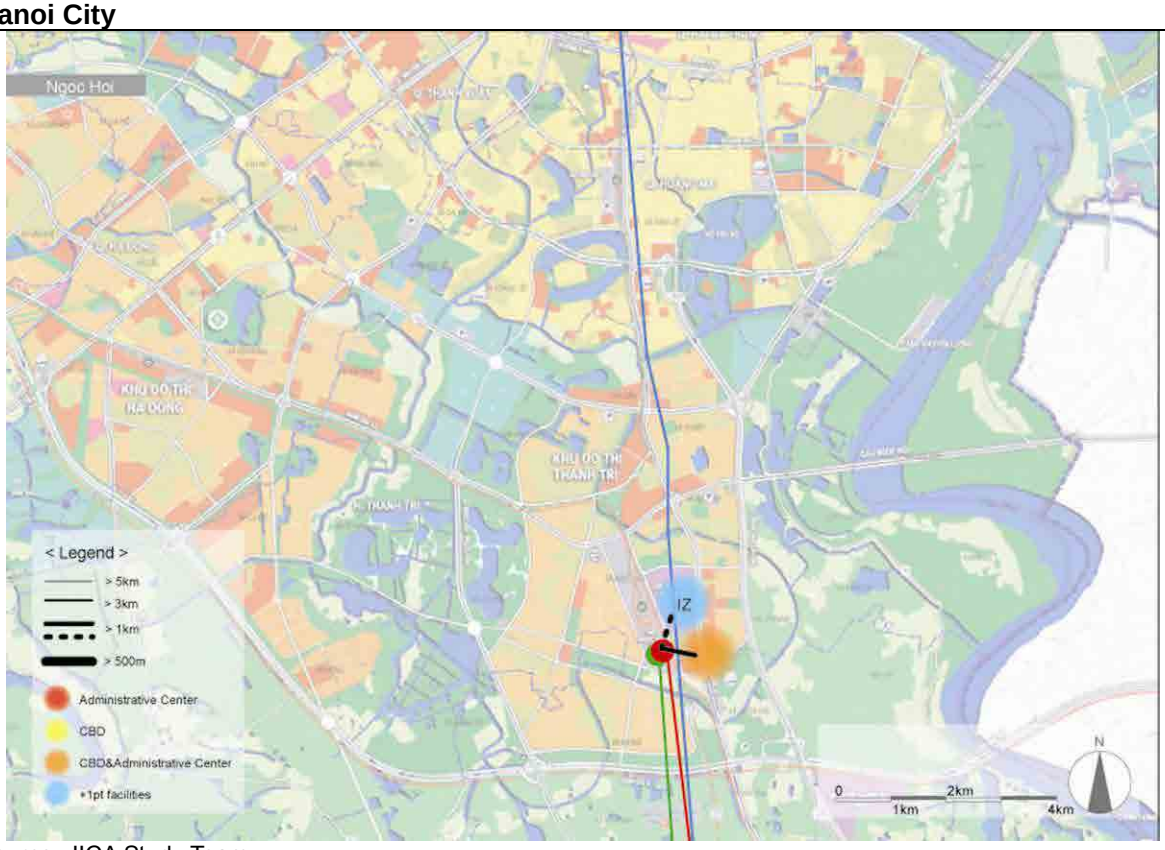
(ii) Accessibility to station annnd potential for integrated development

(iii) Availability of land for integrated development

From this standpoint, in order to further analyze the “convenience” and “(potential for) integrated development” of the candidate station areas, the distance to main urban centers, i.e. administrative center, Central Business District (CBD), and other centers (residential development areas, industrial zones, academic institutions, tourism destinations, etc.) has been illustrated and analyzed in the following maps in this Appendix.

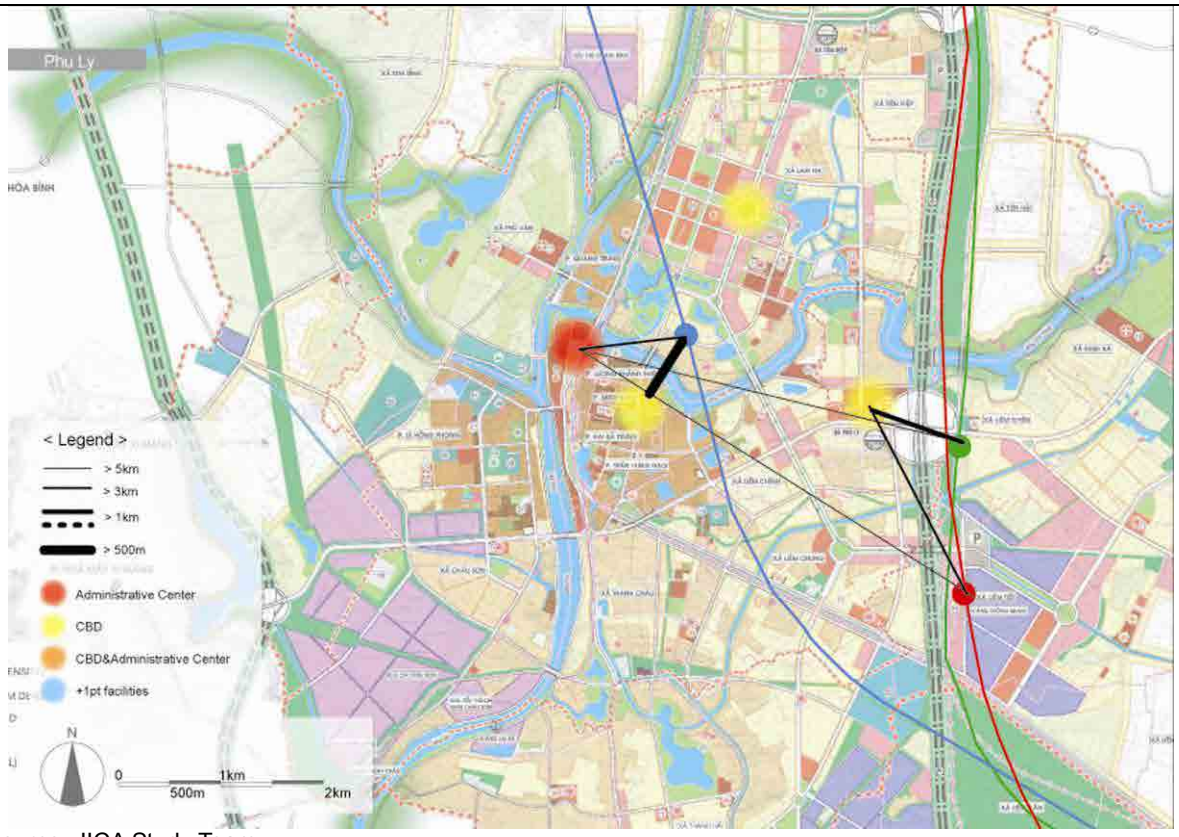
The colored circles indicate the type of urban centers (see legend for details), in which administrative centers and CBD have a unique color but other centers expressed by a single color with text inside, indicating the type of urban center. Note that only urban centers which affect (or in the vicinity of) the candidate station areas are indicated in the map. The distance from the candidate station area to each urban center is expressed by the type of line (width of line, straight or dotted). This distance is the basis to evaluate the aforementioned criteria (ii) Distance from main urban centers in the process of evaluating candidate station locations.

**Hanoi City**



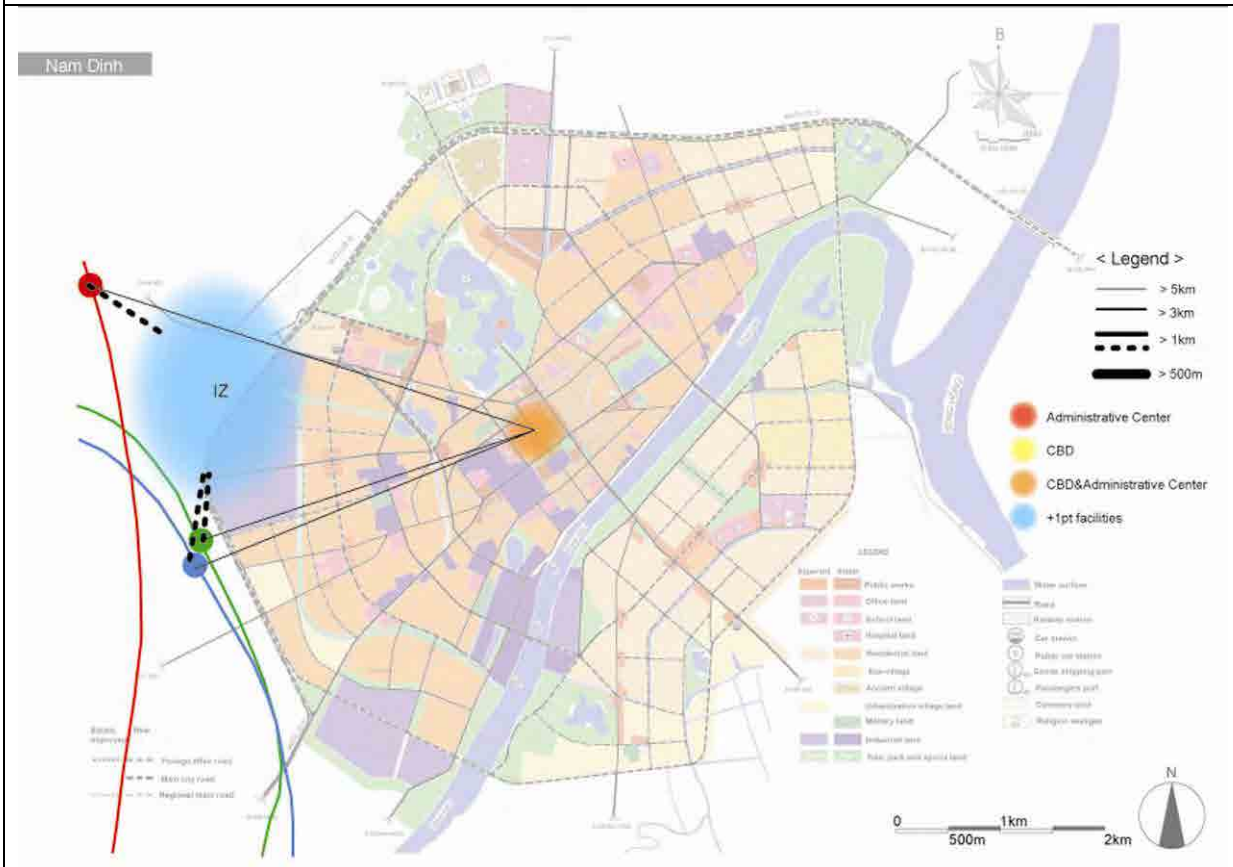

Source: JICA Study Team

**Ha Nam Province**




Source: JICA Study Team

**Nam Dinh Province**

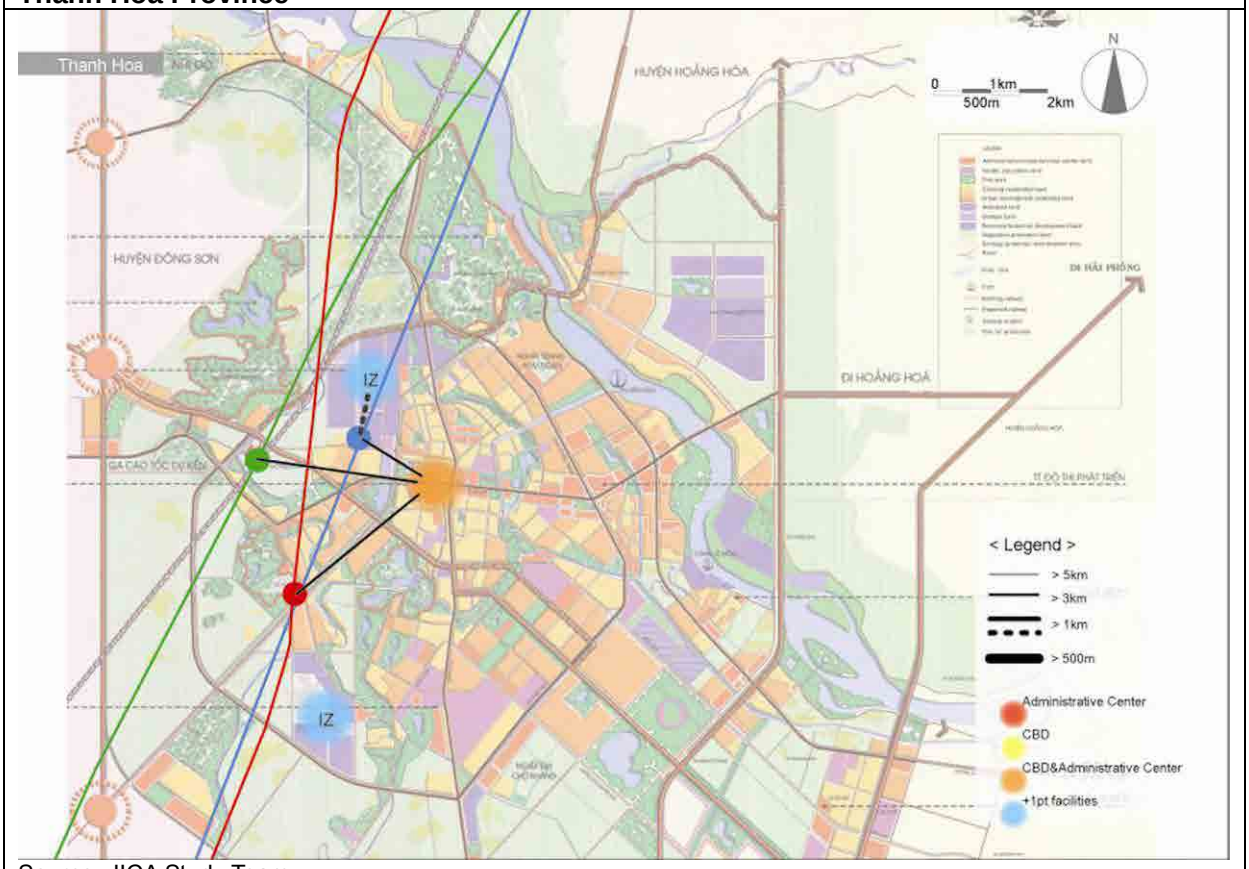



Source: JICA Study Team

**NInh Binh Province**

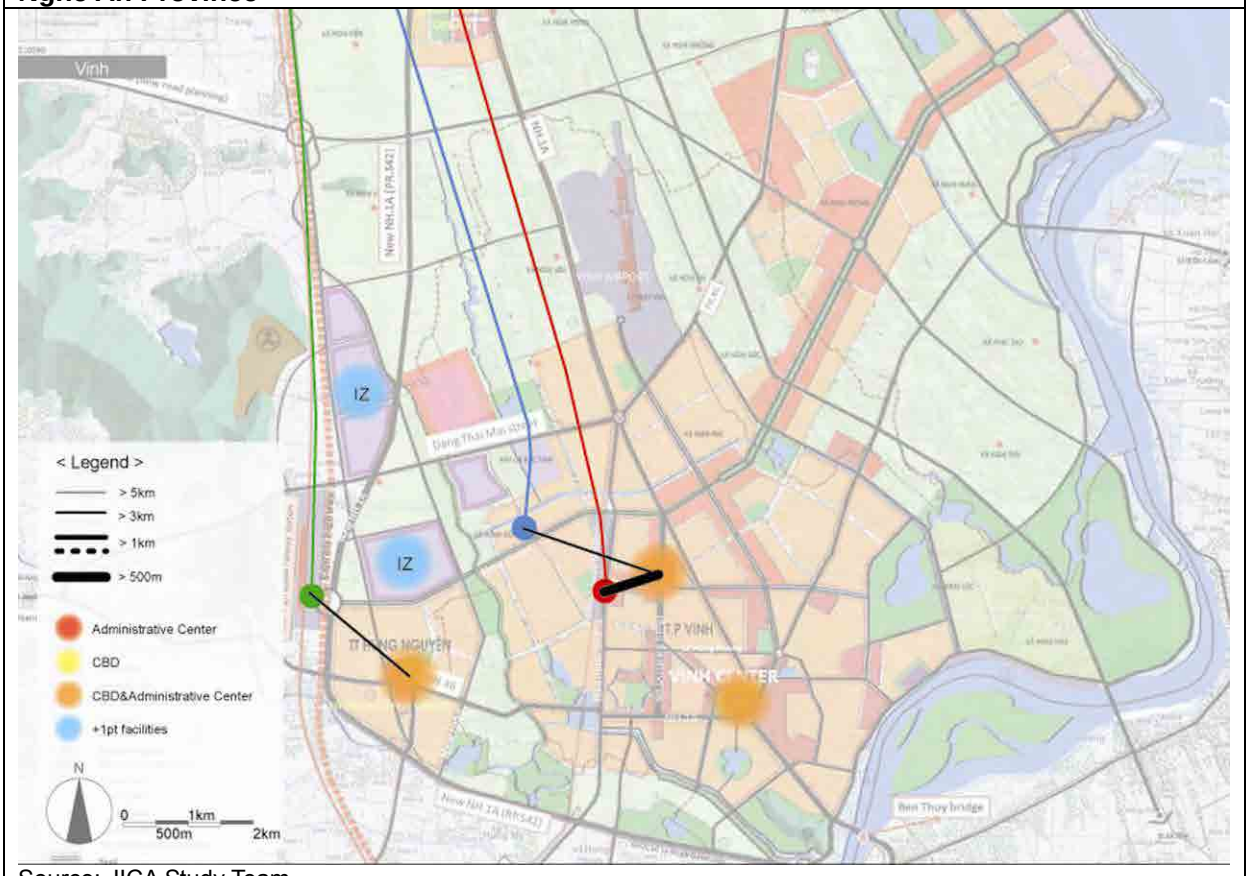

Source: JICA Study Team

**Thanh Hoa Province**



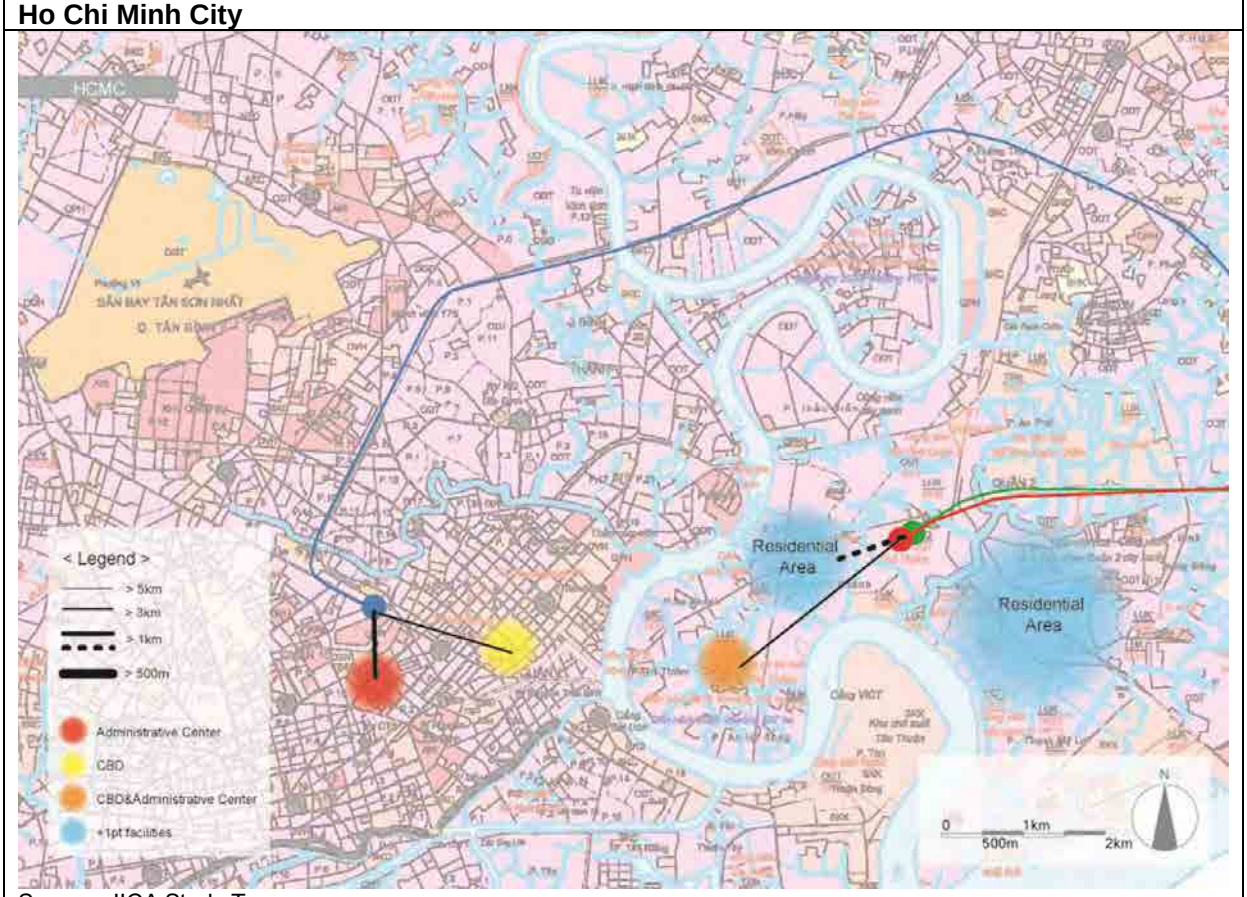

Source: JICA Study Team

**Nghe An Province**




Source: JICA Study Team

**Ho Chi Minh City**

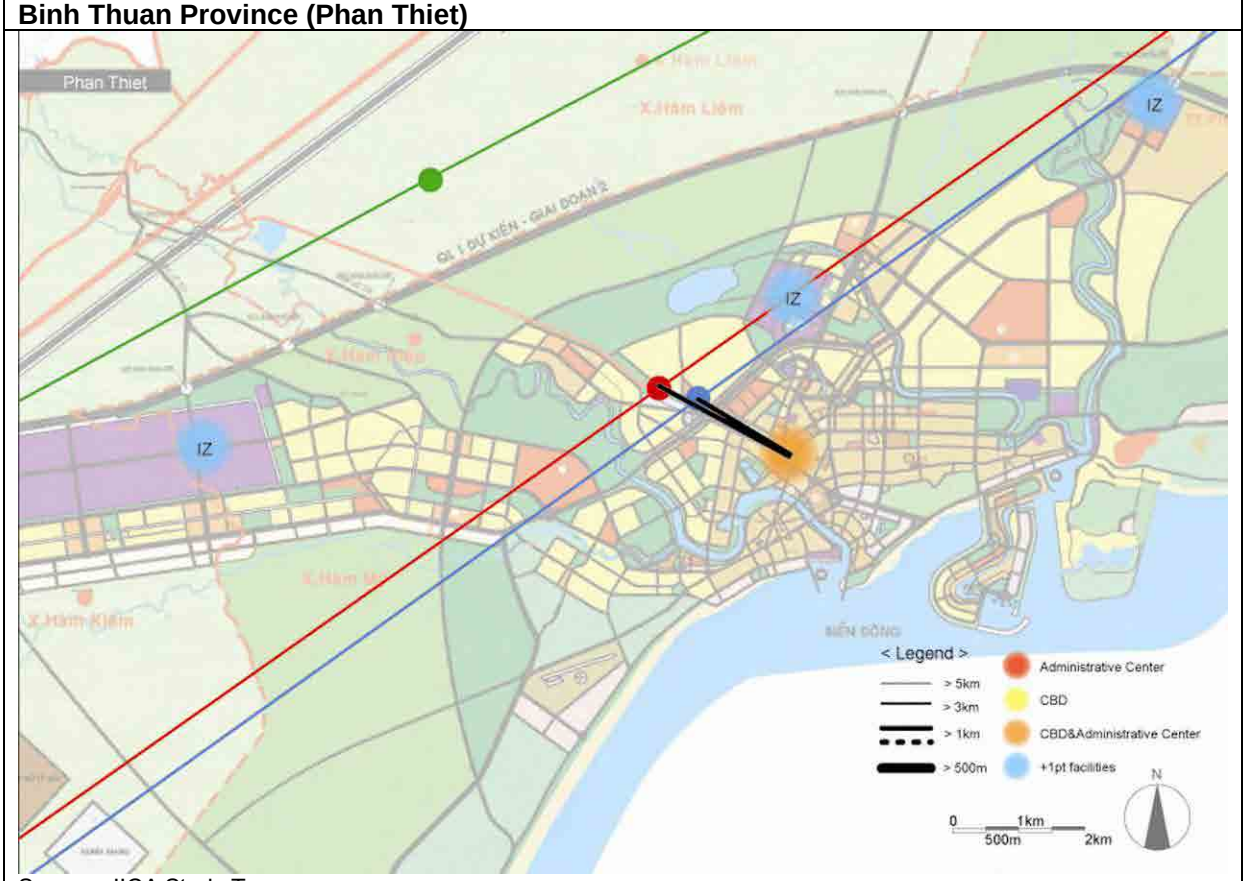



Source: JICA Study Team

**Dong Nai Province**

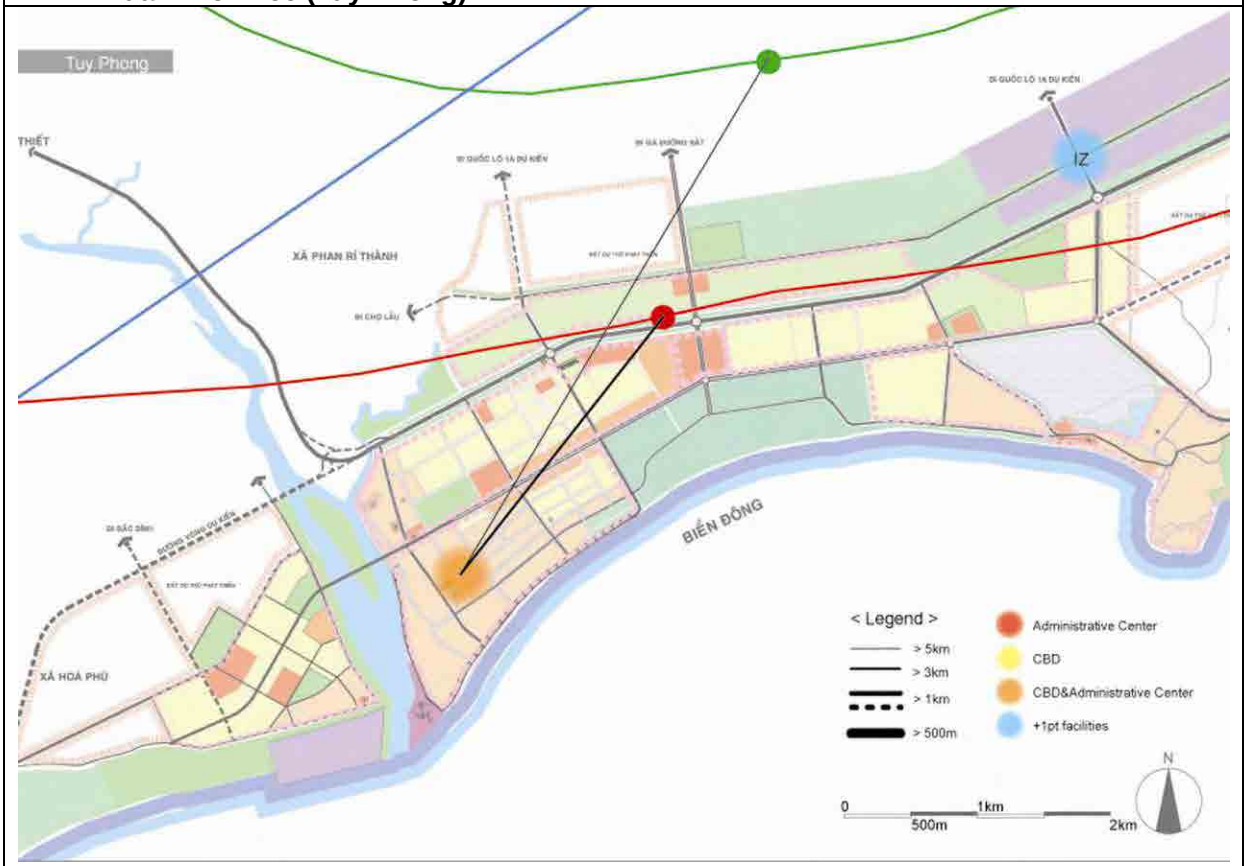

Source: JICA Study Team

**Binh Thuan Province (Phan Thiet)**



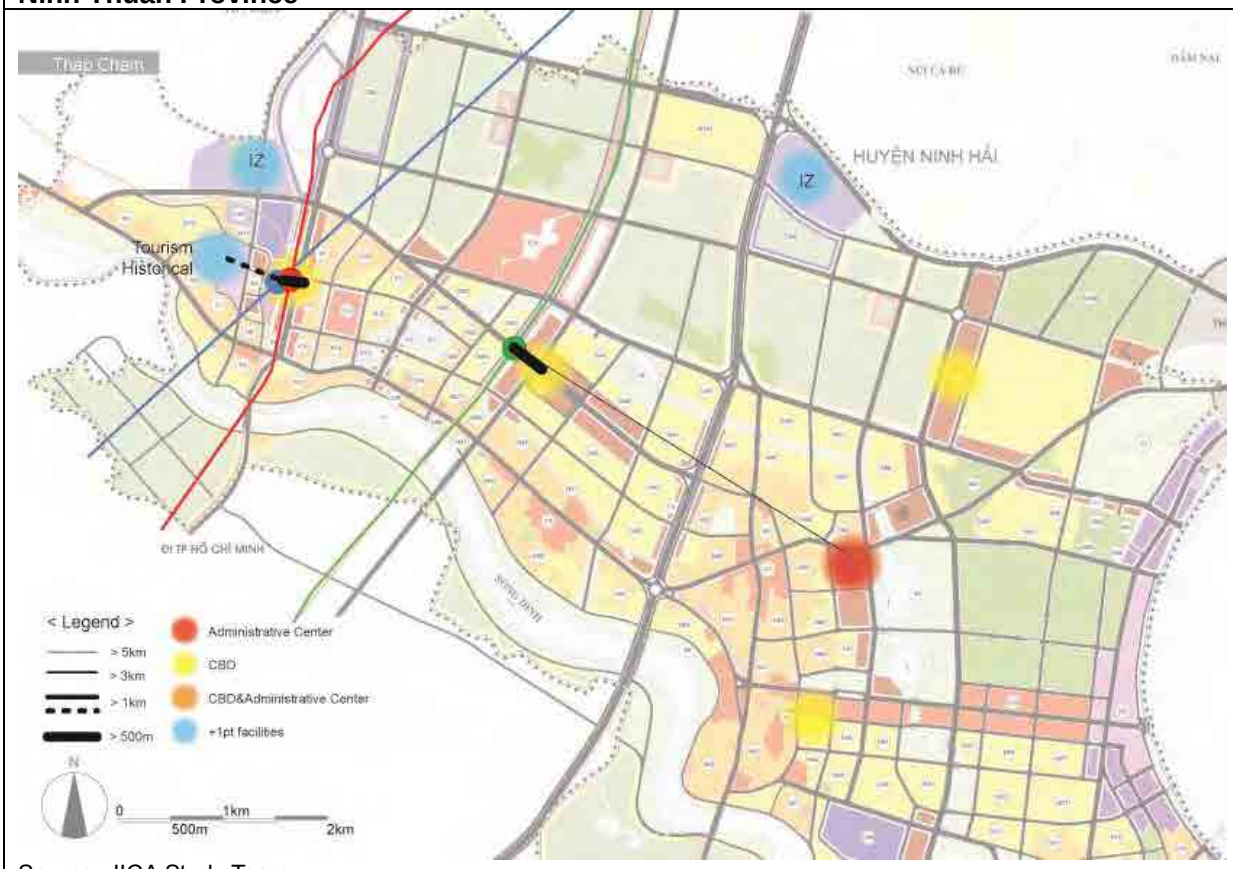

Source: JICA Study Team

**Binh Thuan Province (Tuy Phong)**



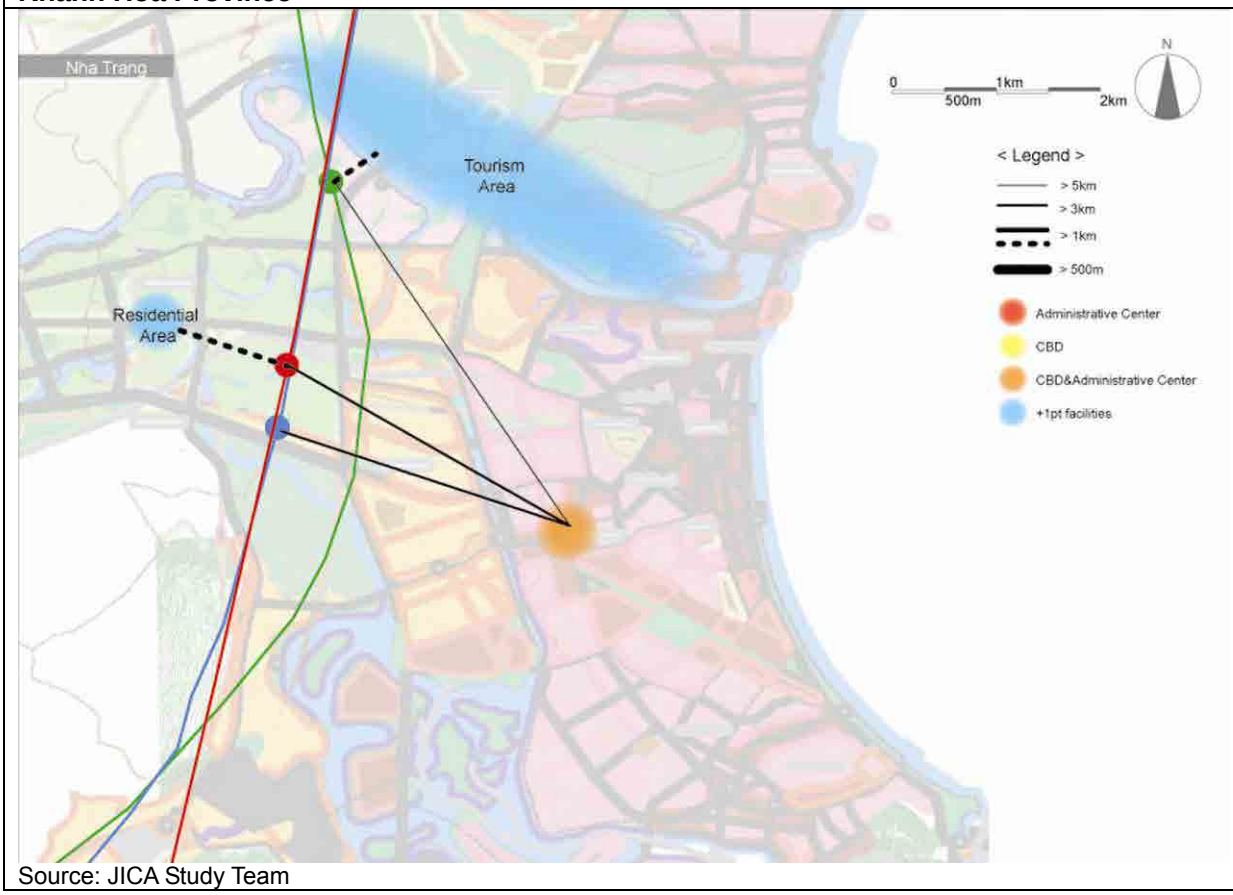

Source: JICA Study Team

**Ninh Thuan Province**




Source: JICA Study Team

**Khanh Hoa Province**




Source: JICA Study Team

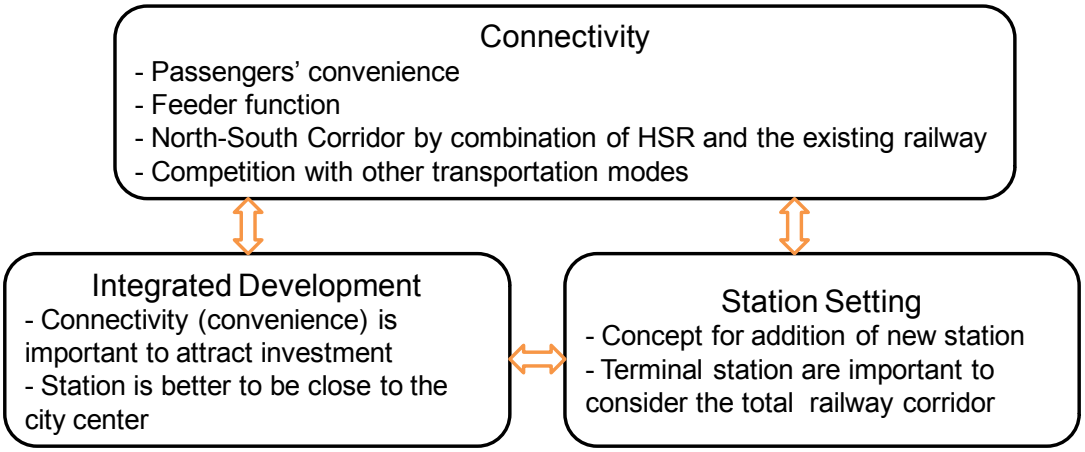
# APPENDIX 3C

# Major Comments Discussed (Topics in Common)

## (1) Important Key for the Successful HSR Development

3.1 Followings are major topics raised in the 2nd SHM in 11 target cities/provinces. To respond to the comments and major topics discussed on the 2nd SHM, following study was conducted in order to consider the alignment planning. The result of the study was presented in the plenary sessions of the 2nd SHM as well.

3.2 From the history of the HSR in Japan and in the world, it is considered that the key for the successful HSR development is highly dependent on its convenience for the passengers. Here, the convenience of HSR is studied from three items or connectivity, integrated development and station setting. These items closely relate to each other, forming the important aspects of the convenience of HSR as is in Figure 3C.1..




Source: JICA Study Team

**Figure 3C.1 Convenience and Three related Items on HSR**

## (2) Connectivity

3.3 In order to maximize the convenience of passengers for the success of the HSR system, the connectivity of the HSR with other transportation modes are important so that to attract more passenger and more investment for integrated development, to form railway corridor, and to compete with other transportation modes.

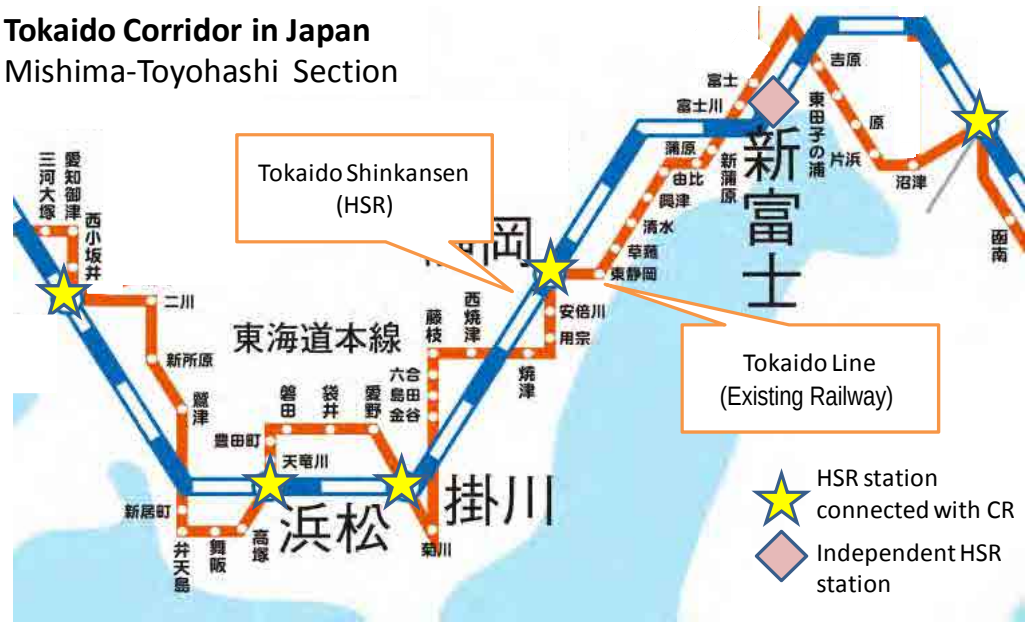
3.4 In the major transportation corridor like the north-south corridor in Vietnam, the comprehensive railway system, or the strategic linkage of HSR and existing railway should be arranged to maximize the benefit of the passengers. The experience in Japanese Tokaido Corridor is shown in Table 3C.1 below.

**Table 3C.1 Combination of HSR and CR (Tokaido Corridor, Japan)**

In the Tokaido Corridor, Tokaido-line (existing railway) service was utilized for passengers before the launch of Tokaido Shinkansen (HSR). After the commencement of the operation of HSR, HSR and CR complement each other by offering the high-speed, longer distance service by HSR and the local, short distance service by CR.

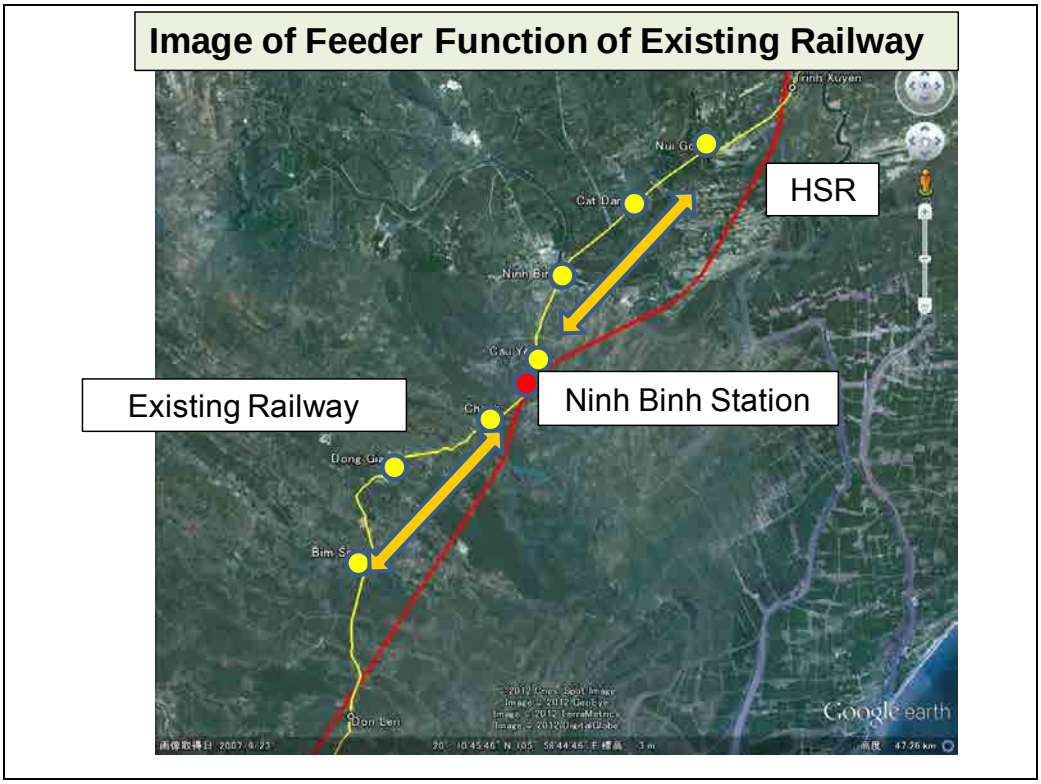
- Before 1964: CR service was for long distance over 600 km (maximum approx. 1,575km)
- After 1964: HSR took over long distance service. Long distance service of CR was significantly decreased.
- Current: CR runs shorter sections mostly around 100km sections and even shorter sections like 30km for busy hours. In the busy hours, trains run less than every 5 minutes especially near large cities.

Following figure is the current image of the Tokaido Corridor (excerpt). It shows that HSR and CR are connected each other so that the passenger can enjoy the convenience of the Tokaido Railway System.




Source: JICA Study Team

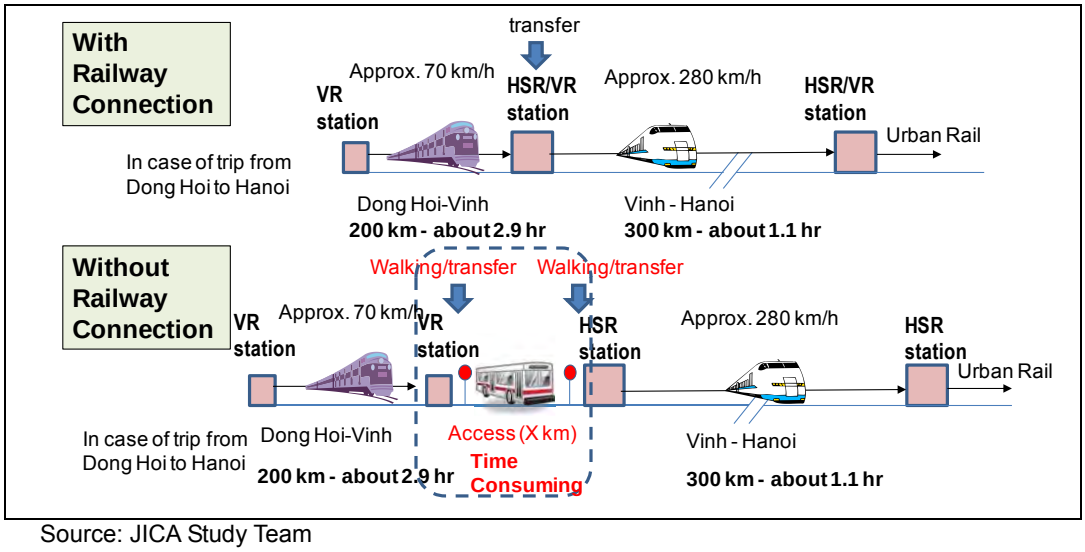
3.5 In the case of Vietnam, to integrate the service of HSR and the existing railway, the improvement of the existing railway is inevitable. With the A2 level improvement (See Volume I regarding the improvement target level of the existing railway), the existing railway comes every 30 minutes. Passengers take the existing railway to reach HSR station, or passengers come to HSR stations to transfer to continue their trip to the local stations of the existing railways. For the success of HSR, the feeder transport is necessary. Figure 3C.2 shows the concept of feeder transport by further activation of the existing railway.




Source: JICA Study Team

**Figure 3C.2 Feeder Function (Integration of HSR and Existing Railway)**

3.6 While many province commented that the convenience will be maintained for stations of a few km distance as long as the road connection is secured, it is concluded that 1) the easy transfer will reduce the travelling time, which is one of the biggest advantage of the HSR, and 2) Transfer by bus/car between stations will be inefficient causing long waiting time for passengers due to the large capacity of railway transport (over 1,000 passengers per time). The image of railway connection (with and without) is shown in Figure 3C.3 below.




Source: JICA Study Team

**Figure 3C.3 Importance of Smooth Transfer at the Station**

3.7 It is also noted that by maximizing the convenience of passengers, HSR will be more advantageous in competing against other transportation modes, especially the air

transportation. The major strength of HSR against air is 1) short access time to the station from city center, 2) punctuality, 3) high frequency and etc. The strategic location of the stations with connectivity is the key. Ridership is important factor for the stable management and operation of HSR, and the competition with air has to be well taken into consideration into the alignment and station location planning of HSR. Table 3C.2 discusses the competition of HSR and the air.

**Table 3C.2 Case Study/ Competition of HSR and Air in Japan**

**Competition of HSR and Air in Japan**

| Origin | Desti-nation | Km | Mode | Access Time | | Travel Time | Total Time | Frequency (Aug2012) |
|---|---|---|---|---|---|---|---|---|
| | | | | Origin | Destination | | | |
| Tokyo | Osaka (Itami/Air) | 500 | HSR | 0:00 | 0:13 | 2:33 | 2:46 | 130 |
| | | | Air | 0:57 | 0:55 | 1:05 | 2:57 | 30 |
| Tokyo | Hiroshima | 900 | HSR | 0:00 | 0:00 | 3:52 | 3:52 | Direct:50 Transfer:130 |
| | | | Air | 0:59 | 1:01 | 1:20 | 3:20 | 17 |
| Osaka (Itami/Air) | Hakata | 630 | HSR | 0:09 | 0:00 | 2:28 | 2:37 | 70 |
| | | | Air | 0:59 | 0:28 | 1:15 | 2:42 | 16 |


Source: JICA Study Team

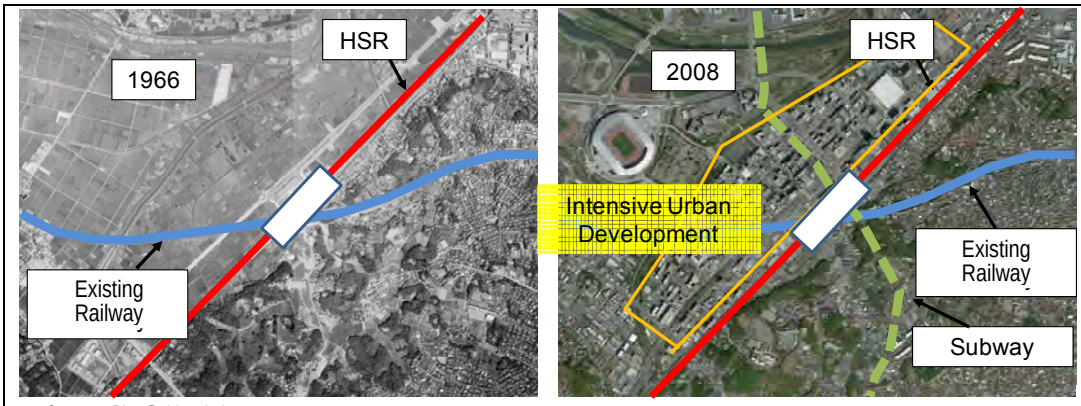
### (3) Integrated Development

3.8 In Vietnamese context, HSR is expected to be one of the triggers of the integrated development of the cities where stations are located. From studying the experiences in many countries including Japan, Taiwan, Korea and etc, the successful integrated development have been achieved with feeder railway network ensuring the better connectivity, more ridership and economic activity. Without convenient railway connections, many cities have failed urban development.

3.9 One of the successful examples is in Japan, Shin-Yokohama Station of Tokaido Shinkansen, where the integrated development is successful by inviting urban development in front of the station including facilities like a soccer stadium and a concert space. Shin-Yokohama Station has currently three railways, HSR, CR and subway. The integrated development can be seen by comparing the satellite images of the past and the current situation. (Figure 3C.4)

3.10 On the other hand, the integrated development of the case in Taiwan HSR is not so successful at this moment after 6 years since its commencement of the operation. The concept of station planning of Taiwan HSR are 1) outside city center, 2) aiming at developing new urban area, and 3) to be connected with existing city center

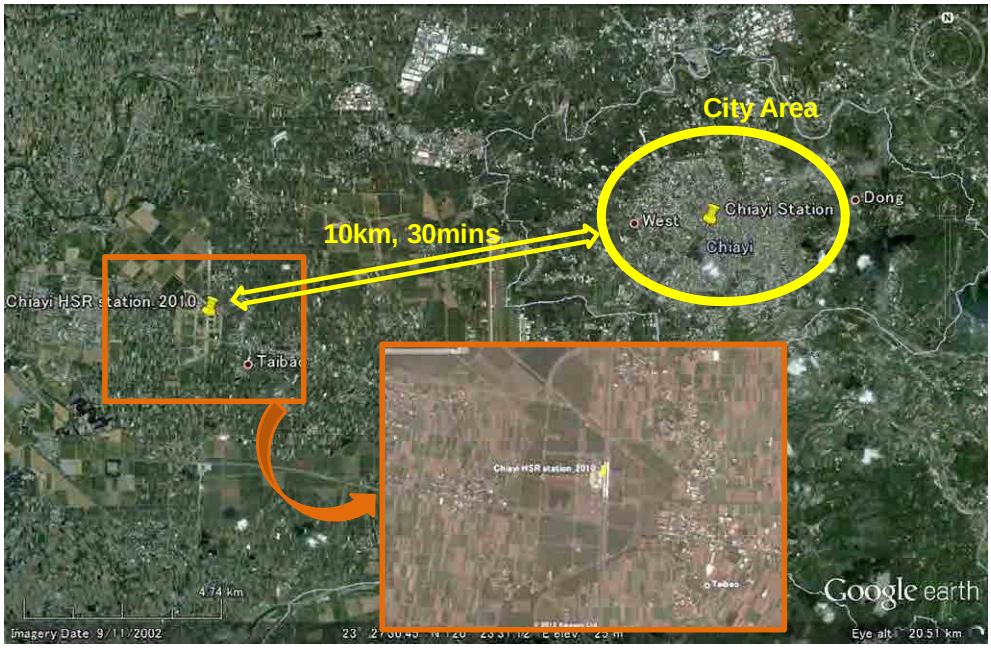
with new roads, and other new transportation (mono-rail/light rail/trams). However, in reality, 1) not enough investment on new connection and city development has been made, resulting in the delay of development of most new station areas, and 2) no financial benefit has been generated as expected from the private investment around station area. It is evaluated that the poor convenience could not attract the private investment smoothly. Figure 3C.5 shows the development of Chiayi Station area, where most land is vacant even after 4 years since its operation.




Source : Blog@shinyokohama

**Figure 3C.4 Successful Integrated Development (Shin-Yokohama Station/Japan)**

**[Taiwan Experience]** Chiayi Station Area; Nearly 4 years after open




Around Chiayi HSR Station, most of the area is not developed, besides a few buildings and parking lots.

Source: JICA Study Team

**Figure 3C.5 Failed Integrated Development (Chiayi Station/Taiwan)**

### (4) Station Setting Concept

3.11 There were many comments regarding the station location and additional station setting.

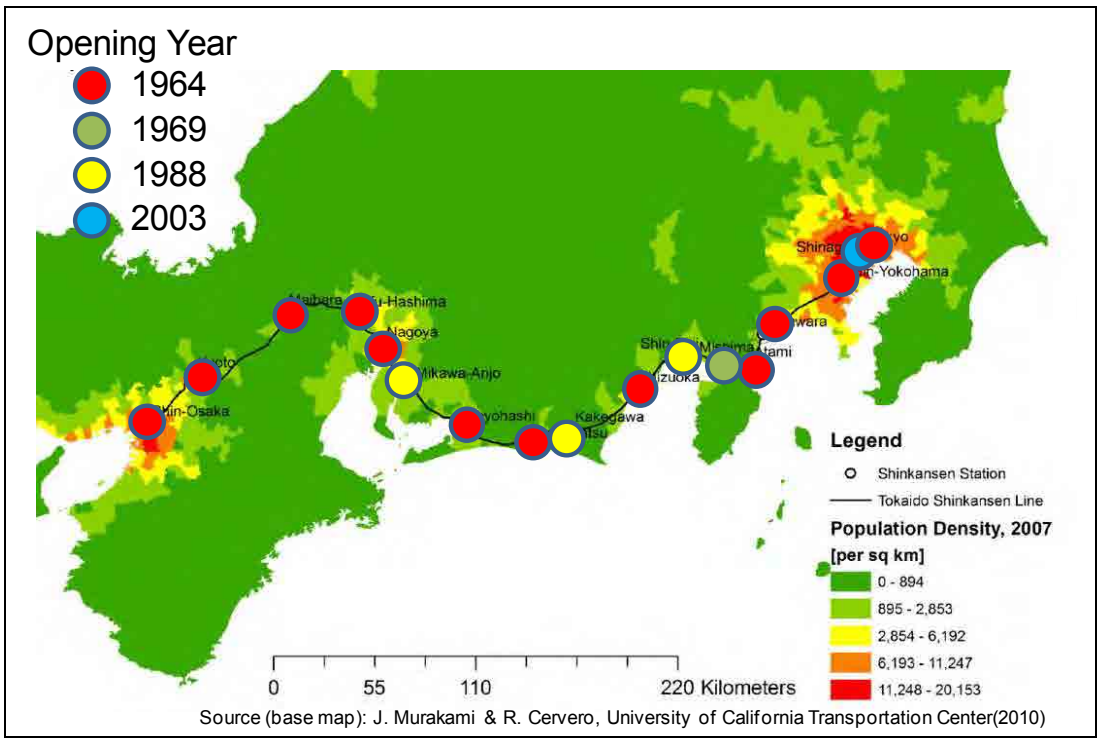
3.12 In this study, stations were set in accordance with following conditions, namely (i) provincial Capitals, if alignment allows, (ii) larger towns (ex. class III) along the alignment, and (iii) special location for passengers' convenience. In these circumstances, other stations may be developed later if there is 1) enough demand with 2) potential of integrated development. Table 3C.3 shows the list of the station with the applied conditions for the selection.

**Table 3C.3 Stations Set with Criteria (North and South Sections)**

| Station | i | ii | iii | Station | i | ii | iii |
|---|---|---|---|---|---|---|---|
| Ngoc Hoi | ✔ | ✔ | ✔ | Nha Trang | ✔ | ✔ | |
| Phu Ly | ✔ | ✔ | | Thap Cham | ✔ | ✔ | |
| Nam Dinh | ✔ | ✔ | | Tuy Phong | | ✔ | |
| Ninh Binh | ✔ | ✔ | | Phan Thiet | ✔ | ✔ | |
| Thanh Hoa | ✔ | ✔ | | Long Thanh | | | ✔ |
| Vinh | ✔ | ✔ | | Thu Thiem | ✔ | ✔ | ✔ |

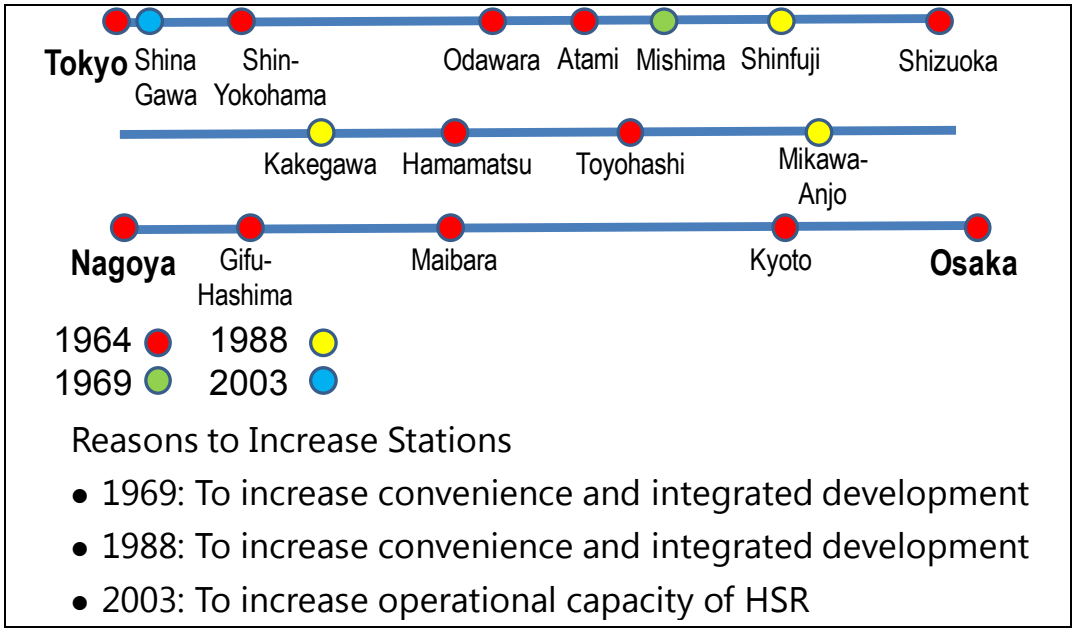
Source: JICA Study Team

3.13 In Japan, the 1st HSR, Tokaido Shinkansen started operation in 1964 with 12 stations and currently (2012) with 17 stations between Tokyo-Osaka of 515.4 km. the stations were added in order to increase convenience and integrated development and to increase operational capacity of HSR as shown in Figure 3C.6 and Figure 3C.7.




Source: JICA Study Team

**Figure 3C.6 Staged Development of Stations of Tokaido Shinkansen**




Source: JICA Study Team

**Figure 3C.7 Staged Development of Stations of Tokaido Shinkansen (Detail)**

3.14 In the target sections of HSR in Vietnam, currently, the areas in Table 3C.4 have potential for setting station in the future, considering the development plan of Vietnam/Province, potential for the demand and the integrated development, and the distances between the stations. The alignment is planned so that the future station development for these areas is possible.

**Table 3C.4 Potential Area for Future Station Setting**

| Areas | Important Considerations as New Station |
|---|---|
| Hoang Mai Town | **Priority area for urbanization** in Nghe An Province (future plan for expansion of town), near Nghi Son **IZ** (major oil refinery factory) |
| Tan Nghia Town | **Priority area for urbanization** in Binh Thuan Province, benefits **La Gi Town** (planned to become 2nd largest urban area after Phan Thiet City) as well |
| Long Khanh Town | Urbanized area in Dong Nai Province (**2nd largest urban area in province** after Bien Hoa City), near Cam My **High-tech IZ** |

Source: JICA Study Team

***JST has set the alignment so that the future station development for three areas above is possible.***

3.15 It is necessary that terminal stations (Ngoc Hoi in Hanoi, Nha Trang and HCMC) should be paid special attention so that the target sections of HSR will be integrated into the north-south corridor transportation system, especially by combining HSR and the existing railway as north-south railway corridor. In this context, the followings are needed to be confirmed and secured for terminal station of HSR. Table 3C.5 summarizes the current considerations.

- Hanoi and HCMC: it has to be **connected with urban railway** to access city center.
- Vinh and Nha Trang: it has to be **connected with the existing railway** to

be the part of North-South Railway System with smooth transfer.

- All terminals: **the potential extension of HSR** should be kept in the mind.

**Table 3C.5 Study on Terminal Station Setting**

| Station | Important Considerations as Terminal |
|---|---|
| - Ha Noi (Ngoc Hoi Station) | - Connection with urban railway (Line 1) / existing railway<br>- Potential extension to North (Hanoi Station, etc) |
| - HCMC (Thu Thiem Station) | - Connection with urban railway (Line 2)<br>- Potential extension to South (Can Tho, etc.) |
| - Vinh and Nha Trang | - Connection with the existing railway<br>- Potential extension of HSR |

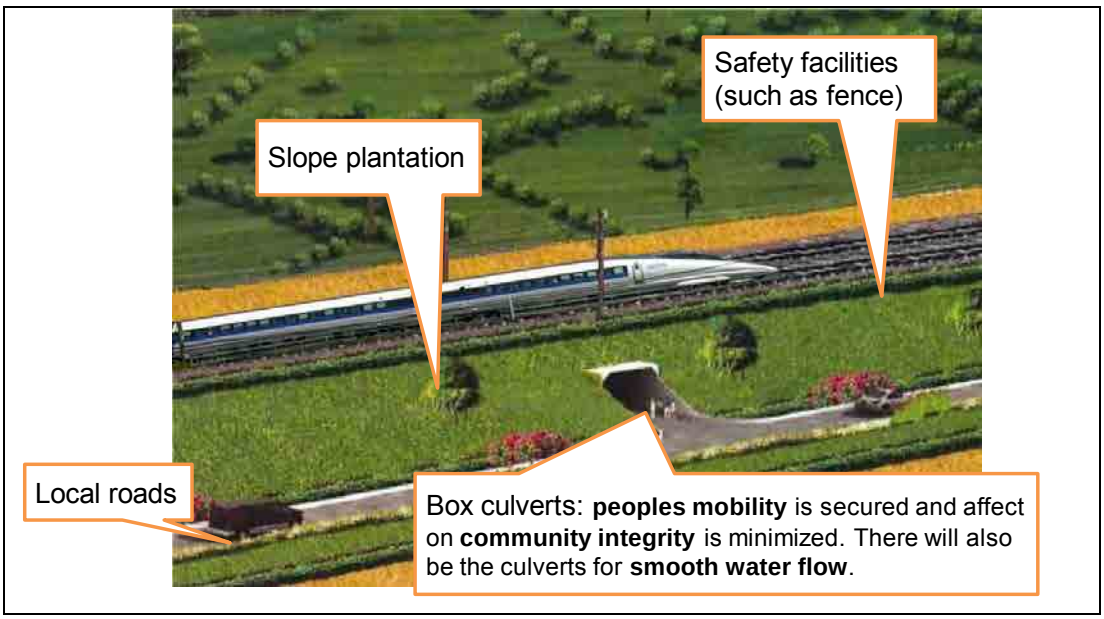
Source: JICA Study Team

### (5) Project Schedule

3.16 Many comments were made on the investment schedule from cities/provinces. As discussed in Volume I, the timing of the investment is to be carefully studied, based on the demand, the growth of GDP and individual income level. In terms of the demand, HSR is considered to be required by 2030 to bear the high demand of traffic along the north-south corridor.

### (6) Structure

3.17 Many provinces requested the section in the populated area should be viaduct and showed negative concern against embankment because of such as division of communities and flooding considering the existing embankments (ex. National highways). Through the careful consideration including field survey, the JICA Study Team design that the viaduct be applied in populated areas, and embankment design will consider the utilization of box culverts to ensure the mobility of people and water flow so that community integrity will not be affected and flood will not be worse. The design of embankment studied in order to minimize the impact on hydrological and social issues is shown in Figure 3C.8. In the study, sample calculation of the drainage capacity of box culverts in Ninh Thuan Province shows that the flooding affect can be minimized with the appropriate density of the culverts (4 culverts/km).

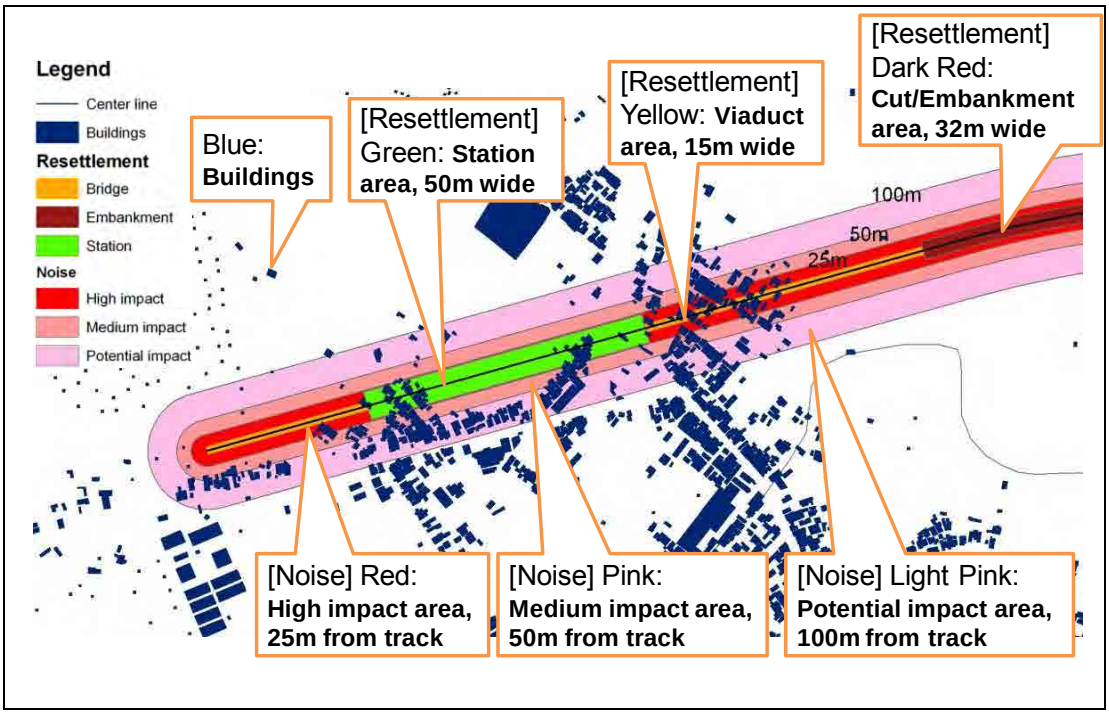



Source: JICA Study Team

**Figure 3C.8 Embankment Structure for HSR**

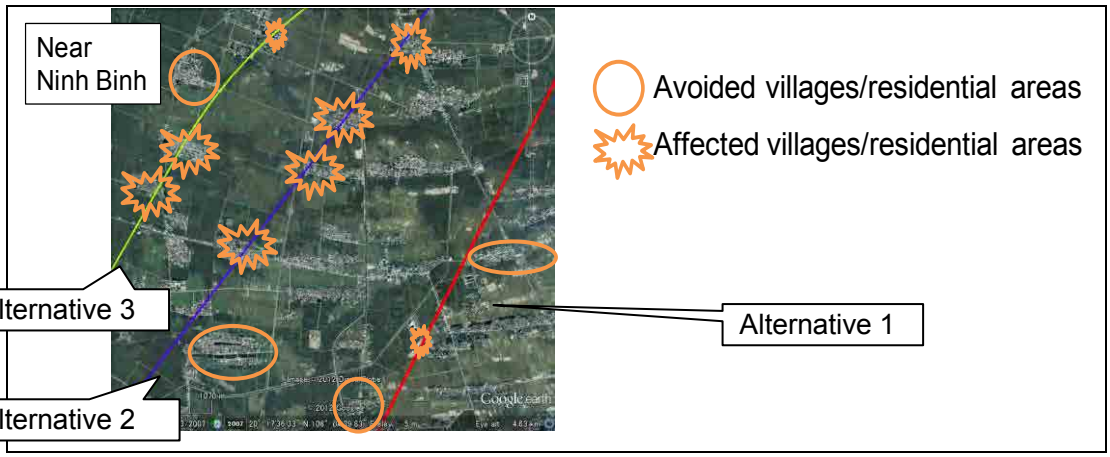
### (7) Counting Affected Buildings and Avoiding Populated Areas

3.18 Some provincial officials commented on the alignment and station locations based on the tendency of demography such as “to the eastern side of the province, more residents”, “more population near the national highway”. The tendency explained by the province is correct, while the study estimated the resettlement and potential noise pollution by the actual counting of affected buildings based on the latest topographic map (1:10,000). In addition, the other sources of updated information were utilized for avoiding populated areas. The methods of counting and the result of alignment planning avoiding settlements are in Figures 3C.9 and 3C.10.




Source: JICA Study Team

**Figure 3C.9 Method of Counting Affected Buildings**




Source: JICA Study Team

**Figure 3C.10 Avoiding Populated Area based on the Latest Information**

# APPENDIX 3D

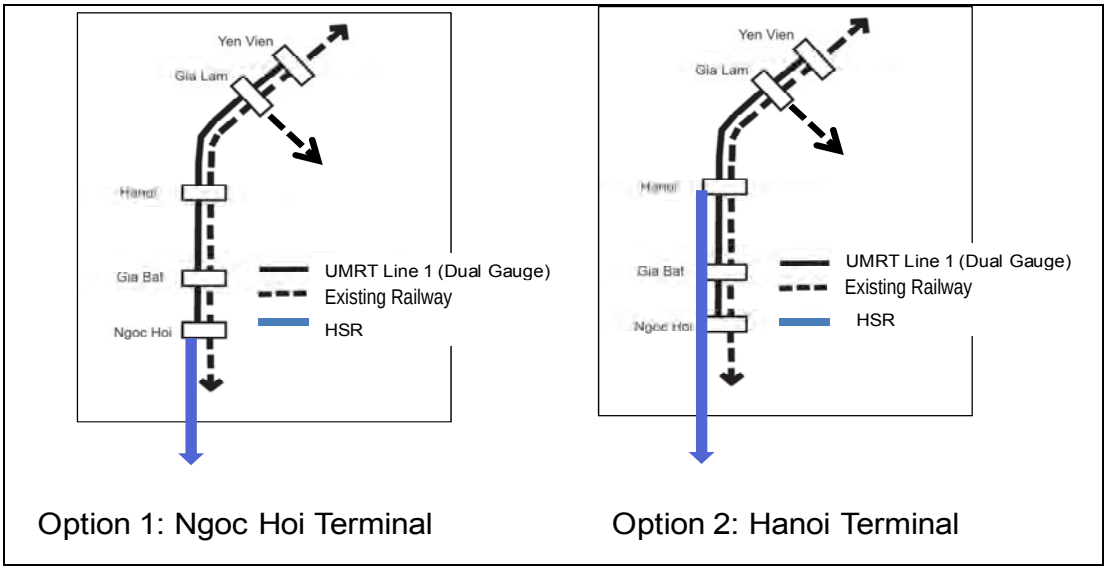
# Major Comments Discussed (Topics in City/Province)

3.1 Followings are major comments raised by each city and province.

## (1) Location of Terminal Station in Ha Noi City

3.2 In the 2nd SHM, various options for the HSR especially in terms of 1) terminal station and 2) potential of the mutual direct operation by HSR/existing railway. Participants showed the preference to set Ngoc Hoi Station as the terminal station.

3.3 JICA Study Team conducted preliminary study on the extension from Ngoc Hoi to the existing Ha Noi Station by the underground option, however, at this moment, this study targets only Ngoc Hoi to Vinh for the north section due to the technical complexity which will lead to high cost and uncertainty in policy decision. The comparison images are shown in the 2nd SHM in Hanoi City.




Note: UMRT: Urban Mass Rapid Transit

Source: JICA Study Team

**Figure 3D.1 Conceivable Options for HSR Terminal in Hanoi City**

**Table 3D.1 Conceivable Sub-Options for HSR Terminal in Hanoi City**

| Options | Sub-options | Remarks |
|---|---|---|
| Option 1 (Ngoc Hoi) | 1-1. Final destination of both HSR and UMRT Line 1 | |
| | 1-2. Through operation of HSR to Hanoi Station | HSR uses URMT track |
| | 1-3. Through operation between HSR and UMRT Line 1 | HSR uses URMT track while URMT use HSR track |
| Option 2 (Hanoi) | 2-1. Approach to Hanoi Station through underground | To be developed as new HSR independent line (Ngoc Hoi – Hanoi) |
| | 2-2. Approach to Hanoi Station through viaduct | |

Source: JICA Study Team

**Table 3D.2 Preliminary Comparison of Options for HSR Terminal in Hanoi City**

| Opt. | Engineering | | | Demand Generation | Env. & Social | Remarks |
|---|---|---|---|---|---|---|
| | Construction Difficulty | Construction Cost | Operation System | | | |
| Opt.1-1 | A | A | A | C | A | - Smooth transfer is required |
| Opt.1-2 | B | B | C | B | A - | - HSR operation is limited<br>- Improvements of security system of existing railway and UMRT facilities are required |
| Opt.1-3 | B | B | C | B | A - | - In addition to above, improvement of security system of HSR is required |
| Opt. 2-1 | C - | C - | A | A | B | - Construction cots is high |
| Opt. 2-2 | C | C | A | A | C - | - Land acquisition is difficult |

A: Better, B: Good, C: Fair

Source: JICA Study Team

### (2) Location of Terminal Station in Nghe An Province

3.4 During the consultation with Nghe An Province, there was discussion on the location of the station, while as discussed in Appendix 3B, Vinh Station, as a terminal station, should be connected directly with the existing railway at the current existing location to develop the comprehensive north-south railway system in Vietnam.

### (3) Impact on Paddy Area in Ninh Thuan Province

3.5 Ninh Thuan Province mentioned that the paddy area in the province is very limited, and requested that the impact by the HSR should be minimized by applying viaduct structure in the paddy area.

3.6 Further study was conducted and it is concluded that the alignment should be planned so that overall environmental and social impact is minimized, not only the paddy area. And paddy area affected by HSR (Alt1) is only 0.26% of total paddy area in Ninh Thuan. (Table-2 of Table 3D.3)

3.7 Since the cost impact may affect the project feasibility and its investment schedule severely, balanced considerations on cost and impact should be made. (Table-2 of Table 3D.3)

**Table 3D.3 Impact on Paddy Area and Landuse in Ninh Thuan Province**

Table-1 Impact on Environment

| Impact | Alt1 | Alt2 | Alt3 |
|---|---|---|---|
| Natural | B(Good) | B(Good) | B(Good) |
| Pollution | B(Good) | C(Fair) | D(Worse) |
| Social | B(Good) | D(Worse) | C(Fair) |

Table-2 Impact related to Paddy

| Impact | Alt1 | Alt2 | Alt3 |
|---|---|---|---|
| Affected Paddy (% of total area) | 58ha (0.26%) | 34ha (0.15%) | 67ha (0.29%) |
| Cost per km (Paddy Section) | 5.2 million USD/km | 20.1 million USD/km | 5.2 million USD/km |

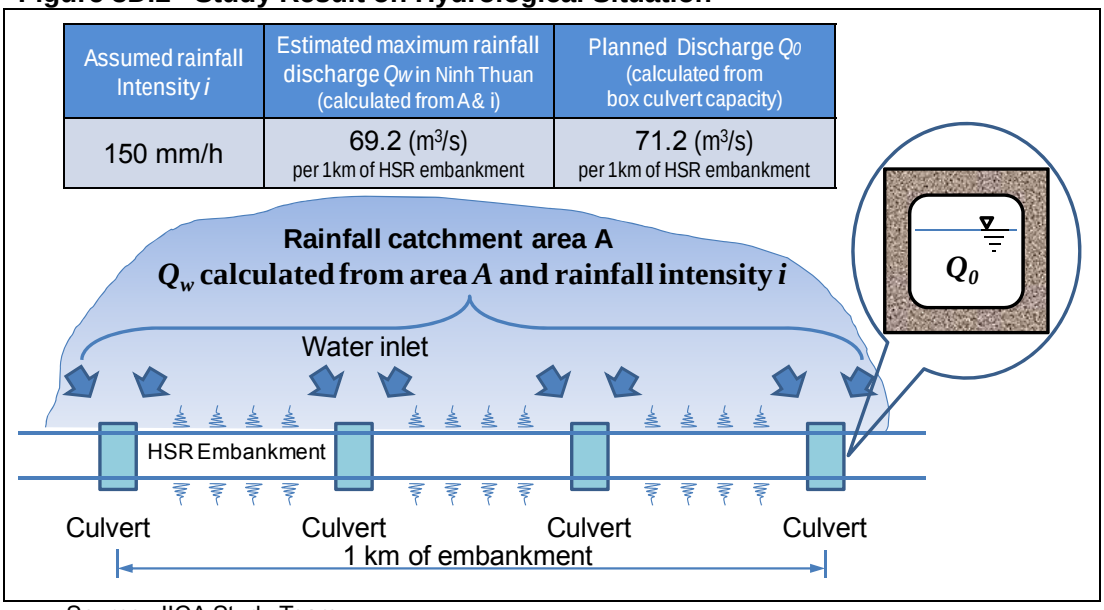
*Cost: estimated land price + compensation+ civil construction work*

Source: JICA Study Team

### (4) Hydrological Condition in Ninh Thuan Province

3.8 Ninh Thuan Province showed concern on the flooding by application of the embankment. Further study was conducted and it was estimated that the drainage capacity of 4 culverts of (2m x 2m) per 1km embankment would be sufficient for the 150mm/h rainfall as below.

**Figure 3D.2 Study Result on Hydrological Situation**

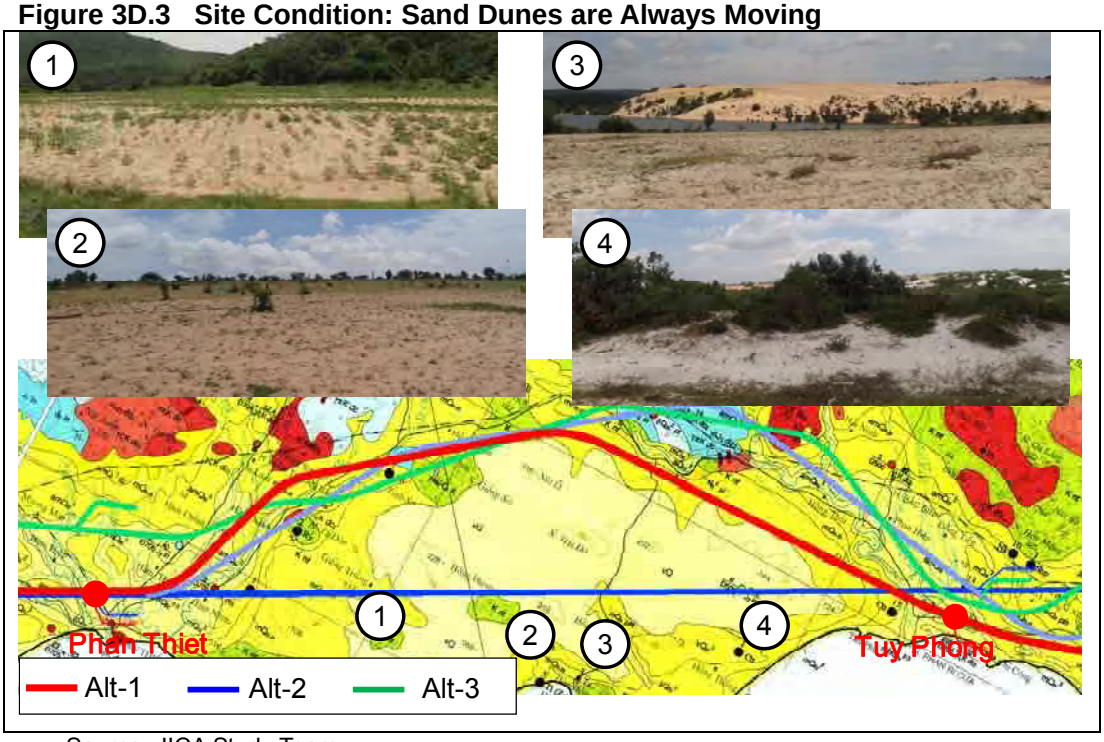



Source: JICA Study Team

### (5) Alignment through Sandy Area in Binh Thuan Province

3.9 Binh Thuan Province commented that the straight route through the sandy area between Phan Thiet and Tuy Phong. Additional study was conducted to assess the engineering feasibility for the alignment through the sandy area. It was concluded that the alignment through the sandy area has a high risk with regard to the stability of the structure.

**Figure 3D.3 Site Condition: Sand Dunes are Always Moving**

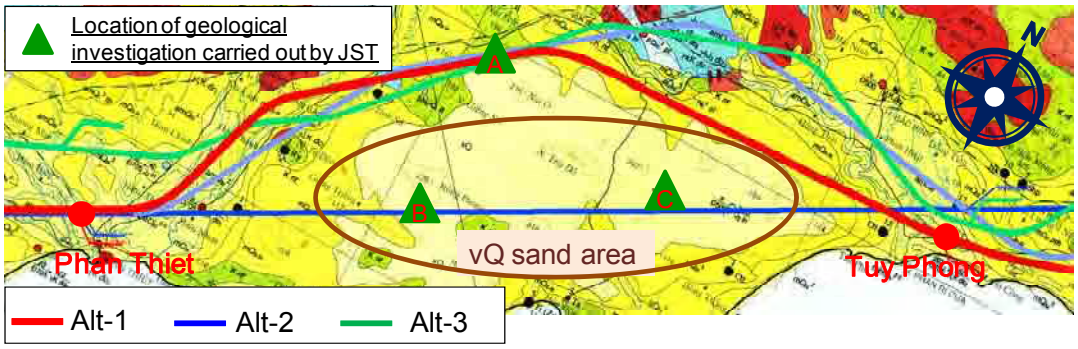



Source: JICA Study Team

**Figure 3D.4 Site Condition: Sand Dunes are Easily Collapsed and Eroded**

Source: JICA Study Team

3.10 The literature survey and boring test both mentions that the sandy area is not appropriate for the constructing structures for the HSR. 1) In Geology and Mineral Resources (Department of Geology and Minerals of Vietnam), it is reported that: 1) vQ sand area is formed by the wind and continues to change. Many sand dunes move each year causing traffic jam, burying many field and garden. 2) As result of geological investigation, compared to location A, location B, C are found easy to collapse due to: top layer (0~6m) is loose, average void ratio e is larger, and average shear strength is smaller.



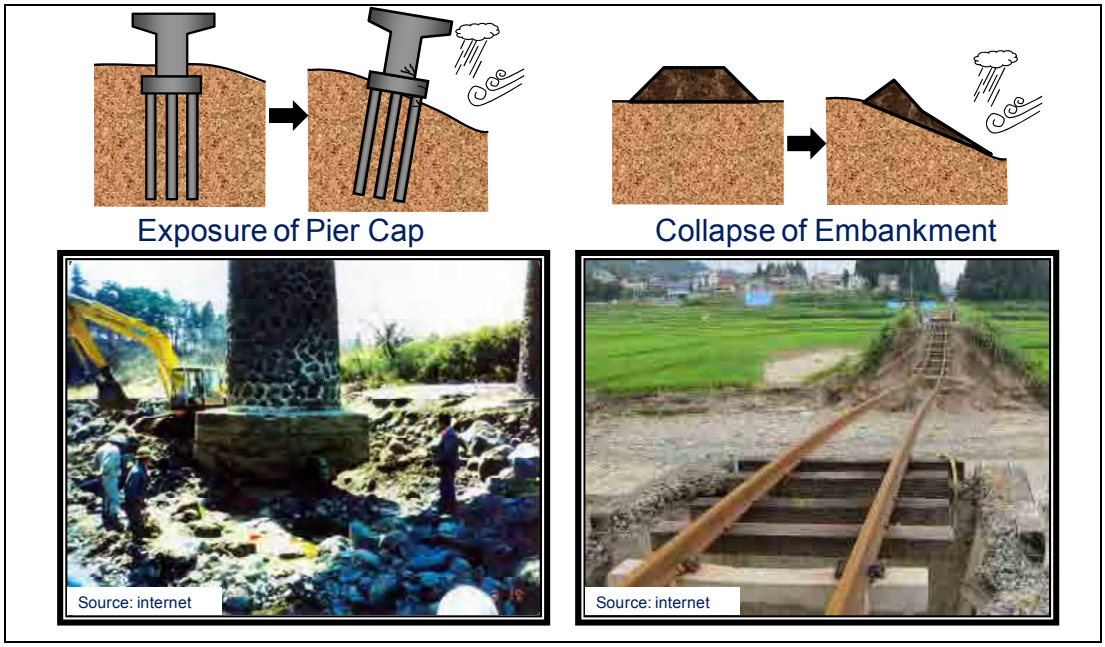

**Laboratory test result by JST**

| | Location | | |
|---|---|---|---|
| | A | B | C |
| Top layer (0~6m) | dense | loose | loose |
| Average void ratio e | 0.569 | 0.631 | 0.603 |
| Average shear strength (kg/cm²) | 0.672 | 0.620 | 0.624 |

Source: JICA Study Team

**Figure 3D.5 Result of Laboratory Soil Test**

3.11 Considering the characteristics revealed by the additional study, there is a high risk of the stability of the structure, regardless of viaduct or embankment. Following images show the major risks.




Source: JICA Study Team

**Figure 3D.6 Major Risk in Construction in Sand Dunes in Binh Thuan**

**(6) Location of Long Thanh Station in Dong Nai Province**

3.12 In the 2nd SHM, and also in previous plans, there were several comments and options regarding the location of the HSR station for Long Thanh Airport. The options

are basically following two. 1) The HSR station to be situated in the center of the airport. The airport master plan also put the station in the center of the airport. 2) The HSR station to be situated beside the airport area.

3.13 The comments are mainly that 1) the convenience, 2) traffic congestion in the access road, and 3) safety of integration of the two large transportation infrastructures. By the comprehensive comparison, it is concluded that the station in the center of the airport has more advantages. (Table 3D.4)

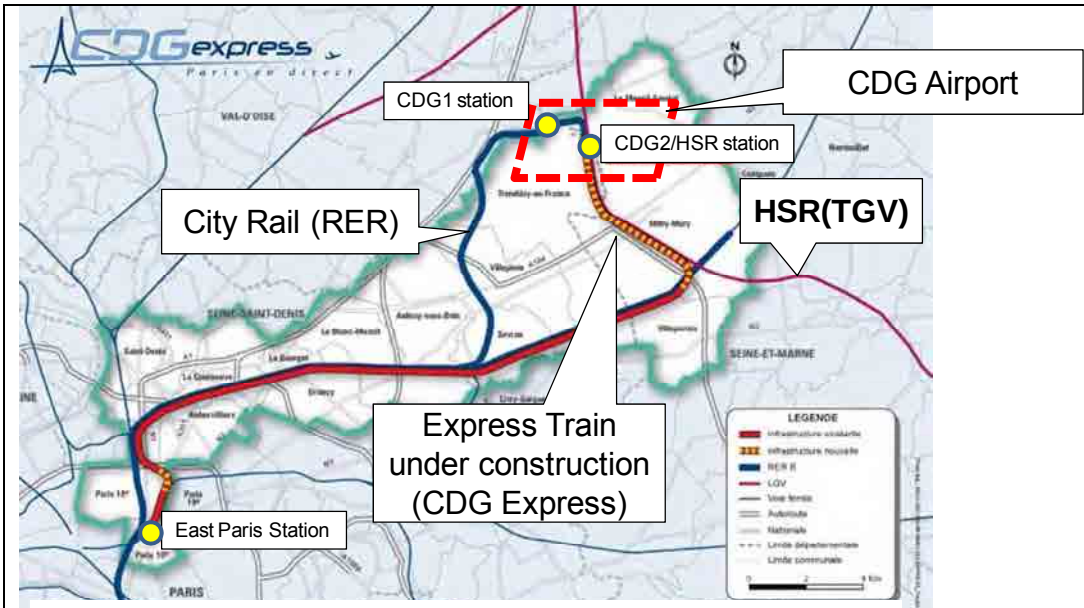
3.14 It is noted that the many major airports like Charles de Gaulle (CDG) Airport in Paris and Frankfurt Airport, have HSR, City Rail directly connected to the airport terminal to enhance the convenience of passengers. Passenger can transfer smoothly between Air and HSR including sometimes operates code-share transport of air and HSR. Charles de Gaulle (CDG) Airport in Paris has HSR (TGV) station at the center of airport. In addition, CDG Express (non-stop train between Paris and airport) is to be operating in 2016. (Figure 3D.7)

3.15 With regard to the safety, many examples of the combination of air and HSR in the world have not faced serious incidents. Though most of airplane accidents occurs during take-off and landing near the runway (59%, *source: 2011 State of Global Aviation Safety, ICAO*), accidents concentrates in the center line of the runway, and few accidents recorded parallel to the runway especially over 120 m from the runway center as shown in Figure 3D.8.

**Table 3D.4 Comparison Study on the Station Location in Long Thanh**

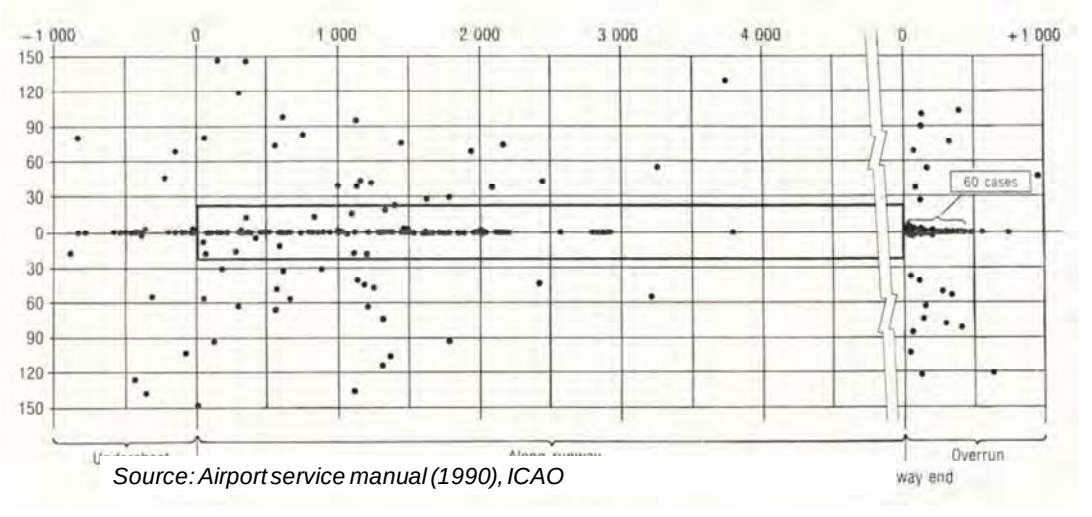
| | Center of airport | Outskirt of airport |
|---|---|---|
| Conformity with Airport plan | **Compatible** with Airport Master Plan approved by Prime Minister | **Incompatible** with Airport Master Plan approved by Prime Minister |
| Estimated Demand | **More passengers feel convenient** | **Less passengers feel convenient** |
| | Per day 40,000 passengers will use railway to access to the airport while there are only 13,000 passengers to access to the area out of the airport | |
| Transfer of Air/ HSR | **Smooth** easy to access Airport Buildings using pedestrian bridges or underground pass | **Difficult** Detour Route is needed to connect air and HSR. Underground access road beneath runway is not permitted |
| Connection with Local Train | **Same Station location** local train will be designed in the center of the airport | **Different Station location** local train station which is planned in the center of the airport |
| Security and Safety | **No issue** no height restriction for HSR to run through the center of the airport | **No issue** Running outside of the airport, parallel with the landing strip |
| Impact to Airport Road Access | **Lower** as Passengers moving from HSR St. to Airport center are reduced | **Higher** Due to passengers from HSR St. to Airport center, the load to Access Road will be higher |
| Noise Resettlement | **Low Impact** No additional land acquisition for the station / HSR will run farther from the residential area | **High Impact** Land acquisition required for the station / HSR will run closer to the residential area |

Source: JICA Study Team




*Source: Ministry of Ecology, sustainable development and energy, France*

**Figure 3D.7 CDG Airport in Paris connected with HSR and CR**

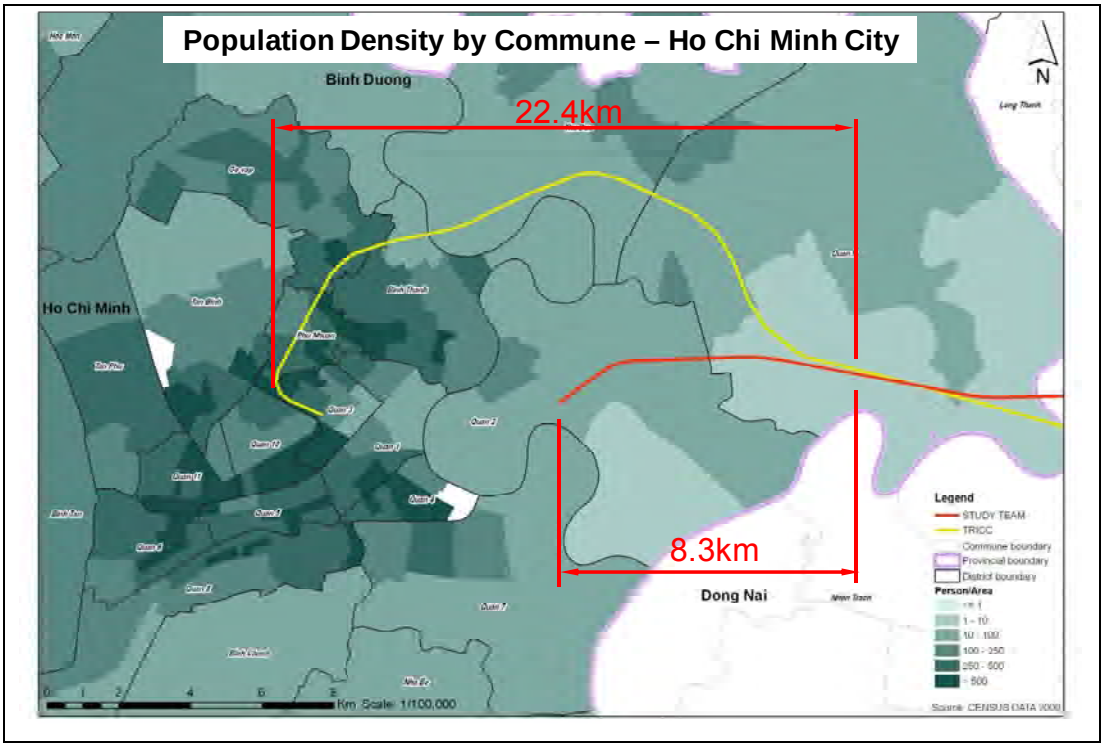



*Source: Airport service manual (1990), ICAO*

**Figure 3D.8 Distribution of Accidents near Airport**

### (7) Location of Terminal Station in Ho Chi Minh City

3.16 In previous studies, there are discussions of the terminal station location in HCMC. Major options are either in Thu Thiem new development area, or Hoa Hung area namely the current Saigon Station Location. The biggest difficulty for Hoa Hung option is the social impact especially on resettlement, since the alignment has to go into the densely populated areas much longer than Thu Thiem option. (Figure 3D.9, Table 3D.5)




Source: JICA Study Team

**Figure 3D.9 Comparative Analysis of Resettlement in HCMC**

**Table 3D.5 Comparative Analysis of Station Location in HCMC**

| | Thu Thiem | Hoa Hung |
|---|---|---|
| Conformity with Urban Planning | **Compatible** (Thu Thiem New Town Development Plan) | **Incompatible** |
| Accessibility | **Smooth** (East-West Avenue, Thu Thiem Tunnel) | **Difficult by Cars/Bikes** (Congested narrow streets around the station area) |
| Station Plaza | **Spacious** | **Narrow** |
| Connection with Railway | **Metro Line 2** | **Existing Railway Metro Line 2** |
| Land acquisition | **Easy (8.3km long in less populated area)** | **Difficult (22.4km long in densely populated area)** |
| Resettlement | **Few (64 buildings affected)** | **Many (866 buildings affected)** |
| Environment Impact (Noise, estimation) | **Minor (Approx 350 people affected by noise impact)** | **Significant (Over 7,000 people affected by noise impact)** |
| Construction Cost | **Low** | **High (+320 million USD)** |
| Extension to the South | **Easy** | **Difficult** |

Note: Resettlement was estimated by the preliminary method based on the population density of the affected districts, not by counting the buildings on the topographic maps.

Source: JICA Study Team

# APPENDIX 3E

# Overall Comparative Analysis Result of Three Alternatives with Zero Option (North Section)

The comparative analysis of alternatives is summarized in the folliwng tables. Table 3E.1 shows the result of overall comparison on Alternatives 1, 2, 3 and the zero-option of the north section and Tables 3E.2-7 show the results of provincial comparison on Alternatives 1, 2 and 3. After the score of each item was assessed based on the objective criteria, the summed score on each aspect was studied statistically by standization. The standardized scores of three alternatives and zero-option are shown in the blacket, or "( )" in the colored rows.

**Table 3E.1 Overall Scoring: North Section**

| Aspect/Item | | Alternative 1 | | Alternative 2 | | Alternative 3 | | Zero-option | |
|---|---|---|---|---|---|---|---|---|---|
| Overall Scoring: North Section | | 16.7 | A(2.37) | 13.5 | B(0.25) | 14.2 | C(-0.19) | 10.6 | D(-2.43) |
| 1 Convenience and Integrated Development | | 4.4 | A(0.72) | 3.4 | B(0.31) | 3.6 | C(-0.28) | 2.1 | D(-0.75) |
| 1.1 | Connectivity with other transport modes | 5.0 | Connectivity is the key concept of alternative to assure the convenience of passangers. | 2.7 | HSR is connected to existing railway only in Ngoc Hoi Station. | 3.0 | Most stations are not connected to existing railway stations, except for Ngoc Hoi and Phu Ly (plan). | 2.0 | Without HSR, connectivity may not be improved much more than the current situation in the case of trans-provincial transportations. Some cases of the improvement of the existing railway, air transportation and road network may be possible, but not significant. |
| 1.2 | Distance from main centers | 3.4 | By setting the station near the administrative center and business/ commercial centers, both the convenience of passengers, and the integrated development of cities by the HSR construction is assured. | 3.5 | In the case that stations are set near to the administrative center and business/ commercial centers, the convenience of passengers and integrated development of cities by the HSR construction is assured. | 3.3 | As most stations are located far from the central area of cities, stations are far and there is low potential for integrated development. | 3.4 | Because road expansion or improvement of existing railway in the city area is expected to be difficult, the distance from the center of city is as far as Alternatives 2 and 3 at minimum (thus, the score is estimated to be the average of Alternatives 2 and 3). |
| 1.3 | Availability of land for integrated development | 4.7 | Stations are planned in accordance with the current situation or land use plan, therefore the land availability is relatively high. | 4.0 | Since several stations are not planned in accordance with the current situation or the land use plan, land availability is relatively low. | 4.7 | Most stations are located far from the central area of cities so that the land availability is high. | 1.0 | Without HSR development, the concept of integrated development may not be achieved. |
| 2 Environmental and Social Considerations | | 4.3 | A(0.58) | 4.1 | B(0.02) | 4.1 | C(-0.06) | 3.5 | D(-0.53) |
| 2.1 | Natural environment | 4.0 | B(0.38) | 4.0 | C(-0.04) | 4.0 | C(-0.04) | 3.7 | C(-0.30) |
| 2.1.1 | Topography | 4.8 | In Ninh Binh section, alignment goes near the precious topography, but does not affect it. | 4.8 | In Ninh Binh section, alignment goes near the precious topography, but does not affect it. | 4.8 | In Ninh Binh section, alignment goes near the precious topography, but does not affect it. | 4.8 | By expansion of road network (including new roads and road width expantion) and improvement of existing railway, some impacts on topography are expected. Since the impact is unknown, the average of the impact by Alternatives 1, 2 and 3 is applied. |

| Aspect/Item | | Alternative 1 | | Alternative 2 | | Alternative 3 | | Zero-option | |
|---|---|---|---|---|---|---|---|---|---|
| 2.1.2 | Geology | 2.0 | Almost of all Hanoi-Ninh Binh section is soft ground. | 2.0 | Almost of all Hanoi-Ninh Binh section is soft ground. | 2.0 | Almost of all Hanoi-Ninh Binh section is soft ground. | 2.0 | For the expansion of road network and improvement of existing railway, the soil condition is the same as the HSR options, thus the the average of the impact by Alternatives 1, 2 and 3 is applied. |
| 2.1.3 | Hydrology | 4.5 | All tunnels are less than 1km, which is not likely to affect hydrological conditions. | 4.5 | Tunnels more than 1km are planned in Ninh Binh-Nghe An sections. | 4.5 | Tunnels more than 1km are planned in Ninh Binh-Nghe An sections. | 3.0 | The impact is unknown, however, the road network under expansion is causing impact on hydrology due to embankment structures without enough drainage system (by the observation of JICA Study Team). Further expansion will incur negative impacts. |
| 2.1.4 | Natural disaster | 4.5 | In Thanh Hoa (many areas) and Nghe An (several areas), the alighnment goes through the area of potential hazard. | 4.5 | In Thanh Hoa, the alighnment goes through the area of potential hazard areas. | 4.5 | In Thanh Hoa, the alighnment goes through the area of potential hazard areas. | 4.5 | By expansion of road network (including new roads and road width expantion) and improvement of existing railway, some impacts on potential hazard area are expected. Since the impact is unknown, the average of the impact by Alternatives 1, 2 and 3 is applied. |
| 2.1.5 | Protected area | 4.4 | In Thanh Hoa and Nghe An, the alighment may affect protection forest areas.<br>Protected: S1 (nursery), Protection: XL4L3M5S8 | 4.2 | The alignment affects one protected area in Ha Nam and some larger protection forest areas in Thanh Hoa and Nghe An.<br>Protected: M1S1, Protection: XL4L2M3S12 | 4.2 | The alignment affects some larger protection forest areas in Thanh Hoa and Nghe An.<br>Protected: 0, Protection: XL3L3M5S8 | 4.3 | By expansion of road network (including new roads and road width expantion) and improvement of existing railway, some impacts on protected area and forest are expected. Since the impact is unknown, the average of the impact by Alternatives 1, 2 and 3 is applied. |
| 2.2 | Pollution | 4.5 | A(0.64) | 4.2 | B(0.27) | 4.4 | A(0.55) | 2.0 | D(-1.46) |
| 2.2.1 | Air Pollution | 5.0 | Positive impact (reduction of air pollutant emission) is expected. | 5.0 | Positive impact (reduction of air pollutant emission) is expected. | 5.0 | Positive impact (reduction of air pollutant emission) is expected. | 2.0 | By increase of road transport with traffic congestion, air pollution is expected to be much worse. Due to the increase of road transport, noise and vibration pollution would also be worse. |
| 2.2.1 | Noise/Vibration | 4.0 | Potentially affected: 3,269 (pop) | 3.3 | Potentially affected: 4,643 (pop) | 3.8 | Potentially affected: 3,553 (pop) | | |
| 2.3 | Social environment | 4.5 | A(0.79) | 4.2 | C(-0.03) | 4.0 | C(-0.40) | 3.9 | C(-0.36) |
| 2.3.1 | Land use | 4.7 | Army/Indstry/Cemetary: L3S0/Ex0Plan1/L4S11<br>It may affect the planned industrial zone and cemetaries in Thanh Hoa. | 3.5 | Army/Indstry/Cemetary: L2S3/Ex3Plan8/L4S17<br>It may affect the existing and planned industrial zones in Nam Dinh severely, and the planned industrial zones and cemetaries in Thanh Hoa. | 3.5 | Army/Indstry/Cemetary: L1S4/Ex3Plan3/L7S14<br>It may affect the existing industrial zones in Nam Dinh severely, and the planned industrial zone and some cemetaries in Thanh Hoa. | 3.9 | By expansion of road network (including new roads and road width expantion) and improvement of existing railway, some impacts are expected. Since the impact is unknown, the average of the impact by Alternatives 1, 2 and 3 is applied. |

| Aspect/Item | | Alternative 1 | | Alternative 2 | | Alternative 3 | | Zero-option | |
|---|---|---|---|---|---|---|---|---|---|
| 2.3.2 | Residential/Urban area | 3.3 | Potentially affected: 931 (buildings) Total affected buildings are minimized, however the scoring is worse than Alt2 due to lower score in some provinces.The impact is expected to be more in Thanh Hoa and Nghe An. | 3.7 | Potentially affected: 938 (buildings) The impact is expected to be large in Thanh Hoa and Nghe An. | 3.2 | Potentially affected: 1,339 (buildings) The impact is expected to be large in Thanh Hoa and Nghe An, more than other alternatives. | 2.0 | By expansion of road network (including new roads and road width expantion) and improvement of existing railway, land acquisition and resettlement will be necessray. Especially, the expansion of exisiting road networks and improvement of existing railway will require much more resettlement than the Alternatives 1, 2 and 3 because the residential area spreads along the roadside. |
| 2.3.3 | Cultual heritage / religeous facilities | 5.0 | Small impact may be expected in Ha Nam. | 4.7 | Small impact may be expected in Thanh Hoa. | 4.5 | Comparatively more impact on Ha Nam and Thanh Hoa is expected. | 4.7 | By expansion of road network (including new roads and road width expantion) and improvement of existing railway, some impacts are expected. Since the impact is unknown, the average of the impact by Alternatives 1, 2 and 3 is applied. |
| 2.3.4 | Ethnic minority | 5.0 | Small impact may be expected in Thanh Hoa. | 5.0 | No impact on ethnic minority is expected in the north section. | 5.0 | No impact on ethnic minority is expected in the north section. | 5.0 | By expansion of road network (including new roads and road width expantion) and improvement of existing railway, some impacts are expected. Since the impact is unknown, the average of the impact by Alternatives 1, 2 and 3 is applied. |
| 3 High speed service and engineering | | 4.5 | A(0.91) | 3.5 | B(0.32) | 2.5 | C(-0.26) | 2.0 | D(-0.97) |
| 3.1 | High speed serviceability | 5 | Curve ratio worse than R=6,000: 0% Steep curve affecting the operation speed:0 Potential connection/extension: No problem | 3.0 | Curve ratio worse than R=6,000: 2.9% Steep curve affecting the operation speed:3 Potential connection/extension: No problem | 1.0 | Curve ratio worse than R=6,000: 17.0% Steep curve affecting the operation speed:3 Potential connection/extension : No problem | 2.0 | No high-speed operation is achieved. |
| 3.2 | Difficulty of construction work | 4 | Average of each province (4/4/4/3/4/5) | 4.0 | Average of each province (4/4/4/3/4/5) | 4.0 | Average of each province (4/4/4/3/4/5) | | |
| 4 Economical Efficiency | | 3.5 | B(0.16) | 2.5 | C(-0.40) | 4.0 | B(0.42) | 3.0 | C(-0.17) |
| 4.1 | Construction cost | 2.0 | Cost is more than 1.5 times and less than 2 times of the cheapest option (Total Cost =4,281mil USD). | 1.0 | Cost is more than 2 times of the cheapest option due to long elevated structure (Total Cost =5,736mil USD). | 4.0 | Cost is minimized with embankment structure (Total Cost =2,468 mil USD). | 5.0 | Cost for the improvement of other transporation is required. However, the actual requried cost is unknown. |
| 4.2 | Regional Development | 5.0 | HSR development would contribute to the regional development. Stations with better convenience would maximize the benefit. | 4.0 | HSR development would contribute to the regional development. | 4.0 | HSR development would contribute to the regional development. | 1.0 | Current existing railway would contribute to the regional development much less than HSR. |

Note: A-Better (0.5 and more than 0.5), B-Good (0 and more than 0, less than 0.5), C-Fair (-0.5 and more than -0.5, less than 0), D-No advantage (less than -0.5). The scores are standardized figures shown in the blacket
Landuse: -Army and cemetery area: L1 means 1 large army area would be affected. S5 means 5 small army areas could be affected. – Indstry area: Ex3 means 3 existing indsustrial zone couled be affected, and Plan 8 means 8 planned industrial zones could be affected
Source: JICA Study Team

## Table 3E.2 City/Province Wise Scoring - Ha Noi Section

| Aspect/Item | | Alternative 1 | | Alternative 2 | | Alternative 3 | |
|---|---|---|---|---|---|---|---|
| Station in the Section | | Ngoc Hoi | | Ngoc Hoi | | Ngoc Hoi | |
| 1 Convenience and Integrated Development | | 5.0 | A | 5.0 | A | 5.0 | A |
| 1.1 | Connectivity with other transport modes | 5 | Terminal station for UMRT Line 1 (Ngoc Hoi - Yen Vien) | 5 | Terminal station for UMRT Line 1 (Ngoc Hoi - Yen Vien) | 5 | Terminal station for UMRT Line 1 (Ngoc Hoi - Yen Vien) |
| 1.2 | Distance from main centers | 5 | Administrative Center: 5 Business/ Commercial Center: 5 Industrial Zone: +1 | 5 | Administrative Center: 5 Business/ Commercial Center: 5 Industrial Zone: +1 | 5 | Administrative Center: 5 Business/ Commercial Center: 5 Industrial Zone: +1 |
| 1.3 | Availability of land for integrated development | 5 | Agricultural land available for development | 5 | Agricultural land available for development | 5 | Agricultural land available for development |
| 2 Environmental and Social Considerations | | 4.5 | A | 4.6 | A | 4.5 | A |
| 2.1 | Natural environment | 4.2 | B | 4.2 | B | 4.2 | B |
| 2.1.1 | Topography | 5 | No precious/characteristic topography exists. | 5 | No precious/characteristic topography exists. | 5 | No precious/characteristic topography exists. |
| 2.1.2 | Geology | 1 | Passing through area of geological difficulty more than 10 km | 1 | Passing through area of geological difficulty more than 10 km | 1 | Passing through area of geological difficulty more than 10 km |
| 2.1.3 | Hydrology | 5 | No tunnel more than 1km exists. | 5 | No tunnel more than 1km exists. | 5 | No tunnel more than 1km exists. |
| 2.1.4 | Natural disaster | 5 | Flood/Landslide Prone: 0/0 Typhoon: n.a | 5 | Flood/Landslide Prone: 0/0 Typhoon: n.a | 5 | Flood/Landslide Prone: 0/0 Typhoon: n.a |
| 2.1.5 | Protected area | 5 | Protected: 0, Protection: 0 | 5 | Protected: 0, Protection: 0 | 5 | Protected: 0, Protection: 0 |
| 2.2 | Pollution | A | | D | | B | |
| 2.2.1 | Noise/Vibration | 5 | Potentially affected: 342 (pop) | 5 | Potentially affected: 267 (pop) | 5 | Potentially affected: 245 (pop) |
| 2.3 | Social environment | 4.8 | | 5.0 | | 4.8 | |
| 2.3.1 | Land use | 5 | Army/Indstry/Cemetary: L1/0/S1 | 5 | Army/Indstry/Cemetary: L1/0/S2 | 5 | Army/Indstry/Cemetary: L1/0/S2 |
| 2.3.2 | Residential/Urban area | 4 | Potentially affected: 72 (buildings) | 5 | Potentially affected: 46 (buildings) | 4 | Potentially affected: 70 (buildings) |
| 2.3.3 | Cultual heritage/Religeous Facility | 5 | n.a./0 | 5 | n.a./1 | 5 | n.a./1 |
| 2.3.4 | Ethnic minority | 5 | 5,000-/1,000-5,000/500-1,000: 0/0/0 | 5 | 5,000-/1,000-5,000/500-1,000: 0/0/0 | 5 | 5,000-/1,000-5,000/500-1,000: 0/0/0 |

Note: Landuse: -Army and cemetery area: L1 means 1 large army area would be affected. S5 means 5 small army areas could be affected.
Source: JICA Study Team

## Table 3E.3 City/Province Wise Scoring - Ha Nam Section

| Aspect/Item | | Alternative 1 | | Alternative 2 | | Alternative 3 | |
|---|---|---|---|---|---|---|---|
| Station in the Section | | Phu Ly | | Phu Ly | | Phu Ly | |
| 1 Convenience and Integrated Development | | 4.2 | A | 3.3 | B | 4.2 | A |
| 1.1 | Connectivity with other transport modes | 5 | Existing Railway (station is planned to be relocated in MP) Road | 3 | Road | 5 | Existing Railway (station is planned to be relocated in MP) Road |
| 1.2 | Distance from main centers | 2.5 | Administrative Center: 2 Business/ Commercial Center: 3 | 4 | Administrative Center: 3 Business/ Commercial Center: 5 | 2.5 | Administrative Center: 2 Business/ Commercial Center: 3 |
| 1.3 | Availability of land for integrated development | 5 | Agricultural land available for development | 3 | Undergoing urban development | 5 | Agricultural land available for development |
| 2 Environmental and Social Considerations | | 4.4 | A | 4.3 | B | 4.2 | B |
| 2.1 | Natural environment | 4.2 | A | 4.0 | A | 4.2 | A |
| 2.1.1 | Topography | 5 | No precious/characteristic topography exists. | 5 | No precious/characteristic topography exists. | 5 | No precious/characteristic topography exists. |
| 2.1.2 | Geology | 1 | Passing through area of geological difficulty more than 10 km | 1 | Passing through area of geological difficulty more than 10 km | 1 | Passing through area of geological difficulty more than 10 km |
| 2.1.3 | Hydrology | 5 | No tunnel more than 1km exists. | 5 | No tunnel more than 1km exists. | 5 | Tunnel(s) (1km-5km) exist, though water use in downstream/neighborhood area is not identified. |
| 2.1.4 | Natural disaster | 5 | Flood/Landslide Prone: n.a/n.a Typhoon prone: n.a | 5 | Flood/Landslide Prone: n.a/n.a Typhoon prone: n.a | 5 | Flood/Landslide Prone: n.a/n.a Typhoon prone: n.a |
| 2.1.5 | Protected area | 5 | Protected: 0, Protection: 0 | 4 | Protected: S1, Protection: 0 | 5 | Protected: 0, Protection: 0 |
| 2.2 | Pollution | A | | A | | A | |
| 2.2.1 | Noise/Vibration | 5 | Potentially affected: 292 (pop) | 5 | Potentially affected: 212 (pop) | 5 | Potentially affected: 196 (pop) |

| Aspect/Item | | Alternative 1 | | Alternative 2 | | Alternative 3 | |
|---|---|---|---|---|---|---|---|
| 2.3 | Social environment | 4.5 | A | 4.5 | A | 4.0 | A |
| 2.3.1 | Land use | 4 | Army/Indstry/Cemetary: L1/0/L1S3 | 3 | Army/Indstry/Cemetary: L1S1/Plan1/L1S4 | 4 | Army/Indstry/Cemetary: 0/0/L2S4 |
| 2.3.2 | Residential/Urban area | 4 | Potentially affected: 64 (buildings) | 5 | Potentially affected: 34 (buildings) | 4 | Potentially affected: 76 (buildings) |
| 2.3.3 | Cultual heritage/Religeous Facility | 5 | n.a./0 | 5 | n.a./3 | 3 | n.a./8 |
| 2.3.4 | Ethnic minority | 5 | 5,000-/1,000-5,000/500-1,000: 0/0/0 | 5 | 5,000-/1,000-5,000/500-1,000: 0/0/0 | 5 | 5,000-/1,000-5,000/500-1,000: 0/0/0 |

Note: Landuse: -Army and cemetery area: L1 means 1 large army area would be affected. S5 means 5 small army areas could be affected. – Indstry area: Plan 8 means 8 planned industrial zones could be affected
Source: JICA Study Team

## Table 3E.4 City/Province Wise Scoring - Nam Dinh Section

| Aspect/Item | | Alternative 1 | | Alternative 2 | | Alternative 3 | |
|---|---|---|---|---|---|---|---|
| Station in the Section | | Nam Dinh | | Nam Dinh | | Nam Dinh | |
| 1 Convenience and Integrated Development | | 4.3 | A | 3.0 | C | 3.0 | C |
| 1.1 | Connectivity with other transport modes | 5 | Existing Railway (1. station will be built at the connecting point of HSR and existing railway, and 2. MP indicates the future relocation of the station in the suburban area, though the location is not fixed yet) Road (NH21) | 1 | No connection (both existing and planned) to other transport modes | 1 | No connection (both existing and planned) to other transport modes |
| 1.2 | Distance from main centers | 3 | Administrative Center: 2 Business/ Commercial Center: 2 Industrial Zone: +1 | 3 | Administrative Center: 2 Business/ Commercial Center: 2 Industrial Zone: +1 | 3 | Administrative Center: 2 Business/ Commercial Center: 2 Industrial Zone: +1 |
| 1.3 | Availability of land for integrated development | 5 | Agricultural land available for development | 5 | Agricultural land available for development | 5 | Agricultural land available for development |
| 2 Environmental and Social Impact | | 4.5 | A | 4.0 | B | 4.0 | B |
| 2.1 | Natural environment | 4.2 | A | 4.2 | A | 4.2 | A |
| 2.1.1 | Topography | 5 | No precious/characteristic topography exists. | 5 | No precious/characteristic topography exists. | 5 | No precious/characteristic topography exists. |
| 2.1.2 | Geology | 1 | Passing through area of geological difficulty more than 10 km | 1 | Passing through area of geological difficulty more than 10 km | 1 | Passing through area of geological difficulty more than 10 km |
| 2.1.3 | Hydrology | 5 | No tunnel more than 1km exists. | 5 | No tunnel more than 1km exists. | 5 | No tunnel more than 1km exists. |
| 2.1.4 | Natural disaster | 5 | Flood/Landslide Prone: n.a./n.a. Typhoon: n.a. | 5 | Flood/Landslide Prone: n.a./n.a. Typhoon: n.a. | 5 | Flood/Landslide Prone: n.a./n.a. Typhoon: n.a. |
| 2.1.5 | Protected area | 5 | Protected: 0, Protection: 0 | 5 | Protected: 0, Protection: 0 | 5 | Protected: 0, Protection: 0 |
| 2.2 | Pollution | A | | B | | B | |
| 2.2.1 | Noise/Vibration | 5 | Potentially affected: 322 (pop) | 4 | Potentially affected: 604 (pop) | 4 | Potentially affected: 405 (pop) |
| 2.3 | Social environment | 4.8 | A | 3.8 | B | 3.8 | B |
| 2.3.1 | Land use | 5 | Army/Indstry/Cemetary: 0/0/L1S2 | 1 | Army/Indstry/Cemetary: 0/Ex3Plan4/L2S10 | 1 | Army/Indstry/Cemetary: 0/Ex3/L1S6 |
| 2.3.2 | Residential/Urban area | 4 | Potentially affected: 95 (buildings) | 4 | Potentially affected: 80 (buildings) | 4 | Potentially affected: 92 (buildings) |
| 2.3.3 | Cultual heritage/Religeous Facility | 5 | n.a./0 | 5 | n.a./2 | 5 | n.a./0 |
| 2.3.4 | Ethnic minority | 5 | 5,000-/1,000-5,000/500-1,000: 0/0/0 | 5 | 5,000-/1,000-5,000/500-1,000: 0/0/0 | 5 | 5,000-/1,000-5,000/500-1,000: 0/0/0 |

Note: Landuse: -Army and cemetery area: L1 means 1 large army area would be affected. S5 means 5 small army areas could be affected. – Indstry area: Ex3 means 3 existing indsustrial zone couled be affected, and Plan 8 means 8 planned industrial zones could be affected
Source: JICA Study Team

## Table 3E.5 City/Province Wise Scoring - Ninh Binh Section

| Aspect/Item | | Alternative 1 | | Alternative 2 | | Alternative 3 | |
|---|---|---|---|---|---|---|---|
| Station in the Section | | Ninh Binh | | Ninh Binh | | Ninh Binh | |
| 1 Convenience and Integrated Development | | 3.7 | B | 2.7 | C | 2.7 | C |
| 1.1 | Connectivity with other transport modes | 5 | Existing Railway (station will be built at the connecting point of HSR and existing railway) Road | 1 | No connection (both existing and planned) to other transport modes | 1 | No connection (both existing and planned) to other transport modes |
| 1.2 | Distance from main centers | 1 | Administrative Center: 1 Business/ Commercial Center: 1 | 2 | Administrative Center: 1 Business/ Commercial Center: 1 Industrial Zone: +1 | 2 | Administrative Center: 1 Business/ Commercial Center: 1 Industrial Zone: +1 |
| 1.3 | Availability of land for integrated development | 5 | Agricultural land available for development | 5 | Agricultural land available for development | 5 | Agricultural land available for development |
| 2 Environmental and Social Considerations | | 4.3 | A | 4.2 | B | 4.1 | B |
| 2.1 | Natural environment | 3.8 | B | 3.8 | B | 3.6 | B |
| 2.1.1 | Topography | 4 | Improtant/valuable topography exists along the alignment, while it is not directly affected. | 4 | Improtant/valuable topography exists along the alignment, while it is not directly affected. | 4 | Improtant/valuable topography exists along the alignment, while it is not directly affected. |
| 2.1.2 | Geology | 1 | Passing through area of geological difficulty more than 10 km | 1 | Passing through area of geological difficulty more than 10 km | 1 | Passing through area of geological difficulty more than 10 km |
| 2.1.3 | Hydrology | 4 | There is a tunnel (1km-5km), while nearby wateruse (especially in the downstream area) is not confirmed. | 4 | There is a tunnel (1km-5km), while nearby wateruse (especially in the downstream area) is not confirmed. | 4 | There is a tunnel (1km-5km), while nearby wateruse (especially in the downstream area) is not confirmed. |
| 2.1.4 | Natural disaster | 5 | Flood/Landslide Prone: 0/n.a. Typhoon prone: n.a. | 5 | Flood/Landslide Prone: 0/n.a. Typhoon prone: n.a. | 5 | Flood/Landslide Prone: 0/n.a. Typhoon prone: n.a. |
| 2.1.5 | Protected area | 5 | Protected: 0, Protection: XL1L0M0S1 | 5 | Protected: 0, Protection: XL1L0M0S1 | 4 | Protected: 0, Protection: XL1L0M1S1 |
| 2.2 | Pollution | A+ | | B | | A | |
| 2.2.1 | Noise/Vibration | 5 | Potentially affected: 231 (pop) | 4 | Potentially affected: 440 (pop) | 5 | Potentially affected: 324 (pop) |
| 2.3 | Social environment | 4.8 | A | 4.8 | A | 4.5 | A |
| 2.3.1 | Land use | 5 | Army/Indstry/Cemetary: L1/0/0 | 5 | Army/Indstry/Cemetary: S1/0/L1S1 | 4 | Army/Indstry/Cemetary: S2/Plan1/L1S0 |
| 2.3.2 | Residential/Urban area | 4 | Potentially affected: 58 (buildings) | 4 | Potentially affected: 71 (buildings) | 4 | Potentially affected: 109 (buildings) |
| 2.3.3 | Cultual heritage/Religeous Facility | 5 | n.a./0 | 5 | n.a./2 | 5 | n.a./0 |
| 2.3.4 | Ethnic minority | 5 | 5,000-/1,000-5,000/500-1,000: 0/0/0 | 5 | 5,000-/1,000-5,000/500-1,000: 0/0/0 | 5 | 5,000-/1,000-5,000/500-1,000: 0/0/0 |

Note: Protected area: XL1L3M2S4 means 1 extra large, 2 large, 2 medium and 4 small size forest area would be affected.
Landuse: -Army and cemetery area: L1 means 1 large army area would be affected. S5 means 5 small army areas could be affected. – Indstry area: Ex3 means 3 existing indsustrial zone couled be affected, and Plan 8 means 8 planned industrial zones could be affected
Source: JICA Study Team

## Table 3E.6 City/Province Wise Scoring - Thanh Hoa Section

| Aspect/Item | | Alternative 1 | | Alternative 2 | | Alternative 3 | |
|---|---|---|---|---|---|---|---|
| Station in the Section (1/2) | | Thanh Hoa | | Thanh Hoa | | Thanh Hoa | |
| 1 Convenience and Integrated Development | | 4.7 | A | 3.3 | B | 3.0 | C |
| 1.1 | Connectivity with other transport modes | 5 | Existing Railway (station will be built at the connecting point of HSR and existing railway) Road | 3 | Road | 3 | Road |
| 1.2 | Distance from main centers | 4 | Administrative Center: 3 Business/ Commercial Center: 3 Industrial Zone: +1 | 4 | Administrative Center: 3 Business/ Commercial Center: 3 Industrial Zone: +1 | 3 | Administrative Center: 2 Business/ Commercial Center: 4 |
| 1.3 | Availability of land for integrated development | 5 | Agricultural land available for development | 3 | Possible difficulty in obtaining land (industrial zone under MP) | 3 | Consistent with latest MP (possible need for adjustment with surrounding development projects, especially urban development residential land under MP) |
| Station in the Section (2/2) | | NO STATION planned | | Truong Lam | | NO STATION planned | |
| 1 Convenience and Integrated Development | | | | | | | |

| Aspect/Item | | Alternative 1 | | Alternative 2 | | Alternative 3 | |
|---|---|---|---|---|---|---|---|
| 1.1 | Connectivity with other transport modes | 5 | Existing Railway Road | 3 | Road | 3 | Road (Expressway) |
| 1.2 | Distance from main centers | 5 | Administrative Center: 5<br>Business/ Commercial Center: 5 | 3 | Administrative Center: 3<br>Business/ Commercial Center: 3 | 4 | Administrative Center: 3<br>Business/ Commercial Center: 3<br>Industrial Zone: +1 |
| 1.3 | Availability of land for integrated development | 3 | Possible difficulty in obtaining land (urban land under MP) | 3 | Possible difficulty in obtaining land (urban land under MP) | 5 | Consistent with latest MP (possible need for adjustment with surrounding development projects) |
| 2 Environmental and Social Considerations | | 3.4 | A | 3.1 | B | 3.2 | B |
| 2.1 | Natural environment | 3.6 | A | 3.6 | A | 3.6 | A |
| 2.1.1 | Topography | 5 | No precious/characteristic topography exists. | 5 | No precious/characteristic topography exists. | 5 | No precious/characteristic topography exists. |
| 2.1.2 | Geology | 4 | Passing through area of geological difficulty less than 1km. | 4 | Passing through area of geological difficulty less than 1km. | 4 | Passing through area of geological difficulty less than 1km. |
| 2.1.3 | Hydrology | 4 | There is a tunnel (1km-5km), and nearby wateruse (especially in the downstream area) is not confirmed. | 4 | There is a tunnel (1km-5km), and nearby wateruse (especially in the downstream area) is not confirmed. | 4 | There is a tunnel (1km-5km), and nearby wateruse (especially in the downstream area) is not confirmed. |
| 2.1.4 | Natural disaster | 2 | Flood/Landslide/erosion Prone: 0/14<br>Typhoon prone: n.a. | 2 | Flood/Landslide/erosion Prone: 0/15<br>Typhoon prone: n.a. | 2 | Flood/Landslide/erosion Prone: 0/15<br>Typhoon prone: n.a. |
| 2.1.5 | Protected area | 3 | Protected: S1(nursery),<br>Protection: XL1L3M4S5 | 3 | Protected: M1, Protection: XL3L1M0S7 | 3 | Protected: 0, Protection: XL2L2M2S2 |
| 2.2 | Pollution | C | | D | | D | |
| 2.2.1 | Noise/Vibration | 1 | Potentially affected: 1,876 (pop) | 1 | Potentially affected: 2,109 (pop) | 1 | Potentially affected: 2,110 (pop) |
| 2.3 | Social environment | 3.8 | B | 3.0 | C | 3.3 | C |
| 2.3.1 | Land use | 4 | Army/Indstry/Cemetary: 0/Plan1/L2S4 | 2 | Army/Indstry/Cemetary: S1/Plan3/L1S8 | 3 | Army/Indstry/Cemetary: S2/Plan2/L3S4 |
| 2.3.2 | Residential/Urban area | 1 | Potentially affected: 406 (buildings) | 2 | Potentially affected: 367 (buildings) | 1 | Potentially affected: 612 (buildings) |
| 2.3.3 | Cultual heritage/Religeous Facility | 5 | Heritage/Religeous: 0/0 | 3 | Heritage/Religeous: 3/4 | 4 | Heritage/Religeous: 1/3 |
| 2.3.4 | Ethnic minority | 5 | 5,000-/1,000-5,000/500-1,000: 0/0/2 | 5 | 5,000-/1,000-5,000/500-1,000: 0/0/1 | 5 | 5,000-/1,000-5,000/500-1,000: 0/0/1 |

Note: Protected area: XL1L3M2S4 means 1 extra large, 2 large, 2 medium and 4 small size forest area would be affected.
Landuse: -Army and cemetery area: L1 means 1 large army area would be affected. S5 means 5 small army areas could be affected. – Indstry area: Ex3 means 3 existing indsustrial zone couled be affected, and Plan 8 means 8 planned industrial zones could be affected
Source: JICA Study Team

**Table 3E.7 City/Province Wise Scoring - Nghe An Section**

| Aspect/Item | | Alternative 1 | | Alternative 2 | | Alternative 3 | |
|---|---|---|---|---|---|---|---|
| Station in the Section | | Vinh | | Vinh | | Vinh | |
| 1 Convenience and Integrated Development | | 4.3 | A | 3.0 | C | 4.0 | B |
| 1.1 | Connectivity with other transport modes | 5 | Existing Railway Road | 3 | Road | 3 | Road (Expressway) |
| 1.2 | Distance from main centers | 5 | Administrative Center: 5<br>Business/ Commercial Center: 5 | 3 | Administrative Center: 3<br>Business/ Commercial Center: 3 | 4 | Administrative Center: 3<br>Business/ Commercial Center: 3<br>Industrial Zone: +1 |
| 1.3 | Availability of land for integrated development | 3 | Possible difficulty in obtaining land (urban land under MP) | 3 | Possible difficulty in obtaining land (urban land under MP) | 5 | Consistent with latest MP (possible need for adjustment with surrounding development projects) |
| 2 Environmental and Social Considerations | | 4.3 | A | 4.0 | B | 4.1 | B |
| 2.1 | Natural environment | 4.4 | A | 4.4 | A | 4.4 | A |
| 2.1.1 | Topography | 5 | No precious/characteristic topography exists. | 5 | No precious/characteristic topography exists. | 5 | No precious/characteristic topography exists. |
| 2.1.2 | Geology | 4 | Passing through area of geological difficulty less than 1km. | 4 | Passing through area of geological difficulty less than 1km. | 4 | Passing through area of geological difficulty less than 1km. |

| Aspect/Item | | Alternative 1 | | Alternative 2 | | Alternative 3 | |
|---|---|---|---|---|---|---|---|
| 2.1.3 | Hydrology | 4 | There is a tunnel (1km-5km), and nearby wateruse (especially in the downstream area) is not confirmed. | 4 | There is a tunnel (1km-5km), and nearby wateruse (especially in the downstream area) is not confirmed. | 4 | There is a tunnel (1km-5km), and nearby wateruse (especially in the downstream area) is not confirmed. |
| 2.1.4 | Natural disaster | 5 | Flood/Landslide Prone: 3/0 Typhoon prone: n.a. | 5 | Flood/Landslide Prone: 3/0 Typhoon prone: n.a. | 5 | Flood/Landslide Prone: 4/0 Typhoon prone: n.a. |
| 2.1.5 | Protected area | 4 | Protected: 0, Protection: XL2L0M1S2 | 4 | Protected: 0, Protection: XL0L1M3S4 | 4 | Protected: 0, Protection: XL0L1M2S5 |
| 2.2 | Pollution | C | | D | | C | |
| 2.2.1 | Noise/Vibration | 3 | Potentially affected: 1,162 (pop) | 1 | Potentially affected: 2,094 (pop) | 3 | Potentially affected: 1,119 (pop) |
| 2.3 | Social environment | 4.5 | A | 4.3 | B | 4.0 | B |
| 2.3.1 | Land use | 5 | Army/Indstry/Cemetary: 0/0/S1 | 5 | Army/Indstry/Cemetary: 0/0/L1S1 | 4 | Army/Indstry/Cemetary: 0/0/L1S3 |
| 2.3.2 | Residential/Urban area | 3 | Potentially affected: 236 (buildings) | 2 | Potentially affected: 340 (buildings) | 2 | Potentially affected: 380 (buildings) |
| 2.3.3 | Cultual heritage/Religeous Facility | 5 | Heritage/Religeous: n.a./0 | 5 | Heritage/Religeous: n.a./0 | 5 | Heritage/Religeous: n.a./1 |
| 2.3.4 | Ethnic minority | 5 | 5,000-/1,000-5,000/500-1,000: 0/0/0 | 5 | 5,000-/1,000-5,000/500-1,000: 0/0/0 | 5 | 5,000-/1,000-5,000/500-1,000: 0/0/0 |

Note: Protected area: XL1L3M2S4 means 1 extra large, 2 large, 2 medium and 4 small size forest area would be affected.
Landuse: -Army and cemetery area: L1 means 1 large army area would be affected. S5 means 5 small army areas could be affected
Source: JICA Study Team

# APPENDIX 3F

# Overall Comparative Analysis Result of Three Alternatives with Zero Option (South Section)

The comparative analysis of alternatives is summarized in the folliwng tables. Table 3F.1 shows the result of overall comparison on Alternatives 1, 2, 3 and the zero-option of the south section and Tables 3F.2-7 show the results of provincial comparison on Alternatives 1, 2 and 3. After the score of each item was assessed based on the objective criteria, the summed score on each aspect was studied statistically by standization. The standardized scores of three alternatives and zero-option are shown in the blacket, or "( )" in the colored rows. The standardized scores in the blacket are refered for the

**Table 3F.1 Overall Scoring: South Section**

| Aspect/Item | | Alternative 1 | | Alternative 2 | | Alternative 3 | | Zero Option | |
|---|---|---|---|---|---|---|---|---|---|
| Overall Scoring: South Section | | 16.1 | A(3.03) | 13.1 | B(0.06) | 13.4 | D(-0.61) | 10.4 | D(-2.48) |
| 1 Convenience and Integrated Development | | 4.3 | A(1.06) | 3.6 | B(0.15) | 3.6 | C(-0.21) | 2.2 | D(-0.99) |
| 1.1 | Connectivity with other transport modes | 4.7 | Connectivity is the key concept of alternative to assure the convenience of passangers. | 3.5 | Half of the stations are connected to existing railway stations. | 2.7 | Most stations are not connected to existing railway stations. | 2.0 | Without HSR, connectivity may not be improved much more than the current situation for trans-provincial transportations. Some cases of the improvement of the existing railway, air transportation and road network may be possible, but not significant. |
| 1.2 | Distance from main centers | 4.0 | By setting the station near the administrative center and business/ commercial centers, both the convenience of passengers, and the integrated development of cities by the HSR construction is assured. | 3.6 | In the case that stations are set near to the administrative center and business/ commercial centers, the convenience of passengers and integrated development of cities by the HSR construction is assured. | 3.3 | As most stations are located far from the central area of cities, stations are far and there is low potential for integrated development. | 3.5 | Because road expansion or improvement of existing railway in the city area is expected to be difficult, the distance from the center of city is as far as Alternatives 2 and 3 at minimum (thus, the score is estimated to be the average of Alternatives 2 and 3). |
| 1.3 | Availability of land for integrated developmen t | 4.3 | Stations are planned in accordance with the current situation or land use plan, therefore the land availability is high. | 3.7 | Since several stations are not planned in accordance with the current situation or the land use plan, land availability is low. | 4.7 | Most stations are located far from the central area of cities so that the land availability is high. | 1.0 | Without HSR development, the concept of integrated development may not be achieved. |
| 2 Environmental and Social Considerations | | 4.1 | A(0.74) | 3.8 | B(0.15) | 3.8 | C(-0.38) | 3.2 | D(-0.51) |
| 2.1 | Natural environment | 3.8 | A(0.57) | 3.9 | A(0.73) | 3.5 | D(-0.99) | 3.5 | C(-0.30) |
| 2.1.1 | Topography | 4.6 | No precious/characteristi c topography exists. | 4.6 | No precious/characteristic topography exists. | 4.2 | No precious/character istic topography exists. | 4.5 | By expansion of road network (including new roads and road width expantion) and improvement of existing railway, some impacts on topography are expected. Since the impact is unknown, the average of the impact by Alternatives 1, 2 and 3 is applied. |
| 2.1.2 | Geology | 2.6 | Most difficult geological areas are in Mekong Delta. | 2.6 | Most difficult geological areas are in Mekong Delta. | 2.2 | Most difficult geological areas are in Mekong Delta. | 2.5 | For the expansion of road network and improvement of existing railway, the soil condition is the same as the HSR options, thus the the average of the impact by Alternatives 1, 2 and 3 is applied. |
| 2.1.3 | Hydrology | 4.2 | Tunnels exist, while | 4.2 | Tunnels exist, while the | 4 | Tunnels exist, | 3.0 | The impact is unknown, however, the |

| Aspect/Item | | Alternative 1 | | Alternative 2 | | Alternative 3 | | Zero Option | |
|---|---|---|---|---|---|---|---|---|---|
| | | | the impact on the water resources is not confirmed. | | impact on the water resources is not confirmed. | | while the impact on the water resources is not confirmed. | | road network under expansion is causing impact on hydrology due to embankment structures without enough drainage system (by the observation of JICA Study Team). Further expansion will incur negative impacts. |
| 2.1.4 | Natural disaster | 3.6 | Flood/Landslide Prone: 3/n.a. | 3.4 | Flood/Landslide Prone: 4/n.a. | 3 | Flood/Landslide Prone: 4/n.a. | 3.3 | By expansion of road network (including new roads and road width expantion) and improvement of existing railway, some impacts on potential hazard area are expected. Since the impact is unknown, the average of the impact by Alternatives 1, 2 and 3 is applied. |
| 2.1.5 | Protected area | 4.2 | Protected: 0, Protection: XL0L4M10 | 4.6 | Protected: 0, Protection: 0 | 4 | Protected: 0, Protection: 0 | 4.3 | By expansion of road network (including new roads and road width expantion) and improvement of existing railway, some impacts on protected area and forest are expected. Since the impact is unknown, the average of the impact by Alternatives 1, 2 and 3 is applied. |
| 2.2 | Pollution | 4.5 | A(0.7) | 3.9 | B(0.0) | 4.5 | A(0.7) | 2.0 | D(-1.4) |
| 2.2.1 | Air Pollution | 5.0 | Positive impact (reduction of air pollutant emission) is expected. | 5.0 | Positive impact (reduction of air pollutant emission) is expected. | 5.0 | Positive impact (reduction of air pollutant emission) is expected. | 2.0 | By increase of road transport with traffic congestion, air pollution is expected to be much worse. Due to the increase of road transport, noise and vibration pollution would also be worse. |
| 2.2.2 | Noise/Vibration | 4 | Potentially affected: 3,087(pop) | 2.8 | Potentially affected: 10,614(pop) | 4 | Potentially affected: 3,434 (pop) | | |

| Aspect/Item | | Alternative 1 | | Alternative 2 | | Alternative 3 | | Zero Option | |
|---|---|---|---|---|---|---|---|---|---|
| 2.3 | Social environment | 4.1 | A(1.00) | 3.6 | D(-0.53) | 3.8 | C(-0.14) | 3.5 | C(-0.34) |
| 2.3.1 | Land use | 4.8 | Army/Indstry/Cemetary: 1/Ex1Plan1/1 | 4.6 | Army/Indstry/Cemetary: 2/Ex1Plan4/0 | 4.6 | Army/Indstry/Cemetary: 0/Plan4/4 | 4.7 | By expansion of road network (including new roads and road width expantion) and improvement of existing railway, some impacts are expected. Since the impact is unknown, the average of the impact by Alternatives 1, 2 and 3 is applied. |
| 2.3.2 | Residential/Urban area | 3.4 | Potentially affected: 855 (buildings) | 2.8 | Potentially affected: (buildings) | 3.4 | Potentially affected: 947 (buildings) | 2.0 | By expansion of road network (including new roads and road width expantion) and improvement of existing railway, land acquisition and resettlement will be necessray. Especially, the expansion of exisiting road networks and improvement of existing railway will require much more resettlement than the Alternatives 1, 2 and 3 because the residential area spreads along the roadside. |
| 2.3.3 | Cultual heritage | 4.8 | n.a. | 4 | n.a. | 4.8 | n.a. | 4.5 | By expansion of road network (including new roads and road width expantion) and improvement of existing railway, some impacts are expected. Since the impact is unknown, the average of the impact by Alternatives 1, 2 and 3 is applied. |
| 2.3.4 | Ethnic minority | 3.4 | 5,000-/1,000-5,000/500-1,000: 0/0/0 | 3 | 5,000-/1,000-5,000/500-1,000: 0/ | 2.4 | 5,000-/1,000-5,000/500-1,000: 0/0/0 | 2.9 | By expansion of road network (including new roads and road width expantion) and improvement of existing railway, some impacts are expected. Since the impact is unknown, the average of the impact by Alternatives 1, 2 and 3 is applied. |
| 3 High speed service and engineering | | 3.7 | A(0.99) | 2.7 | B(0.20) | 2.1 | C(-0.35) | 2.0 | D(-0.84) |
| 3.1 | High speed serviceability | 4 | Curve ratio worse than R=6,000: 2.1%<br>Steep curve affecting the operation speed:0<br>Potential connection/extension: No problem | 2 | Curve ratio worse than R=6,000: 2.4%<br>Steep curve affecting the operation speed:1<br>Potential connection/extension: Difficult | 1 | Curve ratio worse than R=6,000: 17.7%<br>Steep curve affecting the operation speed:0<br>Potential connection/extension: No problem | 2.0 | No high-speed operation is achieved. |
| 3.2 | Difficulty of construction work | 3.4 | Average of each province (4/4/3/3/3) | 3.4 | Average of each province (4/4/3/3/3) | 3.2 | Average of each province (4/4/2/3/3) | | |
| 4 Economical Efficiency | | 4.0 | B(0.24) | 3.0 | C(-0.44) | 4.0 | B(0.34) | 3.0 | C(-0.14) |
| 4.1 | Construction cost | 3.0 | Cost is higher than the cheapest option and less than 1.5 times of the cheapest option (Total Cost = 3,434 mil USD). | 2.0 | Cost is highest due to elevated structure and less than double of the cheapest option (Total Cost = 5,702 mil USD). | 4.0 | Cost is minimized with embankment structure (Total Cost = 2,951 mil USD). | 5.0 | Cost for the improvement of other transporation is required. However, the actual requried cost is unknown. |
| 4.2 | Regional Development | 5.0 | HSR development would contribute to the regional development. Stations with better convenience would maximize the benefit. | 4.0 | HSR development would contribute to the regional development. | 4.0 | HSR development would contribute to the regional development. | *1.0* | Current existing railway would contribute to the regional development much less than HSR. |

Note: A-Better (0.5 and more than 0.5), B-Good (0 and more than 0, less than 0.5), C-Fair (-0.5 and more than -0.5, less than 0), D-No advantage (less than -0.5). The scores are standardized figures shown in the blacket
Landuse: -Army and cemetery area: L1 means 1 large army area would be affected. S5 means 5 small army areas could be affected. – Indstry area: Ex3 means 3 existing indsustrial zone couled be affected, and Plan 8 means 8 planned industrial zones could be affected
Source: JICA Study Team

## Table 3F.2 City/Province Wise Scoring - HCMC Section

| Aspect/Item | | Alternative 1 | | Alternative 2 | | Alternative 3 | |
|---|---|---|---|---|---|---|---|
| Station in the Section | | Thu Thiem | | Hoa Hung | | Thu Thiem | |
| 1 Convenience and Integrated Development | | A | | B | | A | |
| 1.1 | Connectivity with other transport modes | 5 | UMRT Line 2<br>Road<br>Thu Thiem Tunnel | 5 | Existing Railway Road | 5 | UMRT Line 2<br>Road<br>Thu Thiem Tunnel |
| 1.2 | Distance from main centers | 4 | Administrative Center: 3<br>Business/ Commercial Center: 3<br>Residential Development: +1 | 3.5 | Administrative Center: 4<br>Business/ Commercial Center: 3 | 4 | Administrative Center: 3<br>Business/ Commercial Center: 3<br>Residential Development: +1 |
| 1.3 | Availability of land for integrated development | 5 | Thu Thiem New Town Project Area | 1 | Limited available land | 5 | Thu Thiem New Town Project Area |
| 2 Environmental and Social Considerations | | 4.4 | A | 3.5 | B | 4.2 | A |
| 2.1 | Natural environment | B+ | | B | | B | |
| 2.1.1 | Topography | 5 | No precious/characteristic topography exists. | 5 | No precious/characteristic topography exists. | 5 | No precious/characteristic topography exists. |
| 2.1.2 | Geology | 1 | Passing through area of geological difficulty more than 10 km | 1 | Passing through area of geological difficulty more than 10 km | 1 | Passing through area of geological difficulty more than 10 km |
| 2.1.3 | Hydrology | 5 | No tunnel more than 1km exists. | 5 | No tunnel more than 1km exists. | 5 | No tunnel more than 1km exists. |
| 2.1.4 | Natural disaster | 4 | Flood/Landslide Prone: 3/5<br>Typhoon: 0 | 2 | Flood/Landslide Prone: 4/9<br>Typhoon: 0 | 3 | Flood/Landslide Prone: 5/6<br>Typhoon: 0 |
| 2.1.5 | Protected area | 5 | Protected: 0, Protection: 0 | 5 | Protected: 0, Protection: 0 | 5 | Protected: 0, Protection: 0 |
| 2.2 | Pollution | A | | D | | B | |
| 2.2.1 | Noise/Vibration | 5 | Potentially affected: 341 (pop) | 1 | Potentially affected: 7,065 (pop) | 4 | Potentially affected: 486 (pop) |
| 2.3 | Social environment | A+ | | B | | A | |
| 2.3.1 | Land use | 5 | Army/Indstry/Cemetary: 0/0/0 | 5 | Army/Indstry/Cemetary: 0/Plan1/0 | 5 | Army/Indstry/Cemetary: 0/ Plan1/0 |
| 2.3.2 | Residential/Urban area | 4 | Potentially affected: 64 (buildings) | 1 | Potentially affected: 866 (buildings) | 4 | Potentially affected: 138 (buildings) |
| 2.3.3 | Cultual heritage/Religeous Facility | 5 | n.a./0 | 5 | n.a./2 | 5 | n.a./0 |
| 2.3.4 | Ethnic minority | 5 | 5,000-/1,000-5,000/500-1,000: 0/0/0 | 5 | 5,000-/1,000-5,000/500-1,000: 0/0/2 | 5 | 5,000-/1,000-5,000/500-1,000: 0/0/0 |

Note: Landuse: -Army and cemetery area: L1 means 1 large army area would be affected. S5 means 5 small army areas could be affected. – Indstry area: Plan 8 means 8 planned industrial zones could be affected
Source: JICA Study Team

## Table 3F.3 City/Province Wise Scoring - Dong Nai Section

| Aspect/Item | | Alternative 1 | | Alternative 2 | | Alternative 3 | |
|---|---|---|---|---|---|---|---|
| Station in the Section | | Long Thanh | | Long Thanh | | Long Thanh | |
| 1 Convenience and Integrated Development | | A | | B | | A | |
| 1.1 | Connectivity with other transport modes | 5 | UMRT (possible extension of Line 2)<br>Road (HCMC - Long Thanh - Dau Giay expressway) | 3 | Road (HCMC - Long Thanh - Dau Giay expressway) | 3 | Road (HCMC - Long Thanh - Dau Giay expressway) |
| 1.2 | Distance from main centers | 3 | Administrative Center: 3<br>Business/ Commercial Center: 3 | 3 | Administrative Center: 3<br>Business/ Commercial Center: 3 | 5 | Administrative Center: 5<br>Business/ Commercial Center: 5 |
| 1.3 | Availability of land for integrated development | 5 | Potential for integrated development inside airport: transit and commercial functions | 5 | Land available for development adjacent to the airport | 5 | Land available for development adjacent to the airport |
| 2 Environmental and Social Considerations | | 4.1 | A | 4.1 | A | 4.0 | A |
| 2.1 | Natural environment | B | | B+ | | C | |
| 2.1.1 | Topography | 5 | No precious/characteristic topography exists. | 5 | No precious/characteristic topography exists. | 5 | No precious/characteristic topography exists. |
| 2.1.2 | Geology | 1 | Passing through area of geological difficulty more than 10 km | 1 | Passing through area of geological difficulty more than 10 km | 1 | Passing through area of geological difficulty more than 10 km |
| 2.1.3 | Hydrology | 5 | No tunnel more than 1km exists. | 5 | No tunnel more than 1km exists. | 4 | Tunnel(s) (1km-5km) exist, though water use in downstream/neighborhood area is not identified. |
| 2.1.4 | Natural disaster | 4 | Flood/Landslide Prone: 2/0 | 5 | Flood/Landslide Prone: 1/0 | 4 | Flood/Landslide Prone: 2/0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | Tornade prone: 2 | | Tornado: 0 | | Tornade prone: 2 |
| 2.1.5 | Protected area | 4 | Protected: 0, Protection: XL0L1M4S0 | 5 | Protected: 0, Protection: XL0L0M1S0 | 4 | Protected: 0, Protection:XL0 L1M4S1 |
| 2.2 | Pollution | | A+ | | A | | A |
| 2.2.1 | Noise/Vibration | 5 | Potentially affected: 223 (pop) | 5 | Potentially affected: 378 (pop) | 5 | Potentially affected: 344 (pop) |
| 2.3 | Social environment | | A+ | | C | | A+ |
| 2.3.1 | Land use | 5 | Army/Indstry/Cemetary: 0/0/0 | 4 | Army/Indstry/Cemetary: L1S1/ Plan1/0 | 5 | Army/Indstry/Cemetary: 0/0/0 |
| 2.3.2 | Residential/Urban area | 4 | Potentially affected: 85 (buildings) | 4 | Potentially affected: 122 (buildings) | 4 | Potentially affected: 88 (buildings) |
| 2.3.3 | Cultual heritage/Religeous Facility | 5 | n.a./0 | 5 | n.a./0 | 5 | n.a./0 |
| 2.3.4 | Ethnic minority | 3 | 5,000-/1,000-5,000/500-1,000: 0/5/4 | 2 | 5,000-/1,000-5,000/500-1,000: 1/2/4 | 3 | 5,000-/1,000-5,000/500-1,000: 0/5/5 |

Note: Protected area: XL1L3M2S4 means 1 extra large, 2 large, 2 medium and 4 small size forest area would be affected.
Landuse: -Army and cemetery area: L1 means 1 large army area would be affected. S5 means 5 small army areas could be affected. – Indstry area: Ex3 means 3 existing indsustrial zone couled be affected, and Plan 8 means 8 planned industrial zones could be affected
Source: JICA Study Team

## Table 3F.4 City/Province Wise Scoring - Binh Thuan Section

| Aspect/Item | | Alternative 1 | | Alternative 2 | | Alternative 3 | |
|---|---|---|---|---|---|---|---|
| Station in the Section (1/2) | | | Phan Thiet | | Phan Thiet | | Phan Thiet |
| 1 Convenience and Integrated Development | | | A+ | | A+ | | C |
| 1.1 | Connectivity with other transport modes | 5 | Existing Railway (relocated Phan Thiet Station)<br>Road | 5 | Existing Railway (relocated Phan Thiet Station)<br>Road | 1 | No connection (both existing and planned) to other transport modes |
| 1.2 | Distance from main centers | 4 | Administrative Center: 4<br>Business/ Commercial Center: 4 | 4 | Administrative Center: 4<br>Business/ Commercial Center: 4 | 1 | Administrative Center: 1<br>Business/ Commercial Center: 1 |
| 1.3 | Availability of land for integrated development | 5 | Land available in city fringe area adjacent to the new Phan Thiet Station | 5 | Land available in city fringe area adjacent to the new Phan Thiet Station | 5 | Agricultural land available for development |
| Station in the Section (2/2) | | | Tuy Phong | | Tuy Phong | | Tuy Phong |
| 1 Convenience and Integrated Development | | | B | | C | | C |
| 1.1 | Connectivity with other transport modes | 3 | Road (along NH01) | 1 | No connection (both existing and planned) to other transport modes | 1 | No connection (both existing and planned) to other transport modes |
| 1.2 | Distance from main centers | 4 | Administrative Center: 3<br>Business/ Commercial Center: 3<br>Residential Development: +1 | 2 | Administrative Center: 2<br>Business/ Commercial Center: 2 | 2 | Administrative Center: 2<br>Business/ Commercial Center:2 |
| 1.3 | Availability of land for integrated development | 5 | Low density residential development area | 5 | Agricultural land available for development | 5 | Agricultural land available for development |
| 2 Environmental and Social Considerations | | 3.4 | B | 3.5 | A | 3.2 | B |
| 2.1 | Natural environment | | B | | B+ | | C |
| 2.1.1 | Topography | 4 | Precious/characteristic topography exists near the alignment, but not affected directly. | 4 | Precious/characteristic topography exists near the alignment, but not affected directly. | 4 | Precious/characteristic topography exists near the alignment, but not affected directly. |
| 2.1.2 | Geology | 1 | Passing through area of geological difficulty more than 10 km | 1 | Passing through area of geological difficulty more than 10 km | 1 | Passing through area of geological difficulty more than 10 km |
| 2.1.3 | Hydrology | 5 | No tunnel more than 1km exists. | 5 | No tunnel more than 1km exists. | 5 | No tunnel more than 1km exists. |
| 2.1.4 | Natural disaster | 4 | Flood/Landslide Prone: 4/0<br>Typhoon: 9 | 4 | Flood/Landslide Prone: 3/0<br>Typhoon: 10 | 3 | Flood/Landslide Prone: 6/0<br>Typhoon: 7 |
| 2.1.5 | Protected area | 4 | Protected: 0, Protection: XL1L1M3S0 | 5 | Protected: 0, Protection: XL1L3M4S1 | 3 | Protected: 0, Protection: XL2L1M1S1 |
| 2.2 | Pollution | | D | | D | | C |
| 2.2.1 | Noise/Vibration | 2 | Potentially affected: 1,297 (pop) | 1 | Potentially affected: 1,610 (pop) | 4 | Potentially affected: 767 (pop) |
| 2.3 | Social environment | | C | | C+ | | C |
| 2.3.1 | Land use | 4 | Army/Indstry/Cemetary: 0/ Ex1Plan1/0 | 4 | Army/Indstry/Cemetary: 0/ Ex1Plan1/0 | 3 | Army/Indstry/Cemetary: 0/ Plan2/L2S1 |
| 2.3.2 | Residential/Urban area | 2 | Potentially affected: 350 (buildings) | 2 | Potentially affected: 319 (buildings) | 3 | Potentially affected: 234 (buildings) |
| 2.3.3 | Cultual heritage/Religeous | 5 | n.a./0 | 5 | n.a./0 | 5 | n.a./1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Facility | | | | | | |
| 2.3.4 | Ethnic minority | 3 | 5,000-/1,000-5,000/500-1,000: 0/3/2 | 4 | 5,000-/1,000-5,000/500-1,000: 0/1/3 | 1 | 5,000-/1,000-5,000/500-1,000: 3/3/3 |

Note: Protected area: XL1L3M2S4 means 1 extra large, 2 large, 2 medium and 4 small size forest area would be affected.
Landuse: -Army and cemetery area: L1 means 1 large army area would be affected. S5 means 5 small army areas could be affected. – Indstry area: Ex3 means 3 existing indsustrial zone couled be affected, and Plan 8 means 8 planned industrial zones could be affected
Source: JICA Study Team

## Table 3F.5 City/Province Wise Scoring - Ninh Thuan Section

| Aspect/Item | | Alternative 1 | | Alternative 2 | | Alternative 3 | |
|---|---|---|---|---|---|---|---|
| Station in the Section | | Thap Cham | | Thap Cham | | Thap Cham | |
| 1 Convenience and Integrated Development | | A+ | | A | | A+ | |
| 1.1 | Connectivity with other transport modes | 5 | Existing railway<br>Road | 5 | Existing railway<br>Road | 3 | Road |
| 1.2 | Distance from main centers | 5 | Administrative Center: 5<br>Business/ Commercial Center: 5<br>Toursim Destination: +1 | 5 | Administrative Center: 5<br>Business/ Commercial Center: 5<br>Toursim Destination: +1 | 5 | Administrative Center: 5<br>Business/ Commercial Center: 5 |
| 1.3 | Availability of land for integrated development | 3 | Difficulty in obtaining land (built-up old town area) | 3 | Difficulty in obtaining land (built-up old town area) | 5 | Land available for development within the new residential area (still in plan up to 2025) |
| 2 Environmental and Social Considerations | | 4.0 | A | 3.6 | B | 3.8 | B |
| 2.1 | Natural environment | B | | B+ | | B | |
| 2.1.1 | Topography | 5 | No precious/characteristic topography exists. | 5 | No precious/characteristic topography exists. | 5 | No precious/characteristic topography exists. |
| 2.1.2 | Geology | 5 | No geological difficulty section | 5 | No geological difficulty section | 4 | Passing through area of geological difficulty less than 1km (salt farming area) |
| 2.1.3 | Hydrology | 3 | There is a tunnel (over 5km), while nearby wateruse (especially in the downstream area) is not confirmed. | 4 | There is a tunnel (1km-5km), while nearby wateruse (especially in the downstream area) is not confirmed. | 4 | There is a tunnel (1km-5km), while nearby wateruse (especially in the downstream area) is not confirmed. |
| 2.1.4 | Natural disaster | 4 | Flood/Landslide Prone: 2/2<br>Typhoon prone: 7 | 4 | Flood/Landslide Prone: 2/2<br>Typhoon prone: 7 | 3 | Flood/Landslide Prone: 3/3<br>Typhoon prone: 6 |
| 2.1.5 | Protected area | 4 | Protected: 0, Protection: XL0L1M1S0 | 4 | Protected: 0, Protection: XL1L1M1S0 | 4 | Protected: 0, Protection: XL1L1M1S0 |
| 2.2 | Pollution | B | | C | | D | |
| 2.2.1 | Noise/Vibration | 4 | Potentially affected: 501 (pop) | 3 | Potentially affected: 923 (pop) | 4 | Potentially affected: 644 (pop)<br>Residential area development is planned close to the station and will be affected: -1 |
| 2.3 | Social environment | B | | D | | C | |
| 2.3.1 | Land use | 5 | Army/Indstry/Cemetary: 0/0/1 | 5 | Army/Indstry/Cemetary: 0/0/0 | 5 | Army/Indstry/Cemetary: 0/0/1 |
| 2.3.2 | Residential/Urban area | 4 | Potentially affected: 146 (buildings) | 4 | Potentially affected: 185 (buildings) | 4 | Potentially affected: 158 (buildings) |
| 2.3.3 | Cultual heritage/Religeous Facility | 4 | n.a./5 | 1 | n.a./13 | 4 | n.a./6 |
| 2.3.4 | Ethnic minority | 2 | 5,000-/1,000-5,000/500-1,000: 3/0/1 | 1 | 5,000-/1,000-5,000/500-1,000: 3/1/1 | 1 | 5,000-/1,000-5,000/500-1,000: 5/3/0 |

Note: Protected area: XL1L3M2S4 means 1 extra large, 2 large, 2 medium and 4 small size forest area would be affected.
Landuse: -Army and cemetery area: L1 means 1 large army area would be affected. S5 means 5 small army areas could be affected. – Indstry area: Ex3 means 3 existing indsustrial zone couled be affected, and Plan 8 means 8 planned industrial zones could be affected
Source: JICA Study Team

**Table 3F.6 City/Province Wise Scoring - Khanh Hoa Section**

| Aspect/Item | | Alternative 1 | | Alternative 2 | | Alternative 3 | |
|---|---|---|---|---|---|---|---|
| Station in the Section | | Nha Trang | | Nha Trang | | Nha Trang | |
| 1 Convenience and Integrated Development | | A | | C | | C | |
| 1.1 | Connectivity with other transport modes | 5 | Existing Railway (relocated Nha Trang Station) | 2 | Road | 3 | Road |
| 1.2 | Distance from main centers | 4 | Administrative Center: 3<br>Business/ Commercial Center: 3<br>Residential Development: +1 | 4 | Administrative Center: 3<br>Business/ Commercial Center: 3<br>Residential Development: +1 | 3 | Administrative Center: 2<br>Business/ Commercial Center: 2<br>Toursim Development: +1 |
| 1.3 | Availability of land for integrated development | 3 | Reimproved village area under MP | 3 | Reimproved village area under MP | 3 | Water ecology tourism area under MP |
| 2 Environmental and Social Considerations | | 3.9 | A | 3.6 | B | 3.1 | C |
| 2.1 | Natural environment | B | | C | | D | |
| 2.1.1 | Topography | 4 | 4: Improtant/valuable topography exists along the alignment, while it is not directly affected. | 4 | 4: Improtant/valuable topography exists along the alignment, while it is not directly affected. | 2 | 2: Improtant/valuable topography exists along the alignment, and is partially but directly affected. |
| 2.1.2 | Geology | 5 | No geological difficulty section | 5 | No geological difficulty section | 4 | Passing through area of geological difficulty less than 1km (lagoon area) |
| 2.1.3 | Hydrology | 3 | There is a tunnel (over 5km), while nearby wateruse (especially in the downstream area) is not confirmed. | 2 | There is a tunnel (1km-5km), and nearby wateruse (especially in the downstream area) is confirmed. | 2 | There is a tunnel (1km-5km), and nearby wateruse (especially in the downstream area) is confirmed. |
| 2.1.4 | Natural disaster | 2 | Flood/Landslide Prone: 9/2<br>Tyhoon prone: 5 | 2 | Flood/Landslide Prone: 9/2<br>Tyhoon prone: 3 | 2 | Flood/Landslide Prone: 10/2<br>Tyhoon prone: 4 |
| 2.1.5 | Protected area | 4 | Protected: 0, Protection: XL0L1M5S1 | 4 | Protected: 0, Protection: XL0L1M3S2 | 4 | Protected: 0, Protection: XL0L1M3S1 |
| 2.2 | Pollution | B | | B+ | | C | |
| 2.2.1 | Noise/Vibration | 4 | Potentially affected: 725 (pop) | 4 | Potentially affected: 638 (pop) | 3 | Potentially affected: 1,193 (pop) |
| 2.3 | Social environment | A | | C | | C | |
| 2.3.1 | Land use | 5 | Army/Indstry/Cemetary: 0/0/0 | 5 | Army/Indstry/Cemetary: 0/ Plan1/0 | 5 | Army/Indstry/Cemetary: 0/ Plan1/0 |
| 2.3.2 | Residential/Urban area | 3 | Potentially affected: 210 (buildings) | 3 | Potentially affected: 219 (buildings) | 2 | Potentially affected: 329 (buildings) |
| 2.3.3 | Cultual heritage/Religeous Facility | 5 | Heritage/Religeous: 0/0 | 4 | Heritage/Religeous: 0/3 | 5 | Heritage/Religeous: 0/3 |
| 2.3.4 | Ethnic minority | 4 | 5,000-/1,000-5,000/500-1,000: 1/0/0 | 3 | 5,000-/1,000-5,000/500-1,000: 2/0/0 | 2 | 5,000-/1,000-5,000/500-1,000: 3/0/0 |

Note: Protected area: XL1L3M2S4 means 1 extra large, 2 large, 2 medium and 4 small size forest area would be affected.
Landuse: -Army and cemetery area: L1 means 1 large army area would be affected. S5 means 5 small army areas could be affected. – Indstry area: Ex3 means 3 existing indsustrial zone couled be affected, and Plan 8 means 8 planned industrial zones could be affected
Source: JICA Study Team

# APPENDIX 3G

# Result of Final Scoring

For more clear understandings of stakeholders, the final scoring was conducted. Following the advices from environmental advisory committee (See Chapter 9), final scoring was prepared as follows including the zero-option in the comparison table together with Alternatives 1, 2 and 3.

Table 3G.1 shows the scoring result of the north section (raw figure) and Table 3G.2 shows that of the south section (raw figure). Objectively assessed scores for each aspect and item were simply totaled. Tables 3G.3 and 3G.4 show the result of standardized scoring for more appropriate comparison for each section. To sum-up the score of each different aspect and item, scores were standardized before summed by each of the sections.

**Table 3G.1 Result of Scoring (Raw Figure / North Section)**

| North Section | | Alt1 | Alt2 | Alt3 | Zero-Option |
|---|---|---|---|---|---|
| Overall Evaluation | | 16.7 | 14.0 | 14.2 | 11.1 |
| 1 Convenience and Integrated Development | | 4.4 | 3.4 | 3.6 | 2.1 |
| 1.1 | Connectivity with other transport modes | 5.0 | 2.7 | 3.0 | 2.0 |
| 1.2 | Distance from main centers | 3.4 | 3.5 | 3.3 | 3.4 |
| 1.3 | Availability of land for integrated development | 4.7 | 4.0 | 4.7 | 1.0 |
| 2 Environmental and Social Considerations | | 4.3 | 4.1 | 4.1 | 4.0 |
| 2.1 | Natural environment | 4.0 | 4.0 | 4.0 | 3.7 |
| 2.1.1 | Topography | 4.8 | 4.8 | 4.8 | 4.8 |
| 2.1.2 | Geology | 2.0 | 2.0 | 2.0 | 2.0 |
| 2.1.3 | Hydrology | 4.5 | 4.5 | 4.5 | 3.0 |
| 2.1.4 | Natural disaster | 4.5 | 4.5 | 4.5 | 4.5 |
| 2.1.5 | Protected area | 4.4 | 4.2 | 4.2 | 4.3 |
| 2.2 | Living environment | 4.5 | 4.2 | 4.4 | 2.0 |
| 2.2.1 | Air Pollution | 5.0 | 5.0 | 5.0 | 2.0 |
| 2.2.1 | Noise/Vibration | 4.0 | 3.3 | 3.8 | 2.0 |
| 2.3 | Social environment | 4.5 | 4.2 | 4.0 | 3.9 |
| 2.3.1 | Land use | 4.7 | 3.5 | 3.5 | 3.9 |
| 2.3.2 | Residential/Urban area | 3.3 | 3.7 | 3.2 | 2.0 |
| 2.3.3 | Cultural heritage / religious facilities | 5.0 | 4.7 | 4.5 | 4.7 |
| 2.3.4 | Ethnic minority | 5.0 | 5.0 | 5.0 | 5.0 |
| 3 High Speed Serviceability | | 4.5 | 3.5 | 2.5 | 2.0 |
| 3.1 | High speed serviceability | 5.0 | 3.0 | 1.0 | 2.0 |
| 3.2 | Difficulty of construction work | 4.0 | 4.0 | 4.0 | 2.0 |
| 4 Economical Efficiency | | 3.5 | 3.0 | 4.0 | 3.0 |
| 4.1 | Construction cost | 2.0 | 1.0 | 4.0 | 5.0 |
| 4.2 | Regional Development | 5.0 | 4.0 | 4.0 | 1.0 |

Source: JICA Study Team

**Table 3G.2 Result of Scoring (Raw Figure / South Section)**

| South Section | | Alt1 | Alt2 | Alt3 | Zero-Option |
|---|---|---|---|---|---|
| Overall Evaluation | | 16.1 | 13.1 | 13.4 | 10.4 |
| 1 Convenience and Integrated Development | | 4.3 | 3.6 | 3.6 | 2.2 |
| 1.1 | Connectivity with other transport modes | 4.7 | 3.5 | 2.7 | 2.0 |

| | | | | | |
|---|---|---|---|---|---|
| 1.2 | Distance from main centers | 4.0 | 3.6 | 3.3 | 3.5 |
| 1.3 | Availability of land for integrated development | 4.3 | 3.7 | 4.7 | 1.0 |
| 2 Environmental and Social Considerations | | 4.1 | 3.8 | 3.8 | 3.2 |
| 2.1 | Natural environment | 3.8 | 3.9 | 3.5 | 3.5 |
| 2.1.1 | Topography | 4.6 | 4.6 | 4.2 | 4.5 |
| 2.1.2 | Geology | 2.6 | 2.6 | 2.2 | 2.5 |
| 2.1.3 | Hydrology | 4.2 | 4.2 | 4.0 | 3.0 |
| 2.1.4 | Natural disaster | 3.6 | 3.4 | 3.0 | 3.3 |
| 2.1.5 | Protected area | 4.2 | 4.6 | 4.0 | 4.3 |
| 2.2 | Living environment | 4.5 | 3.9 | 4.5 | 2.0 |
| 2.2.1 | Air Pollution | 5.0 | 5.0 | 5.0 | 2.0 |
| 2.2.1 | Noise/Vibration | 4.0 | 2.8 | 4.0 | 2.0 |
| 2.3 | Social environment | 4.1 | 3.6 | 3.8 | 3.5 |
| 2.3.1 | Land use | 4.8 | 4.6 | 4.6 | 4.7 |
| 2.3.2 | Residential/Urban area | 3.4 | 2.8 | 3.4 | 2.0 |
| 2.3.3 | Cultural heritage / religious facilities | 4.8 | 4.0 | 4.8 | 4.5 |
| 2.3.4 | Ethnic minority | 3.4 | 3.0 | 2.4 | 2.9 |
| 3 High Speed Serviceability | | 3.7 | 2.7 | 2.1 | 2.0 |
| 3.1 | High speed serviceability | 4.0 | 2.0 | 1.0 | 2.0 |
| 3.2 | Difficulty of construction work | 3.4 | 3.4 | 3.2 | 2.0 |
| 4 Economical Efficiency | | 4.0 | 3.0 | 4.0 | 3.0 |
| 4.1 | Construction cost | 3.0 | 2.0 | 4.0 | 5.0 |
| 4.2 | Regional Development | 5.0 | 4.0 | 4.0 | 1.0 |

Source: JICA Study Team

**Table 3G.3 Result of Scoring (Standardized Figure / North Section)**

| North Section | | Alt1 | Alt2 | Alt3 | Zero-Option |
|---|---|---|---|---|---|
| Overall Evaluation | | 2.37 | 0.25 | -0.19 | -2.43 |
| 1 Convenience and Integrated Development | | 0.72 | 0.31 | -0.28 | -0.75 |
| 1.1 | Connectivity with other transport modes | 1.42 | -0.39 | -0.13 | -0.90 |
| 1.2 | Distance from main centers | 0.12 | 1.09 | -1.33 | 0.12 |
| 1.3 | Availability of land for integrated development | 0.62 | 0.24 | 0.62 | -1.48 |
| 2 Environmental and Social Considerations | | 0.58 | 0.02 | -0.06 | -0.53 |
| 2.1 | Natural environment | 0.38 | -0.04 | -0.04 | -0.30 |
| 2.1.1 | Topography | *0.00* | *0.00* | *0.00* | *0.00* |
| 2.1.2 | Geology | *0.00* | *0.00* | *0.00* | *0.00* |
| 2.1.3 | Hydrology | 0.50 | 0.50 | 0.50 | -1.50 |
| 2.1.4 | Natural disaster | *0.00* | *0.00* | *0.00* | *0.00* |
| 2.1.5 | Protected area | 1.41 | -0.71 | -0.71 | 0.00 |
| 2.2 | Living environment | 0.64 | 0.27 | 0.55 | -1.46 |
| 2.2.1 | Air Pollution | 0.50 | 0.50 | 0.50 | -1.50 |
| 2.2.1 | Noise/Vibration | 0.78 | 0.05 | 0.60 | -1.42 |
| 2.3 | Social environment | 0.79 | -0.03 | -0.40 | -0.36 |
| 2.3.1 | Land use | 1.41 | -0.71 | -0.71 | 0.00 |
| 2.3.2 | Residential/Urban area | 0.40 | 0.86 | 0.17 | -1.44 |
| 2.3.3 | Cultural heritage / religious facilities | 1.34 | -0.27 | -1.07 | 0.00 |
| 2.3.4 | Ethnic minority | *0.00* | *0.00* | *0.00* | *0.00* |
| 3 High Speed Serviceability | | 0.91 | 0.32 | -0.26 | -0.97 |
| 3.1 | High speed serviceability | 1.32 | 0.15 | -1.02 | -0.44 |
| 3.2 | Difficulty of construction work | 0.50 | 0.50 | 0.50 | -1.50 |
| 4 Economical Efficiency | | 0.16 | -0.40 | 0.42 | -0.17 |
| 4.1 | Construction cost | -0.55 | -1.10 | 0.55 | 1.10 |
| 4.2 | Regional Development | 0.87 | 0.29 | 0.29 | -1.44 |

Source: JICA Study Team

**Table 3G.4 Result of Scoring (Standardized Figure / South Section)**

| South Section | | Alt1 | Alt2 | Alt3 | Zero-Option |
|---|---|---|---|---|---|
| Overall Evaluation | | 3.03 | 0.06 | -0.61 | -2.48 |
| 1 Convenience and Integrated Development | | 1.06 | 0.15 | -0.21 | -0.99 |
| 1.1 | Connectivity with other transport modes | 1.27 | 0.24 | -0.45 | -1.06 |
| 1.2 | Distance from main centers | 1.37 | 0.04 | -0.96 | -0.46 |
| 1.3 | Availability of land for integrated development | 0.52 | 0.16 | 0.76 | -1.45 |
| 2 Environmental and Social Considerations | | 0.74 | 0.15 | -0.38 | -0.51 |
| 2.1 | Natural environment | 0.57 | 0.73 | -0.99 | -0.30 |
| 2.1.1 | Topography | 0.71 | 0.71 | -1.41 | 0.00 |
| 2.1.2 | Geology | 0.71 | 0.71 | -1.41 | 0.00 |
| 2.1.3 | Hydrology | 0.61 | 0.61 | 0.26 | -1.48 |
| 2.1.4 | Natural disaster | 1.07 | 0.27 | -1.34 | 0.00 |
| 2.1.5 | Protected area | -0.27 | 1.34 | -1.07 | 0.00 |
| 2.2 | Living environment | 0.7 | 0.0 | 0.7 | -1.4 |
| 2.2.1 | Air Pollution | 0.50 | 0.50 | 0.50 | -1.50 |
| 2.2.1 | Noise/Vibration | 0.82 | -0.41 | 0.82 | -1.22 |
| 2.3 | Social environment | 1.00 | -0.53 | -0.14 | -0.34 |
| 2.3.1 | Land use | 1.41 | -0.71 | -0.71 | 0.00 |
| 2.3.2 | Residential/Urban area | 0.75 | -0.15 | 0.75 | -1.36 |
| 2.3.3 | Cultural heritage / religious facilities | 0.71 | -1.41 | 0.71 | 0.00 |
| 2.3.4 | Ethnic minority | 1.14 | 0.16 | -1.30 | 0.00 |
| 3 High Speed Serviceability | | 0.99 | 0.20 | -0.35 | -0.84 |
| 3.1 | High speed serviceability | 1.39 | -0.20 | -0.99 | -0.20 |
| 3.2 | Difficulty of construction work | 0.59 | 0.59 | 0.30 | -1.49 |
| 4 Economical Efficiency | | 0.24 | -0.44 | 0.34 | -0.14 |
| 4.1 | Construction cost | -0.39 | -1.16 | 0.39 | 1.16 |
| 4.2 | Regional Development | 0.87 | 0.29 | 0.29 | -1.44 |

Source: JICA Study Team

# APPENDIX 3H

# Result of Sensitivity Analysis

For the two types of scoring, namely raw figure and standardized figure, the sensitivity analysis was conducted for the result of the comparison of three alternatives and zero-option. The sensitivity was analyzed setting three cases of environmental conscious, development conscious, and cost conscious with two intensity (50% and 100%). The detail conditions of these cases are shown in Table 3H.1.

**Table 3H.1 Conditions of Sensitivity Analysis**

| Case | Condition |
|---|---|
| Base Case | |
| Environment Conscious (50%) | 1. Convenience and Integrated Development: -20%<br>2. Environment and Social Considerations: +50%<br>3. High Speed Serviceability and Engineering: -10%<br>4. Construction Cost: -20% |
| Environment Conscious (100%) | 1. Convenience and Integrated Development: -40%<br>2. Environment and Social Considerations: +100%<br>3. High Speed Serviceability and Engineering: -20%<br>4. Construction Cost: -40% |
| Development Conscious (50%) | 1. Convenience and Integrated Development: +40%<br>2. Environment and Social Considerations: -30%<br>3. High Speed Serviceability and Engineering: +10%<br>4. Construction Cost: -20% |
| Development Conscious (100%) | 1. Convenience and Integrated Development: +80%<br>2. Environment and Social Considerations: -60%<br>3. High Speed Serviceability and Engineering: +20%<br>4. Construction Cost: -40% |
| Cost Conscious (50%) | 1. Convenience and Integrated Development: -10%<br>2. Environment and Social Considerations: -20%<br>3. High Speed Serviceability and Engineering: -20%<br>4. Construction Cost: +50% |
| Cost Conscious (100%) | 1. Convenience and Integrated Development: -20%<br>2. Environment and Social Considerations: -40%<br>3. High Speed Serviceability and Engineering: -40%<br>4. Construction Cost: +100% |

Note: Base Case means the scoring result shown in Tables 3.7.1 and 3.7.2 without any weighting among aspects.
Source: JICA Study Team

The result of analysis is shown in Table 3H.2 for the raw figure, and Table 3H.3 for the standardized figure. Vertical axis shows the aspects of evaluation (all: Total Score, 1: Convenience and Intgrated Development, 2: Environmental and Social Considerations, 3: High Speed Serviceability and 4: Economical Efficiency. Right end column show the condition of intensity which is shown in 3H-1 above.

Highlighted column shows the best total score among the alternatives (Alt1, 2 and 3) and the zero-option (Zero). It shows that the Alternative 1 (rev) for the north section and the Alternative 1 for the south section is the optimal alignment and station location in all cases.

## Table 3H.2 Result of Sensitivity Analysis (Raw Figure)

North Section

Base Case

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 16.65 | 13.50 | 14.23 | 10.61 | |
| 1 | 4.36 | 3.39 | 3.64 | 2.13 | |
| 2 | 4.29 | 4.11 | 4.09 | 3.47 | |
| 3 | 4.50 | 3.50 | 2.50 | 2.00 | |
| 4 | 3.50 | 2.50 | 4.00 | 3.00 | |

Environment Conscious: 50%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 16.85 | 13.47 | 13.91 | 10.02 | |
| 1 | 6.10 | 4.74 | 5.09 | 2.99 | 40% |
| 2 | 3.01 | 2.88 | 2.87 | 2.43 | -30% |
| 3 | 4.95 | 3.85 | 2.75 | 2.20 | 10% |
| 4 | 2.80 | 2.00 | 3.20 | 2.40 | -20% |

Environment Conscious: 100%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 17.06 | 13.44 | 13.59 | 9.43 | |
| 1 | 7.84 | 6.10 | 6.55 | 3.84 | 80% |
| 2 | 1.72 | 1.64 | 1.64 | 1.39 | -60% |
| 3 | 5.40 | 4.20 | 3.00 | 2.40 | 20% |
| 4 | 2.10 | 1.50 | 2.40 | 1.80 | -40% |

Development Conscious: 50%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 16.21 | 12.89 | 14.55 | 10.80 | |
| 1 | 3.92 | 3.05 | 3.28 | 1.92 | -10% |
| 2 | 3.44 | 3.29 | 3.28 | 2.78 | -20% |
| 3 | 3.60 | 2.80 | 2.00 | 1.60 | -20% |
| 4 | 5.25 | 3.75 | 6.00 | 4.50 | 50% |

Development Conscious: 100%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 15.76 | 12.28 | 14.87 | 10.99 | |
| 1 | 3.48 | 2.71 | 2.91 | 1.71 | -20% |
| 2 | 2.58 | 2.47 | 2.46 | 2.08 | -40% |
| 3 | 2.70 | 2.10 | 1.50 | 1.20 | -40% |
| 4 | 7.00 | 5.00 | 8.00 | 6.00 | 100% |

Cost Conscious: 50%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 16.47 | 13.24 | 14.37 | 10.66 | |
| 1 | 4.36 | 3.39 | 3.64 | 2.13 | |
| 2 | 3.86 | 3.70 | 3.68 | 3.13 | -10% |
| 3 | 4.05 | 3.15 | 2.25 | 1.80 | -10% |
| 4 | 4.20 | 3.00 | 4.80 | 3.60 | 20% |

Cost Conscious: 100%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 16.21 | 12.89 | 14.55 | 10.80 | |
| 1 | 3.92 | 3.05 | 3.28 | 1.92 | -10% |
| 2 | 3.44 | 3.29 | 3.28 | 2.78 | -20% |
| 3 | 3.60 | 2.80 | 2.00 | 1.60 | -20% |
| 4 | 5.25 | 3.75 | 6.00 | 4.50 | 50% |

South Section

Base Case

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 16.09 | 13.08 | 13.45 | 10.39 | |
| 1 | 4.33 | 3.60 | 3.57 | 2.15 | |
| 2 | 4.05 | 3.78 | 3.78 | 3.24 | |
| 3 | 3.70 | 2.70 | 2.10 | 2.00 | |
| 4 | 4.00 | 3.00 | 4.00 | 3.00 | |

Environment Conscious: 50%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 16.17 | 13.06 | 13.15 | 9.88 | |
| 1 | 6.07 | 5.04 | 4.99 | 3.01 | 40% |
| 2 | 2.84 | 2.65 | 2.65 | 2.27 | -30% |
| 3 | 4.07 | 2.97 | 2.31 | 2.20 | 10% |
| 4 | 3.20 | 2.40 | 3.20 | 2.40 | -20% |

Environment Conscious: 100%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 16.26 | 13.03 | 12.85 | 9.37 | |
| 1 | 7.80 | 6.48 | 6.42 | 3.87 | 80% |
| 2 | 1.62 | 1.51 | 1.51 | 1.30 | -60% |
| 3 | 4.44 | 3.24 | 2.52 | 2.40 | 20% |
| 4 | 2.40 | 1.80 | 2.40 | 1.80 | -40% |

Development Conscious: 50%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 16.10 | 12.93 | 13.92 | 10.63 | |
| 1 | 3.90 | 3.24 | 3.21 | 1.94 | -10% |
| 2 | 3.24 | 3.03 | 3.03 | 2.59 | -20% |
| 3 | 2.96 | 2.16 | 1.68 | 1.60 | -20% |
| 4 | 6.00 | 4.50 | 6.00 | 4.50 | 50% |

Development Conscious: 100%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 16.12 | 12.77 | 14.38 | 10.87 | |
| 1 | 3.47 | 2.88 | 2.85 | 1.72 | -20% |
| 2 | 2.43 | 2.27 | 2.27 | 1.95 | -40% |
| 3 | 2.22 | 1.62 | 1.26 | 1.20 | -40% |
| 4 | 8.00 | 6.00 | 8.00 | 6.00 | 100% |

Cost Conscious: 50%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 14.51 | 11.83 | 12.06 | 9.27 | |
| 1 | 4.33 | 3.60 | 3.57 | 2.15 | |
| 2 | 3.65 | 3.40 | 3.40 | 2.92 | -10% |
| 3 | 3.33 | 2.43 | 1.89 | 1.80 | -10% |
| 4 | 3.20 | 2.40 | 3.20 | 2.40 | -20% |

Cost Conscious: 100%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 16.10 | 12.93 | 13.92 | 10.63 | |
| 1 | 3.90 | 3.24 | 3.21 | 1.94 | -10% |
| 2 | 3.24 | 3.03 | 3.03 | 2.59 | -20% |
| 3 | 2.96 | 2.16 | 1.68 | 1.60 | -20% |
| 4 | 6.00 | 4.50 | 6.00 | 4.50 | 50% |

Source: JICA Study Team

## Table 3H.3 Result of Sensitivity Analysis (Standardized Figure)

North Section

Base Case

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 2.37 | 0.25 | -0.19 | -2.43 | |
| 1 | 0.72 | 0.31 | -0.28 | -0.75 | |
| 2 | 0.58 | 0.02 | -0.06 | -0.53 | |
| 3 | 0.91 | 0.32 | -0.26 | -0.97 | |
| 4 | 0.16 | -0.40 | 0.42 | -0.17 | |

Environment Conscious: 50%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 2.39 | 0.25 | -0.22 | -2.41 | |
| 1 | 0.58 | 0.25 | -0.23 | -0.60 | -20% |
| 2 | 0.87 | 0.03 | -0.10 | -0.80 | 50% |
| 3 | 0.82 | 0.29 | -0.24 | -0.87 | -10% |
| 4 | 0.13 | -0.32 | 0.33 | -0.14 | -20% |

Environment Conscious: 100%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 2.41 | 0.25 | -0.26 | -2.40 | |
| 1 | 0.43 | 0.19 | -0.17 | -0.45 | -40% |
| 2 | 1.15 | 0.04 | -0.13 | -1.07 | 100% |
| 3 | 0.73 | 0.26 | -0.21 | -0.78 | -20% |
| 4 | 0.10 | -0.24 | 0.25 | -0.10 | -40% |

Development Conscious: 50%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 2.54 | 0.49 | -0.39 | -2.63 | |
| 1 | 1.01 | 0.44 | -0.39 | -1.05 | 40% |
| 2 | 0.40 | 0.01 | -0.05 | -0.37 | -30% |
| 3 | 1.00 | 0.36 | -0.29 | -1.07 | 10% |
| 4 | 0.13 | -0.32 | 0.33 | -0.14 | -20% |

Development Conscious: 100%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 2.71 | 0.72 | -0.60 | -2.84 | |
| 1 | 1.30 | 0.57 | -0.51 | -1.35 | 80% |
| 2 | 0.23 | 0.01 | -0.03 | -0.21 | -60% |
| 3 | 1.09 | 0.39 | -0.31 | -1.16 | 20% |
| 4 | 0.10 | -0.24 | 0.25 | -0.10 | -40% |

Cost Conscious: 50%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 2.08 | -0.05 | 0.11 | -2.14 | |
| 1 | 0.65 | 0.28 | -0.25 | -0.68 | -10% |
| 2 | 0.46 | 0.02 | -0.05 | -0.43 | -20% |
| 3 | 0.73 | 0.26 | -0.21 | -0.78 | -20% |
| 4 | 0.24 | -0.61 | 0.63 | -0.26 | 50% |

Cost Conscious: 100%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 1.79 | -0.35 | 0.41 | -1.85 | |
| 1 | 0.58 | 0.25 | -0.23 | -0.60 | -20% |
| 2 | 0.35 | 0.01 | -0.04 | -0.32 | -40% |
| 3 | 0.55 | 0.19 | -0.16 | -0.58 | -40% |
| 4 | 0.32 | -0.81 | 0.84 | -0.35 | 100% |

South Section

Base Case

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 3.03 | 0.06 | -0.61 | -2.48 | |
| 1 | 1.06 | 0.15 | -0.21 | -0.99 | |
| 2 | 0.74 | 0.15 | -0.38 | -0.51 | |
| 3 | 0.99 | 0.20 | -0.35 | -0.84 | |
| 4 | 0.24 | -0.44 | 0.34 | -0.14 | |

Environment Conscious: 50%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 3.04 | 0.17 | -0.79 | -2.42 | |
| 1 | 0.84 | 0.12 | -0.17 | -0.79 | -20% |
| 2 | 1.11 | 0.22 | -0.57 | -0.76 | 50% |
| 3 | 0.89 | 0.18 | -0.31 | -0.76 | -10% |
| 4 | 0.19 | -0.35 | 0.27 | -0.11 | -20% |

Environment Conscious: 100%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 3.05 | 0.28 | -0.97 | -2.36 | |
| 1 | 0.63 | 0.09 | -0.13 | -0.59 | -40% |
| 2 | 1.48 | 0.29 | -0.76 | -1.01 | 100% |
| 3 | 0.79 | 0.16 | -0.28 | -0.67 | -20% |
| 4 | 0.14 | -0.26 | 0.20 | -0.08 | -40% |

Development Conscious: 50%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 3.28 | 0.18 | -0.68 | -2.78 | |
| 1 | 1.48 | 0.21 | -0.30 | -1.38 | 40% |
| 2 | 0.52 | 0.10 | -0.27 | -0.35 | -30% |
| 3 | 1.09 | 0.22 | -0.38 | -0.93 | 10% |
| 4 | 0.19 | -0.35 | 0.27 | -0.11 | -20% |

Development Conscious: 100%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 3.53 | 0.30 | -0.75 | -3.08 | |
| 1 | 1.90 | 0.27 | -0.39 | -1.78 | 80% |
| 2 | 0.30 | 0.06 | -0.15 | -0.20 | -60% |
| 3 | 1.19 | 0.24 | -0.42 | -1.01 | 20% |
| 4 | 0.14 | -0.26 | 0.20 | -0.08 | -40% |

Cost Conscious: 50%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 2.70 | -0.25 | -0.27 | -2.18 | |
| 1 | 0.95 | 0.13 | -0.19 | -0.89 | -10% |
| 2 | 0.59 | 0.12 | -0.31 | -0.40 | -20% |
| 3 | 0.79 | 0.16 | -0.28 | -0.67 | -20% |
| 4 | 0.36 | -0.65 | 0.51 | -0.21 | 50% |

Cost Conscious: 100%

| | Alt1 | Alt2 | Alt3 | Zero | |
|---|---|---|---|---|---|
| All | 2.36 | -0.55 | 0.07 | -1.88 | |
| 1 | 0.84 | 0.12 | -0.17 | -0.79 | -20% |
| 2 | 0.44 | 0.09 | -0.23 | -0.30 | -40% |
| 3 | 0.60 | 0.12 | -0.21 | -0.51 | -40% |
| 4 | 0.48 | -0.87 | 0.68 | -0.28 | 100% |

Source: JICA Study Team

# APPENDIX 4A

# Hearing to NGOs by JICA Study Team

In September 2012, the expert of JICA Study Team visited and worked with specialists of two NGOs as the Birdlife and IUCN at their offices in Ha Noi. The study team (i) showed and explained the alignment on google earth, (ii) discussed if there are naturally/ecologically sensitive/important areas nearby the HSR alignment or not, and (ii) raised some questions to the NGO specialists especially on the areas to be protected. Table 4A.1 is the summary information of these meetings.

**Table 4A.1 Results of Hearing to NGOs**

| NGO | Date | Person met | Discussed Contents |
|---|---|---|---|
| Birdlife International | Aug. 31, 2012 | Mr. Lê Trọng Trãi, Senior Expert of Natural Conservation Program | The JICA Study Team showed the alternative alignment (Alternative 1) of HSR both in Google Earth and map.<br>Q: Are there any naturally/ecologically important pleases/habitats, wetland, biodiversity rich areas, mangrove forest located near or within the proposed alignment of HSR?<br>A: There are not any naturally/ecologically important pleases/habitats, wetland, biodiversity located near or within the proposed alignment.<br>Q: Are there any rare or/and special species of birds and wild animals areas that Birdlife International concerns located near or within the proposed alignment of HSR?<br>A: There are no areas designated for rare and/or special species of birds and wild animals that Birdlife International concerns located near or within the proposed alignment of the HSR.<br>Q: Are there any places that the rare and/or special species of birds and wild animals that Birdlife International concerns are making the temporary nests or/and resident during their migration or movement located near or within the proposed alignment of HSR?<br>A: There are not. |
| | Sept 11, 2012 | -do- | The JICA Study Team showed the alternative alignments (Alternative 1 (revised) of the north section and the Alternative 1 of the south section) of HSR both in Google Earth and map.<br>Q: Are there any naturally/ecologically important pleases/habitats, wetland, biodiversity, mangrove located near or within the proposed alignment of HSR? (especially Alternative 1 (revised) of the north section)<br>A: There are not any naturally/ecologically important pleases/habitats, wetland, biodiversity located near or within the proposed alignment.<br>Q: Are there rare or/and special species of bird and wild animals that Birdlife International concerns located near or within the proposed alignment of HSR?<br>A: I checked the alignment on your maps and could say that there are not any rare or/and special species of bird and wild animals that Birdlife International concerns located near or within the proposed alignment.<br>Q: Are there any habitats that rare or/and special species of birds and wild animals that Birdlife International concerns are making the temporary nests or/and resident during their immigration or movement located near or within the proposed alignment?<br>A: There are not.<br>[Collected Information]: the existing and proposed protected areas and vegetation cover in Viet nam. |

| NGO | Date | Person met | Discussed Contents |
|---|---|---|---|
| IUCN | Aug. 31, 2012 | Mr. Nguyễn Đức Tú, Water and Wetland Coordinator of IUCN and Vegetation and ecological survey specialist. | The JICA Study Team showed the alternative alignment (Alternative 1) of HSR both in Google Earth and map.<br>Q: Are there any naturally/ecologically important pleases/habitats, wetland, biodiversity rich areas, mangrove forest located near or within the proposed alignment of HSR?<br>A: There are not any naturally/ecologically important pleases/habitats, wetland, biodiversity located near or within the proposed alignment.<br>Q: Are there any rare or/and special species of birds and wild animals areas that IUCN concerns located near or within the proposed alignment of HSR?<br>A: There are no areas designated for rare and/or special species of birds and wild animals that IUCN concerns located near or within the proposed alignment of the HSR. The birds and wild animals protection areas are located mostly in the mountain areas of Ninh Binh, Hoa Binh, Nghe An provinces in the north and Dong Nai, Binh Phuoc in the south.<br>Q: Are there any places that the rare and/or special species of birds and wild animals that Birdlife International concerns are making the temporary nests or/and resident during their migration or movement located near or within the proposed alignment of the HSR?<br>A: The proposed alignment of the HSR may slightly impact to the movement path of the wild animals, but there is no serious concern because the places of the animal, bird conservation are located so far from the proposed alignment. For example, the wild animals and birds of special species are distributed in the mountain areas of Hoa Binh, Nghe An, Dong Nai, Binh Phuoc provinces, in Ninh Binh there is Van Long area in Gia Vien district, there is a wetland which is a place for bird migration and endangered species *Vuoc* (one of monkey species) . These areas are located so far away the proposed alignment too. |

| NGO | Date | Person met | Discussed Contents |
|---|---|---|---|
| | Sept. 11, 2012 | -do- | The JICA Study Team showed the alternative alignment (Alternative 1 (revised) of the north section and the Alternative 1 of the south section) of HSR both in Google Earth and map.<br>1. General<br>Q: Are there any naturally/ecologically important pleases/habitats, wetland, biodiversity, mangrove located near or within the proposed alignment of HSR?<br>A: The proposed alignment of HSR mostly does not affect to the naturally/ecologically important places/habitats, wetland, biodiversity areas .<br>Q: Are there any rare or/and special species of bird and wild animal areas that IUCN concerns located near or within the proposed alignment of HSR?<br>A: There are not any rare or/and special species of birds or birds in the Red Book and wild animals located near or within the proposed alignment of HSR. The bird and wild animals reservation areas are located mostly in the mountain areas and wetland area of Ninh Binh, Hoa Binh, Nghe An provinces and Dong Nai, Binh Phuoc in the south.<br>Q: Are there any places that the rare or/and special species of birds and wild animals that IUCN concerns are making the temporary nests or/and resident during their immigration or movement located near or within the proposed alignment of HSR?<br>A: The proposed alignment of HSR may slightly impact to the movement path of the wild animals, but there is no concern because the places of the animal, bird conservation are located far from the proposed alignment. For example, the wild animals and birds of special concern are distributed in the mountain areas of Hoa Binh, Nghe An, Dong Nai, Binh Phuoc provinces, in Ninh Binh there is Van Long area in Gia Vien district, there is a wetland which is a place for bird immigration and endangered species Vooc (one of monkey species) . But those areas are located so far away the proposed alignment.<br>If the planned alignment crosses the limestone mountain, tunneling works may impact to the spineless animals and insect at the limestone mountains at Dong Son, Bim Son, Ha Trung districts. Recently there are some surveys on the ecosystem in the limestone mountains.<br>2. Red book and red list<br>Q; For endangered species, what is the status of Red book and red list in Vietnam now? Could you suggest other reference information for this?<br>A; The latest version of red book is the version 2007 in Vietnam, you can purchase from Vietnam Academy of Social Sciences (VASS).<br>For reference information, now we have Decree 32/2006 on species to be protected and you can access IUCN website for the latest red list. In addition, you can refer to some scientific works, scientific papers on species and etc. visit the Birdlife International's website for relevant Decrees and Reports.<br>3. Eco-system and Common species<br>Q; We concern not only the endangered species, but also the normal species such as the ones in paddy field etc. What is your opinion about the impact on these species by this project?<br>A; It is better to consider the priority of the ecosystems. For example, the critical ecosystems should be prioritized for conservation. Critical ecosystems can be identified by eco-system guidelines from CBD (Convention for BiologicalDiversity, which is a very technical reference), or from MDG (Millennium Development Goals, which is a general reference).<br>4. EBA and Large conservation area<br>Q; When we checked IBA and EBA, we found that some EBA are quite large in Vietnam covering many provinces, while our alignment goes through some of them. What do we have to do with this?<br>A; As you know endemic species has not been listed completely, and you can only check the scientific works. I assume the impact on EBA by this HSR projects is expected to be not significant.<br>Q; When we visited the Dong Nai DARD, some species was mentioned in the rubber forest (man-made forest), how we can access such important data?<br>A; It is very difficult to answer that question, according to the International standard, some species you are not allowed to touch, some you can compensate, some others you have to trade off. |

| NGO | Date | Person met | Discussed Contents |
|---|---|---|---|
| WWF | - | - | WWF staffs preferred the communication through e-mail to the meeting with the JICA Study Team. Though the JICA Study Team sent official request and related information with making follow-up by phone and e-mail, they could not give any response. |

Note: Q stands for the Questions from the JICA Study Team, while A stands for the Answer from the NGOs
The NGO staffs responded as individuals, and their comments do not necessarily represent the organization's view.

Source: JICA Study Team

**APPENDIX**

# APPENDIX 4B

# Supplemental Baseline Survey

# on the Area Adjacent to the Optimal Alignment and Stations

## 1 Introduction

1.1 Upon selecting the optimal alternative (alignment and station location) as discussed in Chapter 3, the collected data and information in the baseline survey were reviewed for provisional scoping. In addition, the supplemental data and information of major facilities and locations to be considered for scoping which are located in the ROW and along the alignment were collected through additional secondary data collection and field reconnaissance.

1.2 As such facilities and locations to be considered for scoping, information on schools, religious facilities and cultural heritages, hospitals were collected with priority, then other locations such as major transmission lines, factories, communal facilities, administarative facilities, antenna tower and etc. identified near the alignment were recorded in the list and map as well.

1.3 To identify the potentially affected buildings by the low pressure wave generated by the HSR development, the distribution of the buildings near the exits of tunnels were also confirmed on the topographic map information.

1.4 In this Appendix 4B, the result of the supplemental baseline survey is summarized.

## 2 North Section

2.1 2.1-2.6 discusses on the optimal alignment and stations in the north section.

### 2.1 Hanoi Section

**1)** Identified Major Facilities and Locations to be Considered for Scoping

2.2 The list of identified major facilities and locations to be considered for scoping are shown in Table 4B.1.

**Table 4B.1 Identified Major Facilities and Locations to be Consoidered for Scoping in Hanoi City Section**

| No | Sites and Facilities | Coordination | Distance to the Alignment (m) | Locality/ Description |
|---|---|---|---|---|
| 1. | Thanh Tri vocational training centers | 20°54'37.04"N 105°51'20.79"E | 810 | Lien Ninh commune, Thanh Tri dist, Ha Noi. |
| 2. | Khu vuc I Hospital | 20°55'16.43"N 105°51'12.64"E | 1,110 | Ngoc Hoi Town, Thanh Tri dist, Ha Noi. |
| 3. | Bat Nhiem pagoda | 20°54'57.91"N 105°51'28.09"E | 1,246 | Tho Am village, Ngu Hiep commune, Thanh Tri dist, Ha Noi. |
| 4. | Yen Phu pagoda | 20°54'5.33"N 105°51'14.55"E | 346 | Lien Ninh commune, Thanh Tri dist, Ha Noi. |
| 5. | Binh Vong village temple | 20°52'34.28"N 105°51'57.94"E | 1,087 | Binh Vong village, Thuong Tin town, Ha Noi |
| 6. | Phap Van pagoda | 20°52'40.55"N 105°51'38.71"E | 499 | 1A national highway, , Thuong Tin town, Ha Noi |

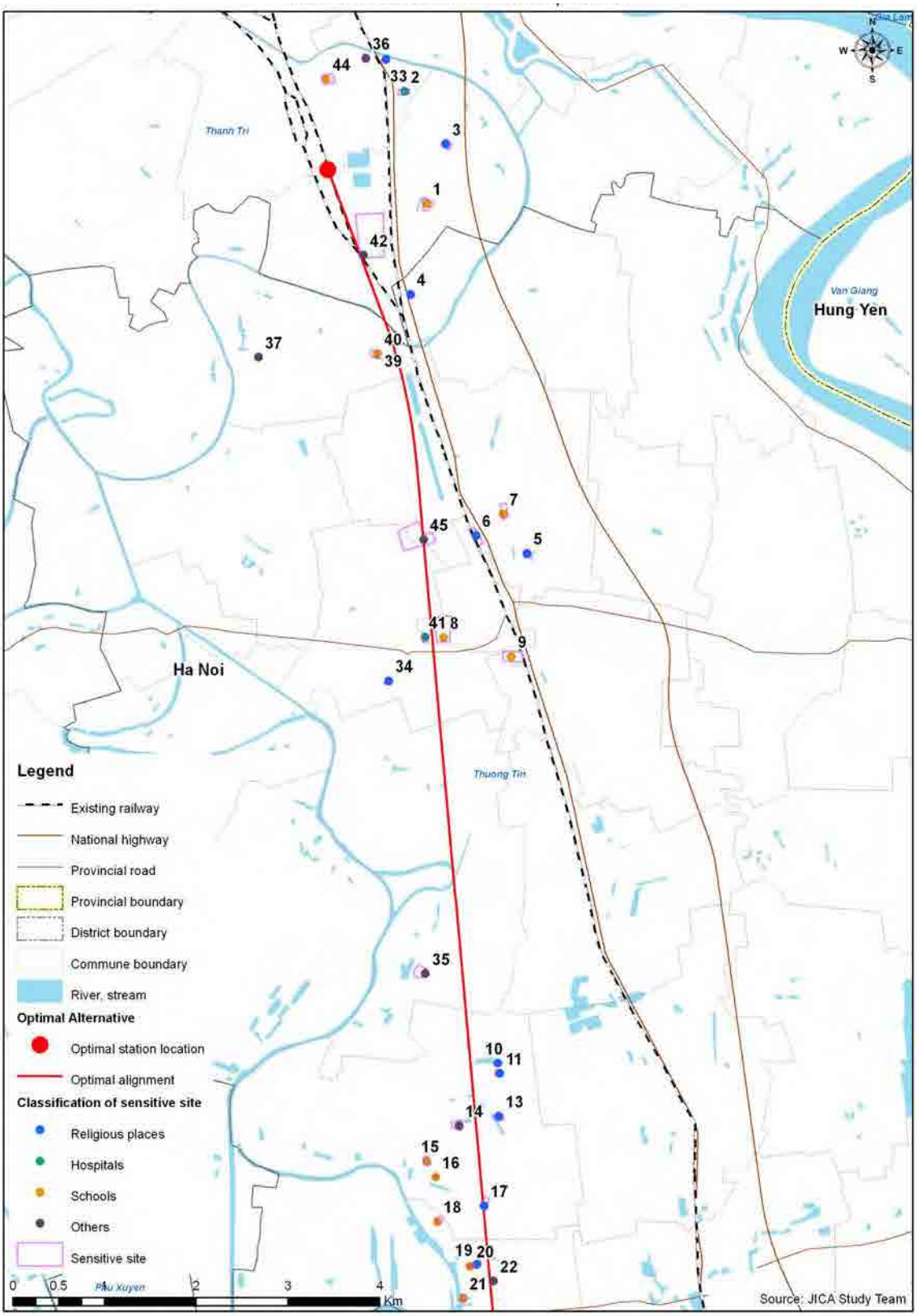
| No | Sites and Facilities | Coordination | Distance to the Alignment (m) | Locality/ Description |
|---|---|---|---|---|
| 7. | Van Binh secondary school | 20°52'48.16"N 105°51'49.09"E | 858 | 1A national highway, , Thuong Tin town, Ha Noi |
| 8. | TV College | 20°52'4.96"N 105°51'26.28"E | 40 | Yen Phu village, Thuong Tin town, Ha Noi |
| 9. | Teacher's colleges | 20°51'58.13"N 105°51'51.85"E | 735 | 1A national highway, , Thuong Tin town, Ha Noi |
| 10. | Hung Khanh pagoda | 20°49'35.80"N 105°51'45.95"E | 264 | Co Chat village, Dung Tien commune, Thuong Tin dist, Ha Noi. |
| 11. | Co Chat temple | 20°49'32.23"N 105°51'46.64"E | 262 | Co Chat village, Dung Tien commune, Thuong Tin dist, Ha Noi. |
| 12. | Dong Cuu temple | 20°49'18.63"N 105°51'38.06"E | 12 | Dong Cuu village, Dung Tien commune, Thuong Tin dist, Ha Noi |
| 13. | Dong Cuu pagoda | 20°49'17.25"N 105°51'46.28"E | 198 | Dong Cuu village, Dung Tien commune, Thuong Tin dist, Ha Noi |
| 14. | Martyrs cemetery at Dung Tien commune | 20°49'13.97"N 105°51'31.15"E | 141 | Dung Tien commune, Thuong Tin dist, Ha Noi |
| 15. | Dung Tien elementary school | 20°49'1.62"N 105°51'18.87"E | 535 | Dung Tien commune, Thuong Tin dist, Ha Noi |
| 16. | Dung Tien kindergarten | 20°48'56.00"N 105°51'22.25"E | 469 | Dung Tien commune, Thuong Tin dist, Ha Noi |
| 17. | Buom pagoda | 20°48'45.82"N 105°51'40.43"E | 0 | Dung Tien commune, Thuong Tin dist, Ha Noi |
| 18. | Nghiem Xuyen secondary school | 20°48'40.39"N 105°51'22.76"E | 444 | Nghiem Xuyen commune, Thuong Tin dist, Ha Noi |
| 19. | Cong Xuyen pagoda | 20°48'25.25"N 105°51'37.54"E | 84 | Cong Xuyen village, Nghiem Xuyen commune, Thuong Tin dist, Ha Noi |
| 20. | Cong Xuyen kindergarten | 20°48'24.63"N 105°51'34.92"E | 177 | Cong Xuyen village, Nghiem Xuyen commune, Thuong Tin dist, Ha Noi |
| 21. | Nghiem Xuyen elementary school | 20°48'13.41"N 105°51'32.21"E | 270 | Cong Xuyen village, Nghiem Xuyen commune, Thuong Tin dist, Ha Noi |
| 22. | Cong Xuyen village well | 20°48'19.42"N 105°51'43.80"E | 25 | Cong Xuyen village, Nghiem Xuyen commune, Thuong Tin dist, Ha Noi |
| 23. | Xuan La village temple | 20°47'5.88"N 105°51'59.24"E | 249 | Xuan La village, Phu Xuyen dist, Ha Noi |
| 24. | Xuan La pagoda | 20°47'0.14"N 105°52'12.55"E | 606 | Xuan La village, Phu Xuyen dist, Ha Noi |
| 25. | Dong Ca pagoda | 20°45'12.66"N 105°52'19.23"E | 52 | Dong Ca village, Tan Dan commune, Phu Xuyen dist, Ha Noi |
| 26. | Thuong Lieu village temple | 20°44'54.25"N 105°52'13.80"E | 234 | Thuong Lieu village, Tan Dan commune, Phu Xuyen dist, Ha Noi |
| 27. | Tan Dan high school | 20°44'25.09"N 105°52'43.19"E | 190 | Tan Dan commune, Phu Xuyen dist, Ha Noi |
| 28. | Le Nhue village temple | 20°44'1.61"N 105°52'30.71"E | 317 | Le Nhue village, Tan Dan commune, Phu Xuyen dist, Ha Noi |
| 29. | Chuon Ha temple | 20°43'43.97"N 105°52'34.28"E | 378 | Chuyen My commune, Phu Xuyen dist, Ha Noi |
| 30. | Ung Cu village pagoda | 20°43'3.50"N 105°52'52.71"E | 467 | Ung Cu village, Van Tu commune, Phu Xuyen dist, Ha Noi |
| 31. | Tu Thuan village temple | 20°42'56.60"N 105°53'17.40"E | 0 | Tu Thuan village, Van Tu commune, Phu Xuyen dist, Ha Noi |
| 32. | Tu Thuan village pagoda | 20°42'49.98"N 105°53'4.36"E | 402 | Tu Thuan village, Van Tu commune, Phu Xuyen dist, Ha Noi |
| 33. | Ngoc Hoi temple and pagoda | 20°55'27.75"N 105°51'05.77"E | 1,200 | national heritage |
| 34. | Yen Phu temple | 20°51'49.98"N 105°37'58.59"E | 570 | Temple |

| No | Sites and Facilities | Coordination | Distance to the Alignment (m) | Locality/ Description |
|---|---|---|---|---|
| 35. | Dau pagoda of national heritage | 20°50'07.30"N 105°51'18.75"E | 420 | National heritage |
| 36. | Victory monument of Ngoc Hoi town | 20°55'28.09"N 105°50'58.14"E | 1,320 | Victory monument |
| 37. | Nguyen Trai monument at Nhi Khe commune | 20°53'43.49"N 105°50'16.99"E | 1,400 | Nguyen Trai monument |
| 38. | Victory monument | 20°41'44.77"N 105°51'18.94"E | 295 | Victory monument |
| 39. | Nguyen Trai school at Nhi Khe commune | 20°53'44.48"N 105°51'01.97"E | 169 | School |
| 40. | Television school | 20°53'44.48"N 105°51'01.97"E | 175 | School |
| 41. | Neurological hospital of Thuong Tin town | 20°52'05.12"N 105°51'19.32"E | 75 | Hospital |
| 42. | Ngoc Linh industrial zone cement factory | 20°54'19.11"N 105°50'56.84"E | 20 | Factory |
| 43. | Ngoc Hoi industrial zone cement factory | 20°16'30.87"N 105°42'21.53"E | 100 | Factory |
| 44. | Ngoc Hoi elementary and secondary school | 20°55'20.86"N 105°50'43.06"E | 512 | School |
| 45. | 220 kV Thuong tin substation and transmission line | 20°52'39.31"N 105°51'18.94"E | Crosses HSR track | Transmission line |

Source: JICA Study Team

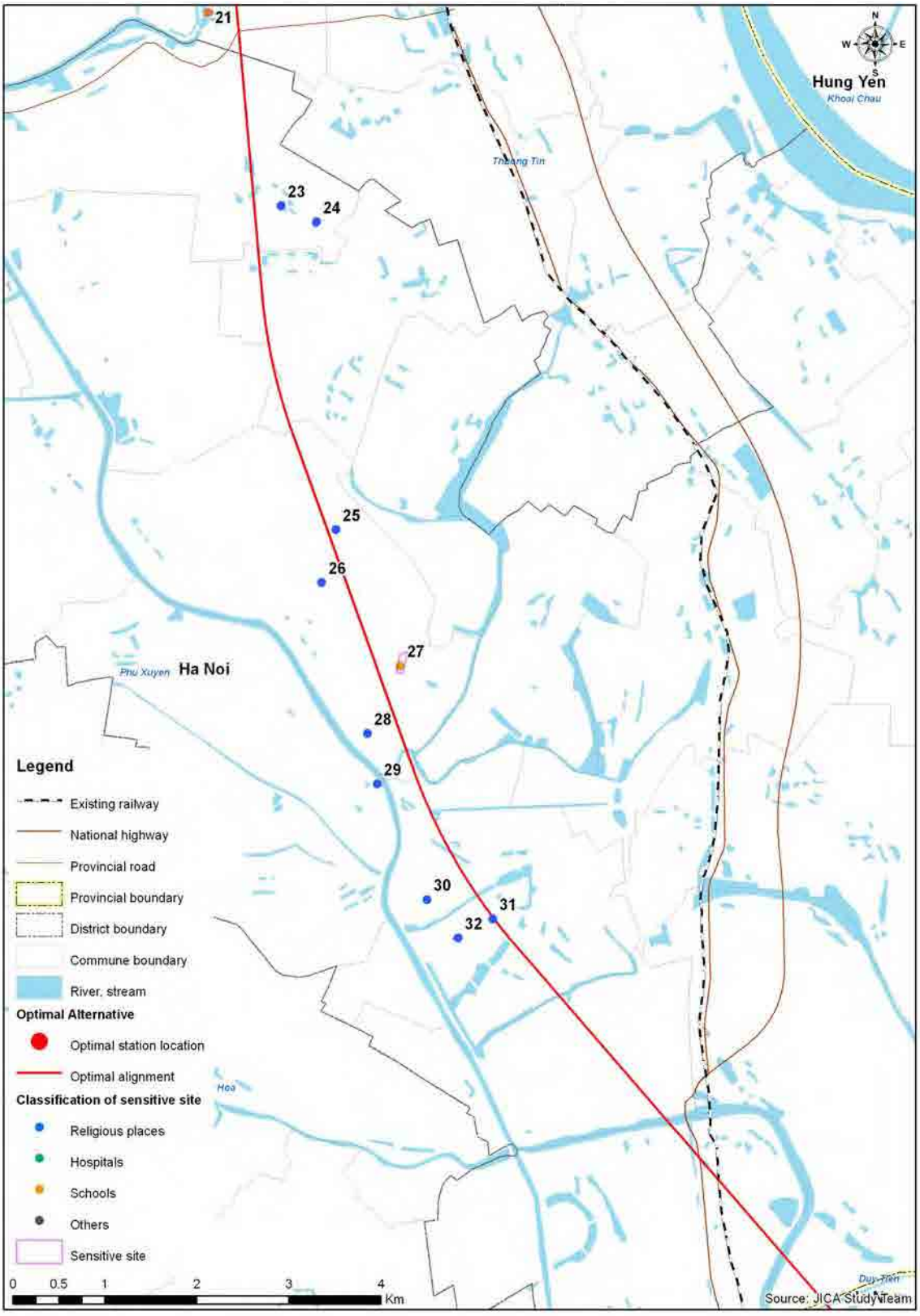
**2)** Map of Identified Major Facitlities and Locations to be Considered for Scoping

2.3 The maps of identified major facilities and locations to be considered for scoping in Hanoi City Section are shown in Figures 4B.1 and 2. Within 200m from the alignment, 6 religious facilities, 5 schools and 1 hospital are identified.




Source：JICA Study Team

**Figure 4B.1 Identified Major Facitlities and Locations to be Considered for Scoping (Hanoi City, 1/2)**




Source：JICA Study Team

**Figure 4B.2 Identified Major Facitlities and Locations to be Considered for Scoping (Hanoi City, 2/2)**

**3)** Map of Tunnel Exit

2.4 There is no tunnel in Hanoi City Section.

## 2.2 Ha Nam Section

### 1) Identified Major Facilities and Locations to be Considered for Scoping

2.5 The identified major facilities and locations to be considered for scoping along alignment are shown in Table 4B.2.

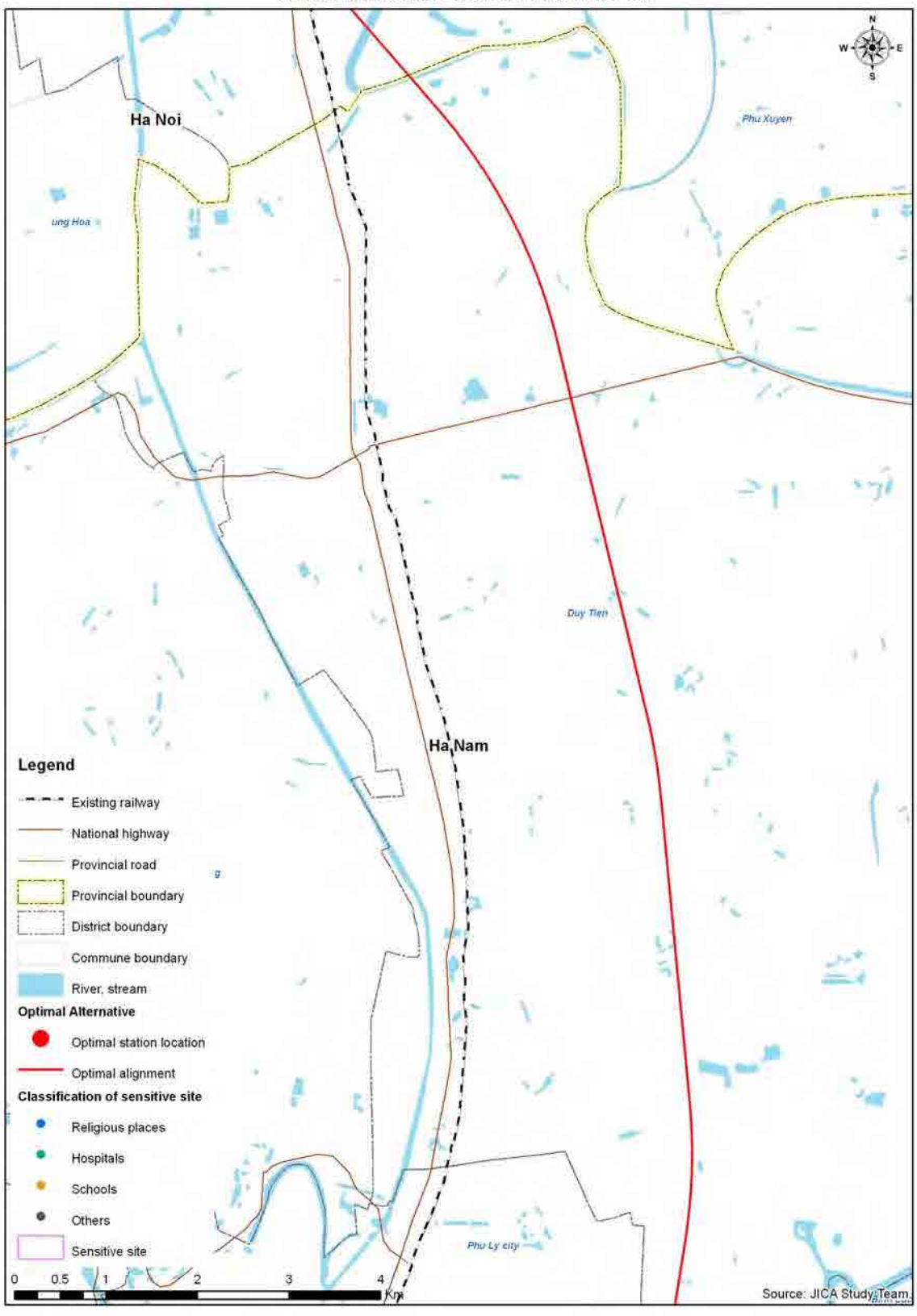
**Table 4B.2 Identified Major Facilities and Locations to be Consoidered for Scoping in Ha Nam Province Section**

| No | Identified Major Facilities and Locations | Coordination | Distance to the Alignment (m) | Locality/ Description |
|---|---|---|---|---|
| 46. | Yen Do church | 20°28'34.63"N 106° 0'51.85"E | 162 | Ha Ngoai village, An Do commune, Binh Luc dist, Ha Nam. |
| 47. | Trung Luong clinics | 20°28'19.90"N 106° 2'37.01"E | 22 | Trung Luong commune , , Binh Luc dist, Ha Nam. |
| 48. | Trung Luong market | 20°28'19.12"N 106° 2'38.82"E | 40 | Trung Luong commune , , Binh Luc dist, Ha Nam. |
| 49. | Lang temple of Le Hoan King | 20°29'51.68"N 105°57'06.22"E | 870 | National heritage |
| 50. | Chay village temple | 20°28'45.28"N 105°58'45.67"E | 330 | National heritage |
| 51. | Van lam temple | 20°31'02.33"N 105°57'09.87"E | 28 | Temple |
| 52. | Pagoda of Dong Tam village | 20°30'19.57"N 105°57'37.85"E | 332 | Pagoda |
| 53. | Pagoda, temple and Martyr's cemetery of Dong Tu village | 20°30'12.24"N 105°57'14.00"E | 380 | Pagoda, temple |
| 54. | Dinh Dien General temple | 20°30'20.37"N 105°57'37.03"E | 330 | Provincial heritage |
| 55. | Coi village temple | 20°29'49.17"N 105°57'40.67"E | 127 | Temple |
| 56. | Lan village temple | 20°29'04.97"N 105°58'14.09"E | 323 | Temple |
| 57. | Song village temple | 20°29'17.77"N 105°58'25.14"E | 173 | Temple |
| 58. | Giua village temple | 20°29'21.57"N 105°58'19.14"E | 148 | Temple - Provincial heritage |
| 59. | Giua village pagoda | 20°29'23.05"N 105°58'16.10"E | 129 | Pagoda - Provincial heritage |
| 60. | Cemetery of Thon Tam village | 20°30'12.18"N 105°57'32.41"E | 83 | Cemetery |
| 61. | Martyr's cemetery of Coi village | 20°29'49.17"N 105°57'40.67"E | 127 | Martyr's cemetery |
| 62. | Martyr's cemetery of Liem Thuan village | 20°29'04.98"N 105°58'12.80"E | 362 | Martyr's cemetery |
| 63. | Cemetery | 20°29'06.59"N 105°58'15.17"E | 354 | Cemetery |
| 64. | School of Lien Con commune | 20°29'52.58"N 105°57'14.26"E | 676 | School |
| 65. | Centre of war invalids care | 20°29'52.58"N 105°57'14.26"E | 10 | Centre of war invalids health care |
| 66. | Neurological hospital of province | 20°31'01.46"N 105°57'10.58"E | 38 | Hospital |
| 67. | School of Lien Liem Thuan commune | 20°29'04.41"N 105°57'53.99"E | 715 | School |
| 68. | Antenna tower | 20°29'05.99"N 105°57'57.11"E | 700 | Antenna tower |

Source: JICA Study Team

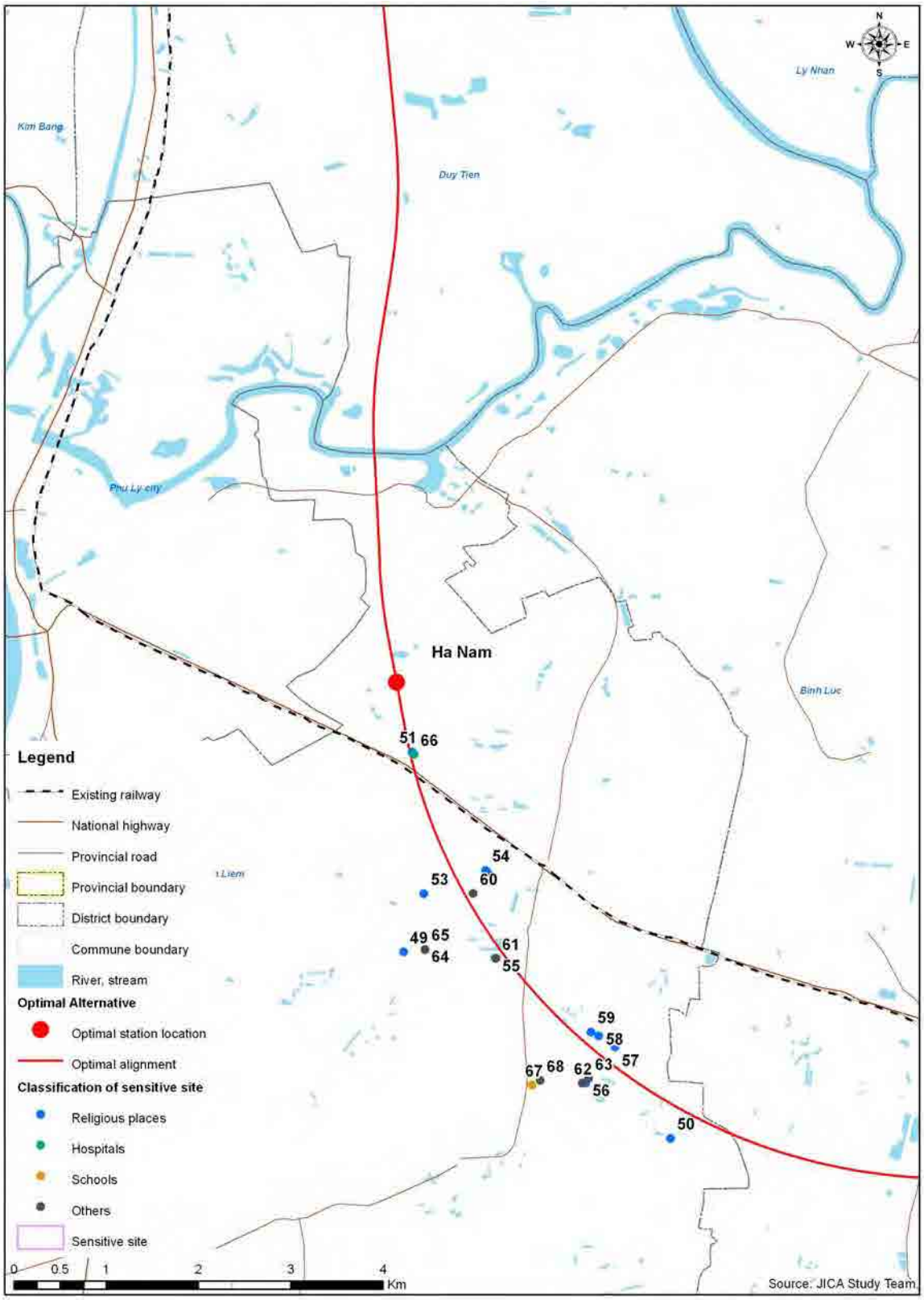
**2)** Map of Identified Major Facitlities and Locations to be Considered for Scoping

2.6 The maps of identified major facitlities and locations to be considered for scoping in Ha Nam Province Section are shown in Figures 4B.3-5. Within 200m from the alignment, 8 religious facilities, 0 school and 3 hospitals are identified.



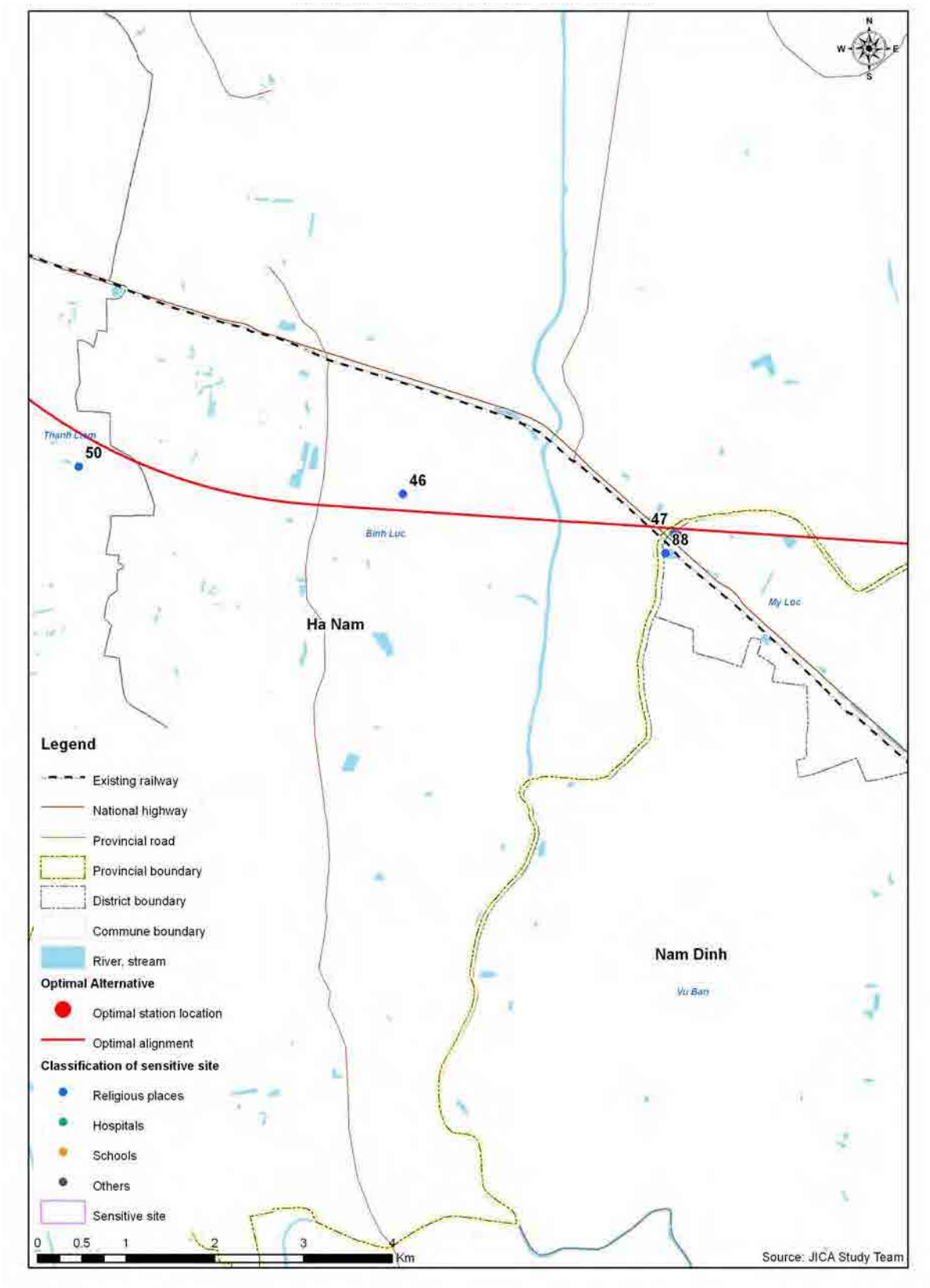

Source: JICA Study Team

**Figure 4B.3 Identified Major Facitlities and Locations to be Considered for Scoping (Ha Nam Province, 1/3)**




Source: JICA Study Team

**Figure 4B.4 Identified Major Facitlities and Locations to be Considered for Scoping (Ha Nam Province, 2/3)**




Source: JICA Study Team

**Figure 4B.5 Identified Major Facitlities and Locations to be Considered for Scoping (Ha Nam Province, 3/3)**

**3)** Map of Tunnel Exit

2.7 There is no tunnel in Ha Nam Province Section.

## 2.3 Nam Dinh Section

### 1) Identified Major Facilities and Locations to be Considered for Scoping

2.8 The identified major facilities and locations to be considered for scoping along alignment are shown in Table 4B.3.

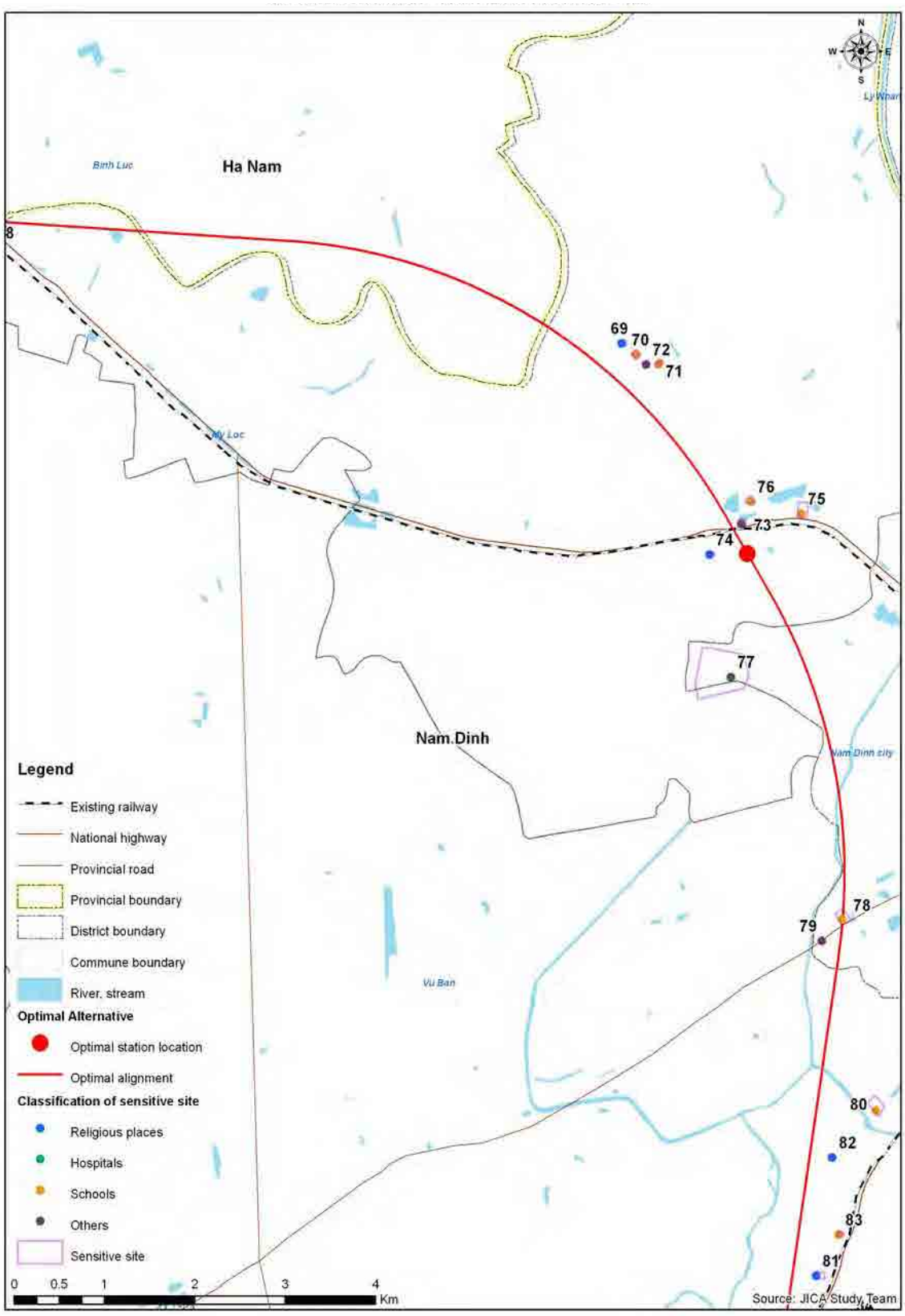
**Table 4B.3 Identified Major Facilities and Locations to be Consoidered for Scoping in Nam Dinh Province Section**

| No | Identified Major Facilities and Locations | Coordination | Distance to the Alignment (m) | Locality/ Description |
|---|---|---|---|---|
| 69. | La Cho pagoda | 20°27'37.42"N 106° 6'34.75"E | 306 | Mi Tien commune, My Loc dist, Nam Dinh. |
| 70. | Mi Tien kindergarten | 20°27'33.44"N 106° 6'40.07"E | 311 | Mi Tien commune, My Loc dist, Nam Dinh. |
| 71. | Mi Tien secondary school | 20°27'30.22"N 106° 6'49.01"E | 315 | Mi Tien commune, My Loc dist, Nam Dinh. |
| 72. | Mi Tien commune PC | 20°27'29.89"N 106° 6'44.02"E | 392 | Mi Tien commune, My Loc dist, Nam Dinh. |
| 73. | My Loc post office | 20°26'33.66"N 106° 7'20.02"E | 71 | My Loc town, My Loc dist, Nam Dinh. |
| 74. | Van Don pagoda | 20°26'23.02"N 106° 7'7.72"E | 308 | My Loc town, My Loc dist, Nam Dinh. |
| 75. | My Loc high school | 20°26'37.14"N 106° 7'42.86"E | 689 | My Loc town, My Loc dist, Nam Dinh. |
| 76. | My Loc secondary school | 20°26'41.53"N 106° 7'23.66"E | 263 | My Loc town, My Loc dist, Nam Dinh. |
| 77. | Nam Dinh waste treatment plant | 20°25'40.08"N 106° 7'15.68"E | 600 | Loc Hoa commune, Nam Dinh city |
| 78. | Nam Dinh colleges | 20°24'14.76"N 106° 7'57.53"E | 0 | Road 486, My Xa commune, Nam Dinh city. |
| 79. | Mai Xa market | 20°24'7.28"N 106° 7'49.63"E | 183 | Road 486, Mai Xa village, My Xa commune, Nam Dinh city. |
| 80. | Nam Dinh industrial college | 20°23'7.56"N 106° 8'9.81"E | 555 | Road 10, Lien Bao commune, Vu Ban dist, Nam Dinh |
| 81. | Trinh Xuyen church | 20°22'9.68"N 106° 7'46.57"E | 256 | Road 10, Lien Bao commune, Vu Ban dist, Nam Dinh |
| 82. | Church at Trinh Xuyen village | 20°22'51.19"N 106° 7'53.05"E | 204 | Lien Bao commune, Vu Ban dist, Nam Dinh |
| 83. | Lien Bao elementary school | 20°22'24.07"N 106° 7'55.34"E | 425 | Lien Bao commune, Vu Ban dist, Nam Dinh |
| 84. | Nguyen Duc Thuan high school | 20°21'53.82"N 106° 7'59.26"E | 591 | Thanh Loi commune, Vu Ban dist, Nam Dinh |
| 85. | Yen Cuong secondary school | 20°17'1.74"N 106° 5'26.25"E | 82 | Yen Cuong commune, Y Yen dist, Nam Dinh. |
| 86. | Yen nhan temple | 20°15'56.84"N 105°04'24.44"E | 482 | Temple |
| 87. | Vinh Tri church | 20°14'42.84"N 105°03'10.32"E | 501 | Church |
| 88. | Thuong Dong church | 20°28'22.53"N 105°02'33.02"E | 286 | Church |
| 89. | Yen Nhan schools | 20°15'49.00"N 106°04'36.63"E | 60 | School |
| 90. | Trinh family cemetery | 20°15'52.54"N 106°04'37.45"E | 96 | Cemetery |
| 91. | Cemetery | 20°15'31.85"N 106°04'28.90"E | 0 | Cemetery |
| 92. | Cemetery | 20°15'25.20"N 106° 4'26.26"E | 79 | Cemetery |

Source: JICA Study Team

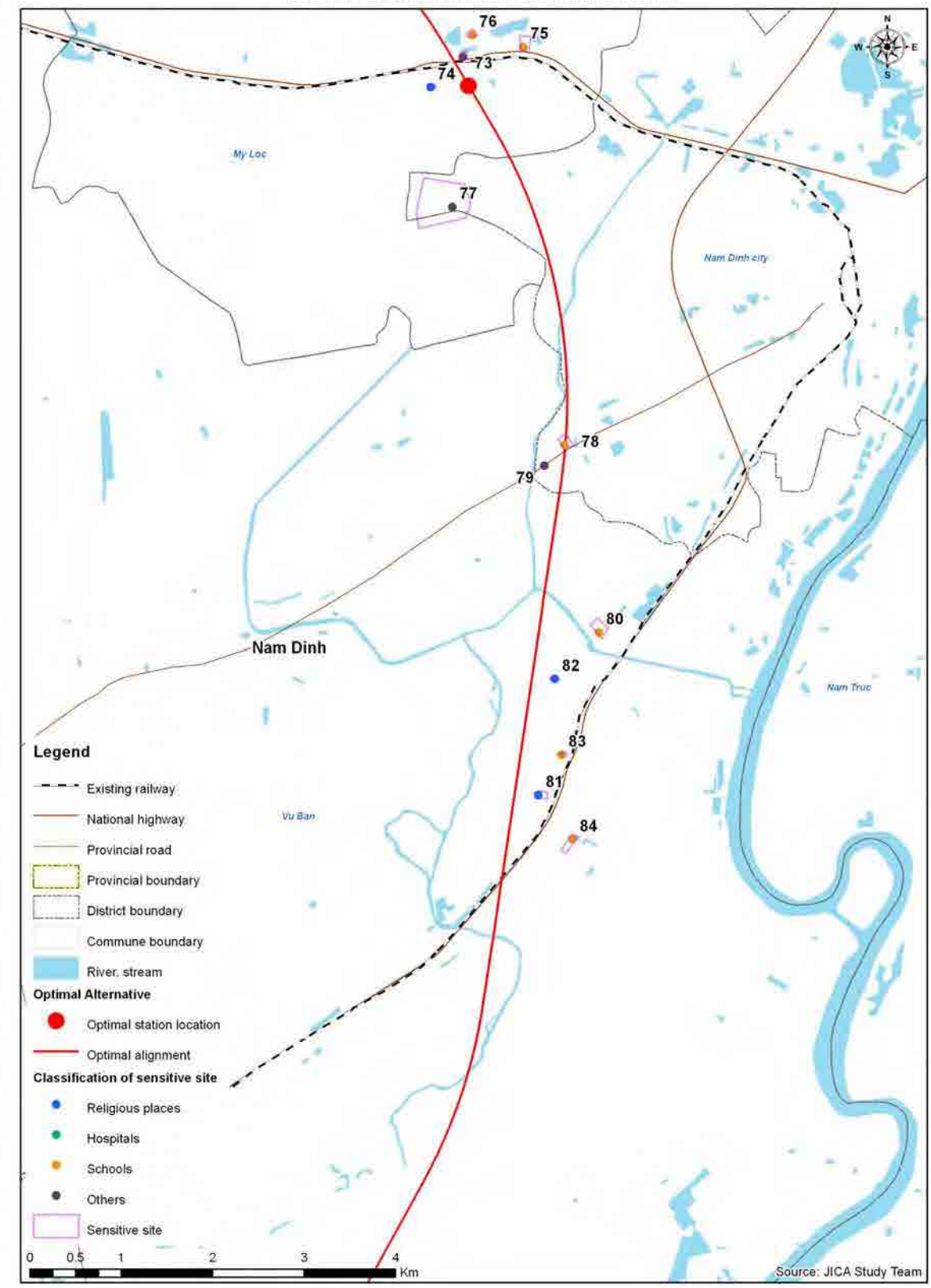
**2)** Map of Identified Major Facitlities and Locations to be Considered for Scoping

2.9 The maps of identified major facitlities and locations to be considered for scoping in Nam Dinh Province Section are shown in Figures 4B.6-8. Within 200m from the alignment, 3 religious facilities, 3 schools and 0 hospital are identified.



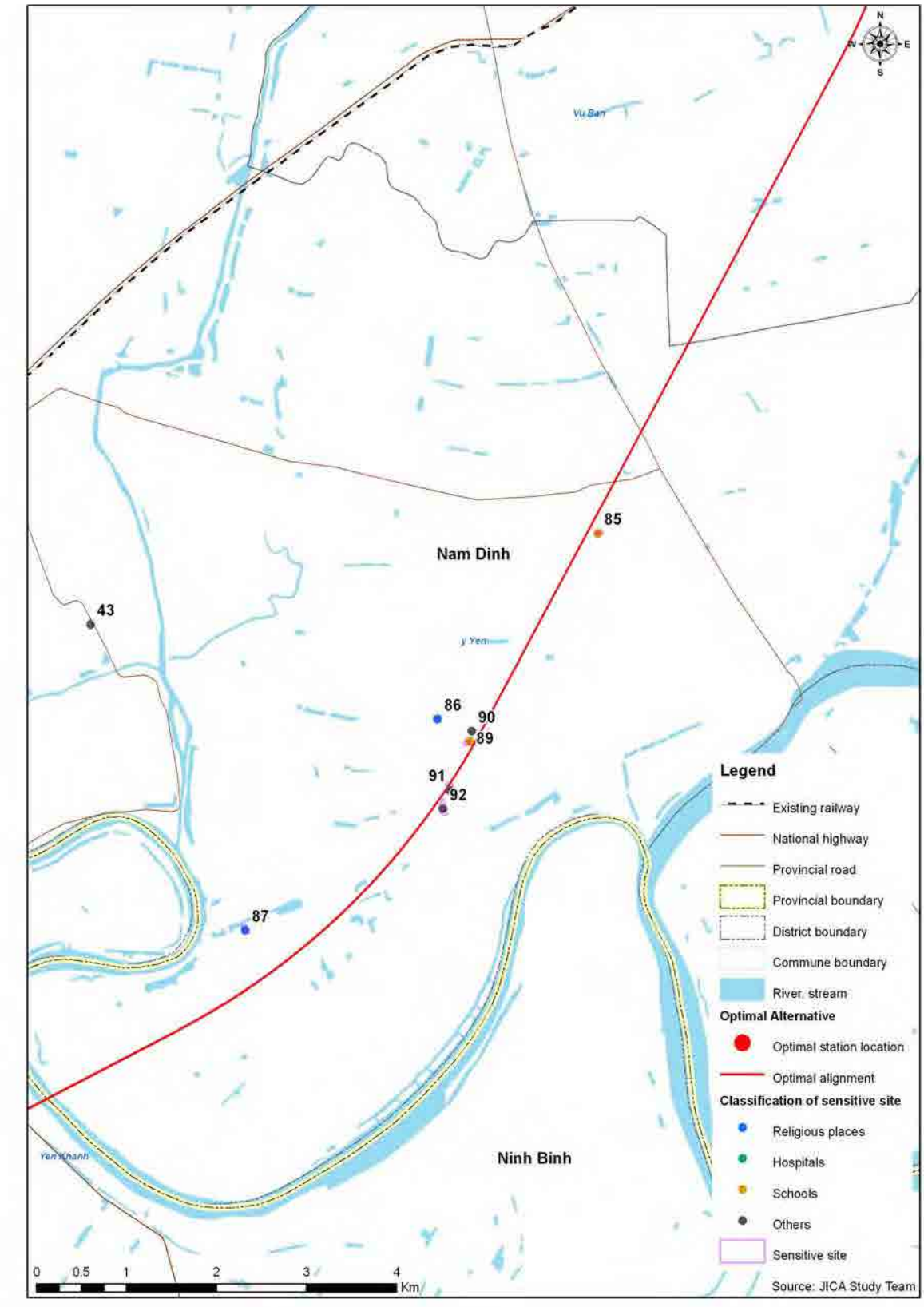

Source: JICA Study Team

**Figure 4B.6 Identified Major Facitlities and Locations to be Considered for Scoping (Nam Dinh Province, 1/3)**




Source: JICA Study Team

**Figure 4B.7 Identified Major Facitlities and Locations to be Considered for Scoping (Nam Dinh Province, 2/3)**




Source: JICA Study Team

**Figure 4B.8 Identified Major Facitlities and Locations to be Considered for Scoping (Nam Dinh Province, 3/3)**

**3)** Map of Tunnel Exit

2.10 There is no tunnel in Nam Dinh Province Section.

## 2.4 Ninh Binh Province Section

### 1) Identified Major Facilities and Locations to be Considered for Scoping

2.11 The identified major facilities and locations to be considered for scoping along alignment are shown in Table 4B.4.

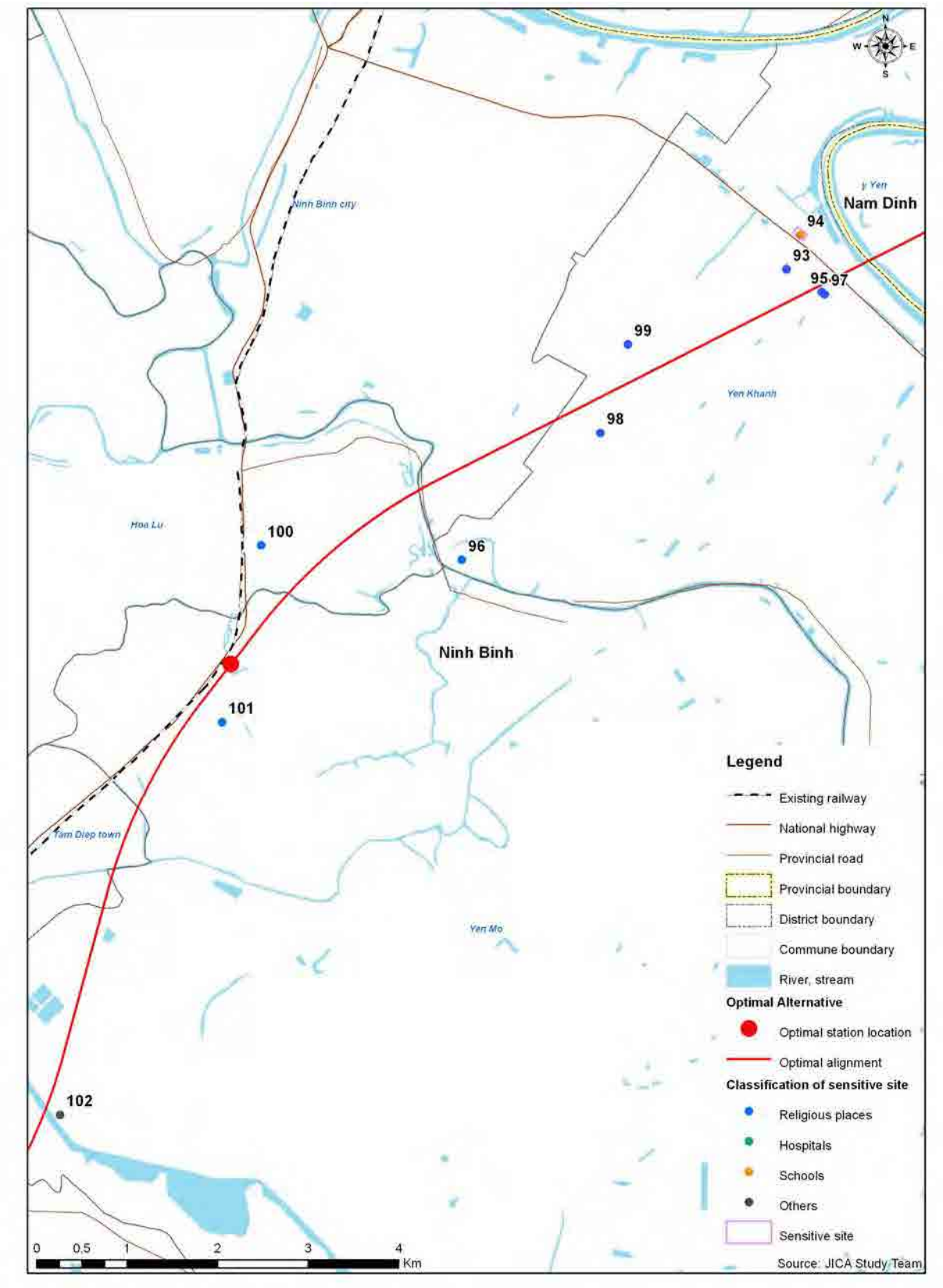
**Table 4B.4 Identified Major Facilities and Locations to be Consoidered for Scoping in Ninh Binh Province Section**

| No | Identified Major Facilities and Locations | Coordination | Distance to the Alignment (m) | Locality/ Description |
|---|---|---|---|---|
| 93. | Yen Khanh church | 20°13'41.08"N 106° 1'22.70"E | 308 | Khanh Phu commune, Yen Khanh dist, Ninh Binh |
| 94. | Khanh Phu elementary school | 20°13'53.37"N 106° 1'28.05"E | 530 | Khanh Phu commune, Yen Khanh dist, Ninh Binh |
| 95. | Tam Thanh temple at Yen Lu village | 20°13'32.79"N 105°01'36.10"E | 67 | National heritage |
| 96. | Dong Hoi temple | 20°11'57.14"N 105°59'18.43"E | 900 | National heritage |
| 97. | Pagoda of yen Lu village | 20°13'32.01"N 105°01'37.19"E | 111 | Pagoda |
| 98. | Khoai Thuong temple | 20°12'42.59"N 105°00'11.39"E | 353 | Provincial heritage |
| 99. | Xuan Binh temple | 20°13'14.36"N 105°00'22.15"E | 387 | Provincial heritage |
| 100. | Church at Xuan Mai village | 20°11'44.31"N 105°58'02.03"E | 203 | Church |
| 101. | Trung Son temple | 20°10'59.31"N 105°57'46.76"E | 319 | Provincial heritage |
| 102. | Yen Thang reservoir | 20°08'50.84"N 105°56'35.39"E | 215 | Reservoir |

Source: JICA Study Team

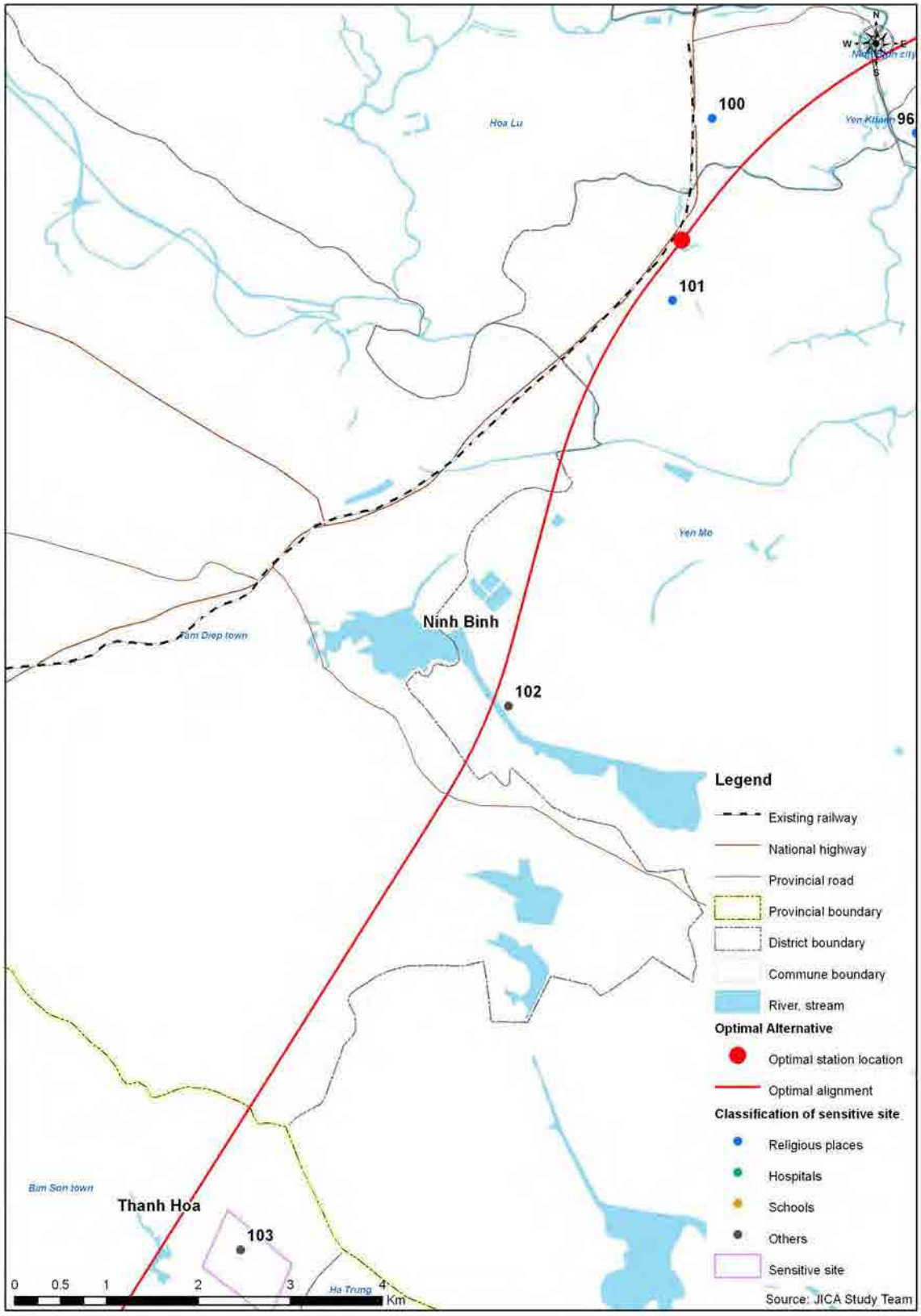
### 2) Map of Identified Major Facitlities and Locations to be Considered for Scoping

2.12 The maps of identified major facitlities and locations to be considered for scoping in Ninh Binh Province Section are shown in Figures 4B.9 and 10. Within 200m from the alignment, 2 religious facilities, 0 school and 0 hospital are identified.




Source: JICA Study Team

**Figure 4B.9 Identified Major Facitlities and Locations to be Considered for Scoping (Ninh Binh Province, 1/2)**




Source: JICA Study Team

**Figure 4B.10 Identified Major Facitlities and Locations to be Considered for Scoping (Ninh Binh Province, 2/2)**

**3)** Map of Tunnel Exit

2.13 One tunnel is planned in Ninh Binh Province Section as shown in Figure 4B.11. It is identified that one building located within the boundary of 200m from the exit of the tunnel.

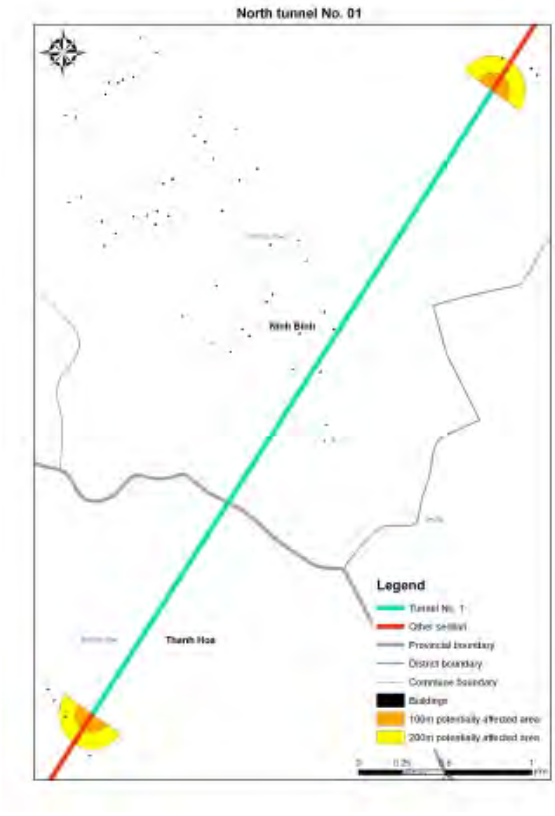



**Figure 4B.11 Tunnel in Ninh Binh Province**

Source: JICA Study Team

## 2.5 Thanh Hoa Province Section

### 1) Identified Major Facilities and Locations to be Considered for Scoping

2.14 The identified major facilities and locations to be considered for scoping along alignment are shown in Table 4B.5.

**Table 4B.5 Identified Major Facilities and Locations to be Consoidered for Scoping in Thanh Hoa Province Section**

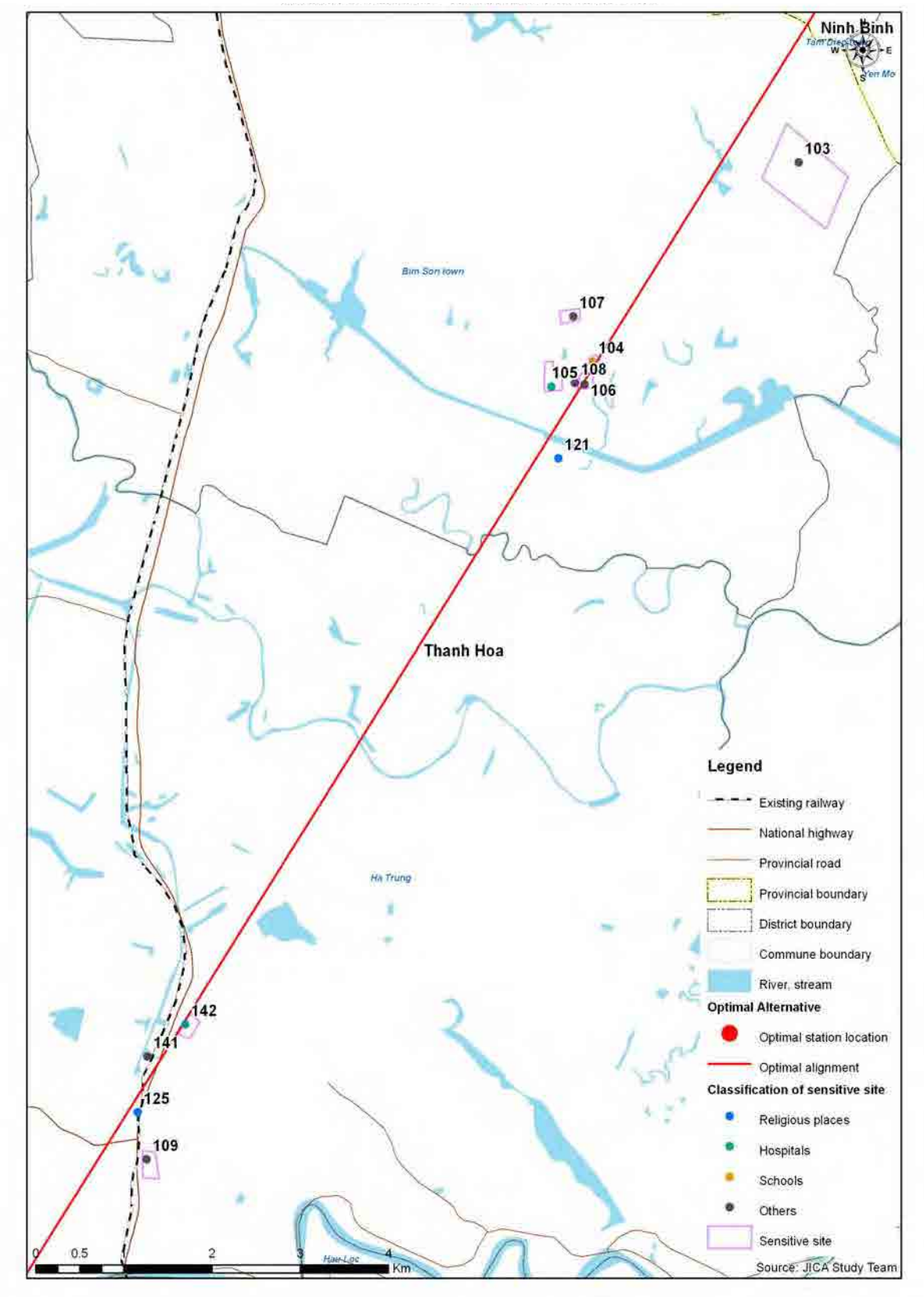
| No | Identified Major Facilities and Locations | Coordination | Distance to the Alignment (m) | Locality/ Description |
|---|---|---|---|---|
| 103. | Dong Son quarry | 20°5'28.99"N 105°55'2.91"E | 409 | Dong Son commune, Bim Son town, Thanh Hoa. |
| 104. | Xi mang Bim Son secondary school | 20°4'17.63"N 105°53'41.97"E | 0 | Dong Son commune, Bim Son town, Thanh Hoa. |
| 105. | Bim Son Hospital | 20°4'8.78"N 105°53'25.78"E | 166 | Dong Son commune, Bim Son town, Thanh Hoa |
| 106. | Lam Son stadium | 20°4'9.49"N 105°53'38.84"E | 0 | Dong Son commune, Bim Son town, Thanh Hoa |
| 107. | Middle school of Building | 20°4'34.00"N 105°53'34.56"E | 406 | Dong Son commune, Bim Son town, Thanh Hoa. |
| 108. | Lam Son super Market | 20° 4'10.02"N 105°53'35.05"E | 55 | Dong Son commune, Bim Son town, Thanh Hoa |
| 109. | Ha Trung stadium | 19°59'31.65"N 105°50'46.27"E | 379 | 1A National highway, Ha Trung town, Ha Trung dist, Thanh Hoa. |
| 110. | Dai Khoi kindergarten | 19°50'38.03"N 105°45'25.81"E | 41 | Dai Khoi commune, Dong Cuong dist, Thanh Hoa |
| 111. | Temple of Dr.Tran Ba Tan at Dong tan commune | 19°48'17.16"N 105°44'30.99"E | 1,070 | National heritage |
| 112. | Con pagoda at Dong tan commune | 19°48'22.80"N 105°44'26.38"E | 1,200 | Pagoda |
| 113. | Quan Thanh pagoda at Dong tan commune | 19°47'45.02"N 105°44'55.42"E | 282 | National heritage |
| 114. | Thuong temple at Dong tan commune | 19°47'45.02"N 105°44'55.42"E | 308 | National heritage |
| 115. | Nam cau Pagoda at Dong tan commune | 19°47'42.97"N 105°44'54.05"E | 321 | Pagoda |
| 116. | Tomb of Duke Le Trung Trac at Nhoi town | 19°47'50.25"N 105°45'10.01"E | 126 | National heritage |
| 117. | Gia Pagoda at Hoang Phuong commune | 19°54'00.80"N 105°46'08.89"E | 680 | National heritage |
| 118. | Phu Mo and To Hien Thanh, Tran Khat Chan temples at Hoang Phuong commune | 19°54'16.25"N 105°46'09.85"E | 883 | National heritage |
| 119. | Church of Hoang Phuong commune | 19°54'11.79"N 105°46'12.21"E | 749 | Church |
| 120. | Temple of Phuong Mao, Hoang Phuong commune | 19°54'04.20"N 105°47'05.82"E | 787 | National heritage |
| 121. | Temple of Cho Gao village, Ha Lan commune | 20°03'42.94"N 105"53'28.47"E | 223 | National heritage |
| 122. | Temple of General Ly Thuong Kiet, Ha Ngoc commune | 19°58'24.15"N 105"49'45.67"E | 133 | National heritage |
| 123. | Nguong Son mountain and Linh Xung pagoda, Ha Ngoc commune | 19°58'25.02"N 105"49'45.35"E | 126 | Provicial heritage |

| No | Identified Major Facilities and Locations | Coordination | Distance to the Alignment (m) | Locality/ Description |
|---|---|---|---|---|
| 124. | Tran temple, Ha Ngoc commune | 19°58'24.84"N 105°49'48.64"E | 201 | Provicial heritage |
| 125. | Phu Trung temple | 19°59'48.60"N 105°50'42.89"E | 108 | Temple |
| 126. | Nui Nap Martyr cemetery of Voluntary Young people at Dong Hung commune, Thanh Hoa city | 19°47'14.87"N 105°44'59.87"E | 60 | National heritage |
| 127. | Martyr cemetery of Dong Hung commune, Thanh Hoa city | 19°47'32.86"N 105°45'13.82"E | 291 | Martyr cemetery |
| 128. | School of Dong Hung commune | 19°47'36.07"N 105°45'12.72"E | 377 | School |
| 129. | School of An Hoach ward, Nhoi town | 19°47'57.85"N 105°45'08.42"E | 61 | School |
| 130. | Cemetery of Dong Tan commune | 19°48'22.28"N 105°45'25.49"E | 514 | cemetery |
| 131. | Antenna tower at An Hoach ward, Nhoi town | 19°47'59.14"N 105°45'07.43"E | 26 | Antenna tower |
| 132. | Clinic of border army forces | 19°48'19.87"N 105°44'34.43"E | 997 | Clinic |
| 133. | Irrigation pump station of Dong Tan commune | 19°48'13.92"N 105°44'41.46"E | 759 | Irrigation facility |
| 134. | Dam of Yen My reservoir of Tinh Gia district | 19°29'32.37"N 105°40'01.13"E | 290 | Dam |
| 135. | Schools of Hoang Phuong commune | 19°54'04.78"N 105°46'26.60"E | 284 | School |
| 136. | Cemetery of Hoang Phuong commune | 19°54'10.69"N 105°47'30.08"E | 1,040 | cemetery |
| 137. | Cemetery of Hoang Xuan commune | 19°54'43.60"N 105°47'37.32"E | 1,080 | cemetery |
| 138. | Schools of Hoang Xuan commune | 19°54'40.25"N 105°46'13.25"E | 1,145 | School |
| 139. | Martyr cemetery of Ha Ngoc commune | 19°58'23.42"N 105°49'45.35"E | 184 | Martyr cemetery |
| 140. | Antenna tower at Ha Ngoc commune | 19°58'26.55"N 105°49'45.99"E | 80 | Antenna tower |
| 141. | 110 kV transmission line and substation | 20°00'08.70"N 105°50'46.86"E | 148 | Transmission line |
| 142. | Hospital of Ha Trung town | 20°00'20.23"N 105°50'57.36"E | 77 | Hospital |

Source: JICA Study Team

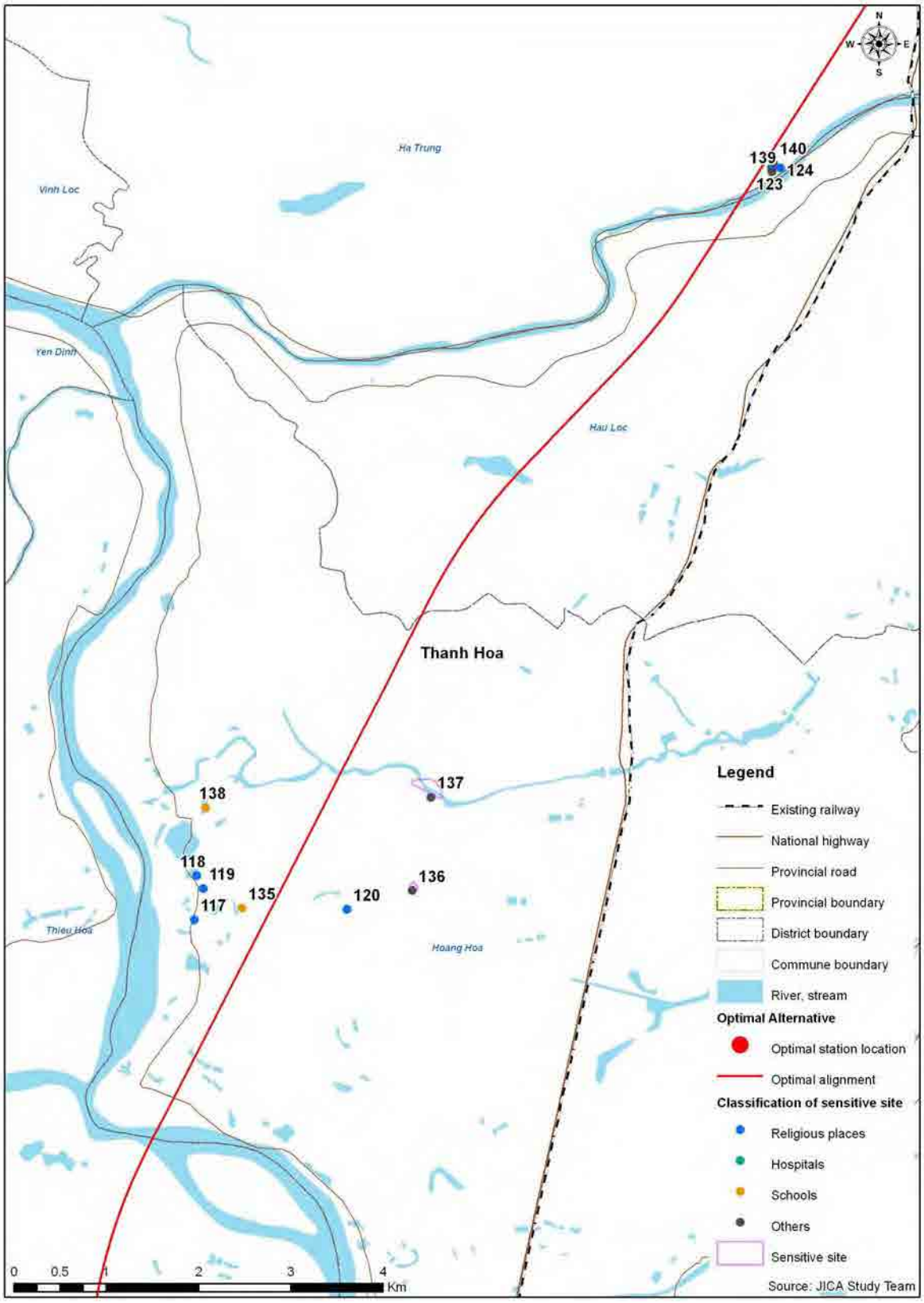
**2)** Map of Identified Major Facitlities and Locations to be Considered for Scoping

2.15 The maps of identified major facitlities and locations to be considered for scoping in Thanh Hoa Province Section are shown in Figures 4B.12-17. Within 200m from the alignment, 6 religious facilities, 3 schools and 2 hospital are identified.



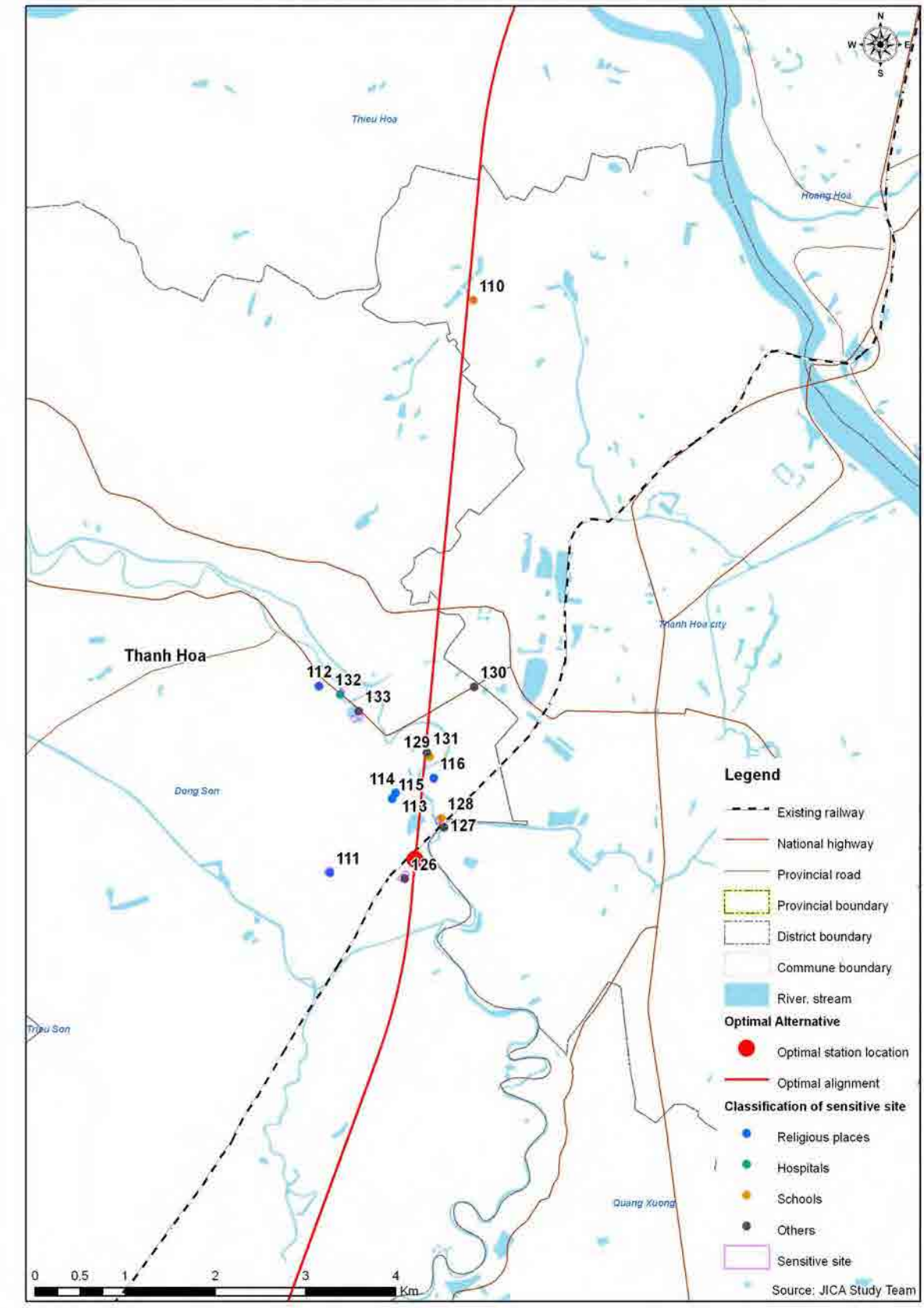

Source: JICA Study Team

**Figure 4B.12 Identified Major Facitlities and Locations to be Considered for Scoping (Thanh Hoa Province, 1/6)**



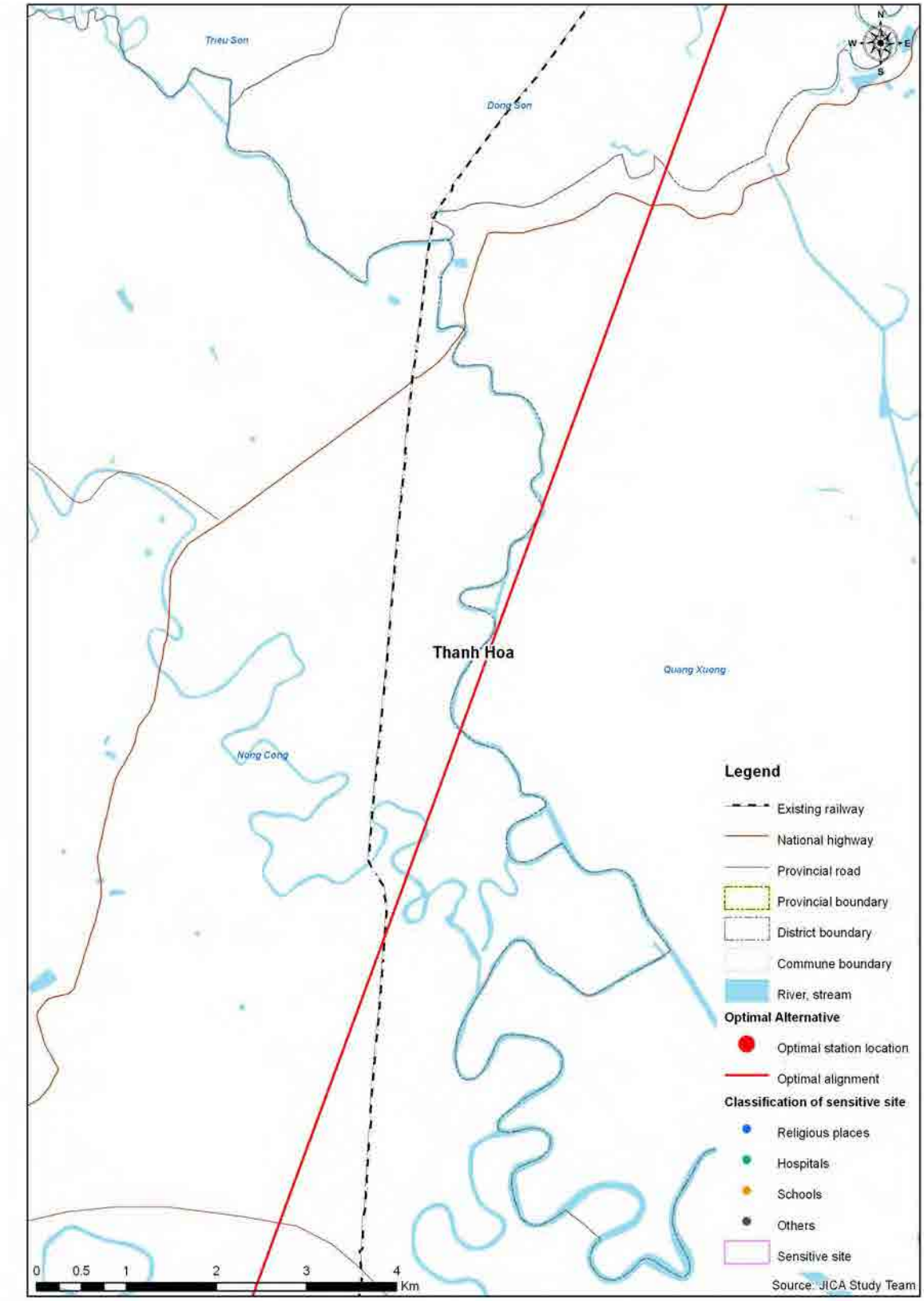

Source: JICA Study Team

**Figure 4B.13 Identified Major Facitlities and Locations to be Considered for Scoping (Thanh Hoa Province, 2/6)**



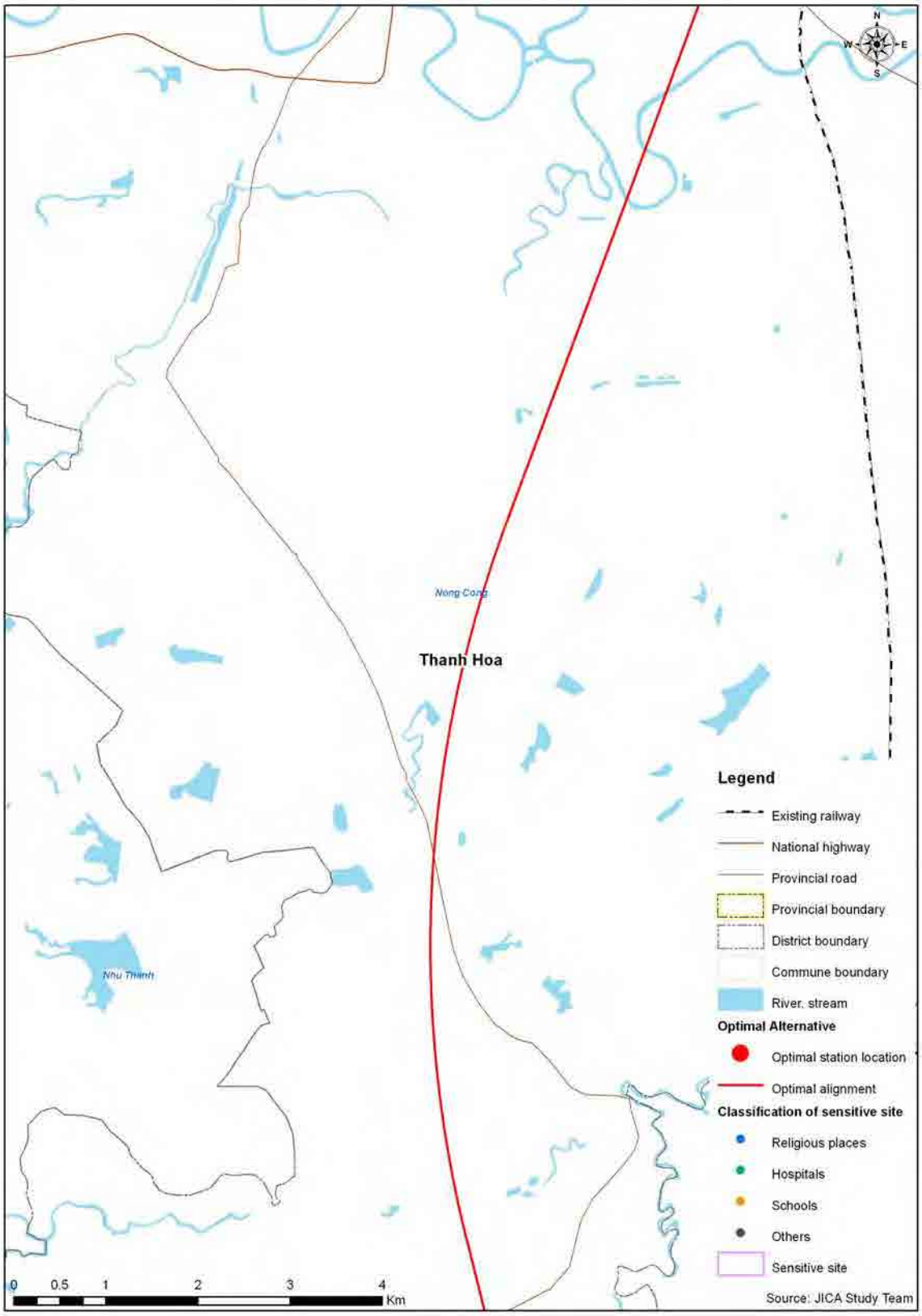

Source: JICA Study Team

**Figure 4B.14 Identified Major Facitlities and Locations to be Considered for Scoping (Thanh Hoa Province, 3/6)**



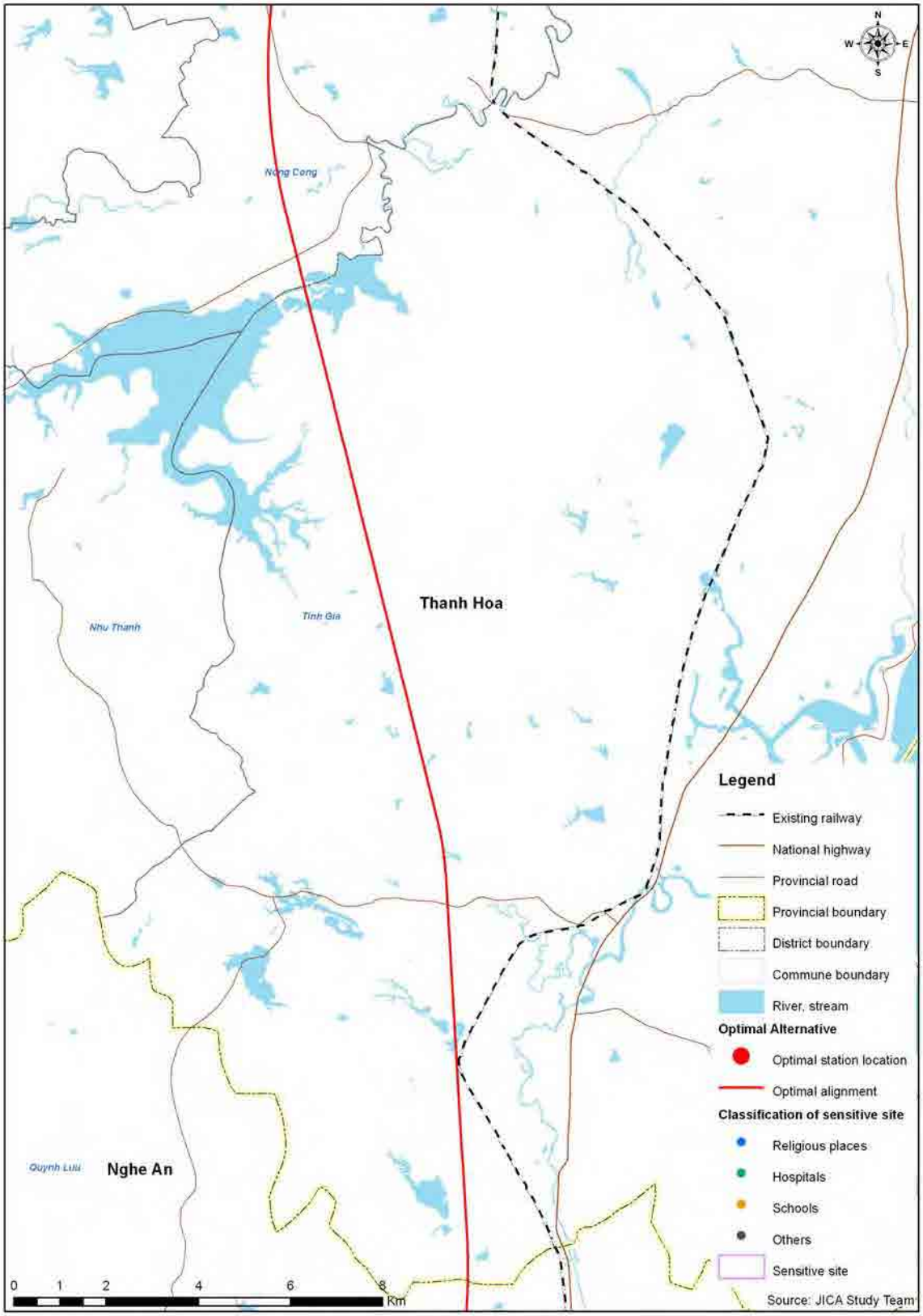

Source: JICA Study Team

**Figure 4B.15 Identified Major Facitlities and Locations to be Considered for Scoping (Thanh Hoa Province, 4/6)**




Source: JICA Study Team

**Figure 4B.16 Identified Major Facitlities and Locations to be Considered for Scoping (Thanh Hoa Province, 5/6)**




Source: JICA Study Team

**Figure 4B.17 Identified Major Facitlities and Locations to be Considered for Scoping (Thanh Hoa Province, 6/6)**

**3)** Map of Tunnel Exit

2.16 Seven tunnels are planned in Thanh Hoa Province Section as shown in Figures 4B.18-24. It is identified that buildings are located within the boundary of 100m from the exits of tunnels in Figures 4B.19 and 20.

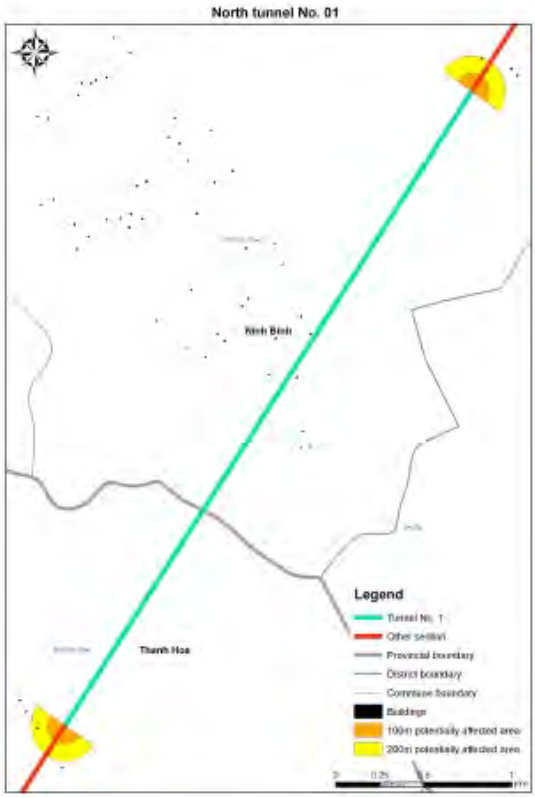



**Figure 4B.18 Tunnel in Thanh Hoa Province**

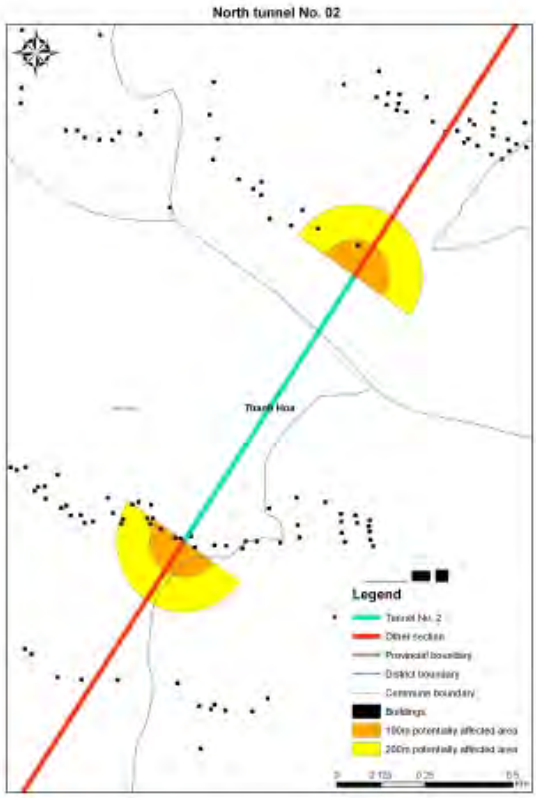



**Figure 4B.19 Tunnel in Thanh Hoa Province**

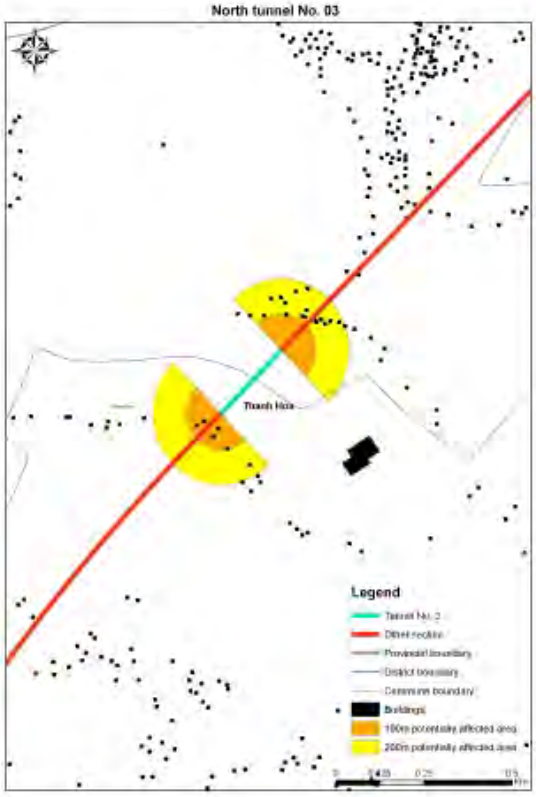



**Figure 4B.20 Tunnel in Thanh Hoa Province**

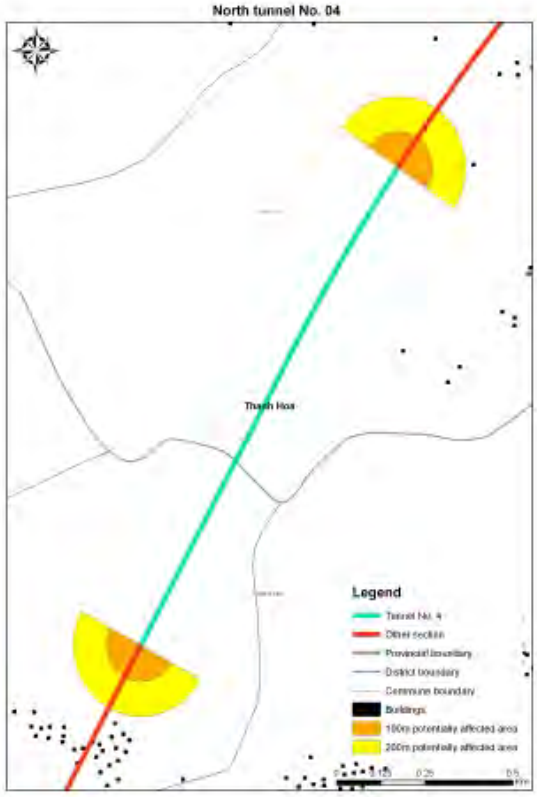



**Figure 4B.21 Tunnel in Thanh Hoa Province**

Source: JICA Study Team

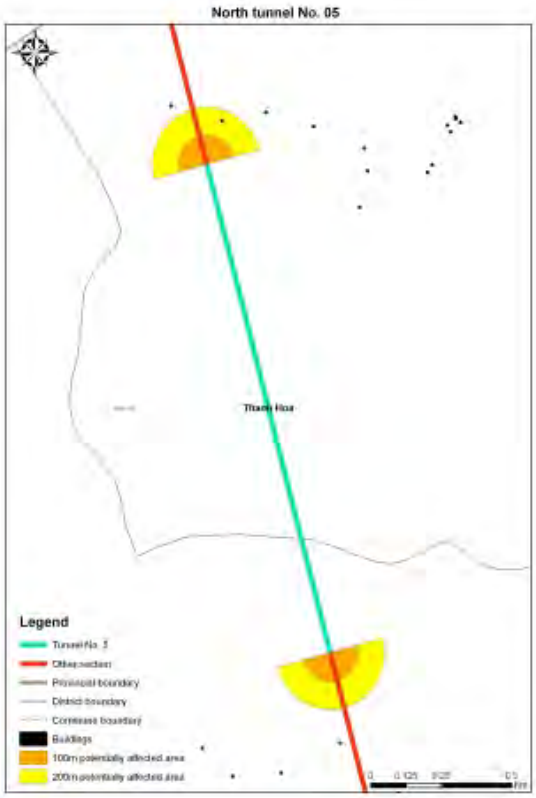



**Figure 4B.22 Tunnel in Thanh Hoa Province**

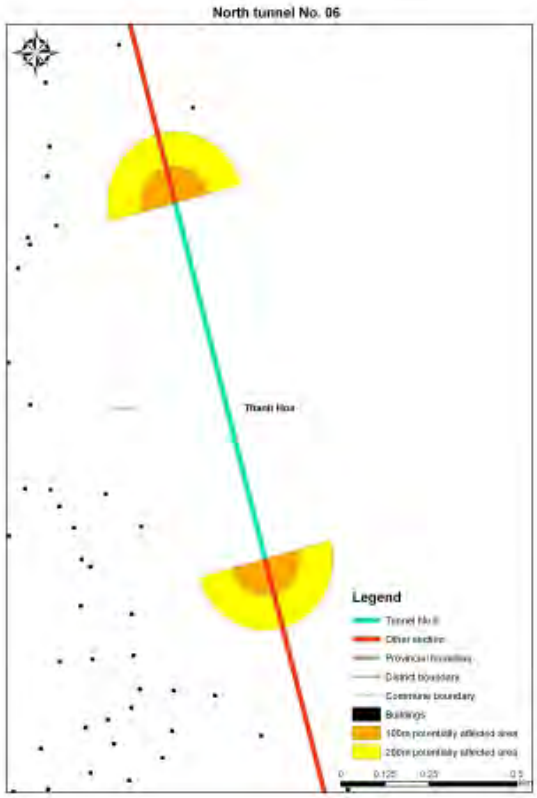



**Figure 4B.23 Tunnel in Thanh Hoa Province**

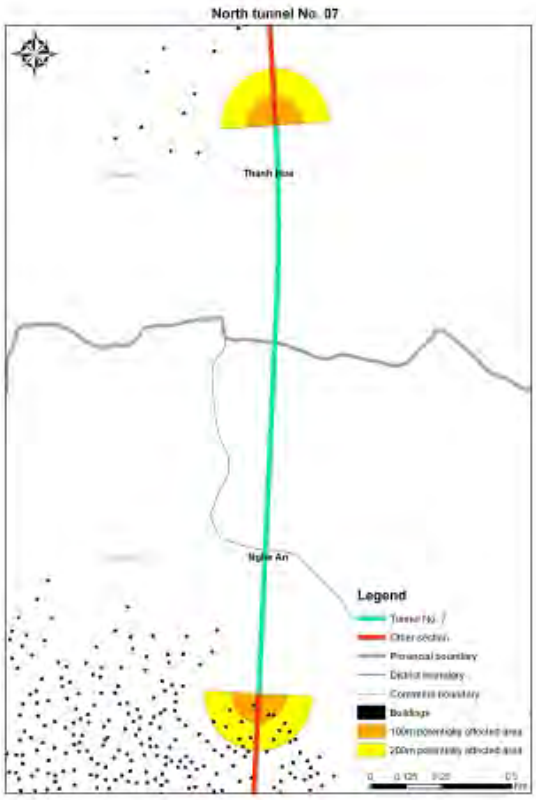



**Figure 4B.24 Tunnel in Thanh Hoa Province**

Source: JICA Study Team

## 2.6 Nghe An Section

### 1) Identified Major Facilities and Locations to be Considered for Scoping

2.17 The identified major facilities and locations to be considered for scoping along alignment are shown in Table 4B.6.

**Table 4B.6 Identified Major Facilities and Locations to be Consoidered for Scoping in Nghe An Province Section**

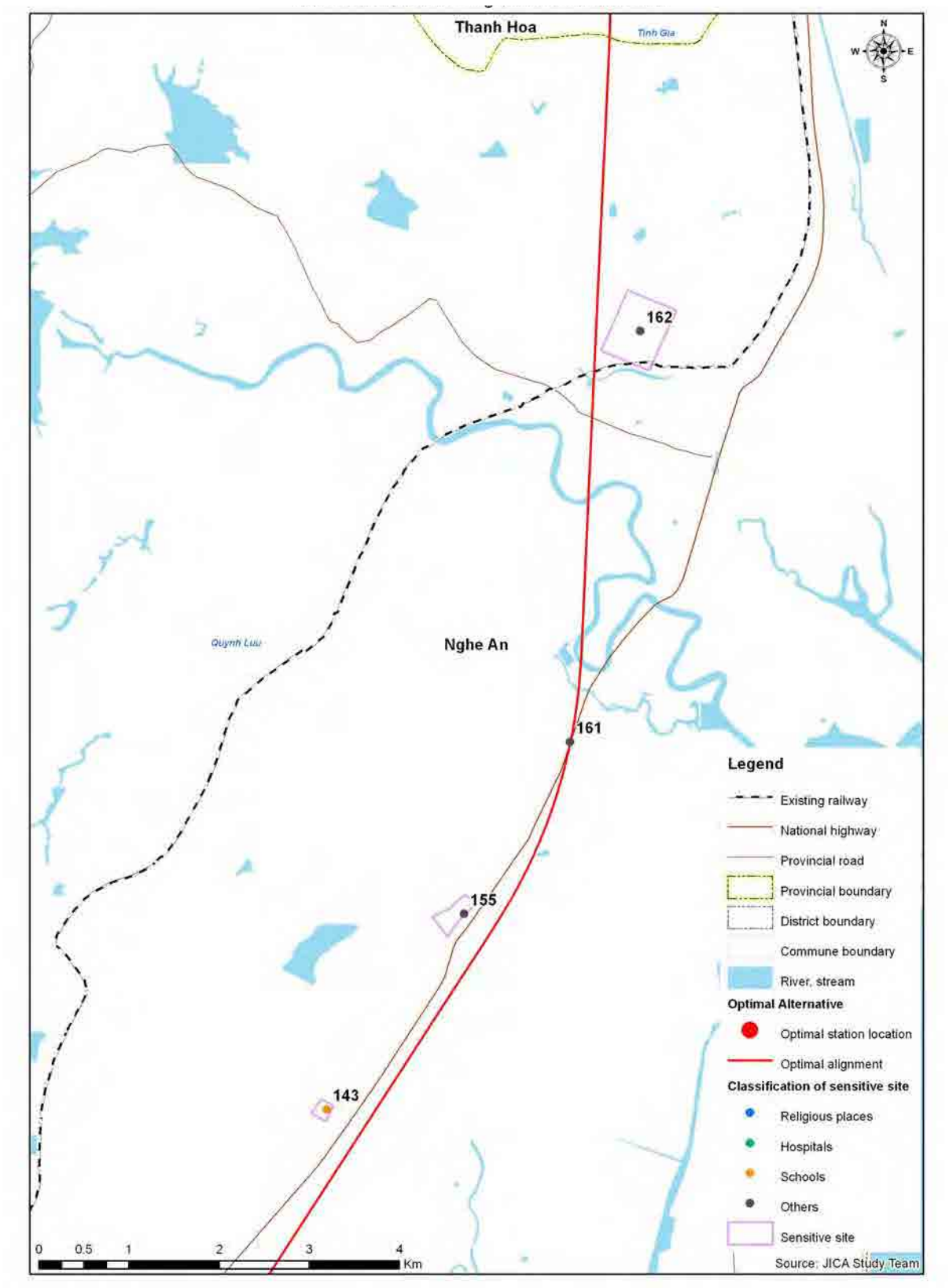
| No. | Identified Major Facilities and Locations | Coordination | Distance to the Alignment (m) | Locality/ Description |
|---|---|---|---|---|
| 143. | Quynh Luu 1 high school | 19°11'50.09"N 105°40'21.19"E | 405 | Cau giat town, Quynh Luu dist, Nghe An |
| 144. | Secondary school of Dien Tan commune | 18°57'7.57"N 105°35'29.34"E | 754 | Dien Tan commune,Dien Chau dist, Nghe An |
| 145. | Elementary school of Dien Tan commune | 18°57'11.10"N 105°35'28.36"E | 736 | Dien Tan commune,Dien Chau dist, Nghe An |
| 146. | Drug rehab center of Nghe An | 18°51'36.83"N 105°37'3.19"E | 796 | Nghi Lien commune, Nghi Loc dist, Nghe An |
| 147. | Ha Huy Tap high school | 18°41'10.46"N 105°40'3.44"E | 346 | Phan Boi Chau st, Vinh city, Nghe An |
| 148. | Thanh An-Sai Gon hospital | 18°40'48.59"N 105°40'8.18"E | 669 | Ly Thuong Kiet st, Vinh city, Nghe An |
| 149. | Church at Ngoc Lâm commune | 19°47'01.32"N 105°38'26.30"E | 410 | Church |
| 150. | Temple and pagoda of Nghi Hoa commune | 19°47'56.70"N 105°37'58.59"E | 215 | Temple |
| 151. | Church at Quynh Hau commune | 19°09'28.08"N 105°39'16.98"E | 340 | Church |
| 152. | An Duong Vuong temple | 18°54'15.84"N 105°36'08.14"E | 320 | Temple |
| 153. | Cuong Temple of national heritage | 18°54'15.84"N 105°36'15.73"E | 860 | National heritage |
| 154. | Martyr cemetery of Quỳnh Hau commune | 19°09'36.61"N 105°39'14.07"E | 242 | Martyr cemetery |
| 155. | Martyr cemetery of Quynh Luu district | 19°13'00.55"N 105°41'13.62"E | 277 | Martyr cemetery |
| 156. | School of Quynh Hau commune | 19°09'31.05"N 105°39'11.60"E | 200 | School |
| 157. | Antenna tower of signal communication company of railway corporation | 18°41'38.24"N 105°39'53.28"E | 16 | Antenna tower |
| 158. | Antenna tower at Vinh city | 18°42'38.02"N 105°40'07.53"E | 600 | Antenna tower |
| 159. | Antenna tower at Quan Hanh Town | 18°46'45.80"N 105°38'45.66"E | 600 | Antenna tower |
| 160. | Antenna tower at Quynh Hau | 19°09'48.04"N 105°38'44.74"E | 762 | Antenna tower |
| 161. | Antenna tower at Hoang Mai town | 19°14'02.55"N 105°41'54.21"E | 10 | Antenna tower |
| 162. | Hoang Mai cement factory | 19°16'30.87"N 105°42'21.53"E | 15 | Factory |
| 163. | 110 kV transmission line | 18°47'21.96"N 105°38'03.63"E | 0 (Crosses HSR track) | Transmission line |

| No. | Identified Major Facilities and Locations | Coordination | Distance to the Alignment (m) | Locality/ Description |
|---|---|---|---|---|
| 164. | 110 kV transmission line under construction | 18°47'21.96"N 105°38'03.63"E | 0 (Under construction and will cross HSR track) | Transmission line |

Source: JICA Study Team

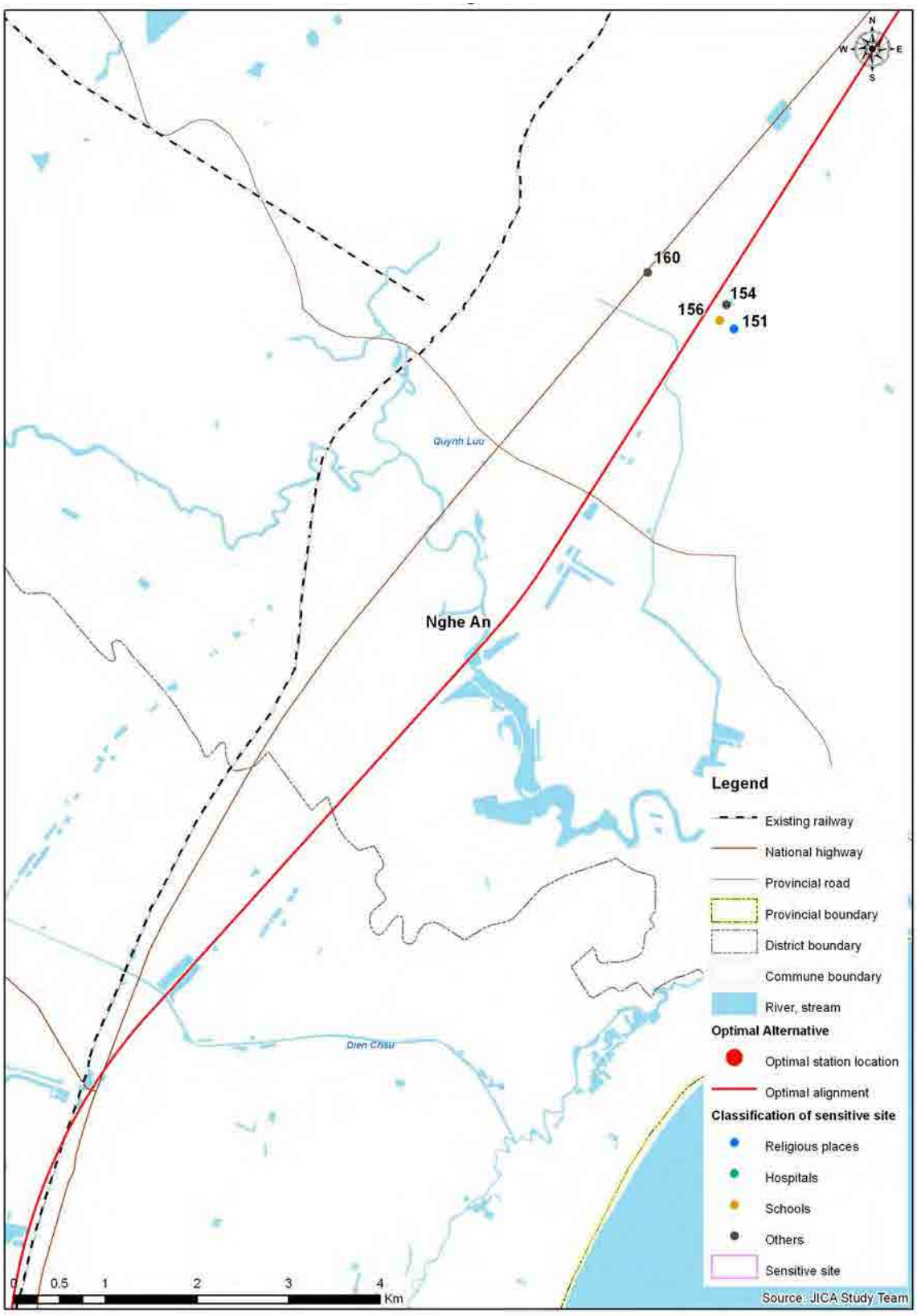
**2)** Map of Identified Major Facitlities and Locations to be Considered for Scoping

2.18 The maps of identified major facitlities and locations to be considered for scoping in Nghe An Province Section are shown in Figures 4B.25-30. Within 200m from the alignment, 0 religious facility, 1 school and 0 hospital are identified.



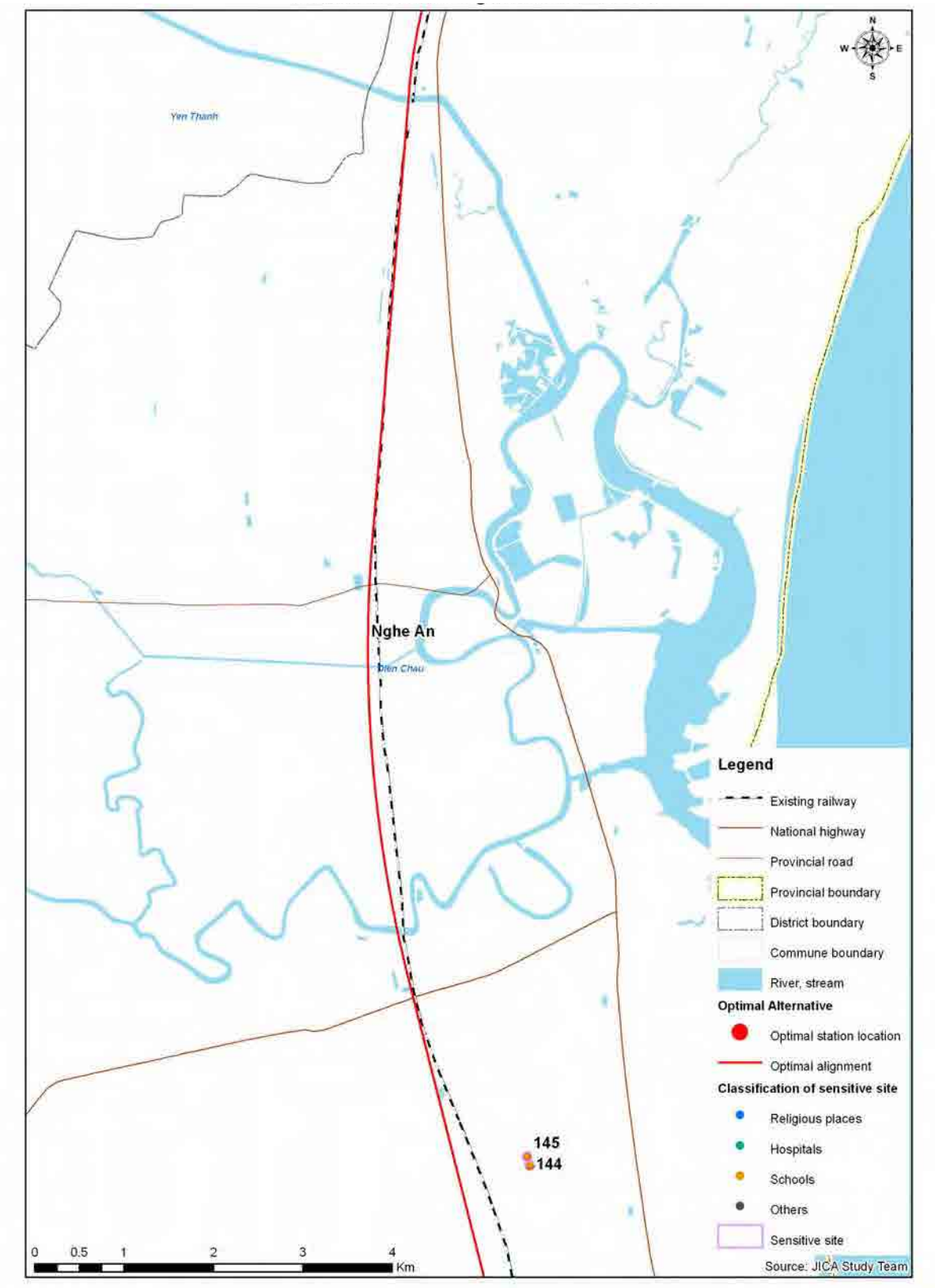

Source: JICA Study Team

**Figure 4B.25 Identified Major Facitlities and Locations to be Considered for Scoping (Nghe An Province, 1/6)**



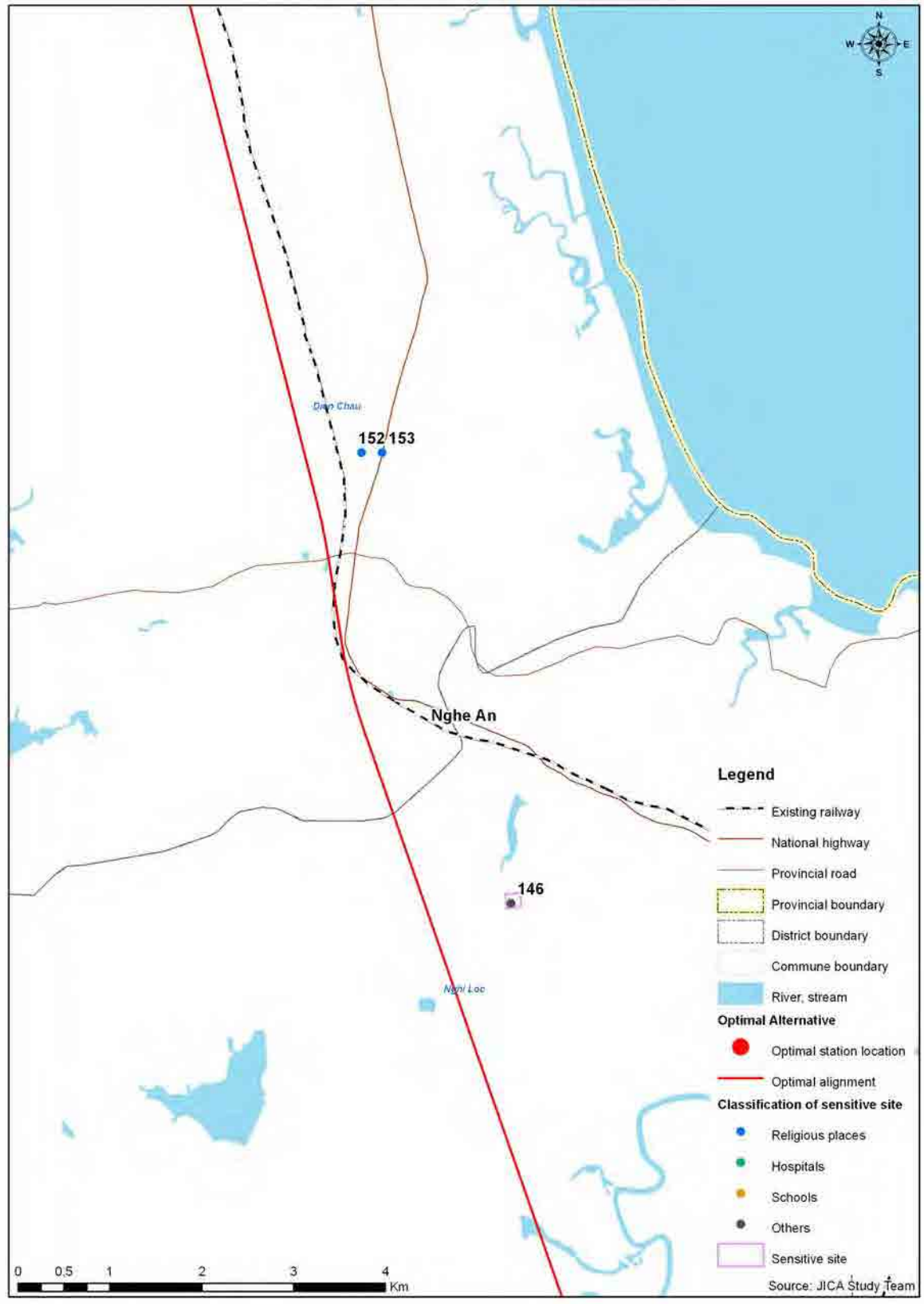

Source: JICA Study Team

**Figure 4B.26 Identified Major Facitlities and Locations to be Considered for Scoping (Nghe An Province, 2/6)**



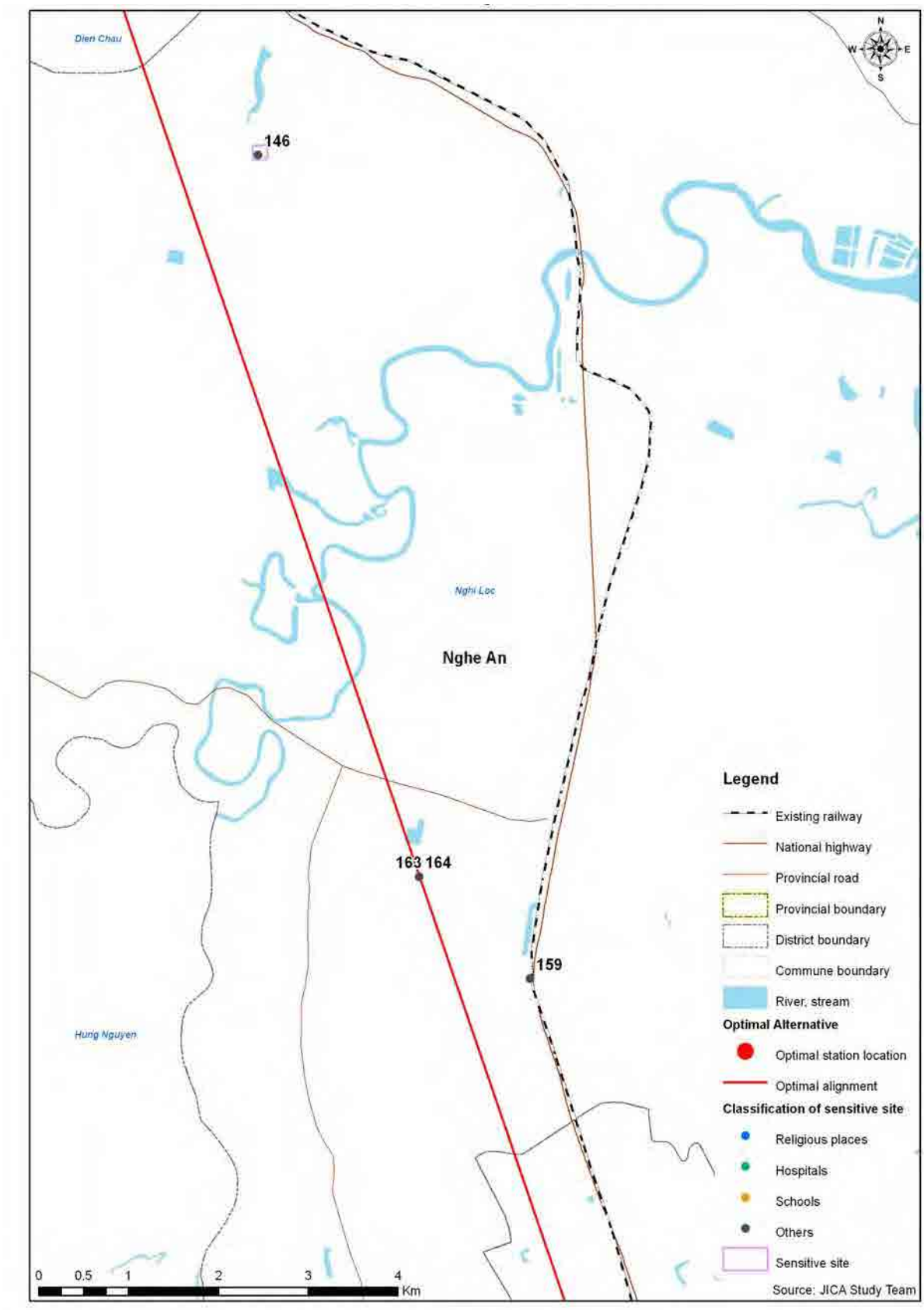

Source: JICA Study Team

**Figure 4B.27 Identified Major Facitlities and Locations to be Considered for Scoping (Nghe An Province, 3/6)**



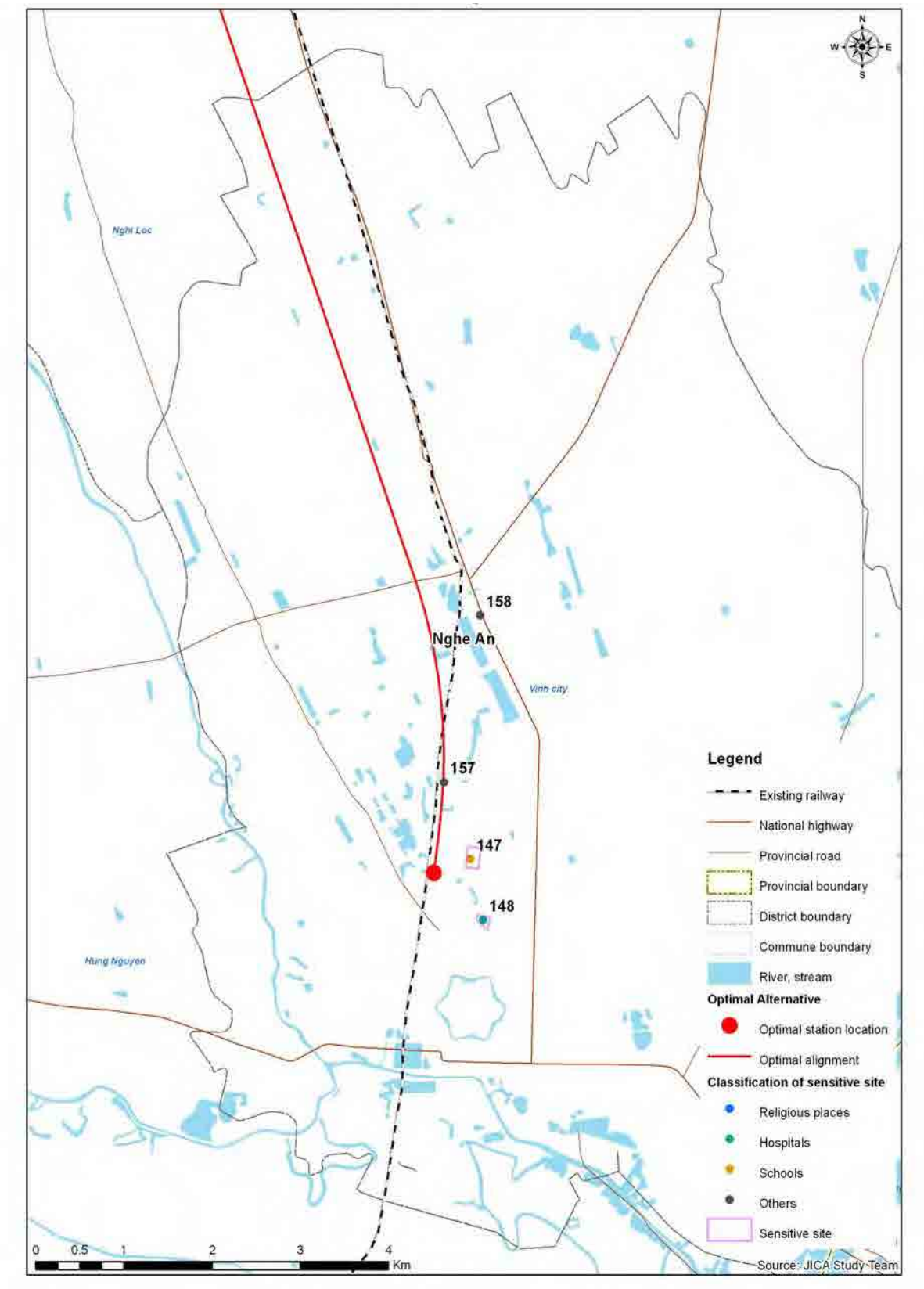

Source: JICA Study Team

**Figure 4B.28 Identified Major Facitlities and Locations to be Considered for Scoping (Nghe An Province, 4/6)**




Source: JICA Study Team

**Figure 4B.29 Identified Major Facitlities and Locations to be Considered for Scoping (Nghe An Province, 5/6)**




Source: JICA Study Team

**Figure 4B.30 Identified Major Facitlities and Locations to be Considered for Scoping (Nghe An Province, 6/6)**

**3)** Map of Tunnel Exit

2.19 Two tunnels are planned in Nghe An Province Section as shown in Figures 4B.31 and 32. It is identified that buildings are located within the boundary of 100m from the exits of tunnels in Figures 4B.31.

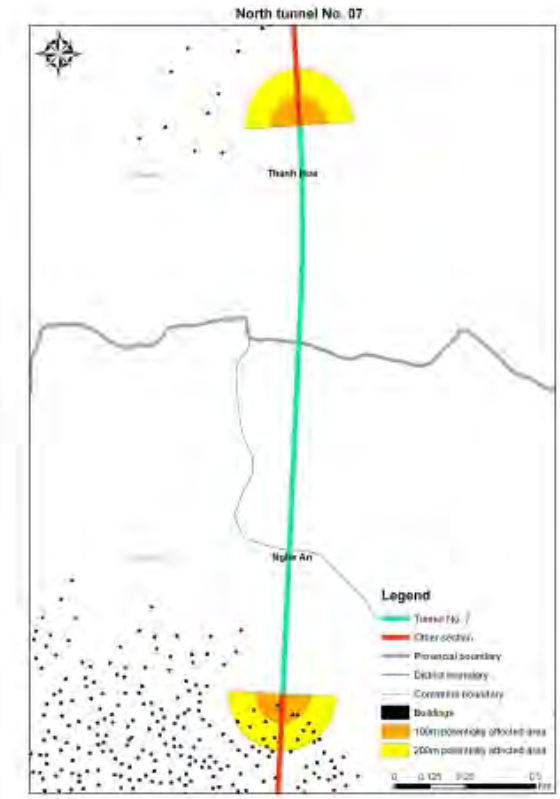



**Figure 4B.31 Tunnel in Nghe An Province**

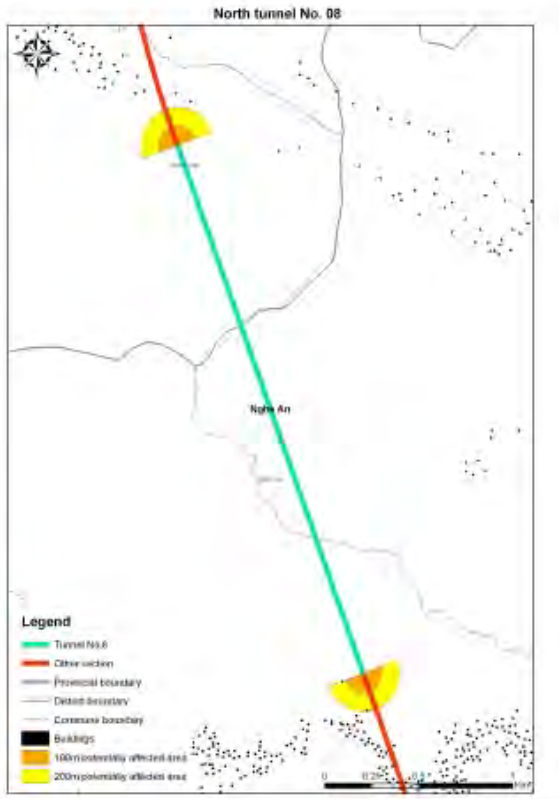



**Figure 4B.32 Tunnel in Nghe An Province**

Source: JICA Study Team

# 3 South Section

3.1 3.1-3.5 discusses on the optimal alignment and stations in the south section.

## 3.1 HCMC Section

**1)** Identified Major Facilities and Locations to be Considered for Scoping

3.2 The identified major facilities and locations to be considered for scoping along alignment are shown in Table 4B.7.

**Table 4B.7 Identified Major Facilities and Locations to be Consoidered for Scoping in HCMC Section**

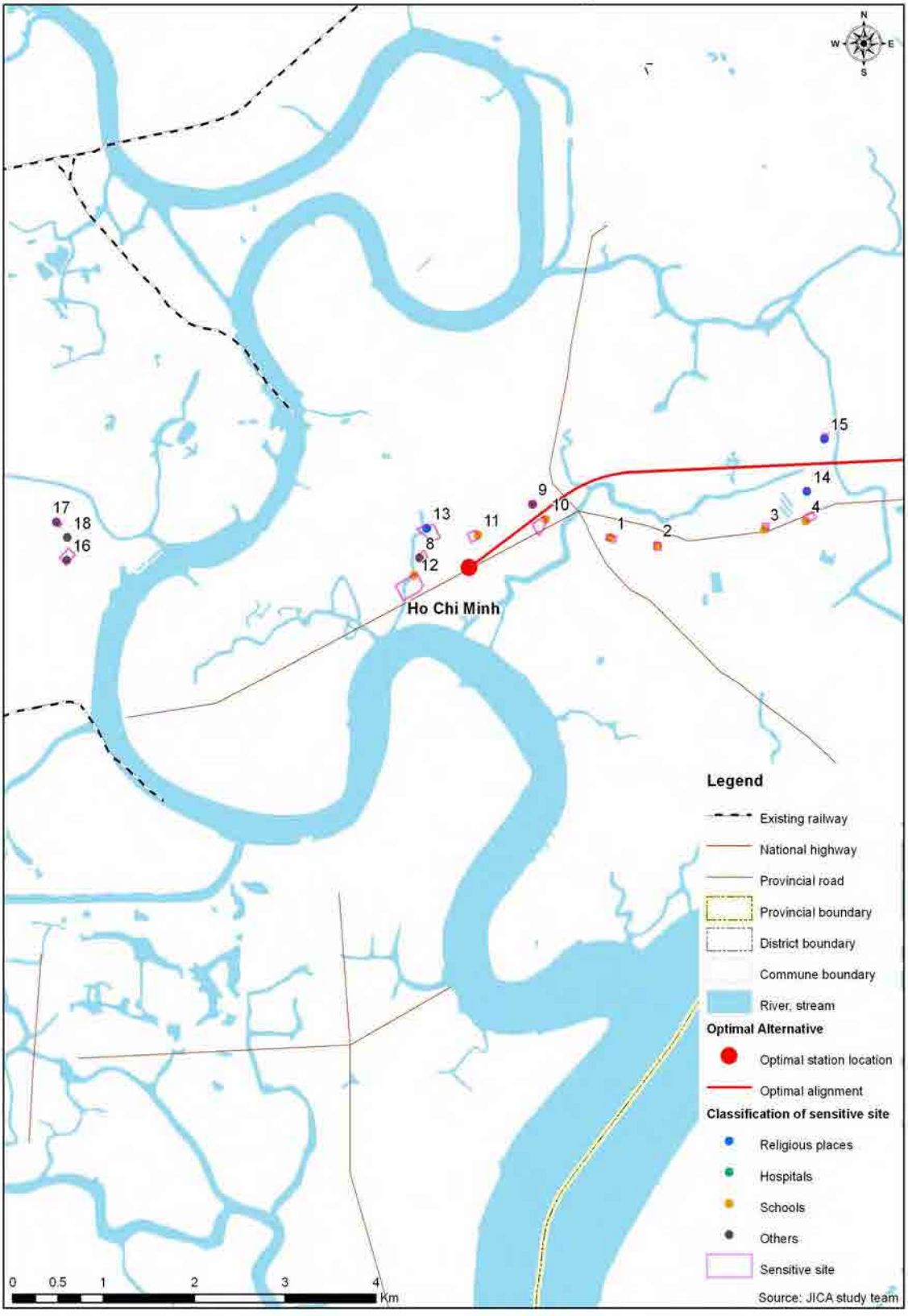
| No | Identified Major Facilities and Locations | Coordination | Distance to the Alignment (m) | Locality/ Description |
|---|---|---|---|---|
| 1. | Giong Ong To secondary school | 10°47'17.81"N 106°45'26.10"E | 595 | 256B Nguyen Duy Trinh, Binh Trung Tay ward, dist 2, HCMC |
| 2. | Children's House at District 2 | 10°47'15.04"N 106°45'43.01"E | 766 | Nguyen Duy Trinh, Binh Trung Tay ward, dist 2, HCMC |
| 3. | Nguyen Van Troi secondary school | 10°47'20.34"N 106°46'21.88"E | 610 | 571 Nguyen Duy Trinh st, Binh Trung Dong ward, Dist 2, HCMC |
| 4. | Nguyen Van Troi elementary school | 10°47'23.20"N 106°46'36.93"E | 510 | A2 st, Binh Trung Dong ward, Dist 2, HCMC |
| 5. | Phu Huu secondary school | 10°47'31.27"N 106°47'56.49"E | 250 | Nguyen Duy Trinh st, Phu Huu ward , Dist 9, HCMC |
| 6. | Phu Huu church | 10°47'30.90"N 106°48'4.32"E | 240 | Nguyen Duy Trinh st, Phu Huu ward , Dist 9, HCMC |
| 7. | Cemetery at Phu Huu ward | 10°47'35.64"N 106°48'1.85"E | 123 | Bung ong Thoan st, Phu Huu ward, Dist 9, HCMC |
| 8. | Binh Khanh market | 10°47'11.06"N 10°47'11.06"N | 107 | 3th quarter, Luong Dinh Cua str, Binh Khanh ward, district 2. HCMC. |
| 9. | District 2 people's committee | 10°47'29.61"N 106°44'57.84"E | 100 | 249,Luong Dinh Cua st, An Phu ward, dist 2, HCMC |
| 10. | Australian international school | 10°47'24.37"N 106°45'2.55"E | 30 | Dong Tay Road, An Phu ward, district 2 ,HCMC. |
| 11. | An Khanh elementary school | 10°47'19.00"N 106°44'38.00"E | Distance to Thu Thiem station: 30m | 311J5 KP1, An Phu ward, district 2, HCMC. |
| 12. | Binh Khanh secondary school | 10°47'5.08"N 106°44'14.89"E | Distance to Thu Thiem station: 30m | Lot P2, Binh Khanh residential, Binh Khanh ward, district 2, HCMC. |
| 13. | Hue Nghiem 2 pagoda. | 10°47'21.44"N 106°44'19.52"E | 230 | 3th quarter, Luong Dinh Cua str, Binh Khanh ward, district 2. HCMC. |
| 14. | Tinh xa Ngoc Thanh pagoda | 10°47'33.48"N 106°46'37.38"E | 260 | A1 Road, Binh Trung Dong Apartment, Binh Trung Dong ward, district 2, HCMC. |
| 15. | Dong Hung pagoda | 10°47'51.50"N 106°46'43.86"E | 240 | Do Xuan Hop st, An Phu ward, Dist 2, HCMC |
| 16. | Television broadcasting of HCMC (HTV) | 10°47'11"N 106°42'08"E | 4,400 | 14 Dinh Tien Hoang, Dist 1, HCMC |
| 17. | HCMC radio station | 10°47'20"N 106°42'05"E | 4,500 | 3 Nguyen Dinh Chieu st., Dist 01, HCMC |
| 18. | VNTV station in HCMC | 10°47'14"N 106°42'11"E | 4,300 | 7B Nguyen Thi Minh Khai, Dist 01, HCMC |

Source: JICA Study Team

**2)** Map of Identified Major Facitlities and Locations to be Considered for Scoping

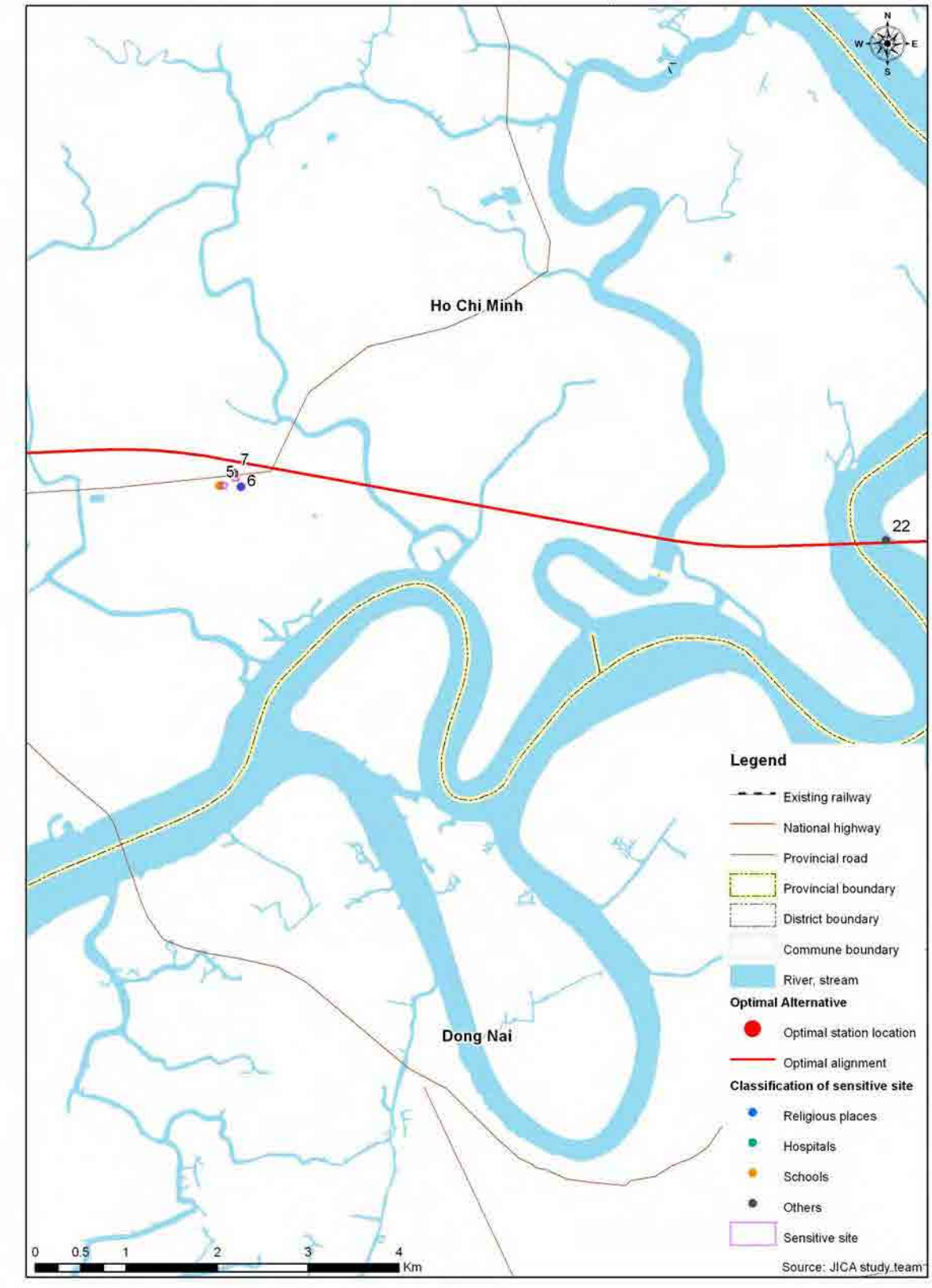
3.3 The maps of identified major facitlities and locations to be considered for scoping

in HCMC Section are shown in Figures 4B.33 and 34. Within 200m from the alignment, 1 religious facility, 3 schools and 0 hospital are identified.




Source: JICA Study Team

**Figure 4B.33 Identified Major Facitlities and Locations to be Considered for Scoping (HCMC, 1/2)**




Source: JICA Study Team

**Figure 4B.34 Identified Major Facitlities and Locations to be Considered for Scoping (HCMC, 2/2)**

**3)** Map of Tunnel Exit

3.4 There is no tunnel in HCMC Section.

## 3.2 Dong Nai Section

**1)** Identified Major Facilities and Locations to be Considered for Scoping

3.5 The identified major facilities and locations to be considered for scoping along alignment are shown in Table 4B.8.

**Table 4B.8 Identified Major Facilities and Locations to be Consoidered for Scoping in Dong Nai Province Section**

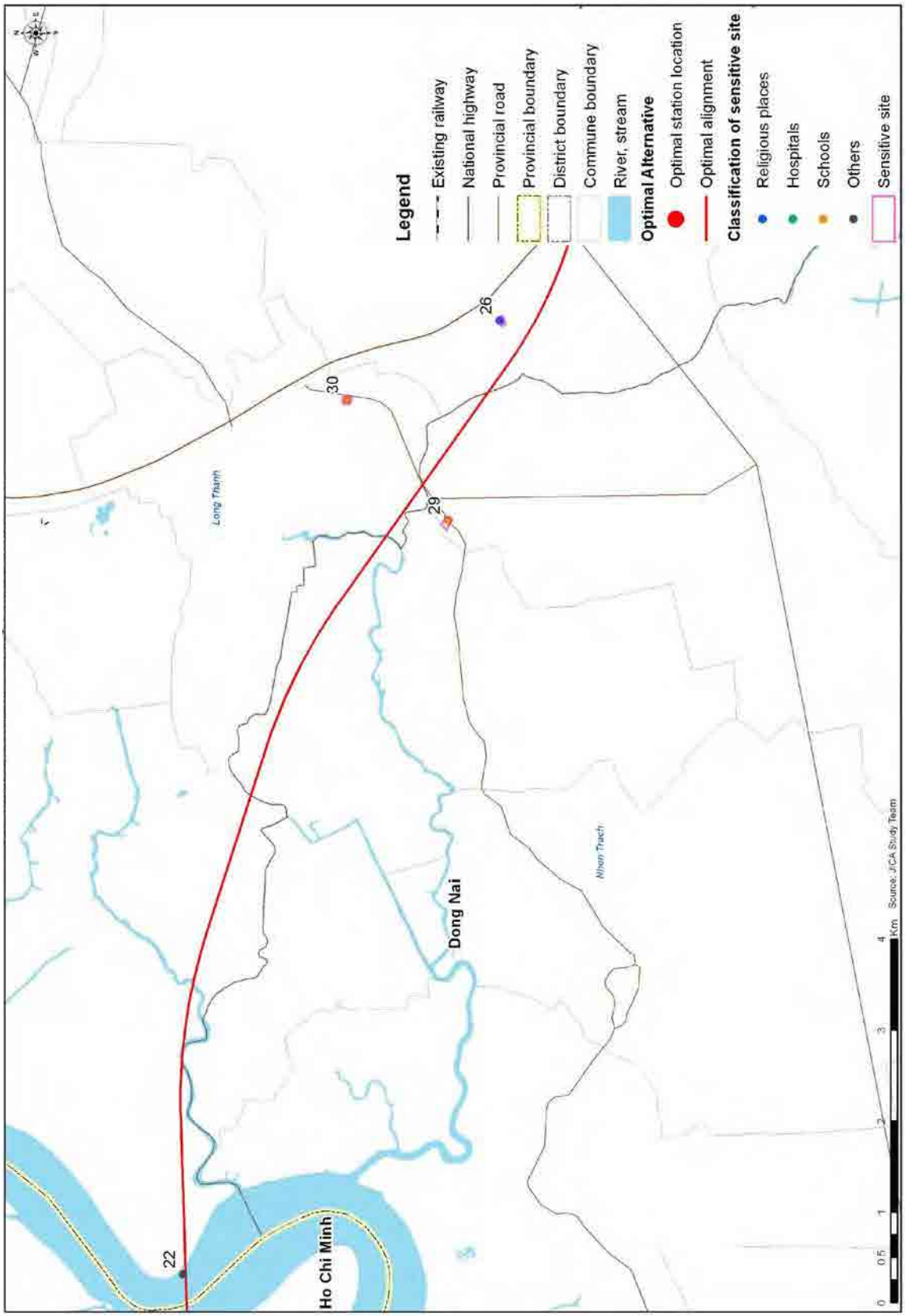
| No | Identified Major Facilities and Locations | Coordination | Distance to the Alignment (m) | Locality/ Description |
|---|---|---|---|---|
| 19. | Xuan Loc alcohol plant | 10°53'19.48"N 107°26'58.27"E | 236 | Xuan Tam commune, Xuan Loc distric, Dong Nai Province |
| 20. | Village 11 cemetery | 10°47'20.83"N 107°03'52.22"E | 0 | Suoi Trau commune, Cam My district, Dong Nai Province |
| 21. | Radio and television broadcasting of Dong Nai Province | 10°57'20.13"N 106°51'47.60"E | 18,600 | Dong Khoi St, Quyet Thang ward, Bien Hoa City, Dong Nai Province |
| 22. | Intersection with Dong Nai river | 10°47'10.35"N 106°51'57.67"E | 0 | Tam An commune, Long Thanh district, Dong Nai Province |
| 23. | Vien An temple | 10°52'17.00"N 107°19'02.00"E | 135 | Xuan Bao commune, Xuan Loc district, Dong Nai Province |
| 24. | Unknown temple | 10°52'19.00"N 107°18'55.00"E | 63 | Xuan Bao commune, Xuan Loc district, Dong Nai Province |
| 25. | Minh Hiep pagoda | 10°52'49.00"N 107°22'16.00"E | 25 | Suoi Cat commune, Xuan Loc district, Dong Nai Province |
| 26. | Quang Minh pagoda | 10°45'14.00"N 106°57'43.00"E | 300 | Long An commune, Long Thanh district, Dong Nai Province |
| 27. | Mac Dinh Chi elementary school | 10°52'48.00"N 107°22'15.00"E | 0 | Suoi Cat commune, Xuan Loc district, Dong Nai Province |
| 28. | Nguyen Hue high school | 10°51'45.45"N 107°13'54.20"E | 300 | Road 56 , Hang Gon commune, Long Khanh town, DN |
| 29. | Phuoc Thien secondary school | 10°45'33.43"N 106°56'30.18"E | 415 | 769 Road, Phuoc Thien commune, Nhon Trach, Dong Nai |
| 30. | Cau Xeo elementary school | 10°46'9.61"N 106°57'14.13"E | 1,160 | 769 Road, Phuoc Thien commune, Nhon Trach, Dong Nai |
| 31. | Suoi Trau elementary school | 10°46'4.59"N 107° 3'26.52"E | 1,454 | Suoi Trau commune, Long Thanh dist, Dong Nai |
| 32. | Song Nhan secondary school | 10°49'50.71"N 107° 7'42.29"E | 877 | Village 2, Song Nhan commune, Cam My dist, Dong Nai |
| 33. | Xuan Trieu church | 10°49'46.03"N 107° 7'43.16"E | 742 | Village 2, Song Nhan commune, Cam My dist, Dong Nai |
| 34. | Phap Linh pagoda | 10°49'57.01"N 107° 8'48.88"E | 334 | Song Nhan commune, Cam My dist, Dong Nai |
| 35. | Ly Tu Trong secondary school | 10°50'28.03"N 107°10'14.90"E | 305 | Xuan Que commune, Cam My dist, Dong Nai |
| 36. | Xuan Que elementary school | 10°50'40.60"N 107°10'1.28"E | 895 | Xuan Que commune, Cam My dist, Dong Nai |
| 37. | Xuan Que church | 10°50'40.98"N 107° 9'59.96"E | 898 | Xuan Que commune, Cam My dist, Dong Nai |
| 38. | Nam Ha church | 10°52'14.90"N 107°16'43.10"E | 380 | Xuan bao commune, Cam My dist, Dong Nai. |

| No | Identified Major Facilities and Locations | Coordination | Distance to the Alignment (m) | Locality/ Description |
|---|---|---|---|---|
| 39. | Cemetery of Nam Ha church | 10°52'16.47"N 107°16'56.57"E | 261 | Xuan bao commune, Cam My dist, Dong Nai. |
| 40. | Xuan Tam 2 elementary school | 10°52'45.26"N 107°26'24.54"E | 1,016 | 1A National highway, Xuan Tam commune, Xuan Loc dist, Dong Nai. |

Source: JICA Study Team

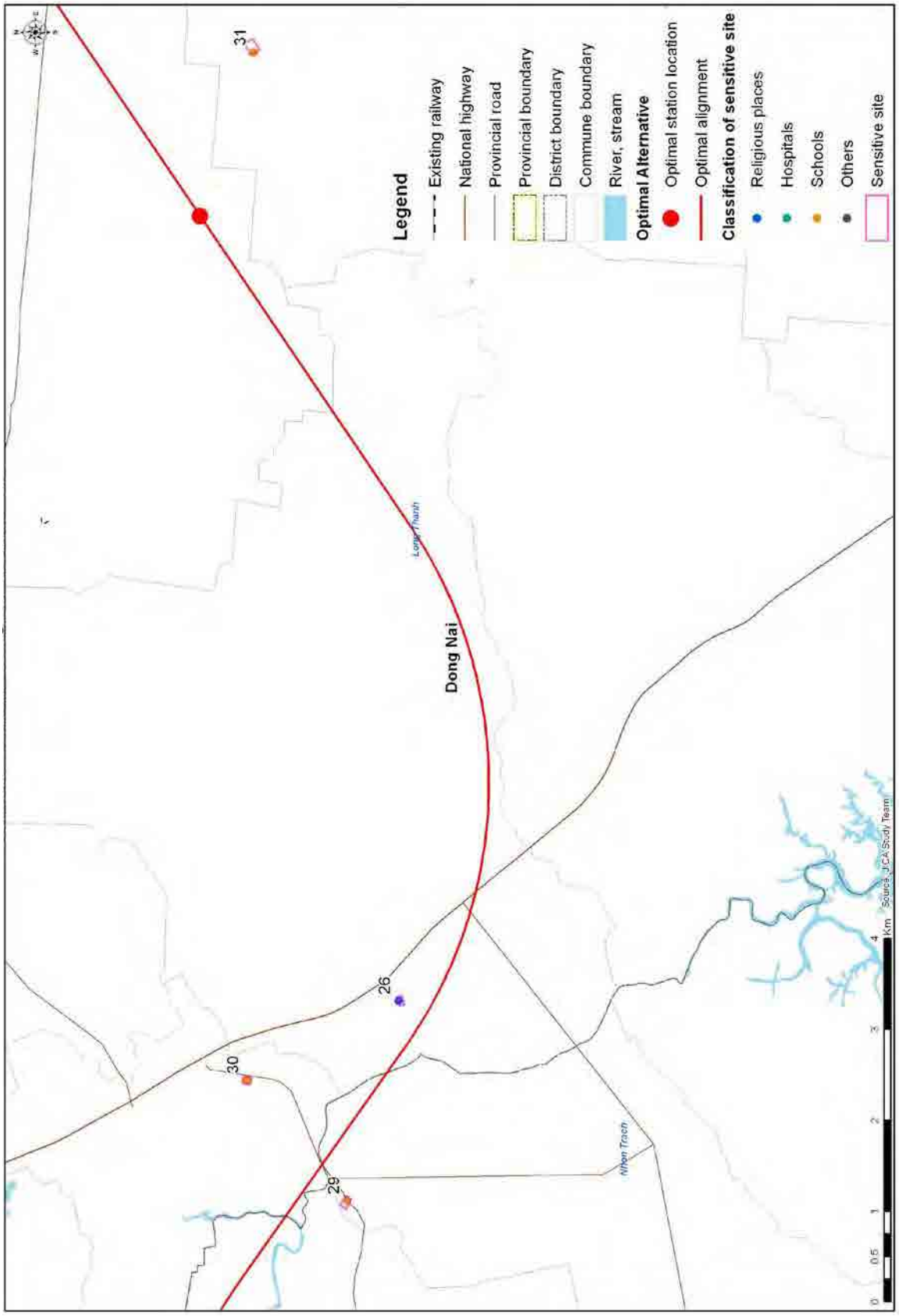
**2)** Map of Identified Major Facitlities and Locations to be Considered for Scoping

3.6 The maps of identified major facitlities and locations to be considered for scoping in Dong Nai Province Section are shown in Figures 4B.35-40. Within 200m from the alignment, 4 religious facilities, 1 school and 0 hospital are identified.



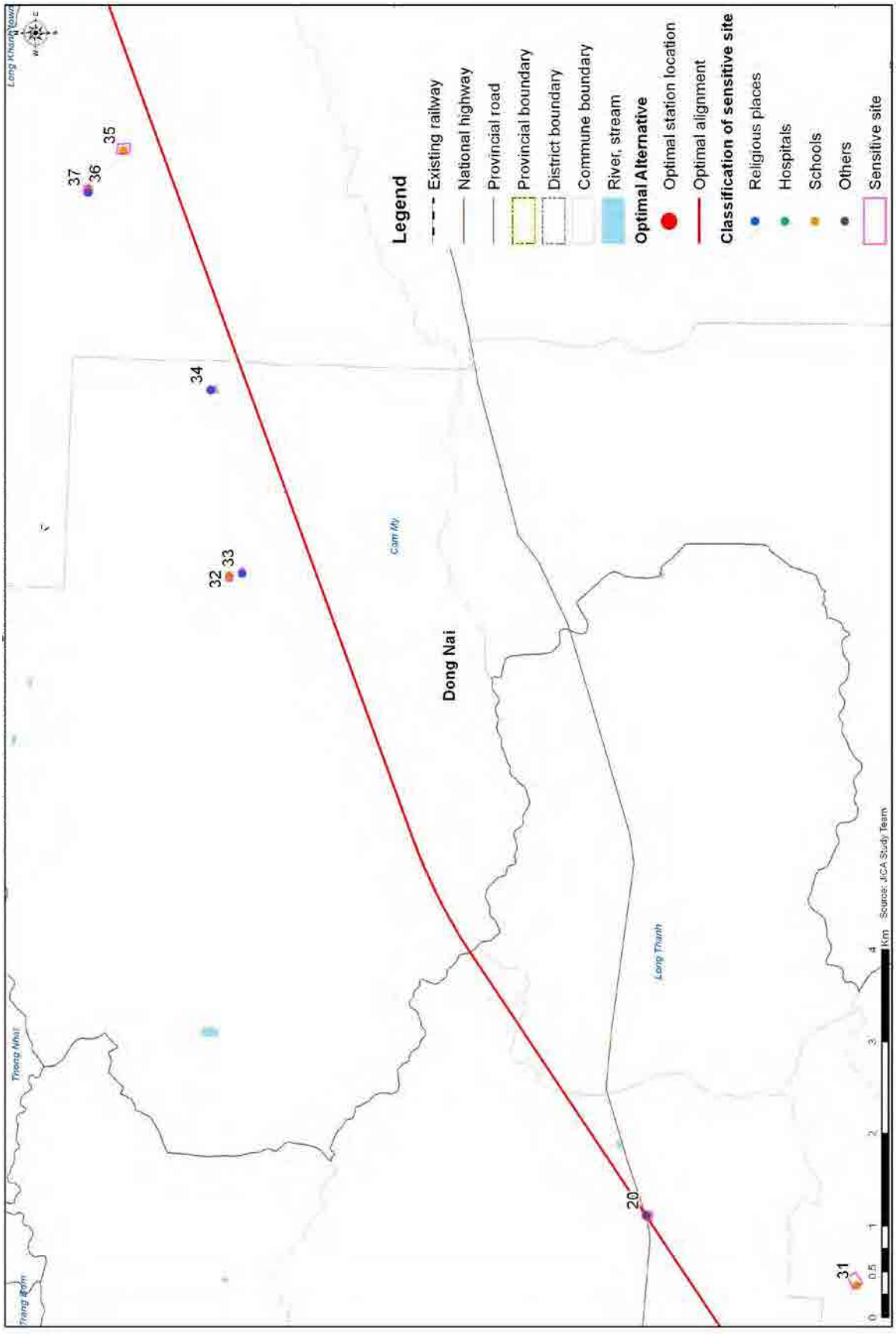

Source: JICA Study Team

**Figure 4B.35 Identified Major Facitlities and Locations to be Considered for Scoping (Dong Nai Province, 1/6)**



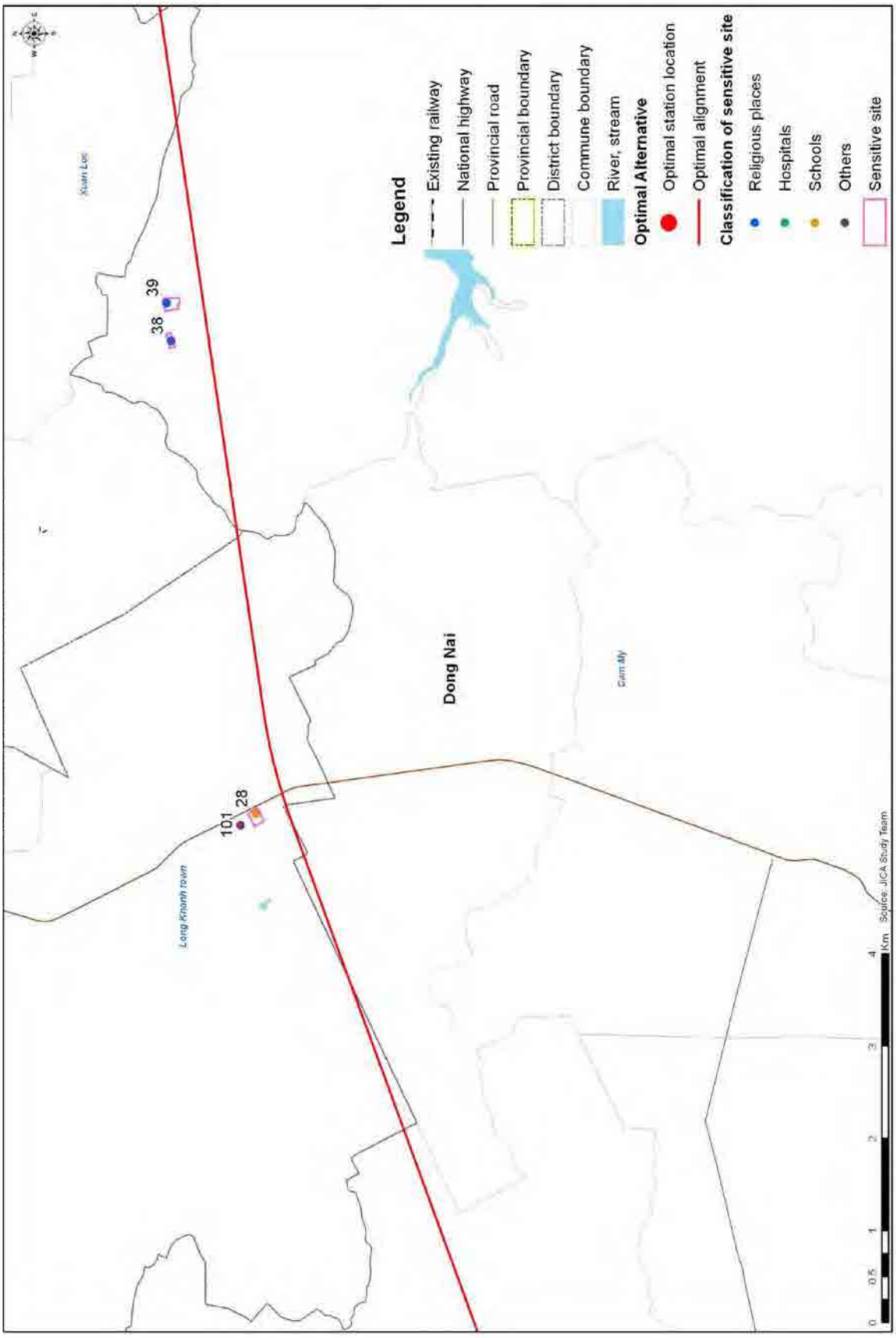

Source: JICA Study Team

**Figure 4B.36 Identified Major Facitlities and Locations to be Considered for Scoping (Dong Nai Province, 2/6)**



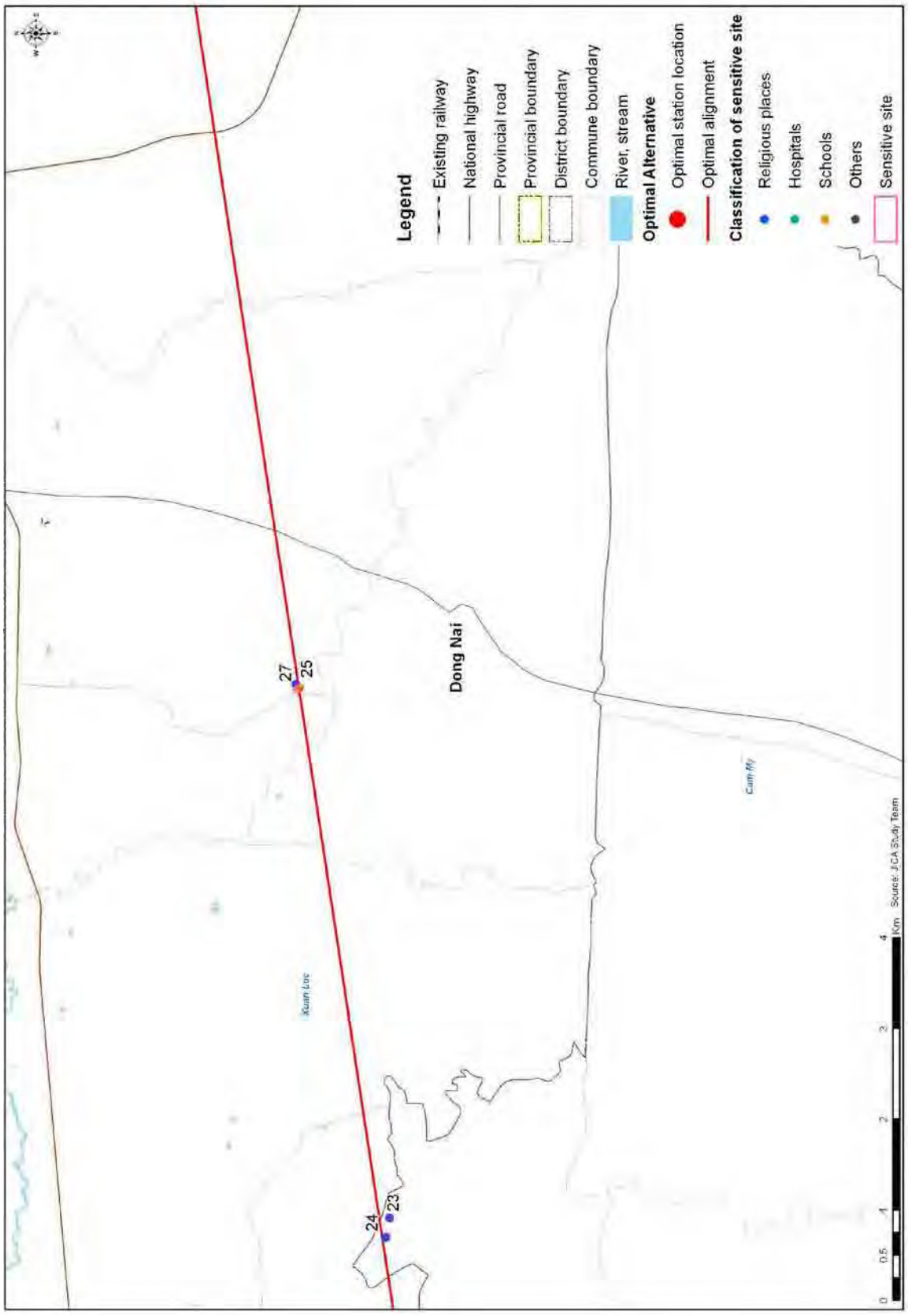

Source: JICA Study Team

**Figure 4B.37 Identified Major Facitlities and Locations to be Considered for Scoping (Dong Nai Province, 3/6)**



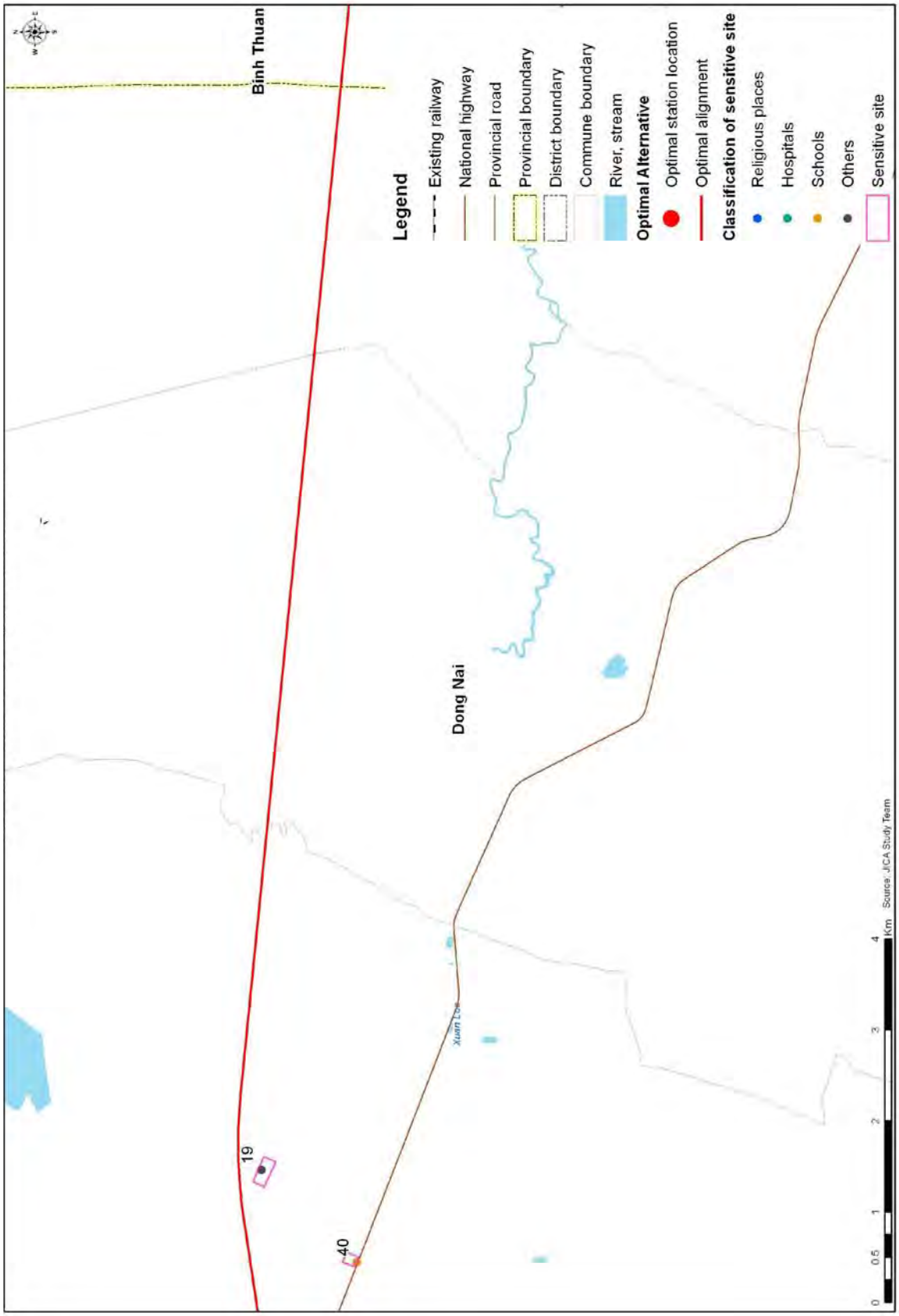

Source: JICA Study Team

**Figure 4B.38 Identified Major Facitlities and Locations to be Considered for Scoping (Dong Nai Province, 4/6)**




Source: JICA Study Team

**Figure 4B.39 Identified Major Facitlities and Locations to be Considered for Scoping (Dong Nai Province, 5/6)**




Source: JICA Study Team

**Figure 4B.40 Identified Major Facitlities and Locations to be Considered for Scoping (Dong Nai Province, 6/6)**

**3)** Map of Tunnel Exit

3.7 There is no tunnel in Dong Nai Province Section.

## 3.3 Binh Thuan Section

### 1) Identified Major Facilities and Locations to be Considered for Scoping

3.8 The identified major facilities and locations to be considered for scoping along alignment are shown in Table 4B.9.

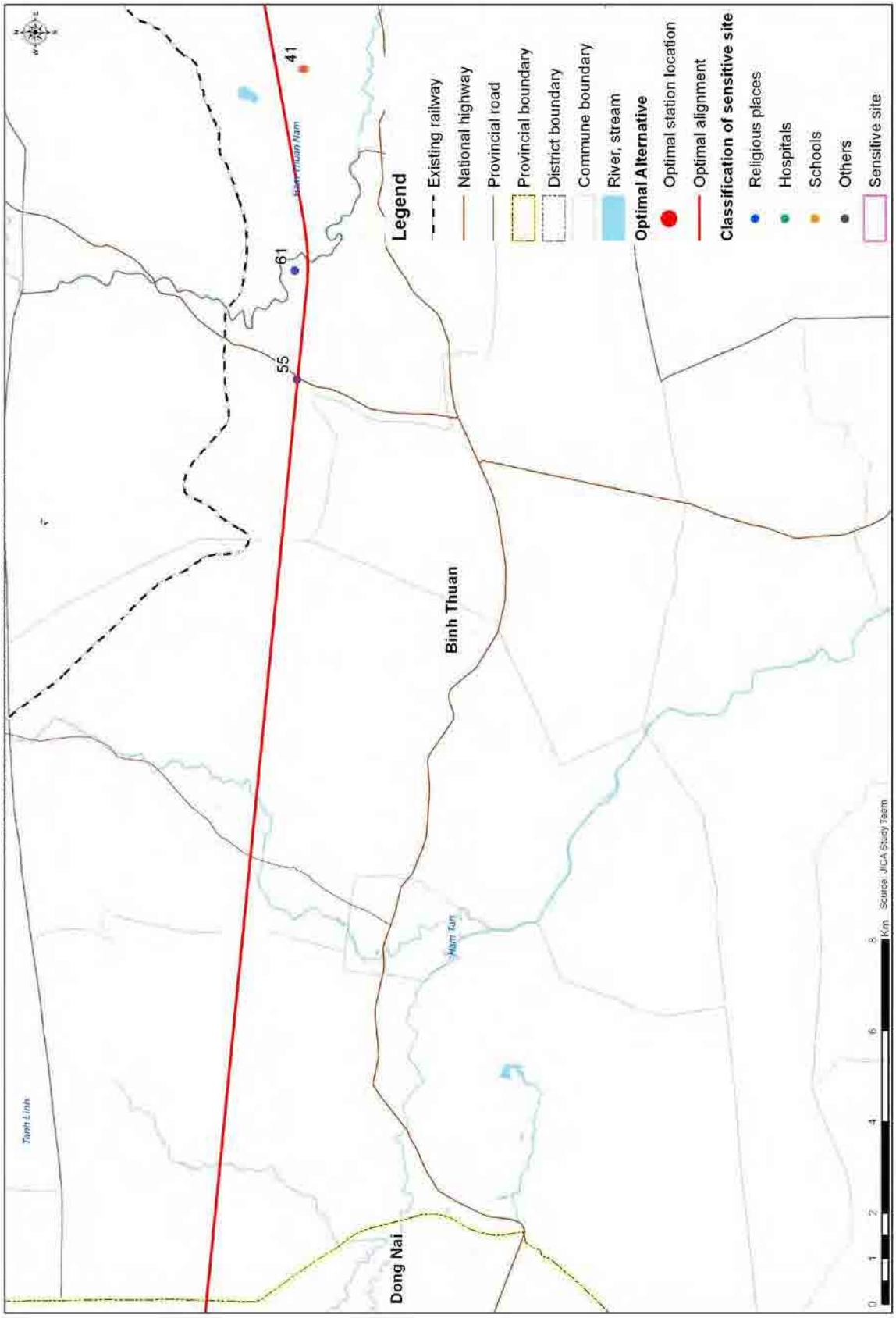
**Table 4B.9 Identified Major Facilities and Locations to be Consoidered for Scoping in Binh Thuan Province Section**

| No | Identified Major Facilities and Locations | Coordination | Distance to the Alignment (m) | Locality/ Description |
|---|---|---|---|---|
| 41. | Tan Lap 3 elementary school | 10°51'28.87"N 107°48'20.73"E | 500 | Ta Mon village, Tan Lap commune, Ham Tan dist, Binh Thuan |
| 42. | Ham minh elementary school | 10°52'57.35"N 107°56'18.09"E | 46 | 1A National highway, Ham Minh commnune, Ham Thuan Nam dist, Binh Thuan. |
| 43. | Ham Minh People's committee | 10°52'54.85"N 107°56'11.73"E | 80 | 1A National highway, Ham Minh commnune, Ham Thuan Nam dist, Binh Thuan. |
| 44. | Phan Ri Thanh elementary school | 11°11'46.87"N 108°33'2.55"E | 693 | Phan Ri Thanh commune, Bac Binh dist, Binh Thuan. |
| 45. | Vo Thi Sau secondary school | 11°10'47.32"N 108°33'38.37"E | 1,023 | Phan Ri Cua town, Bac Binh dist, Binh Thuan. |
| 46. | Hoa Da high school | 11°10'52.03"N 108°33'56.53"E | 830 | Phan Ri Cua town, Bac Binh dist, Binh Thuan. |
| 47. | Long Ha church | 11°11'2.81"N 108°33'25.25"E | 607 | Phan Ri Thanh commune, Bac Binh dist, Binh Thuan. |
| 48. | Hoa Minh elementary school | 11°11'24.62"N 108°34'28.10"E | 175 | 1A national highway, Hoa Minh commune, Bac Binh dist, Binh Thuan |
| 49. | Hoa Minh secondary school | 11°11'22.58"N 108°34'43.67"E | 283 | Hoa Minh commune, Bac Binh dist, Binh Thuan |
| 50. | VINH HAO mineral water plant | 11°17'12.03"N 108°43'45.45"E | 0 | Vinh Hao commune, Tuy Phong dist, Binh Thuan. |
| 51. | Phu Lac secondary school | 11°13'57.87"N 108°42'42.12"E | 1,881 | Lac tri village,Phu Lac commune, Tuy Phong dist, Binh Thuan. |
| 52. | Phu Dien elementary school | 11°14'22.61"N 108°42'4.04"E | 530 | Lac tri village,Phu Lac commune, Tuy Phong dist, Binh Thuan. |
| 53. | Chi cong secondary school | 11°11'10.58"N 108°36'24.54"E | 1,134 | Chi Cong commune, Tuy Phong dist, Binh Thuan. |
| 54. | Binh Thuan wind power plant | 11°13'03.00"N 108°40'13.00"E | 0 | Binh Thanh commune, Tuy Phong distritc, Binh Thuan Province Area of 350 ha with 20 wind turbine towers. |
| 55. | Song Phan People's Committee | 10°51'36.28"N 107°44'36.10"E | 0 | Song Phan commune, Ham Tan district, Binh Thuan Province |
| 56. | Hong Son 4 elementary school | 11°05'25.00"N 108°11'21.00"E | 30 | Hong Son commune, Ham Thuan Bac district, Binh Thuan Province |
| 57. | Binh Thuan hospital | 10°56'24.00"N 108°05'20.00"E | 700 | Phan Thiet City, Binh Thuan Province |
| 58. | Dong Tan hospital | 10°56'42.00"N 108°05'28.00"E | 300 | Phan Thiet City, Binh Thuan Province |
| 59. | Binh Thuan vocational training | 10°56'37.27"N 108°05'30.45"E | 480 | Phan Thiet City, Binh Thuan Province |
| 60. | Ham Thang secondary school | 10°58'36.00"N 108°07'38.00"E | 120 | Ham Thang commune, Ham Thuan Bac district, Binh Thuan Province |
| 61. | Truc Lam Chanh Thien pagoda | 10°51'37.00"N 107°45'55.00"E | 300 | Song Phan commune, Ham Tan district, Binh Thuan Province |

| No | Identified Major Facilities and Locations | Coordination | Distance to the Alignment (m) | Locality/ Description |
|---|---|---|---|---|
| 62. | Kim Sa Tu pagoda | 10°54'59.00"N<br>108°01'19.00"E | 500 | Ham My commune, Ham Thuan Nam district, Binh Thuan Province |
| 63. | Lien Hoa Ni Tu pagoda | 10°55'34.00"N<br>108°02'48.00"E | 200 | Ham My commune, Ham Thuan Nam district, Binh Thuan Province |
| 64. | Kim Binh Village temple | 10°58'53.00"N<br>108°07'54.00"E | 18 | Ham Thang commune, Ham Thuan Bac district, Binh Thuan Province |
| 65. | Kim Linh pagoda | 10°59'05.00"N<br>108°07'57.00"E | 25 | Ham Thang commune, Ham Thuan Bac district, Binh Thuan Province |
| 66. | Pho Quang pagoda | 10°55'41.00"N<br>108°03'14.00"E | 0 | Ham My commune, Ham Thuan Nam district, Binh Thuan Province |
| 67. | Tong Lam Van Duc Tu pagoda | 11°11'21.00"N<br>108°33'20.00"E | 60 | Phan Ri Thanh ward, Phan Ri Cua town, Binh Thuan Province |
| 68. | Hoi Long memorial stone | 11°11'50.27"N<br>108°36'13.67"E | 71 | Binh Thanh commune, Tuy Phong distritc, Binh Thuan Province |
| 69. | Binh Thuan martyrs cemetery | 11°05'52.00"N<br>108°11'38.00"E | 200 | Hong Son commune, Ham Thuan Bac District, Binh Thuan province |
| 70. | Luong Son waste treatment plant | 11°11'07.00"N<br>108°21'45.00"E | 85 | Luong Son commune, Bac Binh dictrict, Binh Thuan Province |
| 71. | National protection forest in Ham Kiem commune | Limited by:<br>1 .10°54'36N<br>108°01'12E<br>2 .10°54'27N<br>108°00'44E<br>3 .10°45'09N<br>108°00'48E<br>4 .10°54'20N<br>108°01'19E | 0 | Ham Kiem commune, Ham Thuan Nam district, Binh Thuan Province |
| 72. | Luong Son water plant | 11°11'06.00"N<br>108°22'15.00"E | 40 | Luong Son townlet, Bac Binh district, Binh Thuan Province |
| 73. | Intersection with Luy river | 11°11'23.33"N<br>108°33'08.11"E | 0 | Phan Ri Thanh ward, Phan Ri Cua town, Binh Thuan Province |
| 74. | Intersection with Ca Ty river | 10°56'18.39"N<br>108°04'23.33"E | 0 | Tien Loi ward, Phan Thiet City, Binh Thuan Province |

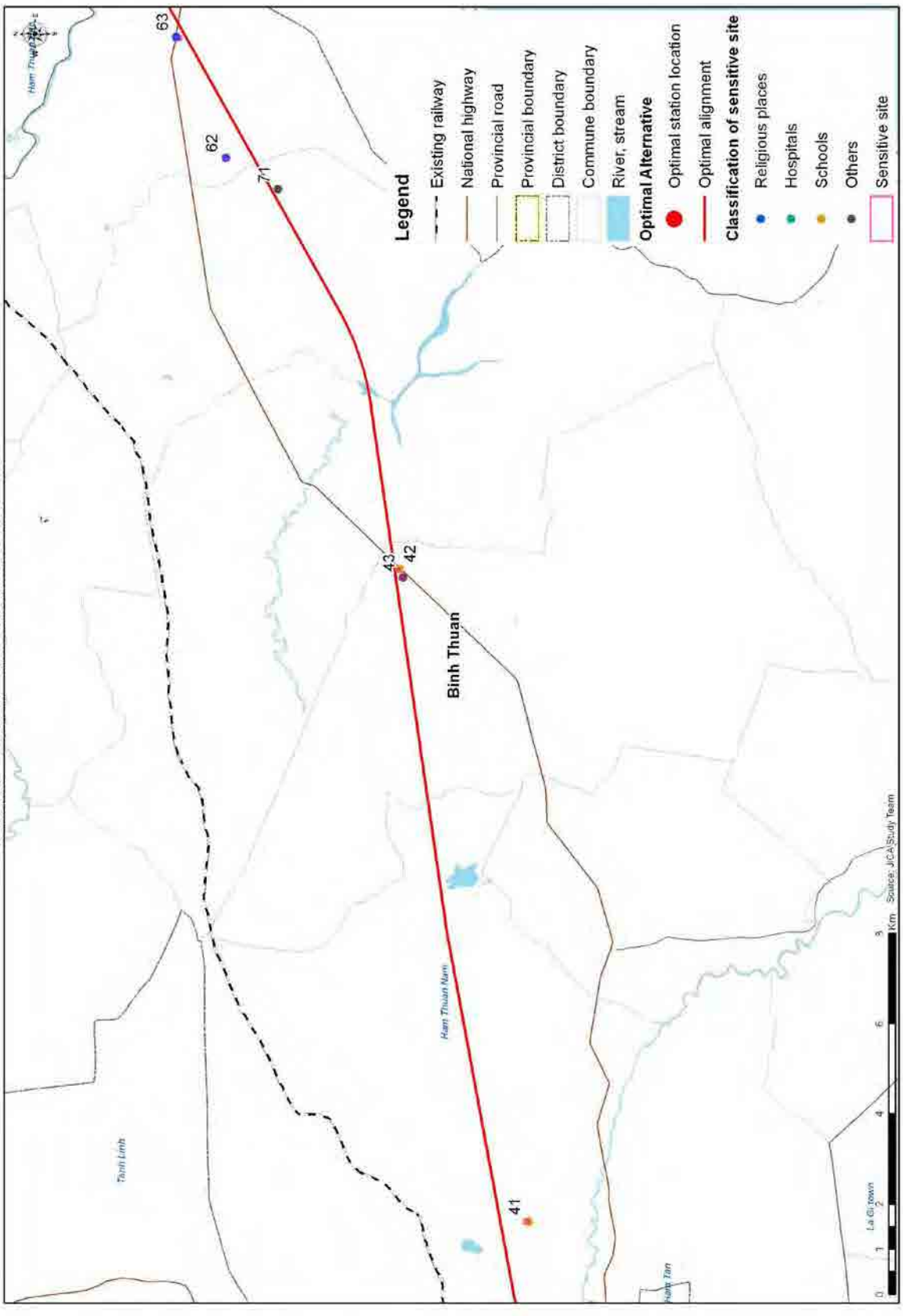
**2)** Map of Identified Major Facitlities and Locations to be Considered for Scoping

3.9 The maps of identified major facitlities and locations to be considered for scoping in Binh Thuan Province Section are shown in Figures 4B.41-46. Within 200m from the alignment, 7 religious facilities, 3 schools and 0 hospital are identified.



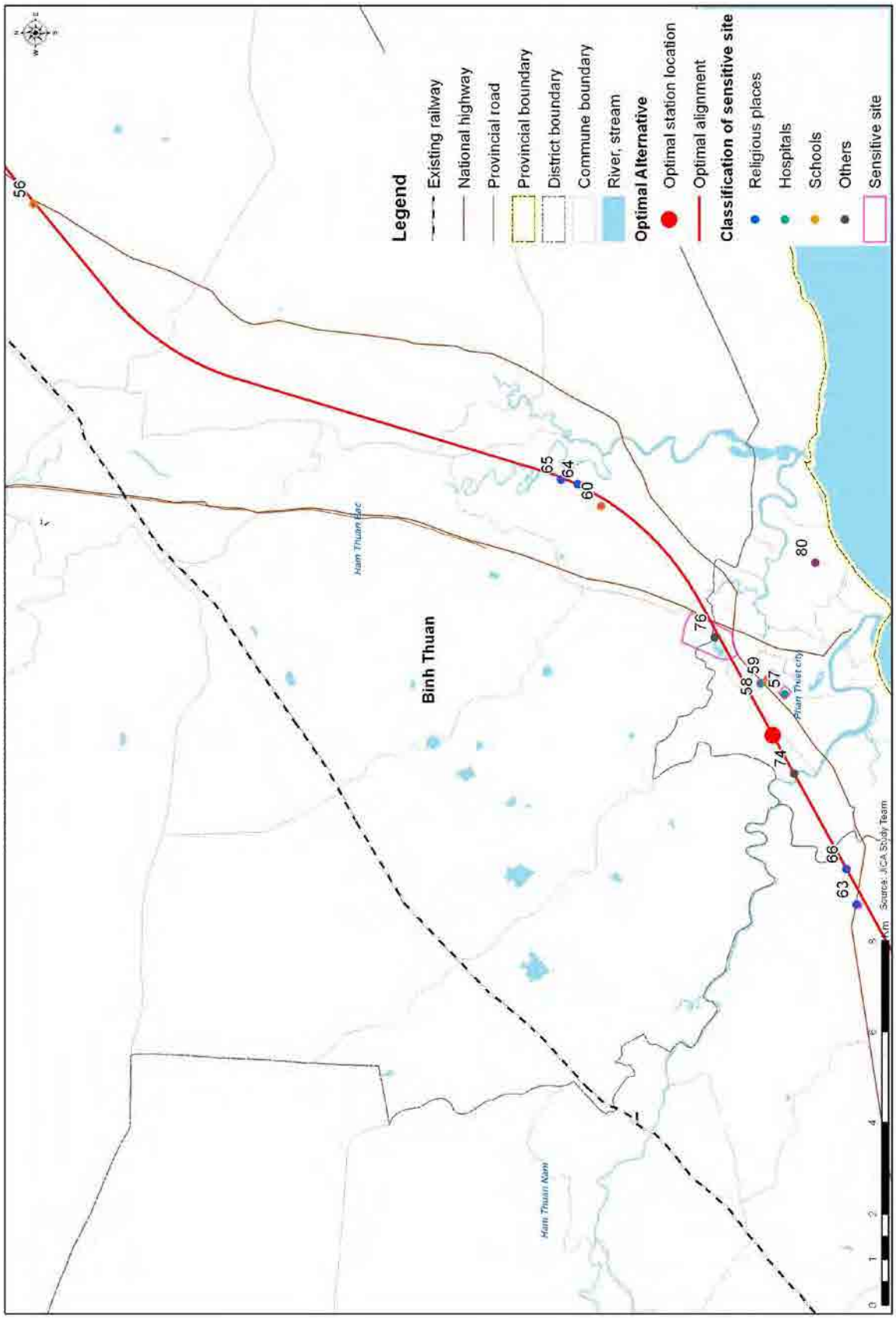

Source: JICA Study Team

**Figure 4B.41 Identified Major Facitlities and Locations to be Considered for Scoping (Binh Thuan Province, 1/6)**



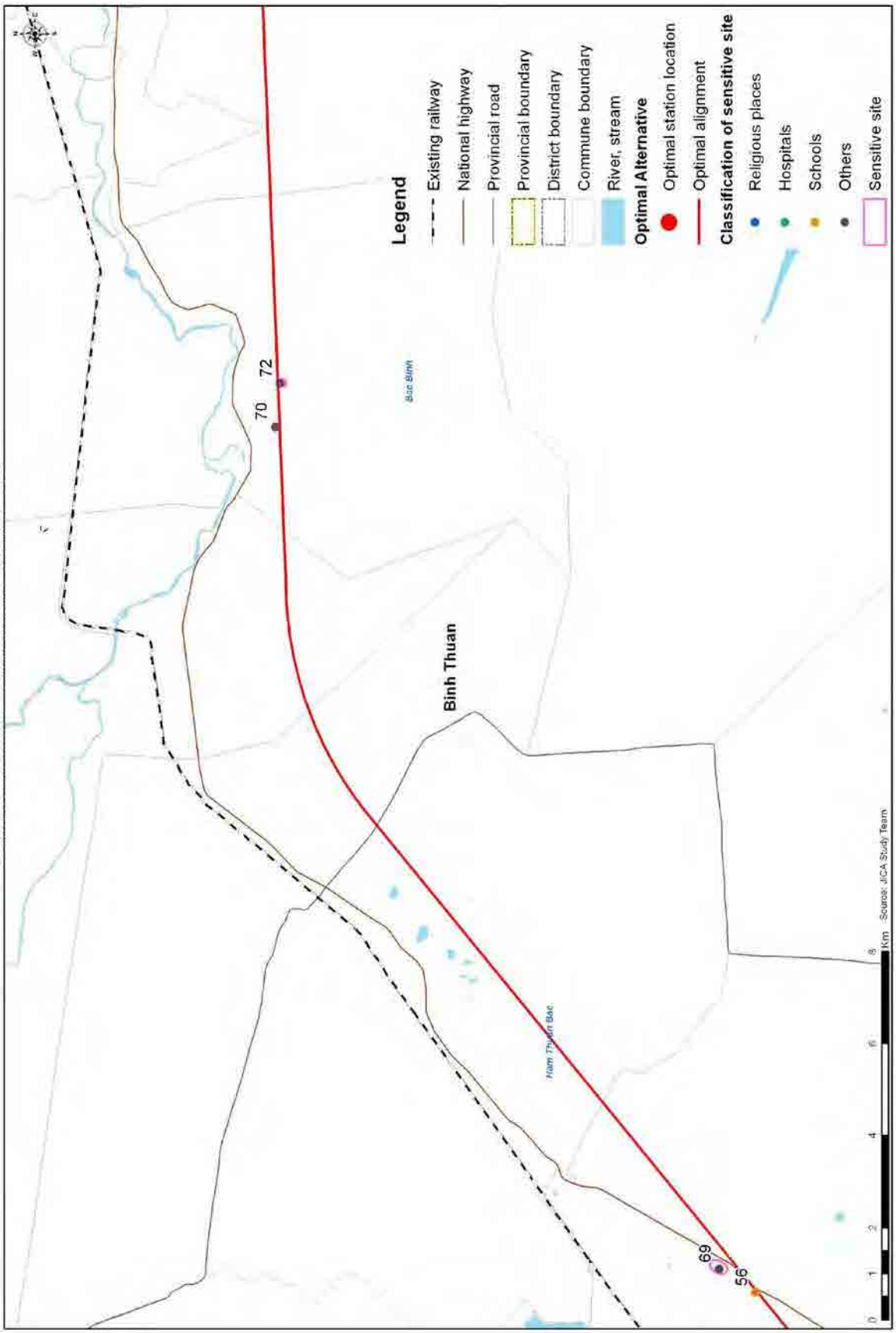

Source: JICA Study Team

**Figure 4B.42 Identified Major Facitlities and Locations to be Considered for Scoping (Binh Thuan Province, 2/6)**



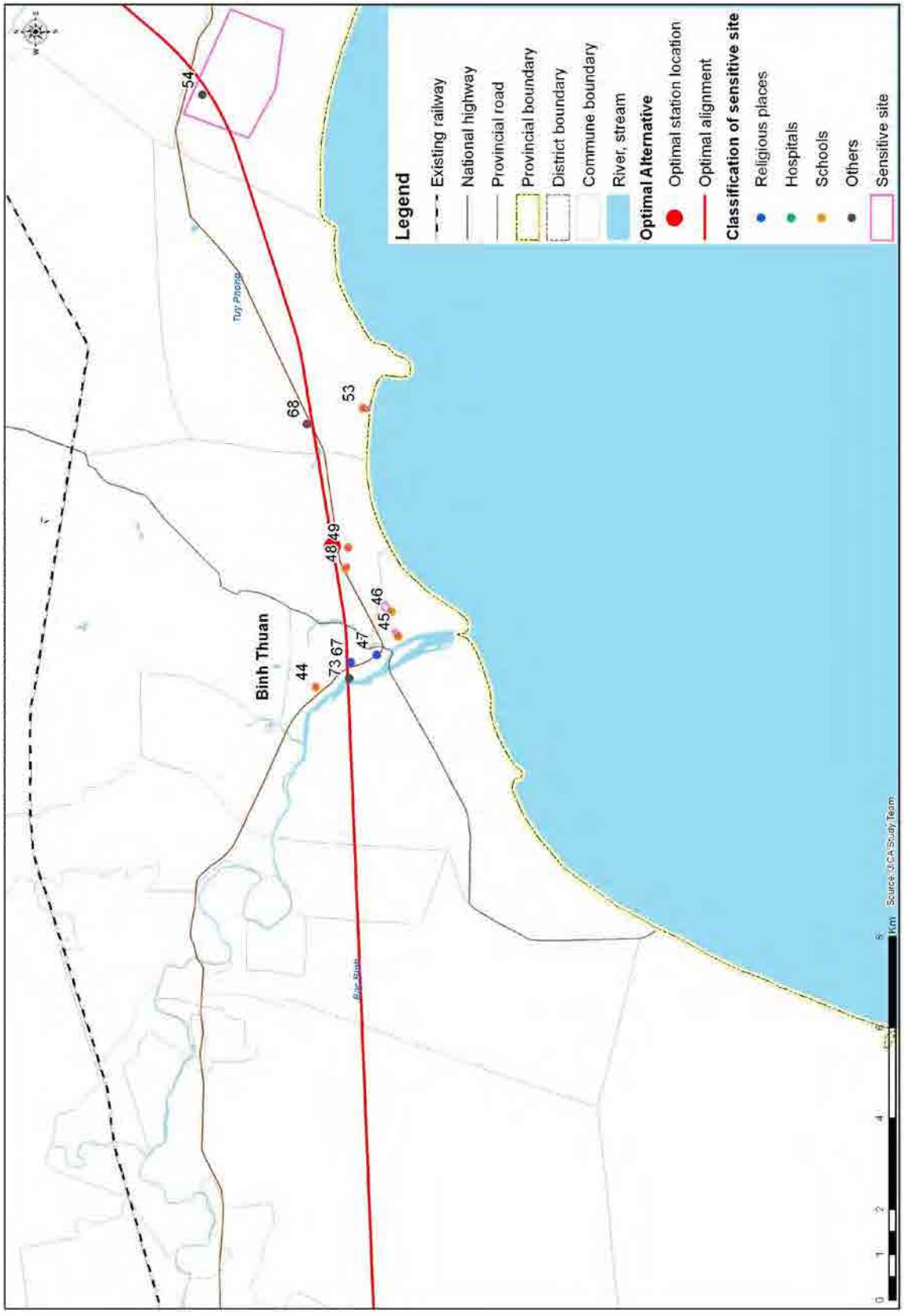

Source: JICA Study Team

**Figure 4B.43 Identified Major Facitlities and Locations to be Considered for Scoping (Binh Thuan Province, 3/6)**



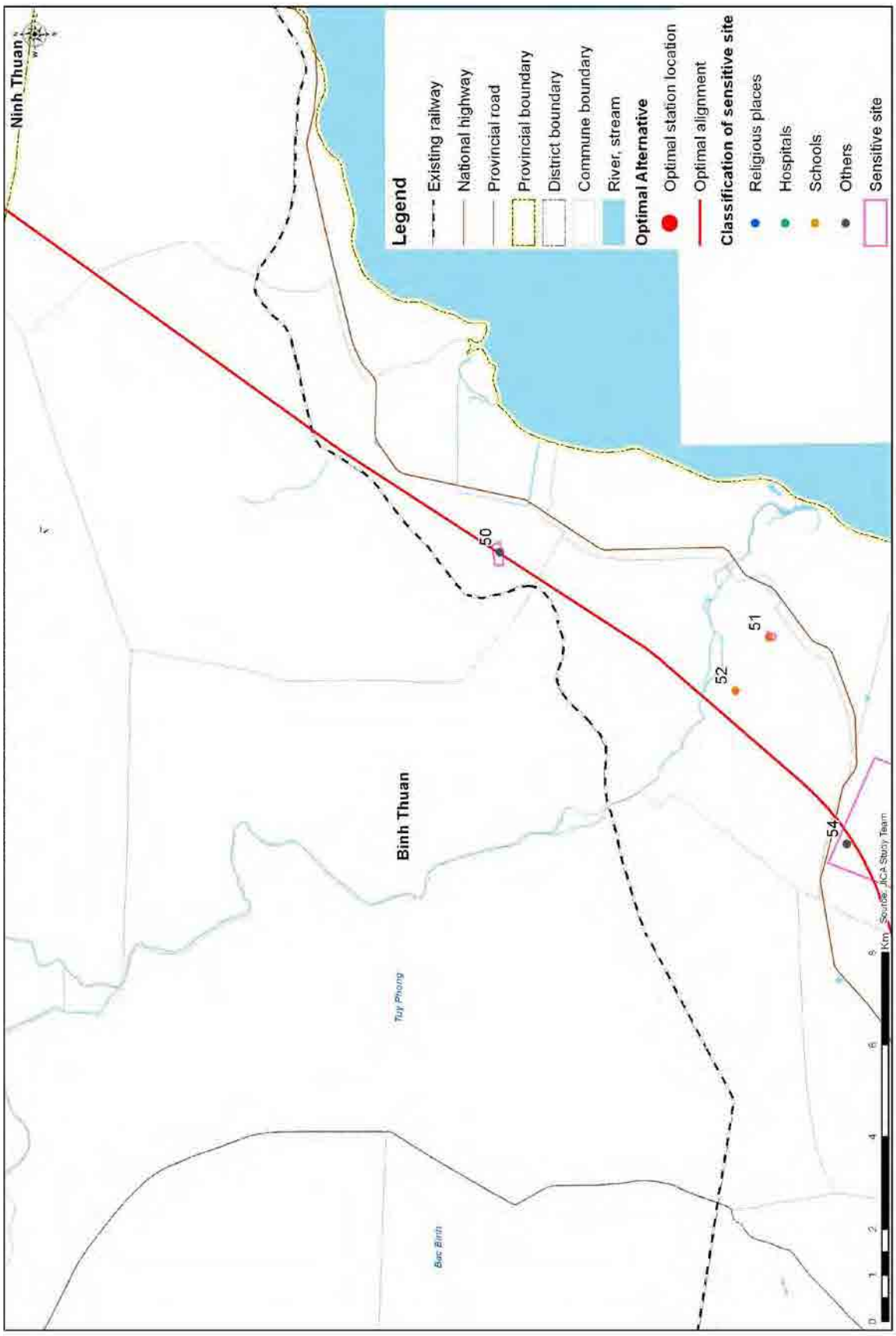

Source: JICA Study Team

**Figure 4B.44 Identified Major Facitlities and Locations to be Considered for Scoping (Binh Thuan Province, 4/6)**




Source: JICA Study Team

**Figure 4B.45 Identified Major Facitlities and Locations to be Considered for Scoping (Binh Thuan Province, 5/6)**




Source: JICA Study Team

**Figure 4B.46 Identified Major Facitlities and Locations to be Considered for Scoping (Binh Thuan Province, 6/6)**

**3)** Map of Tunnel Exit

3.10 One tunnel is planned in Binh Thuan Province Section as shown in Figure 4B.47. There is no building identified within the boundary of 200m from the exit of the tunnel.


**Figure 4B.47 Tunnel in Binh Thuan Province**

Source: JICA Study Team

## 3.4 Ninh Thuan Province Section

### 1) Identified Major Facilities and Locations to be Considered for Scoping

3.11 The identified major facilities and locations to be considered for scoping along alignment are shown in Table 4B.10.

**Table 4B.10 Identified Major Facilities and Locations to be Consoidered for Scoping in Ninh Thuan Province Section**

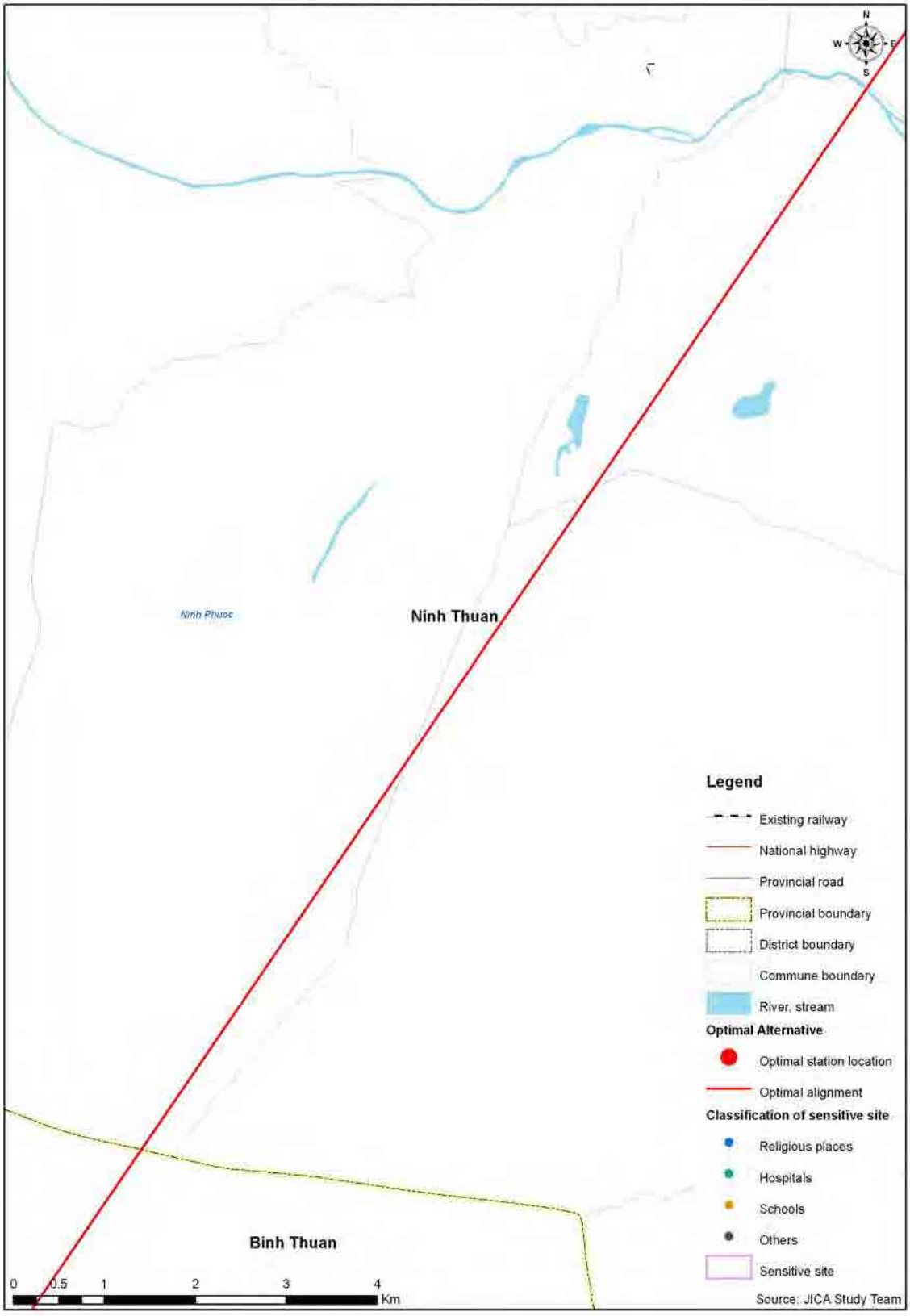
| No | Identified Major Facilities and Locations | Coordination | Distance to the Alignment (m) | Locality/ Description |
|---|---|---|---|---|
| 75. | Thap Cham concrete brick factory | 11°36'11.09"N 108°57'00.02"E | 84 | Do Vinh ward, Phan Rang - Thap Cham City, Ninh Thuan Province |
| 76. | Phan Thiet industrial park | 10°57'15.00"N 108°06'02.00"E | 0 | Industrial zone |
| 77. | Do Vinh cemetery | 11°36'24.34"N 108°57'03.06"E | 90 | Do Vinh ward, Phan Rang - Thap Cham City, Ninh Thuan Province |
| 78. | Mat quy cemetery | 11°34'57.66"N 108°56'36.00"E | 0 | Bao An ward, Phan Rang - Thap Cham City, Ninh Thuan Province |
| 79. | Radio and television broadcasting of Ninh Thuan province | 11°34'48.32"N 108°58'25.70"E | 3,800 | National Highway No.27, Phuoc My ward, Phan Rang - Thap Cham City, Ninh Thuan Province |
| 80. | Radio and television broadcasting of Binh Thuan province | 10°56'01.00"N 108°06'55.00"E | 2,600 | 339-341 Thu Khoa Huan St, Phan Thiet City |
| 81. | Xuan Hai water plant | 11°38'53.26"N 108°58'37.54"E | 200 | Xuan Hai commune, Thuan Bac district, Ninh Thuan Province |
| 82. | Intersection with Dinh River | 11°35'21.06"N 108°56'48.44"E | 0 | Bao An ward, Phan Rang - Thap Cham City, Ninh Thuan Province |
| 83. | Intersection with Southern Main Canal Of Nha Trinh-Lam Cam Irrigation Scheme | 11°33'22.52"N 108°55'25.34"E | 0 | Nhi Ha commune, Thuan Nam district, Ninh Thuan Province |
| 84. | Thanh Son military airport | 11°38'16.86"N 108°57'56.08"E | 230 | Do Vinh ward, Phan Rang - Thap Cham City, Ninh Thuan Province |
| 85. | Dieu Quang pagoda | 11°39'15.49"N 108°58'35.90"E | 198 | Xuan Hai commune, Thuan Bac district, Ninh Thuan Province |
| 86. | Tay Thien pagoda | 11°35'15.33"N 108°56'42.19"E | 95 | Bao An ward, Phan Rang - Thap Cham City, Ninh Thuan Province |
| 87. | Long Phuoc pagoda | 11°34'15.97"N 108°56'06.69"E | 20 | Phuoc Hau commune, Ninh Phuoc district, Ninh Thuan Province |
| 88. | Thanh Son elementary school | 11°38'43.29"N 108°58'23.98"E | 36 | Xuan Hai commune, Thuan Bac district, Ninh Thuan Province |
| 89. | Thanh Son kindergarten | 11°38'40.57"N 108°58'29.66"E | 226 | Xuan Hai commune, Thuan Bac district, Ninh Thuan Province |
| 90. | Thap Cham transport hospital | 11°35'55.04"N 108°56'49.86"E | 196 | Do Vinh ward, Phan Rang - Thap Cham City, Ninh Thuan Province |
| 91. | Do Vinh 3 elementary school | 11°35'50.79"N 108°56'48.84"E | 232 | Do Vinh ward, Phan Rang - Thap Cham City, Ninh Thuan Province |
| 92. | Pham Van Dong high school | 11°34'19.53"N 108°56'02.56"E | 97 | Phuoc Hau commune, Ninh Phuoc district, Ninh Thuan Province |
| 93. | Thap Cham railway station | 11°35'47.83"N 108°57'01.35"E | 50 | Do Vinh ward, Phan Rang - Thap Cham City, Ninh Thuan Province |
| 94. | Phuoc Hau People's Committee | 11°34'19.48"N 108°56'06.46"E | 13 | Phuoc Hau commune, Ninh Phuoc district, Ninh Thuan Province |

Source: JICA Study Team

### 2) Map of Identified Major Facitlities and Locations to be Considered for Scoping

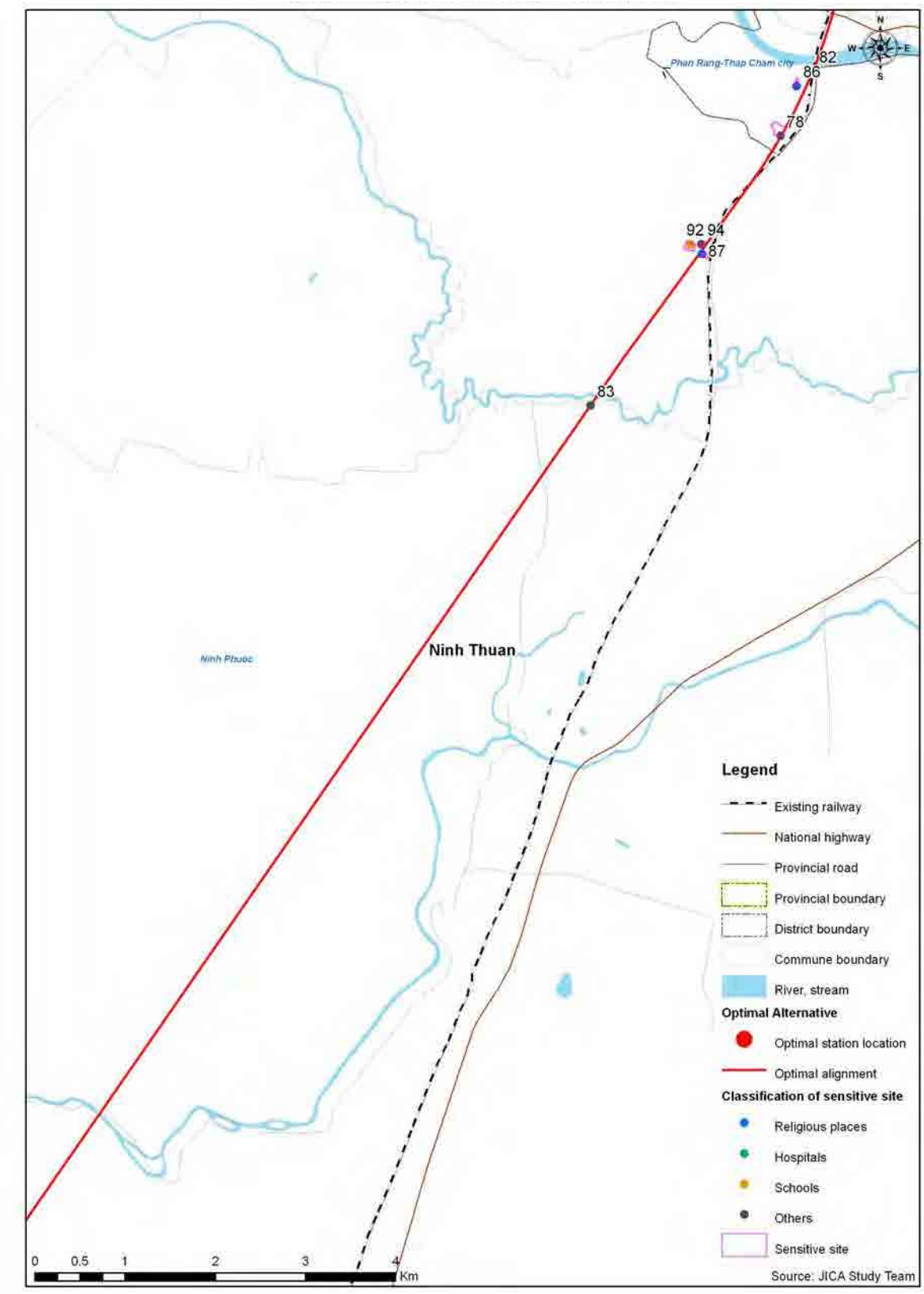
3.12 The maps of identified major facitlities and locations to be considered for scoping in Ninh Thuan Province Section are shown in Figures 4B.48-51. Within 200m from the

alignment, 5 religious facilities, 2 schools and 1 hospitals are identified.



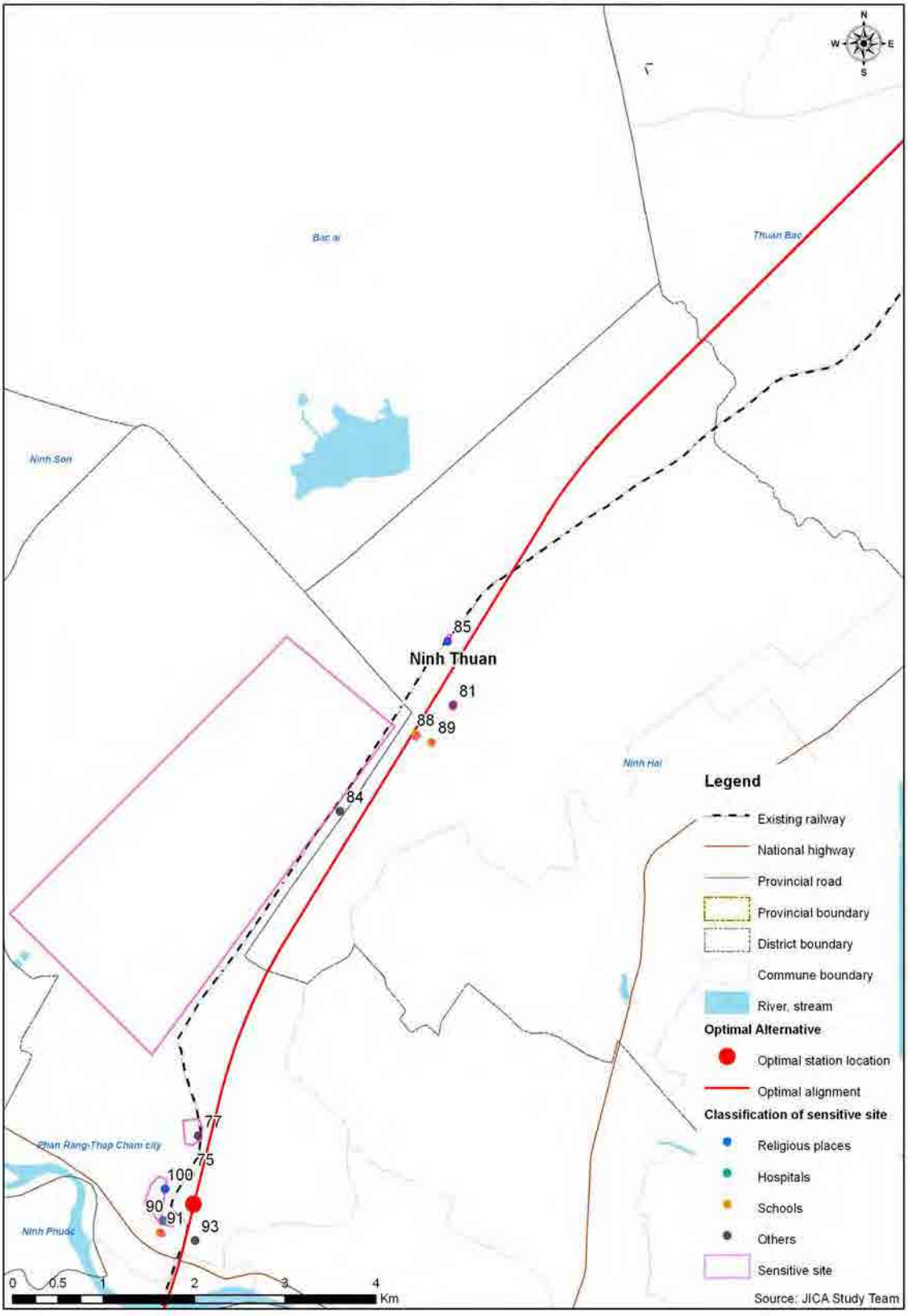

Source: JICA Study Team

**Figure 4B.48 Identified Major Facitlities and Locations to be Considered for Scoping (Ninh Thuan Province, 1/4)**



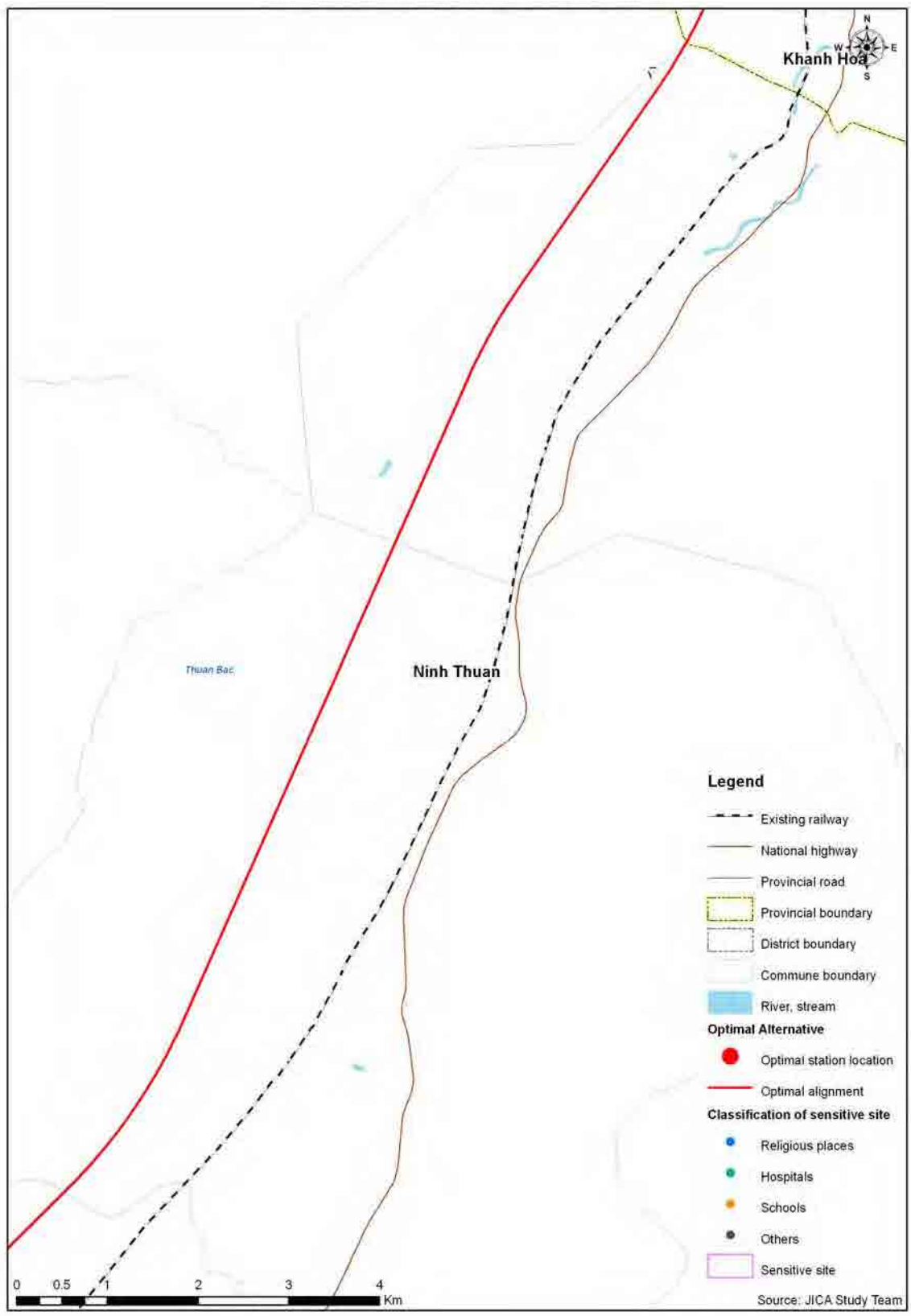

Source: JICA Study Team

**Figure 4B.49 Identified Major Facitlities and Locations to be Considered for Scoping (Ninh Thuan Province, 2/4)**




Source: JICA Study Team

**Figure 4B.50 Identified Major Facitlities and Locations to be Considered for Scoping (Ninh Thuan Province, 3/4)**




Source: JICA Study Team

**Figure 4B.51 Identified Major Facitlities and Locations to be Considered for Scoping (Ninh Thuan Province, 4/4)**

**3)** Map of Tunnel Exit

3.13 Two tunnels are planned in Ninh Thuan Province Section as shown in Figures 4B.52 and 53. There is no building identified within the boundary of 200m from the exits of the tunnels.


**Figure 4B.52 Tunnel in Ninh Thuan Province**

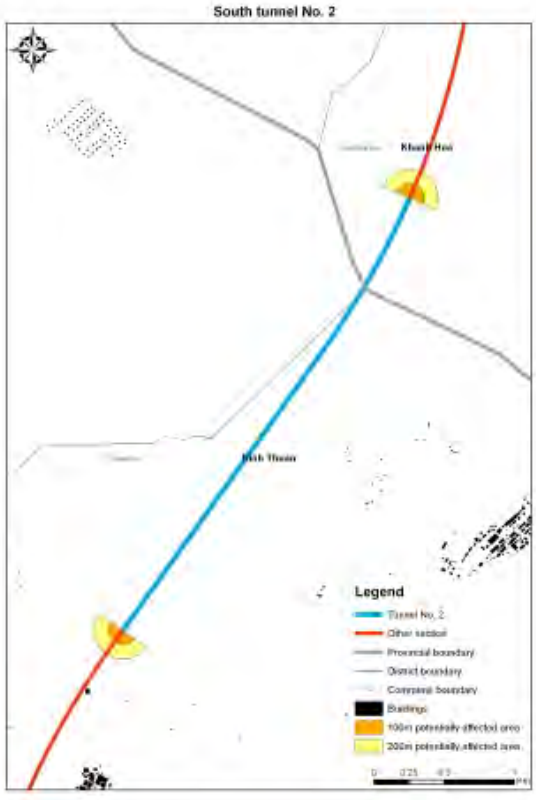



**Figure 4B.53 Tunnel in Ninh Thuan Province**

Source: JICA Study Team

## 3.5 Khanh Hoa Section

### 1) Identified Major Facilities and Locations to be Considered for Scoping

3.14 The identified major facilities and locations to be considered for scoping along alignment are shown in Table 4B.11.

**Table 4B.11 Identified Major Facilities and Locations to be Consoidered for Scoping in Khanh Hoa Province Section**

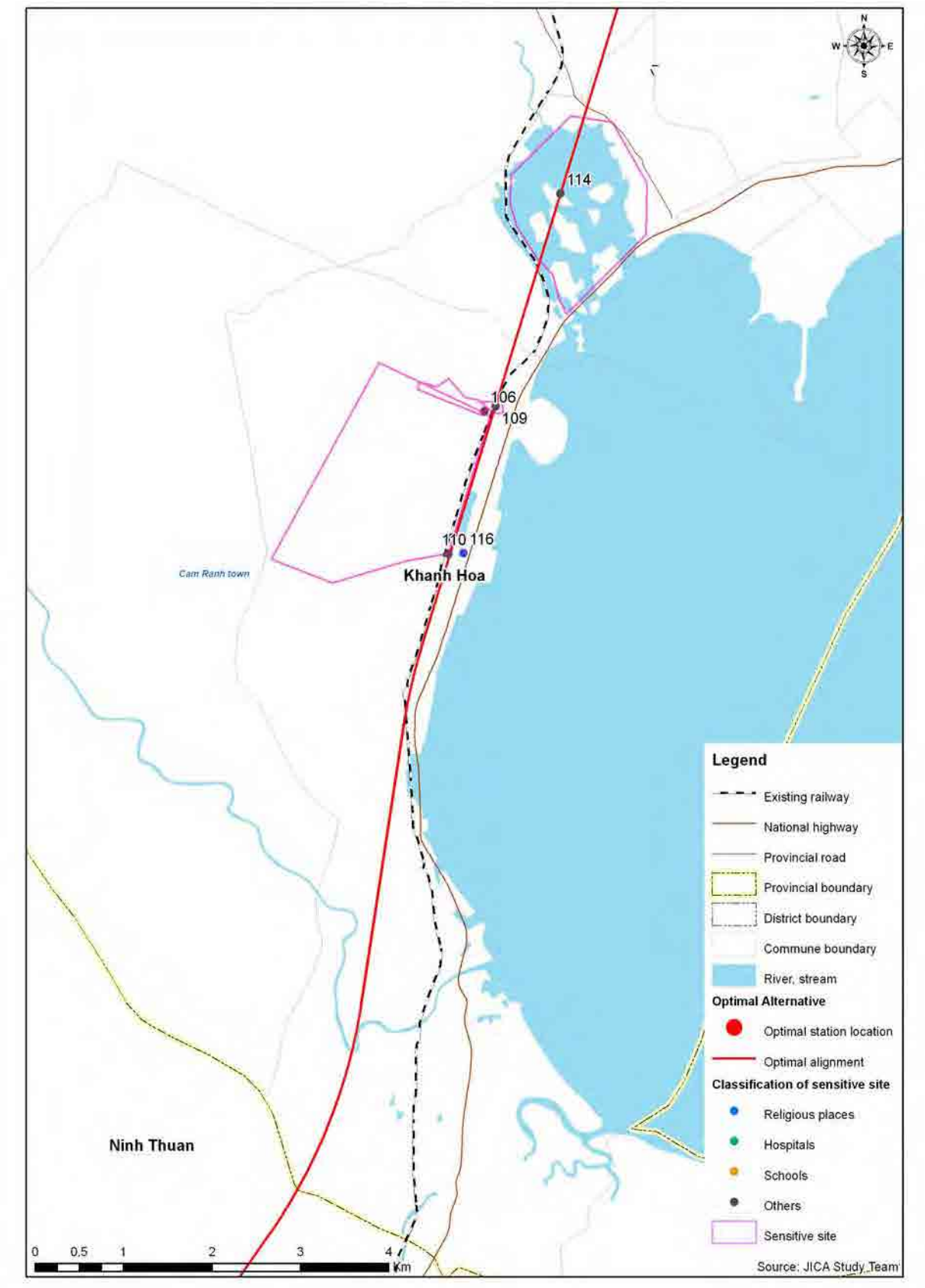
| | Identified Major Facilities and Locations | Coordination | Distance to the Alignment (m) | Locality/ Description |
|---|---|---|---|---|
| 95. | Production forest in Phuoc Dong commune | 12°12'07.98"N 109°08'44.59"E | 0 | Phuoc Dong commune, Nha Trang City, Khanh Hoa Province |
| 96. | Phu Vinh temple | 12°15'51.95"N 109°09'30.23"E | 135 | Vinh Thanh commune, Nha Trang City, Khanh Hoa Province Provincial cultural heritage |
| 97. | An Duong pagoda | 12°14'53.05"N 109°09'25.38"E | 242 | Vinh Thai commune, Nha Trang City, Khanh Hoa Province Provincial cultural heritage |
| 98. | Thai Thong temple | 12°14'51.22"N 109°09'26.06"E | 338 | Vinh Thai commune, Nha Trang City, Khanh Hoa Province Provincial cultural heritage |
| 99. | Lien Hoa Tu temple | 12°16'15.62"N 109°09'33.84"E | 126 | Vinh Ngoc ward, Nha Trang City, Khanh Hoa Province Provincial cultural heritage |
| 100. | Poklong Garai remains | 11°36'06.01"N 108°56'50.76"E | 342 | Do Vinh ward, Phan Rang - Thap Cham City, Ninh Thuan Province National cultural heritage |
| 101. | Hang Gon archaeological ancient tombs monument | 10°51'51.00"N 107°13'50.00"E | 500 | Nhan Nghia commune, Cam My district, Dong Nai Province National cultural heritage |
| 102. | Go Cay Coc cemetery | 12°15'50.57"N 109°09'23.98"E | 0 | Vinh Thanh commune, Nha Trang City, Khanh Hoa Province |
| 103. | Phuoc Dong cemetery | 12"12'20.94"N 109°84'40.94"E | 151 | Phuoc Dong commune, Nha Trang City, Khanh Hoa Province |
| 104. | Cam Hoa cemetery | 12°06'10.71"N 109°07'38.19"E | 0 | Cam Hoa commune, Cam Lam district, Khanh Hoa Province |
| 105. | Cam Hiep Nam cemetery | 12°01'57.03"N 109°08'02.04"E | 157 | Cam Hiep Nam commune, Cam Lam district, Khanh Hoa Province |
| 106. | Doc San cemetery | 11°53'39.80"N 109°06'46.72"E | 89 | Ba Ngoi ward, Cam Ranh City, Khanh Hoa Province |
| 107. | Power frenquency center in region No.7 | 12°15'32.25"N 109°09'23.42"E | 42 | Vinh Thanh commune, Nha Trang City, Khanh Hoa Province This center is currently in the construction phase. Construction is expected to be completed and put into operation in late 2012. |
| 108. | Radio and television broadcasting of Khanh Hoa province | 12°14'04.11"N 109°11'50.15"E | 4,800 | 70 Tran Phu Street, Nha Trang City, Khanh Hoa Province |
| 109. | Cam Ranh wooden chip factory | 11°53'41.53"N 109°06'50.95"E | 0 | Cam Thinh Dong commune, Cam Ranh City, Khanh Hoa Province |

| | Identified Major Facilities and Locations | Coordination | Distance to the Alignment (m) | Locality/ Description |
|---|---|---|---|---|
| 110. | Nam Cam Ranh industrial park | Limited by:<br>11°53'38.04"N<br>109°06'48.20"E<br>to<br>11°52'48.93"N<br>109°06'32.64"E | 30 | Cam Thinh Dong commune, Cam Ranh City, Khanh Hoa Province<br>Planned area of 233 hectares. Currently, investors are Nhatrang Shipbuilding Company is taking steps to establish procedures of infrastructure construction. |
| 111. | Hot water mineral mine in Nha Trang | 12°17'13.41"N<br>109°09'39.26"E | 0 | Vinh Ngoc ward, Nha Trang City, Khanh Hoa Province |
| 112. | Intersection with Cai River | 12°16'41.24"N<br>109°09'35.08"E | 0 | Vinh Thanh commune, Nha Trang City, Khanh Hoa Province |
| 113. | Intersection with Tac River | 12°15'42.67"N<br>109°09'24.11"E | 0 | Vinh Thanh commune, Nha Trang City, Khanh Hoa Province |
| 114. | Shrimp pond area in Ba Ngoi ward | 11°54'57.40"N<br>109°07'16.29"E | 0 | Ba Ngoi ward, Cam Ranh City, Khanh Hoa Province |
| 115. | Thien Y temple | 12°16'15.31"N<br>109°09'33.82"E | 126 | Vinh Ngoc ward, Nha Trang City, Khanh Hoa Province |
| 116. | Hoa Van pagoda | 11°52'49.13"N<br>109°06'38.17"E | 138 | Cam Thinh Dong commune, Cam Ranh City, Khanh Hoa Province |
| 117. | Ha Huy Tap high school | 12°15'26.09"N<br>109°09'17.70"E | 30 | Vinh Thanh commune, Nha Trang City, Khanh Hoa Province |
| 118. | Thai Thong kindergarten | 12°14'51.76"N<br>109°09'25.99"E | 338 | Vinh Thai commune, Nha Trang City, Khanh Hoa Province |
| 119. | Phuoc Lanh residential area | 12°13'36.58"N<br>109°09'07.06"E | 100 | Vinh Thai commune, Nha Trang City, Khanh Hoa Province |

Source: JICA Study Team

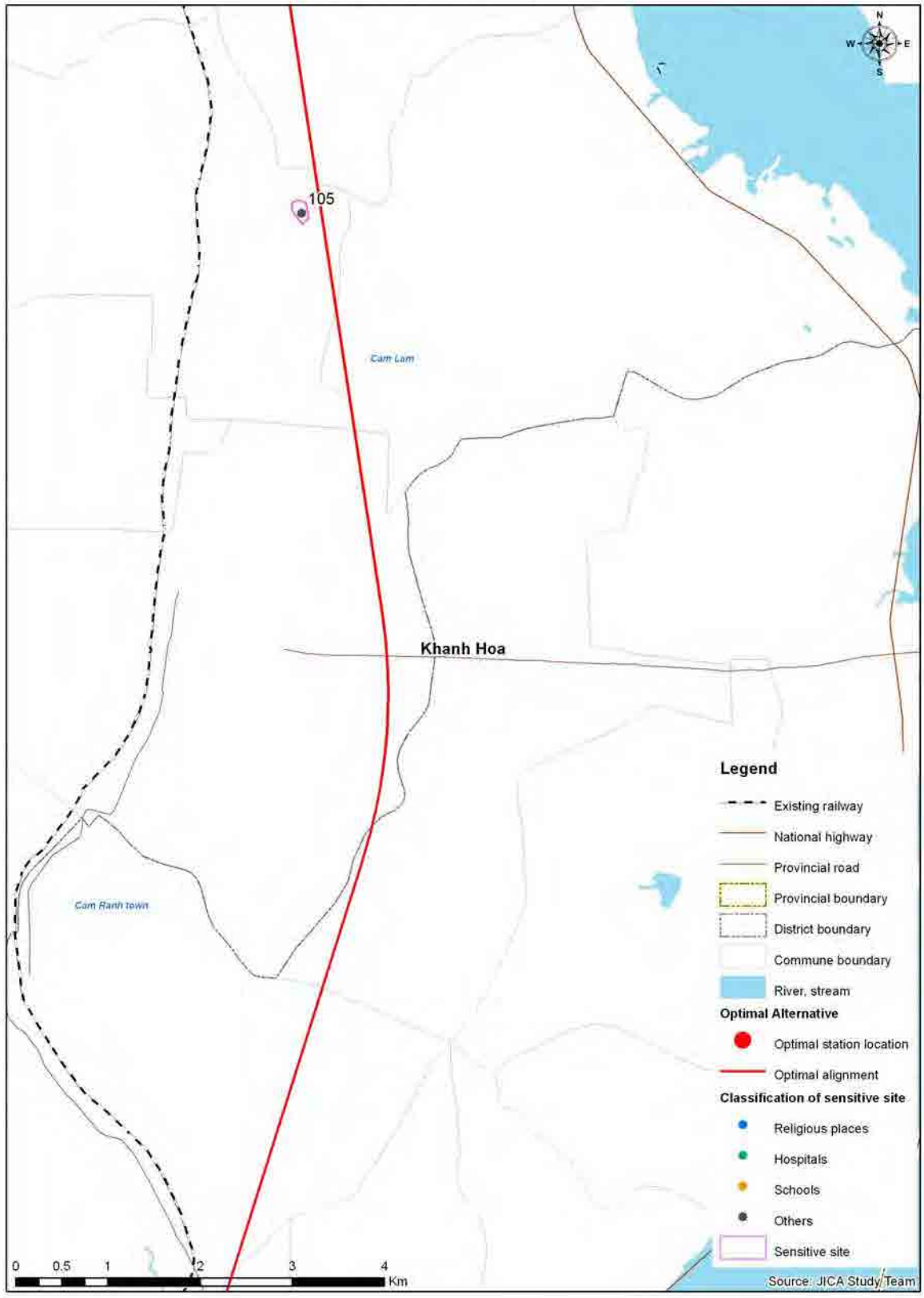
**2)** Map of Identified Major Facitlities and Locations to be Considered for Scoping

3.15 The maps of identified major facitlities and locations to be considered for scoping in Khanh Hoa Province Section are shown in Figures 4B.54-57. Within 200m from the alignment, 9 religious facilities, 1 school and 0 hospital are identified.



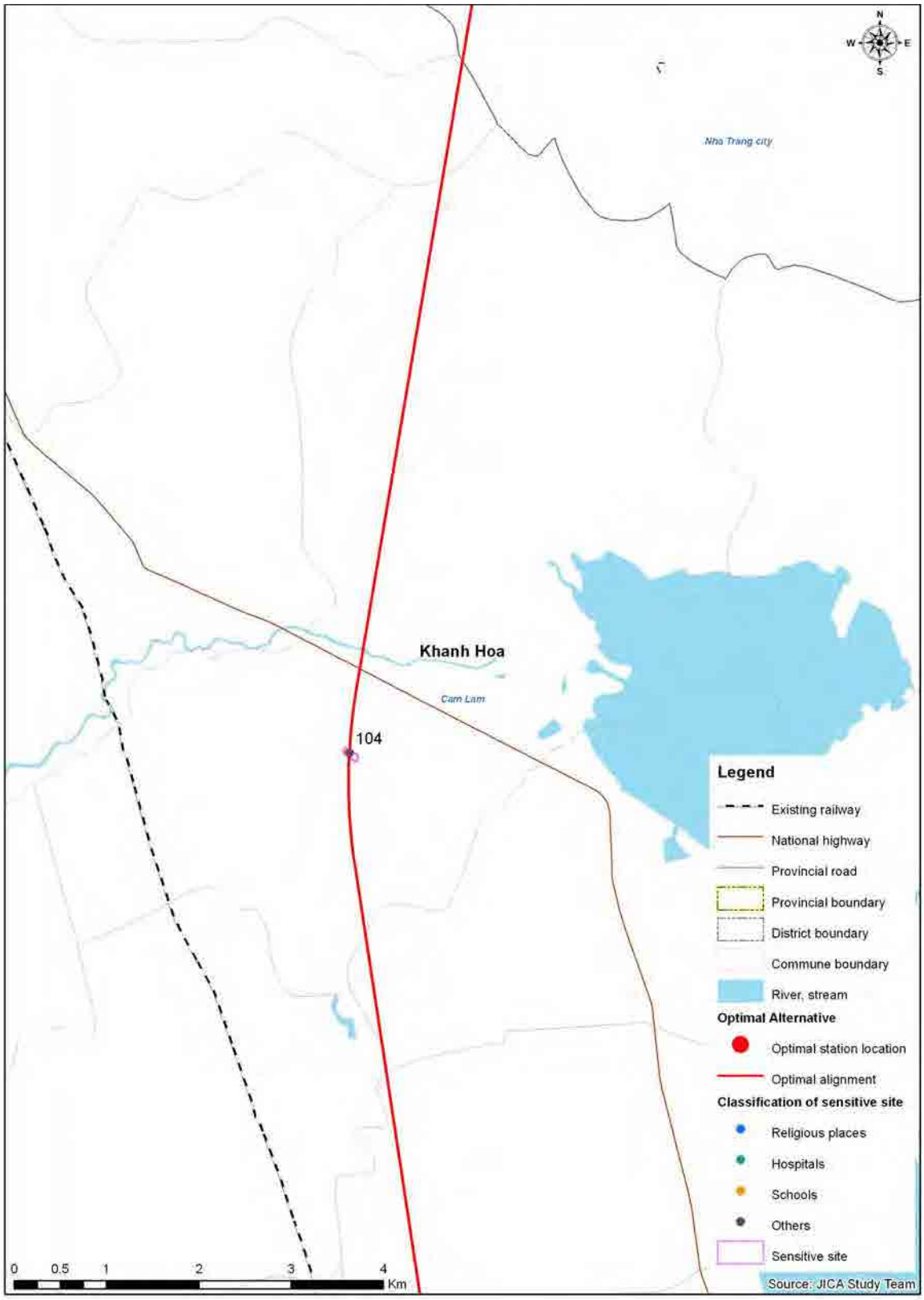

Source: JICA Study Team

**Figure 4B.54 Identified Major Facitlities and Locations to be Considered for Scoping (Khanh Hoa Province, 1/4)**



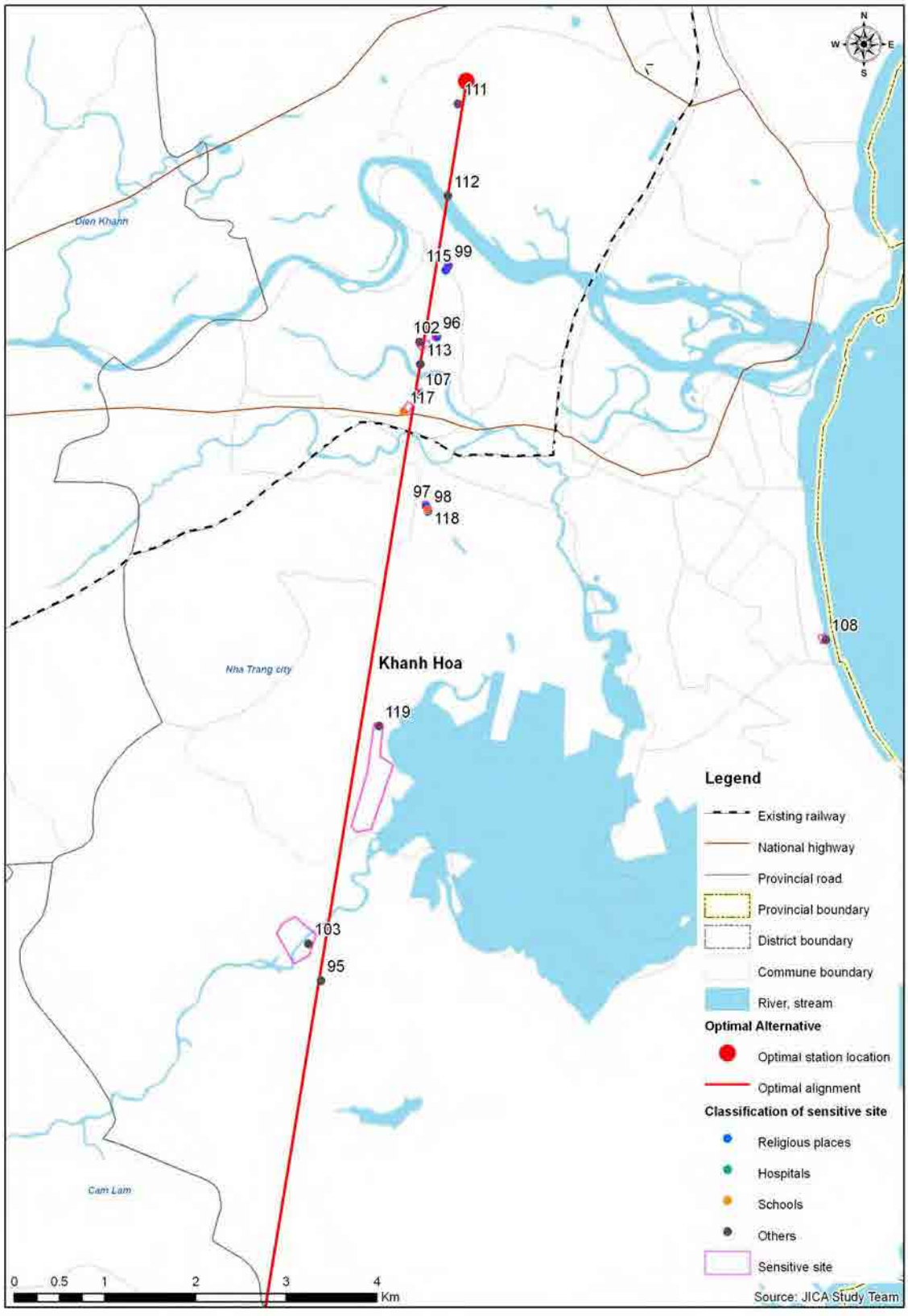

Source: JICA Study Team

**Figure 4B.55 Identified Major Facitlities and Locations to be Considered for Scoping (Khanh Hoa Province, 2/4)**




Source: JICA Study Team

**Figure 4B.56 Identified Major Facitlities and Locations to be Considered for Scoping (Khanh Hoa Province, 3/4)**




Source: JICA Study Team

**Figure 4B.57 Identified Major Facitlities and Locations to be Considered for Scoping (Khanh Hoa Province, 4/4)**

**3)** Map of Tunnel Exit

3.16 Eight tunnels are planned in Khanh Hoa Province Section as shown in Figures 4B.58-64. It is identified that buildings are located within the boundary of 100m from the exits of tunnels in Figures 4B.60, 63 and 64.


**Figure 4B.58 Tunnel in Khanh Hoa Province**

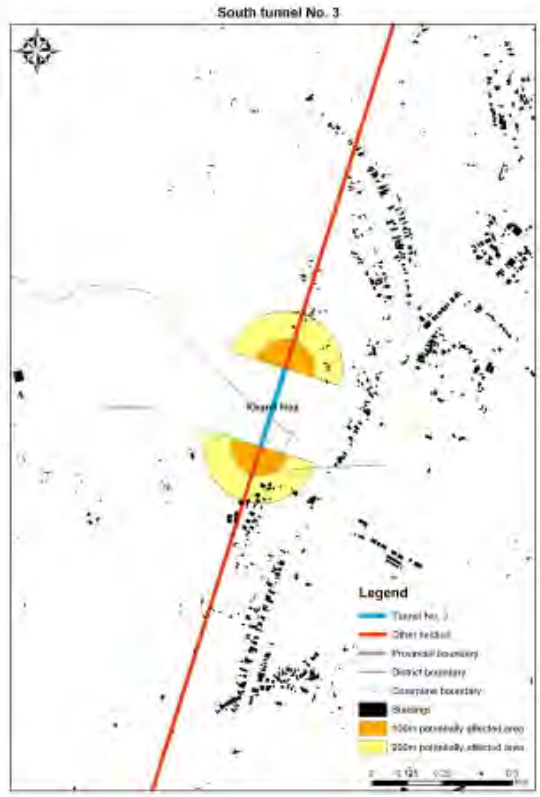



**Figure 4B.59 Tunnel in Khanh Hoa Province**

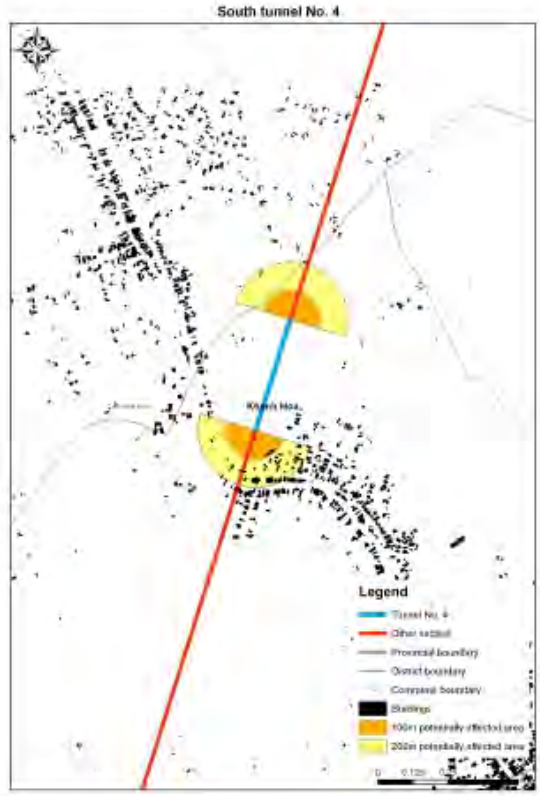



**Figure 4B.60 Tunnel in Khanh Hoa Province**


**Figure 4B.61 Tunnel in Khanh Hoa Province**

Source: JICA Study Team

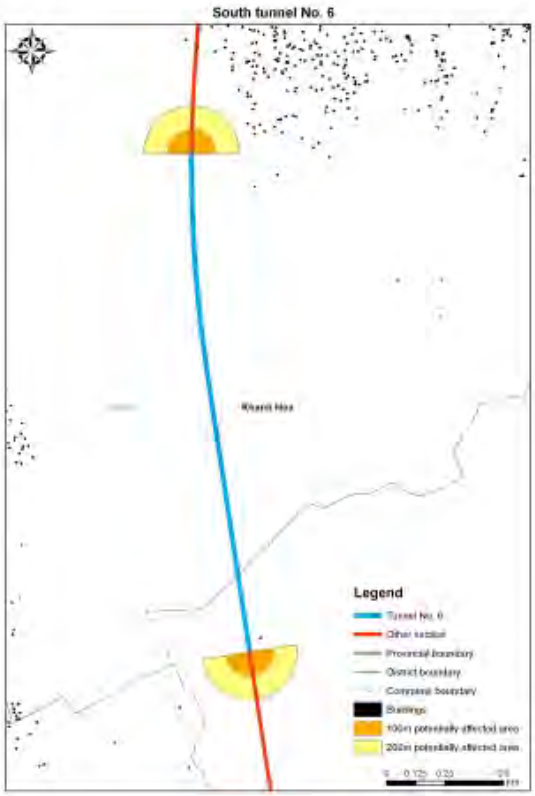



**Figure 4B.62 Tunnel in Khanh Hoa Province**

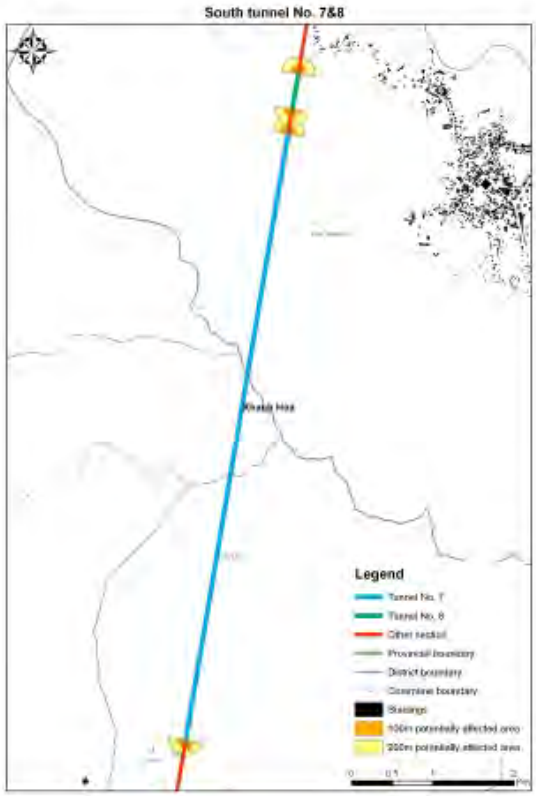



**Figure 4B.63 Tunnel in Khanh Hoa Province**

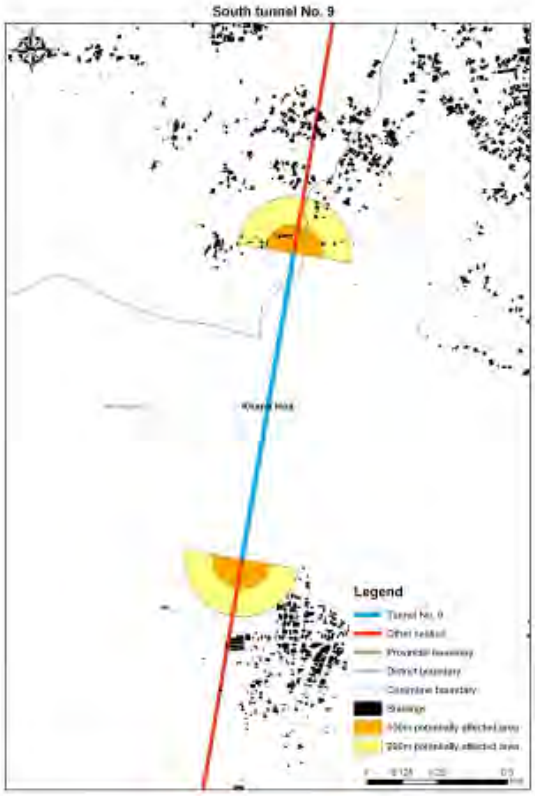



**Figure 4B.64 Tunnel in Khanh Hoa Province**

Source: JICA Study Team

# APPENDIX 4C

# Result of Rating (City/Province)

# (North Section)

## Table 4C.1 Result of Rating (Hanoi Section)

| Hanoi | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| Natural Environment | Climate / Meteorological Phenomena | D | D | D | P: No impact is expected. |
| | | | | | C/O: Although the elevated structures such as viaduct of the HSR track and station building will be constructed, the impacts on micro-climate and micro meteorological phenomena are negligible because these structures would not disturb wind path. |
| | Topography | D | D | D | P: No impact is expected. |
| | | | | | P: No impact is expected. |
| | | | | | O: Completing construction, topography would be stable. No impact is expected |
| | Geology | D | D | D | P: No impact is expected. |
| | | | | | C: Although there are some soft soil areas and soil improvement works will be done there for the constructions, it is not a scale that changes geological features. |
| | | | | | O: No impact is expected. |
| | Soil Erosion | D | B- | C- | P: No impact is expected. |
| | | | | | C: By the earth work, especially when it is raining, some soil erosion is expected. |
| | | | | | O: Embankment or cut section is about 7.8 km, where new surface may be washed by rain water. |
| | Hydrology | D | D | B- | P: No impact is expected. |
| | | | | | C: In the elevated structure section, construction works would cause little impacts on the hydrological cycle or regimes. In embankment or cut section, piled up soil may cause minor and temporal impact on hydrological cycle or regimes. They are not scale that change hydrological regime. |
| | | | | | O: In the embankment section of about 7.8 km, hydrological situation would be affected by the structures. The elevated section will have less and minor impact on the hydrological conditions. |
| | Ground water | D | B- | D | P: No impact is expected. |
| | | | | | C: Ground water in Red River Delta is generally abundant due to many canal/rivers and its low altitude. In addition, ground water utilization by the construction works is not a scale that changes ground water flow. |
| | | | | | O: Utilizing ground water by HSR is not a scale that can change ground water level. |
| | Ecosystem<br>Flora, Fauna and Biodiversity | D | B- | B- | P: No impact is expected. |
| | | | | | C: Most of the area along the alignment is already developed area including residential and agricultural areas. The affected flora, fauna and biodiversity along the alignment are considered to be not critical, while the construction work may interfere with the habitat of flora and fauna. |
| | | | | | O: Existence of the HSR structure and HSR operation may cause negative impact on the ecosystem. |
| | Protected Areas/Forest | D | D | D | P: There are special-use forests (protected areas) in Hanoi city, however those areas are located too far from the planned alignment (more than 10km) to be affected. Protection forests and production forests are not affected by the alignment either. |
| | | | | | C: The construction machines could damage the vegetation. Activities of construction workers may also be the pressure on forest. |
| | | | | | O: By the structure of HSR, some of the forest area is opened, so that more sunshine will be led inside the vegetation, which would affect the edge of the forest area. |
| | Coastal zone | D | D | D | P/C/O: Hanoi city does not have any coastal line. Thus, no impact is expected. |
| | Landscape | D | D | B+/B- | P: No impact is expected. |
| | | | | | C: Change of landscape is temporary and limited during the construction. |
| | | | | | O: By the structures such as viaduct, embankment and station buildings, both positive and negative impacts on landscape are expected. |

| Hanoi | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | Natural disasters | D | C- | C- | P: No impact is expected. |
| | | | | | C: While there is no landslide / erosion prone areas information, riverbank could be eroded due to construction. |
| | | | | | O: Regularly flooding areas are found but far from the planned alignment. The closest flooding area is at more than 4 km away from the planned alignment, while the riverbank along alignment could be affected. No landslide area is reported in the flat areas where alignment is planned. |
| Living Environment | Air Pollution | D | B- | A+/B- | P: No impact is expected. |
| | | | | | C: Some negative impact is expected due to operation of many equipments and vehicles, dust incidental to earth work especially in dry season, although these impacts are temporal and limited. |
| | | | | | O: Overall reduction of air pollutants' emission is expected by the modal shift of passengers' transportation to the HSR (+31% of the share between Hanoi – Vinh, 2030 projection) from cars (-6%), buses (-19%), airs (-1%), and existing railway (-5%). 196 t-$NO_x$/year of air pollutants would be reduced by the development of the HSR in the north section. On the other hand, increase in air pollutants from increased access of cars and buses around the station are expected. |
| | Offensive Odor | D | D | D | P/C/O: No impact is expected. |
| | Water Pollution | D | B- | B- | P: No impact is expected. |
| | | | | | C: Turbid water by the earth work (1.5 km of embankment) and bridge piers' construction work (5 bridges over rivers are planned), and wastewater effluents from construction works' camps/yards are expected to pollute the surrounding rivers/canals water to some extent. |
| | | | | | O: Wastewater effluents from passengers at the station and maintenance activities in the depot are expected. Some impacts on water quality in surrounding water bodies are expected due to discharged polluted water. |
| | Bottom Sediment Contamination | D | D | D | P: No impact is expected. |
| | | | | | C: Although some construction materials such as cement and sand are expected to be washed out mainly by the rain, the impacts on bottom sediment by them are small. |
| | | | | | O: Although some impact is expected on bottom sediment by deposition of pollutants from the wastewater discharged from maintenance activities in the depot in Ngoc Hoi, the impact is small. |
| | Soil Contamination | D | C- | B- | P: No impact is expected. |
| | | | | | C: Although some impact on soil is expected by deposition of pollutants from construction materials and vehicles, the impacts are small. On the other hand, in case the soil at construction sites is already contaminated by other reasons, some impacts are expected by the construction activity. Thus, further study is necessary. |
| | | | | | O: Some impact may be expected on soil by deposition of pollutants from maintenance activities in the depot in Ngoc Hoi. |
| | Ground Subsidence | D | D | D | P: No impact is expected. |
| | | | | | C: Ground water utilization by the construction works is not a scale that changes ground water flow. Thus, no ground subsidence is expected. |
| | | | | | O: Geological condition along alignment in Hanoi is soft soil layers. As viaduct section is planned to be applied, no impact is expected. |
| | Noise/vibration | D | B- | A- | P: No impact is expected. |
| | | | | | C: There are 6 religious facilities, 5 schools and 1 hospital within 200m from the alignment. Noise and vibration generated by operation of heavy equipment and vehicles, although they are temporary, may affect the residential areas and such facilities/places which require quietness. |
| | | | | | O: There are 6 religious facilities, 5 schools and 1 hospital within 200m from the alignment. Noise and vibration generated by movement of high speed trains may affect the residential areas and such facilities/places which require quietness. Maintenance of ballast track would also cause noise. |
| | Low frequency noise/micro-pressure wave | D | D | D | P: No impact is expected. |
| | | | | | C: Construction activities will not cause low frequency noise/micro-pressure wave. |
| | | | | | O: There is no tunnel which may cause low frequency/micro-pressure wave. Low frequency noise from the train passing an open section is small. |
| | Wave Obstruction | D | D | B- | P: No impact is expected. |

| Hanoi | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | C: No wave obstruction is expected by the construction work. |
| | | | | | O: Radio waves would be disturbed by movement of high speed trains and some impacts such as flutter and pulse interferences on TV are expected. In addition, since the elevated structures such as viaduct and Ngoc Hoi station building will be developed (total: 20.5 km, of which 14.1 km is with noise barrier), some impacts by wave disturbed by these structures are expected. |
| | Sunshine Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No sunshine obstruction is expected by the construction works. |
| | | | | | O: There will be elevated structures such as viaduct and station buildings development (total: 20.5 km, of which 14.1 km is with noise barrier); some impacts are expected by shade created by these structures. |
| | Wastes/Hazardous waste | D | B- | B- | P: No impact is expected. |
| | | | | | C: A certain amount of construction and demolition wastes which may include hazardous materials, and waste from construction workers' camps is expected to be generated. |
| | | | | | O: A certain amount of wastes from passengers at the station and maintenance works at the depot is expected to be generated. |
| Social Environment | Involuntary resettlement | A- | B- | D | P: About 120 ha of land would be necessary for development of the HSR structures (viaduct, station, depot, etc.) in this section. In addition, about 60 buildings and 490 households would be affected either by land acquisition or resettlement although the alignment is planned to avoid the land acquisition and resettlement as much as possible though alternative analysis. |
| | | | | | C: Land acquisition and resettlement activities are expected to be continued even during construction stage. Temporal relocation is also required for setting up of construction yards and workers' camps for the construction activities. |
| | | | | | O: No impact is expected. |
| | Land use | B- | B- | A+ | P: The current land use needs to be changed by land acquisition and resettlement in accordance with the planned alignment and station location. |
| | | | | | C: Land clearance for construction yards and workers' camps is temporary. The land use around the construction site may be changed by doing business with construction workers without control. |
| | | | | | O: The HSR station will be developed together around the station areas as an integrated development. In addition, land use is expected to be changed gradually for further development mainly around the station in accordance with a provincial/city plan and private investments. |
| | Utilization of local resources | D | B- | D | P: No impact is expected. |
| | | | | | C: Using a large amount of local resources such as sand and quarry for the construction activities would obstruct its utilization by local people for other purposes. |
| | | | | | O: No impact is expected because the HSR would not use much local resources. |
| | General, regional /city plans | B+/B- | D | B+ | P: While Ngoc Hoi Station area is kept for the future HSR purpose, HSR will result in changing land use purpose in most part in the city. The current general plan and/or regional/city plan of City needs to be updated in accordance with the planned alignment and station location. |
| | | | | | C: No impact is expected (updating plans may continue). |
| | | | | | O: In accordance with the HSR development including development of station area, further general plan/city plans which include further development plan are expected to be prepared in all city/provinces. |
| | Social institutions and local decision-making institutions | C- | C- | C- | P: Some impact on social institutions local decision making institutions is expected by land acquisition and resettlement. However further examination is necessary. |
| | | | | | C: Some impact on social institutions and local decision making institutions is expected by inflow of many construction workers and other relating peoples from outside the area. However further examination is necessary. |
| | | | | | O: Some impact on social institutions and local decision making institutions is expected by disturbing movement of local people by the HSR structures. However further examination is necessary. |
| | Social Infrastructures and Services | B- | B- | B+/B- | P: By land acquisition and resettlement, some impacts on social infrastructure and services such as resettlement of community facility (village hall, etc.) are expected. Cong Xuen Village Well may be affected. |
| | | | | | C: Though temporal, impacts on social infrastructures and services by setting up of construction yards and workers' camps are expected. Especially, impacts on social infrastructures and services are expected by disturbance and interruption of their utilization by the construction activities such as relocation of public |

| Hanoi | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | utilities and local roads. |
| | | | | | O: Development of the HSR station together with its surrounding areas would improve social infrastructures and services in the area and the country. On the other hand, some impacts on social infrastructures and services by the existence of the HSR structures are expected. |
| | Local economy and livelihood | B- | B+ | A+/B- | P: Some negative impacts on the local economy and livelihood are expected because of losses of employment opportunities and income sources by land acquisition and resettlement. |
| | | | | | C: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the construction activities. |
| | | | | | O: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the HSR project, especially around the station and employment of the workers for track maintenance, etc.<br>On the other hand, some negative impacts are also expected after the completion of the construction activities because of termination of temporary employment opportunities of local workers. |
| | Unequal Distribution of Benefit and Damage | B- | B- | B- | P: Unequal situations are expected among the project affected households/peoples and not affected households/peoples. |
| | | | | | C: Some unequal situations are expected among the local peoples between those who receive any benefit and those who receive any damage from the constriction activities, e.g. some affected households need to be relocated far away, while their neighbors not affected can do business with construction workers. |
| | | | | | O: Some unequal situations are expected among the local peoples between those who live near the station and those who live far from the station, especially in the latter case, they have a possibility to receive damages such as noise and vibration impacts, and some impacts on social infrastructures and services, livelihood and water usage, while in the former case, they may enjoy the benefit from the HSR service and related opportunities of businesses. |
| | Local conflicts of interest | C- | C- | C- | P/C/O: Local conflicts of interest are expected among local peoples, especially between beneficiaries and project affected peoples for land acquisition and inconveniences during construction and operation. Further examination would be necessary in case that unequal distribution of benefit and damage is expected to be crucial issues. |
| | Water Usage, Water Rights and Communal Rights | C- | C- | C- | P: Some impacts on water usage for the resettled houses/peoples are expected by land acquisition and resettlement. However, further examination would be necessary for water rights and communal rights. |
| | | | | | C: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses by the construction activities are small and temporal. However, further examination would be necessary for water rights and communal rights. |
| | | | | | O: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses are expected by the existence of the HSR structures. However, further examination would be necessary for disturbance by the structures. |
| | Cultural and Historical Heritages | D | C- | C- | P: National or city cultural and historical heritages are not found within a distance of 100m from the alignment of HSR. Thus, no impact is expected. |
| | | | | | C: Though not directly affected, heritages may exist near the alignment. These may be affected by the noise and vibration, and the traffic congestions caused by vehicles for the construction. Further confirmation is required. |
| | | | | | O: The heritages mainly within 100m from the alignment may suffer the impact of noise and vibration to some extent. |
| | Religious Facilities | B- | B- | B- | P: Though the well known religious places are not directly affected, small scale village level religious facilities may be relocated (ex. Tu Thuan Village Temple, Buom Pagoda on the alignment). |
| | | | | | C/O: 6 religious facilities are found along the HSR within a distance less than 200m, So impacts such as noise and vibration are expected during the construction and operational phases. |
| | Sensitive facilities (ex. hospital, school, precision machine factory) | B- | B- | B- | P: It finds some sensitive places as TV College, 40m away from the alignment and those places may be relocated. Further examination is required. |
| | | | | | C: Especially regarding the school and hospital (such as TV College located at the distance of 40 m, Neurological Hospital located at the distance of 75 m away from planned alignment), the traffic congestion with heavy vehicles affect the local peoples' convenience and safety. |
| | | | | | O: Especially with regard to the 5 schools and 1 hospital along the alignment, noise and vibration caused by HSR may affect the peoples' comfort. |

| Hanoi | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | Poor people | C- | B+ | C- | P: Poor people (who have poor household certificates issued by local authorities) stay everywhere. Further examination would be necessary for them because it is more difficult for them to recover their livelihood after land acquisition and resettlement than other PAPs. |
| | | | | | C: There is a possibility that the poor people would also have employment opportunities in construction and its associated business activities. |
| | | | | | O: There is a possibility that the enjoyment of the benefits of the HSR service by the poor people would be difficult. Further examination would be necessary. |
| | Ethnic Minorities/indigenous people | D | D | D | P: Particular distribution of ethnic minorities along the alignment is not reported. Thus, no impact is expected. |
| | | | | | C: No impact is expected. |
| | | | | | O: No impact is expected. |
| | Gender | C- | C- | C- | P: Land acquisition and resettlement are an important incident to a family and some women would have a bigger burden for that. Further examination would be necessary. |
| | | | | | C: Equal employment opportunities for both sexes are required for the construction works. Further examination would be necessary. |
| | | | | | O: The HSR service will be equal to both sexes. On the other hand, equal employment opportunities for both sexes are required for the HSR operation. Further examination would be necessary. |
| | Children's rights | D | D | D | P: No impact is expected. |
| | | | | | C/O. Since employment of children for the construction works is strictly prohibited by Children Protection, Education and Care Law 2004, no impact is expected. |
| | Public Health (sanitation and infectious diseases) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts on public health are expected due to unsanitary conditions caused by the influx of a large number of workers. In addition, increase of risks related to Sexually Transmitted Diseases (STD) or Sexually Transmitted Infections (STI) and HIV/AIDS is expected among the workers and local communities. |
| | | | | | O: Some impacts on public health are expected due to the influx of a large number of passengers (about 70,000 passengers per day at Ngoc Hoi Station, if Ngoc Hoi - Vinh section is operated in 2030) and business persons around the station area. |
| | Occupational Health and Safety (OHS) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts regarding OHS for the construction workers are expected. |
| | | | | | O: Some impacts regarding OHS for the workers for the HSR operation, especially the workers at the track for maintenance and at the depot are expected. |
| Other | Accidents | D | B- | C+/C- | P: No impact is expected. |
| | | | | | C: Increase of risks of accidents associated with construction activities is expected due to the operation of heavy equipment and vehicles. |
| | | | | | O: Increase of risks of accidents associated with the HSR services is expected due to the high speed train operation. On the other hand, positive and/or negative impacts are expected by the modal sift of passengers' transportation to HSR from cars, buses, airs, and existing railway. |
| | Climate Change | D | D | A+/C- | P: No impact is expected. |
| | | | | | C: Although increase of GHGs emission is expected due to operation of heavy equipment and vehicles, the impact is temporal and small. |
| | | | | | O: Overall reduction of GHGs emission is expected by the modal shift of passengers' transportation to the HSR (+31% of the share between Hanoi – Vinh, 2030 projection) from cars (-6%), buses (-19%), airs (-1%), and existing railway (-5%). 63 kt-$CO_2$e/year of GHGs would be reduced by the development of the HSR in the north section.<br>Though alignment avoids the coastal area, Impact by the rise of sea level should be further studied. |

Source: JICA Study Team

## Table 4C.2 Result of Rating (Ha Nam Section)

| Ha Nam | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| Natural Environment | Climate / Meteorological Phenomena | D | D | D | P: No impact is expected. |
| | | | | | C/O: Although the elevated structures such as viaduct of the HSR track and station building will be constructed, the impacts on micro-climate and micro meteorological phenomena are negligible because these structures would not disturb wind path. |
| | Topography | D | D | D | P: No impact is expected. |
| | | | | | P: No impact is expected. |
| | | | | | O: Completing construction, topography would be stable. No impact is expected |
| | Geology | D | D | D | P: No impact is expected. |
| | | | | | C: Although there are some soft soil areas and soil improvement works will be done there for the constructions, it is not a scale that changes geological features. |
| | | | | | O: No impact is expected. |
| | Soil Erosion | D | B- | C- | P: No impact is expected. |
| | | | | | C: By the earth work, especially when it is raining, some soil erosion is expected. |
| | | | | | O: Embankment or cut section is about 9.0 km, where new surface may be washed by rain water. |
| | Hydrology | D | D | B- | P: No impact is expected. |
| | | | | | C: In the elevated structure section, construction works would cause little impacts on the hydrological cycle or regimes. In embankment or cut section, piled up soil may cause minor and temporal impact on hydrological cycle or regimes. They are not scale that change hydrological regime. |
| | | | | | O: In the embankment section of about 9.0 km, hydrological situation would be affected by the structures. The elevated section will have less and minor impact on the hydrological conditions. |
| | Ground water | D | B- | D | P: No impact is expected. |
| | | | | | C: Ground water in Red River Delta is generally abundant due to many canal/rivers and its low altitude. In addition, ground water utilization by the construction works is not a scale that changes ground water flow. |
| | | | | | O: Utilizing ground water by HSR is not a scale that can change ground water level. |
| | Ecosystem | D | B- | B- | P: No impact is expected. |
| | Flora, Fauna and Biodiversity | | | | C: Most of the area along the alignment is already developed area including residential and agricultural areas. The affected flora, fauna and biodiversity along the alignment are considered to be not critical, while the construction work may interfere with the habitat of flora and fauna. |
| | | | | | O: Existence of the HSR structure and HSR operation may cause negative impact on the ecosystem. |
| | Protected Areas/Forest | D | D | D | P: There is no special-use forest (protected areas) in Ha Nam province. Protection forests and production forests are not affected by the alignment either. |
| | | | | | C: The construction machines could damage the vegetation. Activities of construction workers may also be the pressure on forest. |
| | | | | | O: By the structure of HSR, some of the forest area is opened, so that more sunshine will be led inside the vegetation, which would affect the edge of the forest area. |
| | Coastal zone | D | D | D | P/C/O: Hanam province does not have any coastal line. Thus, no impact is expected. |
| | Landscape | D | D | B+/B- | P: No impact is expected. |
| | | | | | C: Change of landscape is temporary and limited during the construction. |
| | | | | | O: By the structures such as viaduct, embankment and station buildings, both positive and negative impacts on landscape are expected. |
| | Natural disasters | D | C- | C- | P: No impact is expected. |
| | | | | | C: While there is no landslide / erosion prone areas information, riverbank could be eroded due to construction. |
| | | | | | O: Flooding areas is not identified in the map. While the riverbank along alignment could be affected. No landslide area is reported in the flat areas where alignment is planned. |
| Living Environment | Air Pollution | D | B- | A+/B- | P: No impact is expected. |
| | | | | | C: Some negative impact is expected due to operation of many equipments and vehicles, dust incidental to earth work especially in dry season, although these impacts are temporal and limited. |
| | | | | | O: Overall reduction of air pollutants' emission is expected by the modal shift of passengers' transportation to the HSR (+31% of the share between Hanoi – Vinh, 2030 projection) from cars (-6%), buses (-19%), airs (-1%), and existing railway (-5%).196 t-$NO_x$/year of air pollutants would be reduced by the development of the HSR in the north section. On the other hand, increase in air pollutants from increased access of cars and buses around the station are expected. |
| | Offensive Odor | D | D | D | P/C/O: No impact is expected. |
| | Water Pollution | D | B- | B- | P: No impact is expected. |

| Ha Nam | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | C: Turbid water by the earth work (9 km of embankment) and bridge piers' construction work (4 bridges over rivers are planned), and wastewater effluents from construction works' camps/yards are expected to pollute the surrounding rivers/canals water to some extent. |
| | | | | | O: Wastewater effluents from passengers at the station and maintenance activities in the depot are expected. Some impacts on water quality in surrounding water bodies are expected due to discharged polluted water. |
| | Bottom Sediment Contamination | D | D | D | P: No impact is expected. |
| | | | | | C: Although some construction materials such as cement and sand are expected to be washed out mainly by the rain, the impacts on bottom sediment by them are small. |
| | | | | | O: No impact is expected. |
| | Soil Contamination | D | C- | D | P: No impact is expected. |
| | | | | | C: Although some impact on soil is expected by deposition of pollutants from construction materials and vehicles, the impacts are small. On the other hand, in case the soil at construction sites is already contaminated by other reasons, some impacts are expected by the construction activity. Thus, further study is necessary. |
| | | | | | O: No impact is expected. |
| | Ground Subsidence | D | D | D | P: No impact is expected. |
| | | | | | C: Ground water utilization by the construction works is not a scale that changes ground water flow. Thus, no ground subsidence is expected. |
| | | | | | O: Geological condition along alignment in Ha Nam is soft soil layers. As viaduct section is planned to be applied, no impact is expected. |
| | Noise/vibration | D | B- | A- | P: No impact is expected. |
| | | | | | C: There are 8 religious facilities, 0 school and 3 hospitals within 200m from the alignment. Noise and vibration generated by operation of heavy equipment and vehicles, although they are temporary, may affect the residential areas and such facilities/places which require quietness. |
| | | | | | O: There are 6 religious facilities, 5 schools and 1 hospital within 200m from the alignment. Noise and vibration generated by movement of high speed trains may affect the residential areas and such facilities/places which require quietness. Maintenance of ballast track would also cause noise. |
| | Low frequency noise/micro-pressure wave | D | D | D | P: No impact is expected. |
| | | | | | C: Construction activities will not cause low frequency noise/micro-pressure wave. |
| | | | | | O: There is no tunnel which may cause low frequency/micro-pressure wave. Low frequency noise from the train passing an open section is small. |
| | Wave Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No wave obstruction is expected by the construction work. |
| | | | | | O: Radio waves would be disturbed by movement of high speed trains and some impacts such as flutter and pulse interferences on TV are expected. In addition, since the elevated structures such as viaduct and Phu Ly station building will be developed (total: 25.6 km, of which 10.6 km is with noise barrier), some impacts by wave disturbed by these structures are expected. |
| | Sunshine Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No sunshine obstruction is expected by the construction works. |
| | | | | | O: There will be elevated structures such as viaduct and station buildings development (total: 25.6 km, of which 10.6 km is with noise barrier); some impacts are expected by shade created by these structures. |
| | Wastes/Hazardous waste | D | B- | B- | P: No impact is expected. |
| | | | | | C: A certain amount of construction and demolition wastes which may include hazardous materials, and waste from construction workers' camps is expected to be generated. |
| | | | | | O: A certain amount of wastes from passengers at the station and maintenance works at the depot is expected to be generated. |
| Social Environment | Involuntary resettlement | A- | B- | D | P: About 110 ha of land would be necessary for development of the HSR structures (viaduct, station, depot, etc.) in this section. In addition, about 60 buildings and 360 households would be affected either by land acquisition or resettlement although the alignment is planned to avoid the land acquisition and resettlement as much as possible though alternative analysis. |
| | | | | | C: Land acquisition and resettlement activities are expected to be continued even during construction stage. Temporal relocation is also required for setting up of construction yards and workers' camps for the construction activities. |
| | | | | | O: No impact is expected. |
| | Land use | B- | B- | A+ | P: The current land use needs to be changed by land acquisition and resettlement in accordance with the planned alignment and station location. |
| | | | | | C: Land clearance for construction yards and workers' camps is temporary. The land use around the construction site may be changed by doing business with construction workers without control. |

| Ha Nam | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | O: The HSR station will be developed together around the station areas as an integrated development. In addition, land use is expected to be changed gradually for further development mainly around the station in accordance with a provincial/city plan and private investments. |
| | Utilization of local resources | D | B- | D | P: No impact is expected. |
| | | | | | C: Using a large amount of local resources such as sand and quarry for the construction activities would obstruct its utilization by local people for other purposes. |
| | | | | | O: No impact is expected because the HSR would not use much local resources. |
| | General, regional /city plans | B+/B- | D | B+ | P: While Phu Ly Station area and sections along the express way is kept for the future HSR purpose, HSR will result in changing land use purpose in other part of the province. The current general plan and/or regional/city plan of Province needs to be updated in accordance with the planned alignment and station location. |
| | | | | | C: No impact is expected (updating plans may continue). |
| | | | | | O: In accordance with the HSR development including development of station area, further general plan/city plans which include further development plan are expected to be prepared in all city/provinces. |
| | Social institutions and local decision - making institutions | C- | C- | C- | P: Some impact on social institutions local decision making institutions is expected by land acquisition and resettlement. However further examination is necessary. |
| | | | | | C: Some impact on social institutions and local decision making institutions is expected by inflow of many construction workers and other relating peoples from outside the area. However further examination is necessary. |
| | | | | | O: Some impact on social institutions and local decision making institutions is expected by disturbing movement of local people by the HSR structures. However further examination is necessary. |
| | Social Infrastructures and Services | B- | B- | B+/B- | P: By land acquisition and resettlement, some impacts on social infrastructure and services such as resettlement of community facility (village hall, etc.) are expected. Trung Luong market may be affected. |
| | | | | | C: Though temporal, impacts on social infrastructures and services by setting up of construction yards and workers' camps are expected. Especially, impacts on social infrastructures and services are expected by disturbance and interruption of their utilization by the construction activities such as relocation of public utilities and local roads. |
| | | | | | O: Development of the HSR station together with its surrounding areas would improve social infrastructures and services in the area and the country. On the other hand, some impacts on social infrastructures and services by the existence of the HSR structures are expected. |
| | Local economy and livelihood | B- | B+ | A+/B- | P: Some negative impacts on the local economy and livelihood are expected because of losses of employment opportunities and income sources by land acquisition and resettlement. |
| | | | | | C: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the construction activities. |
| | | | | | O: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the HSR project, especially around the station and employment of the workers for track maintenance, etc.<br>On the other hand, some negative impacts are also expected after the completion of the construction activities because of termination of temporary employment opportunities of local workers. |
| | Unequal Distribution of Benefit and Damage | B- | B- | B- | P: Unequal situations are expected among the project affected households/peoples and not affected households/peoples. |
| | | | | | C: Some unequal situations are expected among the local peoples between those who receive any benefit and those who receive any damage from the constriction activities, e.g. some affected households need to be relocated far away, while their neighbors not affected can do business with construction workers. |
| | | | | | O: Some unequal situations are expected among the local peoples between those who live near the station and those who live far from the station, especially in the latter case, they have a possibility to receive damages such as noise and vibration impacts, and some impacts on social infrastructures and services, livelihood and water usage, while in the former case, they may enjoy the benefit from the HSR service and related opportunities of businesses. |
| | Local conflicts of interest | C- | C- | C- | P/C/O: Local conflicts of interest are expected among local peoples, especially between beneficiaries and project affected peoples for land acquisition and inconveniences during construction and operation. Further examination would be necessary in case that unequal distribution of benefit and damage is expected to be crucial issues. |
| | Water Usage, Water Rights and Communal Rights | C- | C- | C- | P: Some impacts on water usage for the resettled houses/peoples are expected by land acquisition and resettlement. However, further examination would be necessary for water rights and communal rights. |
| | | | | | C: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses by the construction activities are small and temporal. However, further examination would be necessary for water rights and communal rights. |

| Ha Nam | | | | | |
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| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | O: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses are expected by the existence of the HSR structures. However, further examination would be necessary for disturbance by the structures. |
| | Cultural and Historical Heritages | D | C- | C- | P: National or provincial cultural and historical heritages are not found within a distance of 100m from the alignment of HSR. Thus, no impact is expected. |
| | | | | | C: Though not directly affected, many heritages are found near the alignment. These may be affected by the noise and vibration, and the traffic congestions caused by vehicles for the construction. Followings are the examples of heritages near the alignment.<br>Chay village temple (National heritage, 330m), Giua village temple (Provincial heritage, 148m), Giua village pagoda (Provincial heritage, 129m) |
| | | | | | O: The heritages mainly within 100m from the alignment may suffer the impact of noise and vibration to some extent. |
| | Religious Facilities | C- | B- | B- | P: Though the well known religious places are not directly affected, small scale village level religious facilities may be relocated (ex. Van lam temple, 28m from the alignment). |
| | | | | | C/O: 8 religious facilities are found along the HSR within a distance less than 200m, So impacts such as noise and vibration are expected during the construction and operational phases. |
| | Sensitive facilities (ex. hospital, school, precision machine factory) | A- | B- | B- | P: It finds some sensitive places as the center of war invalid health care, 10m away from the alignment and those places may be relocated. Further examination is required. |
| | | | | | C: Especially regarding the school and hospital (such as Neurological hospital located at the distance of 38 m away from planned alignment), the traffic congestion with heavy vehicles affect the local peoples' convenience and safety. |
| | | | | | O: Especially with regard to the 0 school and 3 hospitals along the alignment, noise and vibration caused by HSR may affect the peoples' comfort. |
| | Poor people | C- | B+ | C- | P: Poor people (who have poor household certificates issued by local authorities) stay everywhere. Further examination would be necessary for them because it is more difficult for them to recover their livelihood after land acquisition and resettlement than other PAPs. |
| | | | | | C: There is a possibility that the poor people would also have employment opportunities in construction and its associated business activities. |
| | | | | | O: There is a possibility that the enjoyment of the benefits of the HSR service by the poor people would be difficult. Further examination would be necessary. |
| | Ethnic Minorities/indigenous people | D | D | D | P: Particular distribution of ethnic minorities along the alignment is not reported. Thus, no impact is expected. |
| | | | | | C: No impact is expected. |
| | | | | | O: No impact is expected. |
| | Gender | C- | C- | C- | P: Land acquisition and resettlement are an important incident to a family and some women would have a bigger burden for that. Further examination would be necessary. |
| | | | | | C: Equal employment opportunities for both sexes are required for the construction works. Further examination would be necessary. |
| | | | | | O: The HSR service will be equal to both sexes. On the other hand, equal employment opportunities for both sexes are required for the HSR operation. Further examination would be necessary. |
| | Children's rights | D | D | D | P: No impact is expected. |
| | | | | | C/O. Since employment of children for the construction works is strictly prohibited by Children Protection, Education and Care Law 2004, no impact is expected. |
| | Public Health (sanitation and infectious diseases) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts on public health are expected due to unsanitary conditions caused by the influx of a large number of workers. In addition, increase of risks related to Sexually Transmitted Diseases (STD) or Sexually Transmitted Infections (STI) and HIV/AIDS is expected among the workers and local communities. |
| | | | | | O: Some impacts on public health are expected due to the influx of a large number of passengers (about 10,000 passengers per day at Phu Ly Station, if Ngoc Hoi - Vinh section is operated in 2030) and business persons around the station area. |
| | Occupational Health and Safety (OHS) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts regarding OHS for the construction workers are expected. |
| | | | | | O: Some impacts regarding OHS for the workers for the HSR operation, especially the workers at the track for maintenance and at the depot are expected. |
| Other | Accidents | D | B- | C+/C- | P: No impact is expected. |
| | | | | | C: Increase of risks of accidents associated with construction activities is expected due to the operation |

| Ha Nam | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | of heavy equipment and vehicles. |
| | | | | | O: Increase of risks of accidents associated with the HSR services is expected due to the high speed train operation. On the other hand, positive and/or negative impacts are expected by the modal sift of passengers' transportation to HSR from cars, buses, airs, and existing railway. |
| | Climate Change | D | D | A+/C- | P: No impact is expected. |
| | | | | | C: Although increase of GHGs emission is expected due to operation of heavy equipment and vehicles, the impact is temporal and small. |
| | | | | | O: Overall reduction of GHGs emission is expected by the modal shift of passengers' transportation to the HSR (+31% of the share between Hanoi – Vinh, 2030 projection) from cars (-6%), buses (-19%), airs (-1%), and existing railway (-5%). 63 kt-$CO_2$e/year of GHGs would be reduced by the development of the HSR in the north section.<br>Though alignment avoids the coastal area, Impact by the rise of sea level should be further studied. |

Source: JICA Study Team

**Table 4C.3 Result of Rating (Nam Dinh Section)**

| Nam Dinh | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| Natural Environment | Climate / Meteorological Phenomena | D | D | D | P: No impact is expected. |
| | | | | | C/O: Although the elevated structures such as viaduct of the HSR track and station building will be constructed, the impacts on micro-climate and micro meteorological phenomena are negligible because these structures would not disturb wind path. |
| | Topography | D | D | D | P: No impact is expected. |
| | | | | | P: No impact is expected. |
| | | | | | O: Completing construction, topography would be stable. No impact is expected |
| | Geology | D | D | D | P: No impact is expected. |
| | | | | | C: Although there are some soft soil areas and soil improvement works will be done there for the constructions, it is not a scale that changes geological features. |
| | | | | | O: No impact is expected. |
| | Soil Erosion | D | B- | C- | P: No impact is expected. |
| | | | | | C: By the earth work, especially when it is raining, some soil erosion is expected. |
| | | | | | O: Embankment or cut section is about 2.7 km, where new surface may be washed by rain water. |
| | Hydrology | D | D | B- | P: No impact is expected. |
| | | | | | C: In the elevated structure section, construction works would cause little impacts on the hydrological cycle or regimes. In embankment or cut section, piled up soil may cause minor and temporal impact on hydrological cycle or regimes. They are not scale that change hydrological regime. |
| | | | | | O: In the embankment section of about 2.7 km, hydrological situation would be affected by the structures. The elevated section will have less and minor impact on the hydrological conditions. |
| | Ground water | D | B- | D | P: No impact is expected. |
| | | | | | C: Ground water in Red River Delta is generally abundant due to many canal/rivers and its low altitude. In addition, ground water utilization by the construction works is not a scale that changes ground water flow. |
| | | | | | O: Utilizing ground water by HSR is not a scale that can change ground water level. |
| | Ecosystem | D | B- | B- | P: No impact is expected. |
| | Flora, Fauna and Biodiversity | | | | C: Most of the area along the alignment is already developed area including residential and agricultural areas. The affected flora, fauna and biodiversity along the alignment are considered to be not critical, while the construction work may interfere with the habitat of flora and fauna. |
| | | | | | O: Existence of the HSR structure and HSR operation may cause negative impact on the ecosystem. |
| | Protected Areas/Forest | D | D | D | P: There are special-use forests (protected areas) in Nam Dinh province, however those areas are located too far from the planned alignment (more than 10km) to be affected. Protection forests and production forests are not affected by the alignment either. |
| | | | | | C: The construction machines could damage the vegetation. Activities of construction workers may also |

| Nam Dinh | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | be the pressure on forest. |
| | | | | | O: By the structure of HSR, some of the forest area is opened, so that more sunshine will be led inside the vegetation, which would affect the edge of the forest area. |
| | Coastal zone | D | D | D | P/C/O: The closest distance to the alignment from the coastal line is nearly 30 km and no mudflats or no mangrove areas are affected. Thus, no impact is expected. |
| | Landscape | D | D | B+/B- | P: No impact is expected. |
| | | | | | C: Change of landscape is temporary and limited during the construction. |
| | | | | | O: By the structures such as viaduct, embankment and station buildings, both positive and negative impacts on landscape are expected. |
| | Natural disasters | D | C- | C- | P: No impact is expected. |
| | | | | | C: While there is no landslide / erosion prone areas information, riverbank could be eroded due to construction. |
| | | | | | O: Regularly flooding areas are found but far from the planned alignment. The closest flooding area is at more than 4 km away from the planned alignment, while the riverbank along alignment could be affected. No landslide area is reported in the flat areas where alignment is planned. |
| Living Environment | Air Pollution | D | B- | A+/B- | P: No impact is expected. |
| | | | | | C: Some negative impact is expected due to operation of many equipments and vehicles, dust incidental to earth work especially in dry season, although these impacts are temporal and limited. |
| | | | | | O: Overall reduction of air pollutants' emission is expected by the modal shift of passengers' transportation to the HSR (+31% of the share between Hanoi – Vinh, 2030 projection) from cars (-6%), buses (-19%), airs (-1%), and existing railway (-5%). 196 t-$NO_x$/year of air pollutants would be reduced by the development of the HSR in the north section. On the other hand, increase in air pollutants from increased access of cars and buses around the station are expected. |
| | Offensive Odor | D | D | D | P/C/O: No impact is expected. |
| | Water Pollution | D | B- | B- | P: No impact is expected. |
| | | | | | C: Turbid water by the earth work (2.7 km of embankment) and bridge piers' construction work (8 bridges over rivers are planned), and wastewater effluents from construction works' camps/yards are expected to pollute the surrounding rivers/canals water to some extent. |
| | | | | | O: Wastewater effluents from passengers at the station and maintenance activities in the depot are expected. Some impacts on water quality in surrounding water bodies are expected due to discharged polluted water. |
| | Bottom Sediment Contamination | D | D | D | P: No impact is expected. |
| | | | | | C: Although some construction materials such as cement and sand are expected to be washed out mainly by the rain, the impacts on bottom sediment by them are small. |
| | | | | | O: No impact is expected. |
| | Soil Contamination | D | C- | D | P: No impact is expected. |
| | | | | | C: Although some impact on soil is expected by deposition of pollutants from construction materials and vehicles, the impacts are small. On the other hand, in case the soil at construction sites is already contaminated by other reasons, some impacts are expected by the construction activity. Thus, further study is necessary. |
| | | | | | O: No impact is expected. |
| | Ground Subsidence | D | D | D | P: No impact is expected. |
| | | | | | C: Ground water utilization by the construction works is not a scale that changes ground water flow. Thus, no ground subsidence is expected. |
| | | | | | O: Geological condition along alignment in Nam Dinh is soft soil layers. As viaduct section is planned to be applied, no impact is expected. |
| | Noise/vibration | D | B- | A- | P: No impact is expected. |
| | | | | | C: There are 8 religious facilities, 0 school and 3 hospitals within 200m from the alignment. Noise and vibration generated by operation of heavy equipment and vehicles, although they are temporary, may affect the residential areas and such facilities/places which require quietness. |
| | | | | | O: There are 6 religious facilities, 5 schools and 1 hospital within 200m from the alignment. Noise and vibration generated by movement of high speed trains may affect the residential areas and such facilities/places which require quietness. Maintenance of ballast track would also cause noise. |
| | Low frequency noise/micro-pressure wave | D | D | D | P: No impact is expected. |
| | | | | | C: Construction activities will not cause low frequency noise/micro-pressure wave. |
| | | | | | O: There is no tunnel which may cause low frequency/micro-pressure wave. Low frequency noise from the train passing an open section is small. |

| Nam Dinh | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | Wave Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No wave obstruction is expected by the construction work. |
| | | | | | O: Radio waves would be disturbed by movement of high speed trains and some impacts such as flutter and pulse interferences on TV are expected. In addition, since the elevated structures such as viaduct and Nam Dinh station building will be developed (total: 29.6 km, of which 21.2 km is with noise barrier), some impacts by wave disturbed by these structures are expected. |
| | Sunshine Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No sunshine obstruction is expected by the construction works. |
| | | | | | O: There will be elevated structures such as viaduct and station buildings development(total: 29.6 km, of which 21.2 km is with noise barrier); some impacts are expected by shade created by these structures. |
| | Wastes/Hazardous waste | D | B- | B- | P: No impact is expected. |
| | | | | | C: A certain amount of construction and demolition wastes which may include hazardous materials, and waste from construction workers' camps is expected to be generated. |
| | | | | | O: A certain amount of wastes from passengers at the station and maintenance works at the depot is expected to be generated. |
| Social Environment | Involuntary resettlement | A- | B- | D | P: About 110 ha of land would be necessary for development of the HSR structures (viaduct, station, depot, etc.) in this section. In addition, about 80 buildings and 400 households would be affected either by land acquisition or resettlement although the alignment is planned to avoid the land acquisition and resettlement as much as possible though alternative analysis. |
| | | | | | C: Land acquisition and resettlement activities are expected to be continued even during construction stage. Temporal relocation is also required for setting up of construction yards and workers' camps for the construction activities. |
| | | | | | O: No impact is expected. |
| | Land use | B- | B- | A+ | P: The current land use needs to be changed by land acquisition and resettlement in accordance with the planned alignment and station location. |
| | | | | | C: Land clearance for construction yards and workers' camps is temporary. The land use around the construction site may be changed by doing business with construction workers without control. |
| | | | | | O: The HSR station will be developed together around the station areas as an integrated development. In addition, land use is expected to be changed gradually for further development mainly around the station in accordance with a provincial/city plan and private investments. |
| | Utilization of local resources | D | B- | D | P: No impact is expected. |
| | | | | | C: Using a large amount of local resources such as sand and quarry for the construction activities would obstruct its utilization by local people for other purposes. |
| | | | | | O: No impact is expected because the HSR would not use much local resources. |
| | General, regional /city plans | B+/B- | D | B+ | P: HSR requires changing land use purpose in the province. The current general plan and/or regional/city plan of Province needs to be updated in accordance with the planned alignment and station location. |
| | | | | | C: No impact is expected (updating plans may continue). |
| | | | | | O: In accordance with the HSR development including development of station area, further general plan/city plans which include further development plan are expected to be prepared in all city/provinces. |
| | Social institutions and local decision - making institutions | C- | C- | C- | P: Some impact on social institutions local decision making institutions is expected by land acquisition and resettlement. However further examination is necessary. |
| | | | | | C: Some impact on social institutions and local decision making institutions is expected by inflow of many construction workers and other relating peoples from outside the area. However further examination is necessary. |
| | | | | | O: Some impact on social institutions and local decision making institutions is expected by disturbing movement of local people by the HSR structures. However further examination is necessary. |
| | Social Infrastructures and Services | B- | B- | B+/B- | P: By land acquisition and resettlement, some impacts on social infrastructure and services such as resettlement of community facility (village hall, etc.) are expected. Post Office in My Loc and Mai Xa market may be affected. |
| | | | | | C: Though temporal, impacts on social infrastructures and services by setting up of construction yards and workers' camps are expected. Especially, impacts on social infrastructures and services are expected by disturbance and interruption of their utilization by the construction activities such as relocation of public utilities and local roads. |
| | | | | | O: Development of the HSR station together with its surrounding areas would improve social infrastructures and services in the area and the country. On the other hand, some impacts on social infrastructures and services by the existence of the HSR structures are expected. |
| | Local economy and livelihood | B- | B+ | A+/B- | P: Some negative impacts on the local economy and livelihood are expected because of losses of employment opportunities and income sources by land acquisition and resettlement. |

| Nam Dinh | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | C: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the construction activities. |
| | | | | | O: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the HSR project, especially around the station and employment of the workers for track maintenance, etc.<br>On the other hand, some negative impacts are also expected after the completion of the construction activities because of termination of temporary employment opportunities of local workers. |
| | Unequal Distribution of Benefit and Damage | B- | B- | B- | P: Unequal situations are expected among the project affected households/peoples and not affected households/peoples. |
| | | | | | C: Some unequal situations are expected among the local peoples between those who receive any benefit and those who receive any damage from the constriction activities, e.g. some affected households need to be relocated far away, while their neighbors not affected can do business with construction workers. |
| | | | | | O: Some unequal situations are expected among the local peoples between those who live near the station and those who live far from the station, especially in the latter case, they have a possibility to receive damages such as noise and vibration impacts, and some impacts on social infrastructures and services, livelihood and water usage, while in the former case, they may enjoy the benefit from the HSR service and related opportunities of businesses. |
| | Local conflicts of interest | C- | C- | C- | P/C/O: Local conflicts of interest are expected among local peoples, especially between beneficiaries and project affected peoples for land acquisition and inconveniences during construction and operation. Further examination would be necessary in case that unequal distribution of benefit and damage is expected to be crucial issues. |
| | Water Usage, Water Rights and Communal Rights | C- | C- | C- | P: Some impacts on water usage for the resettled houses/peoples are expected by land acquisition and resettlement. However, further examination would be necessary for water rights and communal rights. |
| | | | | | C: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses by the construction activities are small and temporal. However, further examination would be necessary for water rights and communal rights. |
| | | | | | O: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses are expected by the existence of the HSR structures. However, further examination would be necessary for disturbance by the structures. |
| | Cultural and Historical Heritages | D | C- | C- | P: National or provincial cultural and historical heritages are not found within a distance of 100m from the alignment of HSR. Thus, no impact is expected. |
| | | | | | C: Though not directly affected, heritages may exist near the alignment. These may be affected by the noise and vibration, and the traffic congestions caused by vehicles for the construction. Further confirmation is required. |
| | | | | | O: The heritages mainly within 100m from the alignment may suffer the impact of noise and vibration to some extent. |
| | Religious Facilities | B- | B- | B- | P: Though the well known religious places are not directly affected, small scale village level religious facilities may be relocated (ex. One cemetery area on the alignment). |
| | | | | | C/O: 2 religious facilities are found along the HSR within a distance less than 200m, So impacts such as noise and vibration are expected during the construction and operational phases. |
| | Sensitive facilities (ex. hospital, school, precision machine factory) | A- | B- | B- | P: It finds some sensitive places as Nam Dinh College on the alignment and those places may be relocated. Further examination is required. |
| | | | | | C: Especially regarding the school and hospital (such as Yen Nhan school located at the distance of 60 m away from planned alignment), the traffic congestion with heavy vehicles affect the local peoples' convenience and safety. |
| | | | | | O: Especially with regard to the 3 schools and 0 hospital along the alignment, noise and vibration caused by HSR may affect the peoples' comfort. |
| | Poor people | C- | B+ | C- | P: Poor people (who have poor household certificates issued by local authorities) stay everywhere. Further examination would be necessary for them because it is more difficult for them to recover their livelihood after land acquisition and resettlement than other PAPs. |
| | | | | | C: There is a possibility that the poor people would also have employment opportunities in construction and its associated business activities. |
| | | | | | O: There is a possibility that the enjoyment of the benefits of the HSR service by the poor people would be difficult. Further examination would be necessary. |
| | Ethnic Minorities/indigenous people | D | D | D | P: Particular distribution of ethnic minorities along the alignment is not reported. Thus, no impact is expected. |
| | | | | | C: No impact is expected. |
| | | | | | O: No impact is expected. |

| Nam Dinh | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | Gender | C- | C- | C- | P: Land acquisition and resettlement are an important incident to a family and some women would have a bigger burden for that. Further examination would be necessary. |
| | | | | | C: Equal employment opportunities for both sexes are required for the construction works. Further examination would be necessary. |
| | | | | | O: The HSR service will be equal to both sexes. On the other hand, equal employment opportunities for both sexes are required for the HSR operation. Further examination would be necessary. |
| | Children's rights | D | D | D | P: No impact is expected. |
| | | | | | C/O. Since employment of children for the construction works is strictly prohibited by Children Protection, Education and Care Law 2004, no impact is expected. |
| | Public Health (sanitation and infectious diseases) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts on public health are expected due to unsanitary conditions caused by the influx of a large number of workers. In addition, increase of risks related to Sexually Transmitted Diseases (STD) or Sexually Transmitted Infections (STI) and HIV/AIDS is expected among the workers and local communities. |
| | | | | | O: Some impacts on public health are expected due to the influx of a large number of passengers (about 23,000 passengers per day at Nam Dinh Station, if Ngoc Hoi - Vinh section is operated in 2030) and business persons around the station area. |
| | Occupational Health and Safety (OHS) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts regarding OHS for the construction workers are expected. |
| | | | | | O: Some impacts regarding OHS for the workers for the HSR operation, especially the workers at the track for maintenance and at the depot are expected. |
| Other | Accidents | D | B- | C+/C- | P: No impact is expected. |
| | | | | | C: Increase of risks of accidents associated with construction activities is expected due to the operation of heavy equipment and vehicles. |
| | | | | | O: Increase of risks of accidents associated with the HSR services is expected due to the high speed train operation. On the other hand, positive and/or negative impacts are expected by the modal sift of passengers' transportation to HSR from cars, buses, airs, and existing railway. |
| | Climate Change | D | D | A+/C- | P: No impact is expected. |
| | | | | | C: Although increase of GHGs emission is expected due to operation of heavy equipment and vehicles, the impact is temporal and small. |
| | | | | | O: Overall reduction of GHGs emission is expected by the modal shift of passengers' transportation to the HSR (+31% of the share between Hanoi – Vinh, 2030 projection) from cars (-6%), buses (-19%), airs (-1%), and existing railway (-5%). 63 kt-$CO_2$e/year of GHGs would be reduced by the development of the HSR in the north section.<br>Though alignment avoids the coastal area, Impact by the rise of sea level should be further studied. |

Source: JICA Study Team

## Table 4C.4 Result of Rating (Ninh Binh Section)

| Ninh Binh | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| Natural Environment | Climate / Meteorological Phenomena | D | D | D | P: No impact is expected. |
| | | | | | C/O: Although the elevated structures such as viaduct of the HSR track and station building will be constructed, the impacts on micro-climate and micro meteorological phenomena are negligible because these structures would not disturb wind path. |
| | Topography | D | B- | D | P: No impact is expected. |
| | | | | | P: There are small limestone mountains and some of them may be affected (direct physical impact and landscape impact can be expected). Though cut section is only 270 m, there is a long tunnel of 3,630m in the boarder with Ninh Binh Province. |

| Ninh Binh | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | O: Completing construction, topography would be stable. No impact is expected |
| | Geology | D | D | D | P: No impact is expected. |
| | | | | | C: Although there are some soft soil areas and soil improvement works will be done there for the constructions, it is not a scale that changes geological features. |
| | | | | | O: No impact is expected. |
| | Soil Erosion | D | B- | C- | P: No impact is expected. |
| | | | | | C: By the earth work, especially when it is raining, some soil erosion is expected. |
| | | | | | O: Embankment or cut section is about 7.9 km, where new surface may be washed by rain water. |
| | Hydrology | D | D | B- | P: No impact is expected. |
| | | | | | C: In the elevated structure section, construction works would cause little impacts on the hydrological cycle or regimes. In embankment or cut section, piled up soil may cause minor and temporal impact on hydrological cycle or regimes. They are not scale that change hydrological regime. |
| | | | | | O: In the embankment section of about 7.6 km, hydrological situation would be affected by the structures. The elevated section will have less and minor impact on the hydrological conditions. |
| | Ground water | D | B- | B- | P: No impact is expected. |
| | | | | | C: Ground water in Red River Delta is generally abundant due to many canal/rivers and its low altitude. In addition, ground water utilization by the construction works is not a scale that changes ground water flow. However, there may be impact on the ground water flow by construction activities of tunnels. |
| | | | | | O: Utilizing ground water by HSR is not a scale that can change ground water level. However, in the tunnel section, there may be impact on the ground water flow by the structure. |
| | Ecosystem Flora, Fauna and Biodiversity | D | B- | B- | P: No impact is expected. |
| | | | | | C: Besides two plots of protection forest to be affected, most of the area along the alignment is already developed area including residential and agricultural areas. The affected flora, fauna and biodiversity along the alignment are considered to be not critical, while the construction work may interfere with the habitat of flora and fauna. |
| | | | | | O: Existence of the HSR structure and HSR operation may cause negative impact on the ecosystem. |
| | Protected Areas/Forest | B- | B- | B- | P: There are special-use forests (protected areas) in Ninh Binh province, however those areas are located too far from the planned alignment (more than 10km) to be affected. Protection forests (6.2ha) and production forests (0.6 ha) are affected by the alignment. |
| | | | | | C: The construction machines could damage the vegetation. Activities of construction workers may also be the pressure on forest. |
| | | | | | O: By the structure of HSR, some of the forest area is opened, so that more sunshine will be led inside the vegetation, which would affect the edge of the forest area. |
| | Coastal zone | D | D | D | P/C/O: The closest distance to the alignment from the coastal line is nearly 30 km and no mudflats or no mangrove areas are affected. Thus, no impact is expected. |
| | Landscape | D | D | B+/B- | P: No impact is expected. |
| | | | | | C: Change of landscape is temporary and limited during the construction. |
| | | | | | O: By the structures such as viaduct, embankment and station buildings, both positive and negative impacts on landscape are expected. |
| | Natural disasters | D | C- | C- | P: No impact is expected. |
| | | | | | C: While there is no landslide / erosion prone areas information, riverbank could be eroded due to construction. |
| | | | | | O: Regularly flooding areas are found but far from the planned alignment. The closest flooding area is at more than 4 km away from the planned alignment, while the riverbank along alignment could be affected. No landslide area is reported in the flat areas where alignment is planned. |
| Living Environment | Air Pollution | D | B- | A+/B- | P: No impact is expected. |
| | | | | | C: Some negative impact is expected due to operation of many equipments and vehicles, dust incidental to earth work especially in dry season, although these impacts are temporal and limited. |
| | | | | | O: Overall reduction of air pollutants' emission is expected by the modal shift of passengers' transportation to the HSR (+31% of the share between Hanoi – Vinh, 2030 projection) from cars (-6%), buses (-19%), airs (-1%), and existing railway (-5%). 196 t-$NO_x$/year of air pollutants would be reduced by the development of the HSR in the north section. On the other hand, increase in air pollutants from increased access of cars and buses around the station are expected. |
| | Offensive Odor | D | D | D | P/C/O: No impact is expected. |
| | Water Pollution | D | B- | B- | P: No impact is expected. |

| Ninh Binh | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | C: Turbid water by the earth work (7.6 km of embankment, 0.3 km of cut) and bridge piers' construction work (3 bridges over rivers are planned), and wastewater effluents from construction works' camps/yards are expected to pollute the surrounding rivers/canals water to some extent. |
| | | | | | O: Wastewater effluents from passengers at the station and maintenance activities in the depot are expected. Some impacts on water quality in surrounding water bodies are expected due to discharged polluted water. |
| | Bottom Sediment Contamination | D | D | D | P: No impact is expected. |
| | | | | | C: Although some construction materials such as cement and sand are expected to be washed out mainly by the rain, the impacts on bottom sediment by them are small. |
| | | | | | O: No impact is expected. |
| | Soil Contamination | D | C- | D | P: No impact is expected. |
| | | | | | C: Although some impact on soil is expected by deposition of pollutants from construction materials and vehicles, the impacts are small. On the other hand, in case the soil at construction sites is already contaminated by other reasons, some impacts are expected by the construction activity. Thus, further study is necessary. |
| | | | | | O: No impact is expected. |
| | Ground Subsidence | D | D | D | P: No impact is expected. |
| | | | | | C: Ground water utilization by the construction works is not a scale that changes ground water flow. Thus, no ground subsidence is expected. |
| | | | | | O: Geological condition along alignment in Ninh Binh is soft soil layers. As viaduct section is planned to be applied, no impact is expected. |
| | Noise/vibration | D | B- | A- | P: No impact is expected. |
| | | | | | C: There are 2 religious facilities, 0 school and 0 hospitals within 200m from the alignment. Noise and vibration generated by operation of heavy equipment and vehicles, although they are temporary, may affect the residential areas and such facilities/places which require quietness. |
| | | | | | O: There are 2 religious facilities, 0 schools and 0 hospital within 200m from the alignment. Noise and vibration generated by movement of high speed trains may affect the residential areas and such facilities/places which require quietness. Maintenance of ballast track would also cause noise. |
| | Low frequency noise/micro-pressure wave | D | D | C- | P: No impact is expected. |
| | | | | | C: Construction activities will not cause low frequency noise/micro-pressure wave. |
| | | | | | O: Significant low frequency/micro-pressure wave at long tunnel sub-sections is expected. One long tunnel of 3.6 km exists in the boarder of Ninh Binh and Thanh Hoa, however, there is no building near the exit of the tunnel within 200m. Low frequency noise from the train passing an open section is small. |
| | Wave Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No wave obstruction is expected by the construction work. |
| | | | | | O: Radio waves would be disturbed by movement of high speed trains and some impacts such as flutter and pulse interferences on TV are expected. In addition, since the elevated structures such as viaduct will be developed (total: 7.4 km, of which 4.5 km is with noise barrier), some impacts by wave disturbed by these structures are expected. |
| | Sunshine Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No sunshine obstruction is expected by the construction works. |
| | | | | | O: There will be elevated structures such as viaduct development (total: 7.4 km, of which 4.5 km is with noise barrier); some impacts are expected by shade created by these structures. |
| | Wastes/Hazardous waste | D | B- | B- | P: No impact is expected. |
| | | | | | C: A certain amount of construction and demolition wastes which may include hazardous materials, and waste from construction workers' camps is expected to be generated. |
| | | | | | O: A certain amount of wastes from passengers at the station and maintenance works at the depot is expected to be generated. |
| Social Environment | Involuntary resettlement | A- | B- | D | P: About 80 ha of land would be necessary for development of the HSR structures (viaduct, station, depot, etc.) in this section. In addition, about 60 buildings and 300 households would be affected either by land acquisition or resettlement although the alignment is planned to avoid the land acquisition and resettlement as much as possible though alternative analysis. |
| | | | | | C: Land acquisition and resettlement activities are expected to be continued even during construction stage. Temporal relocation is also required for setting up of construction yards and workers' camps for the construction activities. |
| | | | | | O: No impact is expected. |
| | Land use | B- | B- | A+ | P: The current land use needs to be changed by land acquisition and resettlement in accordance with the planned alignment and station location. |

| Ninh Binh | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | C: Land clearance for construction yards and workers' camps is temporary. The land use around the construction site may be changed by doing business with construction workers without control. |
| | | | | | O: The HSR station will be developed together around the station areas as an integrated development. In addition, land use is expected to be changed gradually for further development mainly around the station in accordance with a provincial/city plan and private investments. |
| | Utilization of local resources | D | B- | D | P: No impact is expected. |
| | | | | | C: Using a large amount of local resources such as sand and quarry for the construction activities would obstruct its utilization by local people for other purposes. |
| | | | | | O: No impact is expected because the HSR would not use much local resources. |
| | General, regional /city plans | B+/B- | D | B+ | P: HSR requires changing land use purpose in the province. The current general plan and/or regional/city plan of Province needs to be updated in accordance with the planned alignment and station location. |
| | | | | | C: No impact is expected (updating plans may continue). |
| | | | | | O: In accordance with the HSR development including development of station area, further general plan/city plans which include further development plan are expected to be prepared in all city/provinces. |
| | Social institutions and local decision - making institutions | C- | C- | C- | P: Some impact on social institutions local decision making institutions is expected by land acquisition and resettlement. However further examination is necessary. |
| | | | | | C: Some impact on social institutions and local decision making institutions is expected by inflow of many construction workers and other relating peoples from outside the area. However further examination is necessary. |
| | | | | | O: Some impact on social institutions and local decision making institutions is expected by disturbing movement of local people by the HSR structures. However further examination is necessary. |
| | Social Infrastructures and Services | C- | B- | B+/B- | P: By land acquisition and resettlement, some impacts on social infrastructure and services such as resettlement of community facility (village hall, etc.) are expected although it is not identified so far. |
| | | | | | C: Though temporal, impacts on social infrastructures and services by setting up of construction yards and workers' camps are expected. Especially, impacts on social infrastructures and services are expected by disturbance and interruption of their utilization by the construction activities such as relocation of public utilities and local roads. |
| | | | | | O: Development of the HSR station together with its surrounding areas would improve social infrastructures and services in the area and the country. On the other hand, some impacts on social infrastructures and services by the existence of the HSR structures are expected. |
| | Local economy and livelihood | B- | B+ | A+/B- | P: Some negative impacts on the local economy and livelihood are expected because of losses of employment opportunities and income sources by land acquisition and resettlement. |
| | | | | | C: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the construction activities. |
| | | | | | O: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the HSR project, especially around the station and employment of the workers for track maintenance, etc.<br>On the other hand, some negative impacts are also expected after the completion of the construction activities because of termination of temporary employment opportunities of local workers. |
| | Unequal Distribution of Benefit and Damage | B- | B- | B- | P: Unequal situations are expected among the project affected households/peoples and not affected households/peoples. |
| | | | | | C: Some unequal situations are expected among the local peoples between those who receive any benefit and those who receive any damage from the constriction activities, e.g. some affected households need to be relocated far away, while their neighbors not affected can do business with construction workers. |
| | | | | | O: Some unequal situations are expected among the local peoples between those who live near the station and those who live far from the station, especially in the latter case, they have a possibility to receive damages such as noise and vibration impacts, and some impacts on social infrastructures and services, livelihood and water usage, while in the former case, they may enjoy the benefit from the HSR service and related opportunities of businesses. |
| | Local conflicts of interest | C- | C- | C- | P/C/O: Local conflicts of interest are expected among local peoples, especially between beneficiaries and project affected peoples for land acquisition and inconveniences during construction and operation. Further examination would be necessary in case that unequal distribution of benefit and damage is expected to be crucial issues. |
| | Water Usage, Water Rights and Communal Rights | C- | C- | C- | P: Some impacts on water usage for the resettled houses/peoples are expected by land acquisition and resettlement. However, further examination would be necessary for water rights and communal rights. |
| | | | | | C: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses by the construction activities are small and temporal. However, further examination would be necessary for water rights and communal rights. |

| Ninh Binh | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | O: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses are expected by the existence of the HSR structures. However, further examination would be necessary for disturbance by the structures. |
| | Cultural and Historical Heritages | D | B- | B- | P: Although 1 national cultural and historical heritage is found in Ninh Binh provinces within a distance of 100m from the alignment (Tam Thanh temple, 68 m), they are not affected directly by HSR. Thus, no impact is expected. |
| | | | | | C: Together with above mentioned, many heritages are found near the alignment. These may be affected by the noise and vibration, and the traffic congestions caused by vehicles for the construction. Followings are the examples of heritages near the alignment.<br>Tomb of Duke Le Trung Trac (National heritage, 126m), Temple of General Ly Thuong Kiet (National heritage, 133m), Nguong Son mountain and Linh Xung pagoda (Provincial heritage, 126m) |
| | | | | | O: The heritages mainly within 100m from the alignment may suffer the impact of noise and vibration to some extent. |
| | Religious Facilities | C- | B- | B- | P: Though not directly affected, Tam Thanh temple near the alignment (67m) is ranked as a national heritage. And small scale village level religious facilities may be relocated. |
| | | | | | C/O: 2 religious facilities are found along the HSR within a distance less than 200m, So impacts such as noise and vibration are expected during the construction and operational phases. |
| | Sensitive facilities (ex. hospital, school, precision machine factory) | C- | C- | C- | P: No sensitive places along the alignment is found. Further examination is required. |
| | | | | | C: In case school and hospital exist near the alignment, the traffic congestion with heavy vehicles may affect the local peoples' convenience and safety. Further examination is required. |
| | | | | | O: With regard to the schools and hospitals, further examination is required along the alignment |
| | Poor people | C- | B+ | C- | P: Poor people (who have poor household certificates issued by local authorities) stay everywhere. Further examination would be necessary for them because it is more difficult for them to recover their livelihood after land acquisition and resettlement than other PAPs. |
| | | | | | C: There is a possibility that the poor people would also have employment opportunities in construction and its associated business activities. |
| | | | | | O: There is a possibility that the enjoyment of the benefits of the HSR service by the poor people would be difficult. Further examination would be necessary. |
| | Ethnic Minorities/indigenous people | D | D | D | P: Particular distribution of ethnic minorities along the alignment is not reported. Thus, no impact is expected. |
| | | | | | C: No impact is expected. |
| | | | | | O: No impact is expected. |
| | Gender | C- | C- | C- | P: Land acquisition and resettlement are an important incident to a family and some women would have a bigger burden for that. Further examination would be necessary. |
| | | | | | C: Equal employment opportunities for both sexes are required for the construction works. Further examination would be necessary. |
| | | | | | O: The HSR service will be equal to both sexes. On the other hand, equal employment opportunities for both sexes are required for the HSR operation. Further examination would be necessary. |
| | Children's rights | D | D | D | P: No impact is expected. |
| | | | | | C/O. Since employment of children for the construction works is strictly prohibited by Children Protection, Education and Care Law 2004, no impact is expected. |
| | Public Health (sanitation and infectious diseases) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts on public health are expected due to unsanitary conditions caused by the influx of a large number of workers. In addition, increase of risks related to Sexually Transmitted Diseases (STD) or Sexually Transmitted Infections (STI) and HIV/AIDS is expected among the workers and local communities. |
| | | | | | O: Some impacts on public health are expected due to the influx of a large number of passengers (about 12,000 passengers per day at Ninh Binh Station, if Ngoc Hoi - Vinh section is operated in 2030) and business persons around the station area. |
| | Occupational Health and Safety (OHS) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts regarding OHS for the construction workers are expected. |
| | | | | | O: Some impacts regarding OHS for the workers for the HSR operation, especially the workers at the track for maintenance and at the depot are expected. |
| Other | Accidents | D | B- | C+/C- | P: No impact is expected. |
| | | | | | C: Increase of risks of accidents associated with construction activities is expected due to the operation |

| Ninh Binh | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | of heavy equipment and vehicles. |
| | | | | | O: Increase of risks of accidents associated with the HSR services is expected due to the high speed train operation. On the other hand, positive and/or negative impacts are expected by the modal sift of passengers' transportation to HSR from cars, buses, airs, and existing railway. |
| | Climate Change | D | D | A+/C- | P: No impact is expected. |
| | | | | | C: Although increase of GHGs emission is expected due to operation of heavy equipment and vehicles, the impact is temporal and small. |
| | | | | | O: Overall reduction of GHGs emission is expected by the modal shift of passengers' transportation to the HSR (+31% of the share between Hanoi – Vinh, 2030 projection) from cars (-6%), buses (-19%), airs (-1%), and existing railway (-5%). 63 kt-$CO_2$e/year of GHGs would be reduced by the development of the HSR in the north section.<br>Though alignment avoids the coastal area, Impact by the rise of sea level should be further studied. |

Source: JICA Study Team

## Table 4C.5 Result of Rating (Thanh Hoa Section)

| Thanh Hoa | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| Natural Environment | Climate / Meteorological Phenomena | D | D | D | P: No impact is expected. |
| | | | | | C/O: Although the elevated structures such as viaduct of the HSR track and station building will be constructed, the impacts on micro-climate and micro meteorological phenomena are negligible because these structures would not disturb wind path. |
| | Topography | D | B- | D | P: No impact is expected. |
| | | | | | P: Cut section of 8,900m in the mountainous area may have impacts on topography. There are long tunnels in the boarder with neighboring provinces (3,630 m in Ninh Binh / Thanh Hoa boarder and 2,130 m in Thanh Hoa / Nghe An boarder. |
| | | | | | O: Completing construction, topography would be stable. No impact is expected |
| | Geology | D | D | D | P: No impact is expected. |
| | | | | | C: Soft soil areas are limited and no impact is expected. |
| | | | | | O: No impact is expected. |
| | Soil Erosion | D | B- | B- | P: No impact is expected. |
| | | | | | C: By the earth work, especially when it is raining, some soil erosion is expected. |
| | | | | | O: Embankment or cut section is about 55.9 km, where new surface may be washed by rain water. |
| | Hydrology | D | D | B- | P: No impact is expected. |
| | | | | | C: In the elevated structure section, construction works would cause little impacts on the hydrological cycle or regimes. In embankment or cut section, piled up soil may cause minor and temporal impact on hydrological cycle or regimes. They are not scale that change hydrological regime. |
| | | | | | O: In the embankment section of about 47.0 km, hydrological situation would be affected by the structures. The elevated section will have less and minor impact on the hydrological conditions. |
| | Ground water | D- | B- | B- | P: No impact is expected. |
| | | | | | C: Ground water utilization by the construction works is not a scale that changes ground water flow. However, there may be impact on the ground water flow by construction activities of tunnels. |
| | | | | | O: Utilizing ground water by HSR is not a scale that can change ground water level. However, in the tunnel section, there may be impact on the ground water flow by the structure. |
| | Ecosystem Flora, Fauna and Biodiversity | D | B- | B- | P: No impact is expected. |
| | | | | | C: Besides 13 plots of protection forest to be affected, most of the area along the alignment is already developed area including residential and agricultural areas. The affected flora, fauna and biodiversity along the alignment are considered to be not critical, while the construction work may interfere with the habitat of flora and fauna. |
| | | | | | O: Existence of the HSR structure and HSR operation may cause negative impact on the ecosystem. |

| Thanh Hoa | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | Protected Areas/Forest | B- | B- | B- | P: There are special-use forests (protected areas) in Thanh Hoa province, however those areas are located too far from the planned alignment (more than 10km) to be affected. Protection forests (0.7ha) and production forests (46.6 ha) are affected by the alignment. |
| | | | | | C: The construction machines could damage the vegetation. Activities of construction workers may also be the pressure on forest. |
| | | | | | O: By the structure of HSR, some of the forest area is opened, so that more sunshine will be led inside the vegetation, which would affect the edge of the forest area. |
| | Coastal zone | D | D | D | P/C/O: The closest distance to the alignment from the coastal line is about 13 km and no mudflats or no mangrove areas are affected. Thus, no impact is expected. |
| | Landscape | D | D | B+/B- | P: No impact is expected. |
| | | | | | C: Change of landscape is temporary and limited during the construction. |
| | | | | | O: By the structures such as viaduct, embankment and station buildings, both positive and negative impacts on landscape are expected. |
| | Natural disasters | D | B- | B- | P: No impact is expected. |
| | | | | | C: Civil work in landslide/ erosion prone areas in Thanh Hoa may trigger landslide. |
| | | | | | O: The alignment goes through landslide/erosion prone areas. Embankment construction in some sub-sections may result in a higher risk of flooding. |
| Living Environment | Air Pollution | D | B- | A+/B- | P: No impact is expected. |
| | | | | | C: Some negative impact is expected due to operation of many equipments and vehicles, dust incidental to earth work especially in dry season, although these impacts are temporal and limited. |
| | | | | | O: Overall reduction of air pollutants' emission is expected by the modal shift of passengers' transportation to the HSR (+31% of the share between Hanoi – Vinh, 2030 projection) from cars (-6%), buses (-19%), airs (-1%), and existing railway (-5%). 196 t-$NO_x$/year of air pollutants would be reduced by the development of the HSR in the north section. On the other hand, increase in air pollutants from increased access of cars and buses around the station are expected. |
| | Offensive Odor | D | D | D | P/C/O: No impact is expected. |
| | Water Pollution | D | B- | B- | P: No impact is expected. |
| | | | | | C: Turbid water by the earth work(47.0 km of embankment, 8.9 km of cut) and bridge piers' construction work (5 bridges over rivers are planned), and wastewater effluents from construction works' camps/yards are expected to pollute the surrounding rivers/canals water to some extent. |
| | | | | | O: Wastewater effluents from passengers at the station and maintenance activities in the depot are expected. Some impacts on water quality in surrounding water bodies are expected due to discharged polluted water. |
| | Bottom Sediment Contamination | D | D | D | P: No impact is expected. |
| | | | | | C: Although some construction materials such as cement and sand are expected to be washed out mainly by the rain, the impacts on bottom sediment by them are small. |
| | | | | | O: No impact is expected. |
| | Soil Contamination | D | C- | D | P: No impact is expected. |
| | | | | | C: Although some impact on soil is expected by deposition of pollutants from construction materials and vehicles, the impacts are small. On the other hand, in case the soil at construction sites is already contaminated by other reasons, some impacts are expected by the construction activity. Thus, further study is necessary. |
| | | | | | O: No impact is expected. |
| | Ground Subsidence | D | D | D | P: No impact is expected. |
| | | | | | C: Ground water utilization by the construction works is not a scale that changes ground water flow. Thus, no ground subsidence is expected. |
| | | | | | O: Geological condition along alignment in Ninh Binh is soft soil layers. As viaduct section is planned to be applied, no impact is expected. |
| | Noise/vibration | D | B- | A- | P: No impact is expected. |
| | | | | | C: There are 7 religious facilities, 3 school and 2 hospitals within 200m from the alignment. Noise and vibration generated by operation of heavy equipment and vehicles, although they are temporary, may affect the residential areas and such facilities/places which require quietness. |
| | | | | | O: There are 7 religious facilities, 3 schools and 2 hospital within 200m from the alignment. Noise and vibration generated by movement of high speed trains may affect the residential areas and such facilities/places which require quietness. Maintenance of ballast track would also cause noise. |
| | Low frequency | D | D | A- | P: No impact is expected. |

| Thanh Hoa | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | noise/micro-pressure wave | | | | C: Construction activities will not cause low frequency noise/micro-pressure wave. |
| | | | | | O: Significant low frequency/micro-pressure wave at long tunnel sub-sections is expected. 7 tunnels exist and 5 of them are more than 1km long. A few buildings are located within 200m from 2 exits of long tunnels, while many buildings are located near the exits of 800m and 320m tunnels and impacts are expected. Near the exits of the short tunnel Low frequency noise from the train passing an open section is small. |
| | Wave Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No wave obstruction is expected by the construction work. |
| | | | | | O: Radio waves would be disturbed by movement of high speed trains and some impacts such as flutter and pulse interferences on TV are expected. In addition, since the elevated structures such as viaduct and Thanh Hoa station building will be developed (total: 32.4 km, of which 25.9 km is with noise barrier), some impacts by wave disturbed by these structures are expected. |
| | Sunshine Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No sunshine obstruction is expected by the construction works. |
| | | | | | O: There will be elevated structures such as viaduct and station buildings development (total: 32.4 km, of which 25.9 km is with noise barrier); some impacts are expected by shade created by these structures. |
| | Wastes/Hazardous waste | D | B- | B- | P: No impact is expected. |
| | | | | | C: A certain amount of construction and demolition wastes which may include hazardous materials, and waste from construction workers' camps is expected to be generated. |
| | | | | | O: A certain amount of wastes from passengers at the station and maintenance works at the depot is expected to be generated. |
| Social Environment | Involuntary resettlement | A- | B- | D | P: About 380 ha of land would be necessary for development of the HSR structures (viaduct, station, depot, etc.) in this section. In addition, about 520 buildings and 1,400 households would be affected either by land acquisition or resettlement although the alignment is planned to avoid the land acquisition and resettlement as much as possible though alternative analysis. |
| | | | | | C: Land acquisition and resettlement activities are expected to be continued even during construction stage. Temporal relocation is also required for setting up of construction yards and workers' camps for the construction activities. |
| | | | | | O: No impact is expected. |
| | Land use | B- | B- | A+ | P: The current land use needs to be changed by land acquisition and resettlement in accordance with the planned alignment and station location. |
| | | | | | C: Land clearance for construction yards and workers' camps is temporary. The land use around the construction site may be changed by doing business with construction workers without control. |
| | | | | | O: The HSR station will be developed together around the station areas as an integrated development. In addition, land use is expected to be changed gradually for further development mainly around the station in accordance with a provincial/city plan and private investments. |
| | Utilization of local resources | D | B- | D | P: No impact is expected. |
| | | | | | C: Using a large amount of local resources such as sand and quarry for the construction activities would obstruct its utilization by local people for other purposes. |
| | | | | | O: No impact is expected because the HSR would not use much local resources. |
| | General, regional /city plans | B+/B- | D | B+ | P: HSR requires changing land use purpose in the province. The current general plan and/or regional/city plan of Province needs to be updated in accordance with the planned alignment and station location. |
| | | | | | C: No impact is expected (updating plans may continue). |
| | | | | | O: In accordance with the HSR development including development of station area, further general plan/city plans which include further development plan are expected to be prepared in all city/provinces. |
| | Social institutions and local decision - making institutions | C- | C- | C- | P: Some impact on social institutions local decision making institutions is expected by land acquisition and resettlement. However further examination is necessary. |
| | | | | | C: Some impact on social institutions and local decision making institutions is expected by inflow of many construction workers and other relating peoples from outside the area. However further examination is necessary. |
| | | | | | O: Some impact on social institutions and local decision making institutions is expected by disturbing movement of local people by the HSR structures. However further examination is necessary. |
| | Social Infrastructures and Services | B- | B- | B+/B- | P: By land acquisition and resettlement, some impacts on social infrastructure and services such as resettlement of community facility (village hall, etc.) are expected. Stadium and market in Lam Son may be affected. |
| | | | | | C: Though temporal, impacts on social infrastructures and services by setting up of construction yards and workers' camps are expected. Especially, impacts on social infrastructures and services are expected by disturbance and interruption of their utilization by the construction activities such as |

| Thanh Hoa | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | relocation of public utilities and local roads. |
| | | | | | O: Development of the HSR station together with its surrounding areas would improve social infrastructures and services in the area and the country. On the other hand, some impacts on social infrastructures and services by the existence of the HSR structures are expected. |
| | Local economy and livelihood | B- | B+ | A+/B- | P: Some negative impacts on the local economy and livelihood are expected because of losses of employment opportunities and income sources by land acquisition and resettlement. |
| | | | | | C: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the construction activities. |
| | | | | | O: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the HSR project, especially around the station and employment of the workers for track maintenance, etc.<br>On the other hand, some negative impacts are also expected after the completion of the construction activities because of termination of temporary employment opportunities of local workers. |
| | Unequal Distribution of Benefit and Damage | B- | B- | B- | P: Unequal situations are expected among the project affected households/peoples and not affected households/peoples. |
| | | | | | C: Some unequal situations are expected among the local peoples between those who receive any benefit and those who receive any damage from the constriction activities, e.g. some affected households need to be relocated far away, while their neighbors not affected can do business with construction workers. |
| | | | | | O: Some unequal situations are expected among the local peoples between those who live near the station and those who live far from the station, especially in the latter case, they have a possibility to receive damages such as noise and vibration impacts, and some impacts on social infrastructures and services, livelihood and water usage, while in the former case, they may enjoy the benefit from the HSR service and related opportunities of businesses. |
| | Local conflicts of interest | C- | C- | C- | P/C/O: Local conflicts of interest are expected among local peoples, especially between beneficiaries and project affected peoples for land acquisition and inconveniences during construction and operation. Further examination would be necessary in case that unequal distribution of benefit and damage is expected to be crucial issues. |
| | Water Usage, Water Rights and Communal Rights | C- | C- | C- | P: Some impacts on water usage for the resettled houses/peoples are expected by land acquisition and resettlement. However, further examination would be necessary for water rights and communal rights. |
| | | | | | C: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses by the construction activities are small and temporal. However, further examination would be necessary for water rights and communal rights. |
| | | | | | O: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses are expected by the existence of the HSR structures. However, further examination would be necessary for disturbance by the structures. |
| | Cultural and Historical Heritages | D | B- | B- | P: Although 1 national cultural and historical heritage is found in Thanh Hoa provinces within a distance of 100m from the alignment (Nui Nap Martyr cemetery, 60 m), they are not affected directly by HSR. Thus, no impact is expected. |
| | | | | | C: Together with above mentioned, many heritages are found near the alignment. These may be affected by the noise and vibration, and the traffic congestions caused by vehicles for the construction. Followings are the examples of heritages near the alignment.<br>Tomb of Duke Le Trung Trac (National heritage, 126m), Temple of General Ly Thuong Kiet (National heritage, 133m), Nguong Son mountain and Linh Xung pagoda (Provincial heritage, 126m) |
| | | | | | O: The heritages mainly within 100m from the alignment may suffer the impact of noise and vibration to some extent. |
| | Religious Facilities | C- | B- | B- | P: Though not directly affected, Nui Nap Martyr temple near the alignment (60m) is ranked as a national heritage. And small scale village level religious facilities may be relocated. |
| | | | | | C/O: 7 religious facilities are found along the HSR within a distance less than 200m, So impacts such as noise and vibration are expected during the construction and operational phases. |
| | Sensitive facilities (ex. hospital, school, precision machine factory) | A- | B- | B- | P: It finds some sensitive places as Xi Mang Bim Son secondary school on the alignment and those places may be relocated. Further examination is required. |
| | | | | | C: Especially the school and hospital (such as Bim Son hospital located at the distance of 166 m away from planned alignment), the traffic congestion with heavy vehicles affect the local peoples' convenience and safety. |
| | | | | | O: Especially with regard to the 3 schools and 2 hospital along the alignment, noise and vibration caused by HSR may affect the peoples' comfort. |
| | Poor people | C- | B+ | C- | P: Poor people (who have poor household certificates issued by local authorities) stay everywhere, particularly concentrate in Thanh Hoa province. Further examination would be necessary for them |

| Thanh Hoa | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | because it is more difficult for them to recover their livelihood after land acquisition and resettlement than other PAPs. |
| | | | | | C: There is a possibility that the poor people would also have employment opportunities in construction and its associated business activities. |
| | | | | | O: There is a possibility that the enjoyment of the benefits of the HSR service by the poor people would be difficult. Further examination would be necessary. |
| | Ethnic Minorities/indigenous people | C- | C- | C- | P: Ethnic groups such as Muong and Kho Me, live particularly in Tinh Gia district. Some impact on their culture as well as livelihood is expected, however, further examination would be necessary. |
| | | | | | C: Some impact on ethnic groups is expected by the influx of a large number of construction workers and relating peoples outside the area. Further examination would be necessary. |
| | | | | | O: Some impact on ethnic groups is expected by disturbed movement of peoples by the existence of HSR structures. Further examination would be necessary. |
| | Gender | C- | C- | C- | P: Land acquisition and resettlement are an important incident to a family and some women would have a bigger burden for that. Further examination would be necessary. |
| | | | | | C: Equal employment opportunities for both sexes are required for the construction works. Further examination would be necessary. |
| | | | | | O: The HSR service will be equal to both sexes. On the other hand, equal employment opportunities for both sexes are required for the HSR operation. Further examination would be necessary. |
| | Children's rights | D | D | D | P: No impact is expected. |
| | | | | | C/O. Since employment of children for the construction works is strictly prohibited by Children Protection, Education and Care Law 2004, no impact is expected. |
| | Public Health (sanitation and infectious diseases) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts on public health are expected due to unsanitary conditions caused by the influx of a large number of workers. In addition, increase of risks related to Sexually Transmitted Diseases (STD) or Sexually Transmitted Infections (STI) and HIV/AIDS is expected among the workers and local communities. |
| | | | | | O: Some impacts on public health are expected due to the influx of a large number of passengers (about 17,000 passengers per day at Thanh Hoa Station, if Ngoc Hoi - Vinh section is operated in 2030) and business persons around the station area. |
| | Occupational Health and Safety (OHS) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts regarding OHS for the construction workers are expected. |
| | | | | | O: Some impacts regarding OHS for the workers for the HSR operation, especially the workers at the track for maintenance and at the depot are expected. |
| Other | Accidents | D | B- | C+/C- | P: No impact is expected. |
| | | | | | C: Increase of risks of accidents associated with construction activities is expected due to the operation of heavy equipment and vehicles. |
| | | | | | O: Increase of risks of accidents associated with the HSR services is expected due to the high speed train operation. On the other hand, positive and/or negative impacts are expected by the modal sift of passengers' transportation to HSR from cars, buses, airs, and existing railway. |
| | Climate Change | D | D | A+/C- | P: No impact is expected. |
| | | | | | C: Although increase of GHGs emission is expected due to operation of heavy equipment and vehicles, the impact is temporal and small. |
| | | | | | O: Overall reduction of GHGs emission is expected by the modal shift of passengers' transportation to the HSR (+31% of the share between Hanoi – Vinh, 2030 projection) from cars (-6%), buses (-19%), airs (-1%), and existing railway (-5%). 63 kt-$CO_2$e/year of GHGs would be reduced by the development of the HSR in the north section.<br>Though alignment avoids the coastal area, Impact by the rise of sea level should be further studied. |

Source: JICA Study Team

## Table 4C.6 Result of Rating (Nghe An Section)

| Nghe An | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| Natural Environment | Climate / Meteorological Phenomena | D | D | D | P: No impact is expected. |
| | | | | | C/O: Although the elevated structures such as viaduct of the HSR track and station building will be constructed, the impacts on micro-climate and micro meteorological phenomena are negligible because these structures would not disturb wind path. |
| | Topography | D | C- | D | P: No impact is expected. |
| | | | | | P: Cut section of 690m in the mountainous area may have impacts on topography. There is a long tunnel of 2,130m in the border with Thanh Hoa province. |
| | | | | | O: Completing construction, topography would be stable. No impact is expected |
| | Geology | D | D | D | P: No impact is expected. |
| | | | | | C: Soft soil areas are limited and no impact is expected. |
| | | | | | O: No impact is expected. |
| | Soil Erosion | D | B- | B- | P: No impact is expected. |
| | | | | | C: By the earth work, especially when it is raining, some soil erosion is expected. |
| | | | | | O: Embankment or cut section is about 46.2 km, where new surface may be washed by rain water. |
| | Hydrology | D | D | B- | P: No impact is expected. |
| | | | | | C: In the elevated structure section, construction works would cause little impacts on the hydrological cycle or regimes. In embankment or cut section, piled up soil may cause minor and temporal impact on hydrological cycle or regimes. They are not scale that change hydrological regime. |
| | | | | | O: In the embankment section of about 45.4 km, hydrological situation would be affected by the structures. The elevated section will have less and minor impact on the hydrological conditions. |
| | Ground water | D- | B- | B- | P: No impact is expected. |
| | | | | | C: Ground water utilization by the construction works is not a scale that changes ground water flow. However, there may be impact on the ground water flow by construction activities of tunnels. |
| | | | | | O: Utilizing ground water by HSR is not a scale that can change ground water level. However, in the tunnel section, there may be impact on the ground water flow by the structure. |
| | Ecosystem Flora, Fauna and Biodiversity | D | B- | B- | P: No impact is expected. |
| | | | | | C: Besides 5 plots of protection forest to be affected, most of the area along the alignment is already developed area including residential and agricultural areas. The affected flora, fauna and biodiversity along the alignment are considered to be not critical, while the construction work may interfere with the habitat of flora and fauna. |
| | | | | | O: Existence of the HSR structure and HSR operation may cause negative impact on the ecosystem. |
| | Protected Areas/Forest | B- | B- | B- | P: There are special-use forests (protected areas) in Nghe An province, however those areas are located too far from the planned alignment (more than 10km) to be affected. Protection forests (7.2ha) and production forests (10.6 ha) are affected by the alignment. |
| | | | | | C: The construction machines could damage the vegetation. Activities of construction workers may also be the pressure on forest. |
| | | | | | O: By the structure of HSR, some of the forest area is opened, so that more sunshine will be led inside the vegetation, which would affect the edge of the forest area. |
| | Coastal zone | D | D | D | P/C/O: The closest distance to the alignment from the coastal line is about 3.5 km and no mudflats or no mangrove areas are affected. Thus, no impact is expected. |
| | Landscape | D | D | B+/B- | P: No impact is expected. |
| | | | | | C: Change of landscape is temporary and limited during the construction. |
| | | | | | O: By the structures such as viaduct, embankment and station buildings, both positive and negative impacts on landscape are expected. |
| | Natural disasters | D | C- | B- | P: No impact is expected. |
| | | | | | C: Though there is no landslide / erosion prone area along the alignment, riverbank could be eroded due to construction. |
| | | | | | O: The alignment goes through some flood prone areas. Embankment construction in such sub-sections may result in a higher risk of flooding. |
| Living Environment | Air Pollution | D | B- | A+/B- | P: No impact is expected. |
| | | | | | C: Some negative impact is expected due to operation of many equipments and vehicles, dust incidental to earth work especially in dry season, although these impacts are temporal and limited. |
| | | | | | O: Overall reduction of air pollutants' emission is expected by the modal shift of passengers' transportation to the HSR (+31% of the share between Hanoi – Vinh, 2030 projection) from cars (-6%), |

| Nghe An | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | buses (-19%), airs (-1%), and existing railway (-5%). 196 t-$NO_x$/year of air pollutants would be reduced by the development of the HSR in the north section. On the other hand, increase in air pollutants from increased access of cars and buses around the station are expected. |
| | Offensive Odor | D | D | D | P/C/O: No impact is expected. |
| | Water Pollution | D | B- | B- | P: No impact is expected. |
| | | | | | C: Turbid water by the earth work(45.5 km of embankment, 0.7 km of cut) and bridge piers' construction work (3 bridges over rivers are planned), and wastewater effluents from construction works' camps/yards are expected to pollute the surrounding rivers/canals water to some extent. |
| | | | | | O: Wastewater effluents from passengers at the station and maintenance activities in the depot are expected. Some impacts on water quality in surrounding water bodies are expected due to discharged polluted water. |
| | Bottom Sediment Contamination | D | D | D | P: No impact is expected. |
| | | | | | C: Although some construction materials such as cement and sand are expected to be washed out mainly by the rain, the impacts on bottom sediment by them are small. |
| | | | | | O: Although some impact is expected on bottom sediment by deposition of pollutants from the wastewater discharged from maintenance activities in the depot in Vinh, the impact is small. |
| | Soil Contamination | D | C- | B- | P: No impact is expected. |
| | | | | | C: Although some impact on soil is expected by deposition of pollutants from construction materials and vehicles, the impacts are small. On the other hand, in case the soil at construction sites is already contaminated by other reasons, some impacts are expected by the construction activity. Thus, further study is necessary. |
| | | | | | O: Some impact may be expected on soil by deposition of pollutants from maintenance activities in the depot in Vinh. |
| | Ground Subsidence | D | D | D | P: No impact is expected. |
| | | | | | C: Ground water utilization by the construction works is not a scale that changes ground water flow. Thus, no ground subsidence is expected. |
| | | | | | O: Geological condition along alignment in Ninh Binh is soft soil layers. As viaduct section is planned to be applied, no impact is expected. |
| | Noise/vibration | D | B- | A- | P: No impact is expected. |
| | | | | | C: There are 7 religious facilities, 3 school and 2 hospitals within 200m from the alignment. Noise and vibration generated by operation of heavy equipment and vehicles, although they are temporary, may affect the residential areas and such facilities/places which require quietness. |
| | | | | | O: There are 7 religious facilities, 3 schools and 2 hospital within 200m from the alignment. Noise and vibration generated by movement of high speed trains may affect the residential areas and such facilities/places which require quietness. Maintenance of ballast track would also cause noise. |
| | Low frequency noise/micro-pressure wave | D | D | A- | P: No impact is expected. |
| | | | | | C: Construction activities will not cause low frequency noise/micro-pressure wave. |
| | | | | | O: Significant low frequency/micro-pressure wave at long tunnel sub-sections is expected. 2 tunnels exist and both of them are more than 1km long. Buildings are located near one exit. Low frequency noise from the train passing an open section is small. |
| | Wave Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No wave obstruction is expected by the construction work. |
| | | | | | O: Radio waves would be disturbed by movement of high speed trains and some impacts such as flutter and pulse interferences on TV are expected. In addition, since the elevated structures such as viaduct and Vinh station building will be developed (total: 23.2 km, of which 18.2 km is with noise barrier), some impacts by wave disturbed by these structures are expected. |
| | Sunshine Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No sunshine obstruction is expected by the construction works. |
| | | | | | O: There will be elevated structures such as viaduct and station buildings development (total: 23.2 km, of which 18.2 km is with noise barrier); some impacts are expected by shade created by these structures. |
| | Wastes/Hazardous waste | D | B- | B- | P: No impact is expected. |
| | | | | | C: A certain amount of construction and demolition wastes which may include hazardous materials, and waste from construction workers' camps is expected to be generated. |
| | | | | | O: A certain amount of wastes from passengers at the station and maintenance works at the depot is expected to be generated. |
| Social Environm | Involuntary resettlement | A- | B- | D | P: About 320 ha of land would be necessary for development of the HSR structures (viaduct, station, depot, etc.) in this section. In addition, about 710 buildings and 1670 households would be affected either by land acquisition or resettlement although the alignment is planned to avoid the land acquisition and |

| Nghe An | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | resettlement as much as possible though alternative analysis. |
| | | | | | C: Land acquisition and resettlement activities are expected to be continued even during construction stage. Temporal relocation is also required for setting up of construction yards and workers' camps for the construction activities. |
| | | | | | O: No impact is expected. |
| | Land use | B- | B- | A+ | P: The current land use needs to be changed by land acquisition and resettlement in accordance with the planned alignment and station location. |
| | | | | | C: Land clearance for construction yards and workers' camps is temporary. The land use around the construction site may be changed by doing business with construction workers without control. |
| | | | | | O: The HSR station will be developed together around the station areas as an integrated development. In addition, land use is expected to be changed gradually for further development mainly around the station in accordance with a provincial/city plan and private investments. |
| | Utilization of local resources | D | B- | D | P: No impact is expected. |
| | | | | | C: Using a large amount of local resources such as sand and quarry for the construction activities would obstruct its utilization by local people for other purposes. |
| | | | | | O: No impact is expected because the HSR would not use much local resources. |
| | General, regional /city plans | B+/B- | D | B+ | P: HSR requires changing land use purpose in the province. The current general plan and/or regional/city plan of Province needs to be updated in accordance with the planned alignment and station location. |
| | | | | | C: No impact is expected (updating plans may continue). |
| | | | | | O: In accordance with the HSR development including development of station area, further general plan/city plans which include further development plan are expected to be prepared in all city/provinces. |
| | Social institutions and local decision - making institutions | C- | C- | C- | P: Some impact on social institutions local decision making institutions is expected by land acquisition and resettlement. However further examination is necessary. |
| | | | | | C: Some impact on social institutions and local decision making institutions is expected by inflow of many construction workers and other relating peoples from outside the area. However further examination is necessary. |
| | | | | | O: Some impact on social institutions and local decision making institutions is expected by disturbing movement of local people by the HSR structures. However further examination is necessary. |
| | Social Infrastructures and Services | C- | B- | B+/B- | P: By land acquisition and resettlement, some impacts on social infrastructure and services such as resettlement of community facility (village hall, etc.) are expected although it is not identified so far. |
| | | | | | C: Though temporal, impacts on social infrastructures and services by setting up of construction yards and workers' camps are expected. Especially, impacts on social infrastructures and services are expected by disturbance and interruption of their utilization by the construction activities such as relocation of public utilities and local roads. |
| | | | | | O: Development of the HSR station together with its surrounding areas would improve social infrastructures and services in the area and the country. On the other hand, some impacts on social infrastructures and services by the existence of the HSR structures are expected. |
| | Local economy and livelihood | B- | B+ | A+/B- | P: Some negative impacts on the local economy and livelihood are expected because of losses of employment opportunities and income sources by land acquisition and resettlement. |
| | | | | | C: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the construction activities. |
| | | | | | O: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the HSR project, especially around the station and employment of the workers for track maintenance, etc.<br>On the other hand, some negative impacts are also expected after the completion of the construction activities because of termination of temporary employment opportunities of local workers. |
| | Unequal Distribution of Benefit and Damage | B- | B- | B- | P: Unequal situations are expected among the project affected households/peoples and not affected households/peoples. |
| | | | | | C: Some unequal situations are expected among the local peoples between those who receive any benefit and those who receive any damage from the constriction activities, e.g. some affected households need to be relocated far away, while their neighbors not affected can do business with construction workers. |
| | | | | | O: Some unequal situations are expected among the local peoples between those who live near the station and those who live far from the station, especially in the latter case, they have a possibility to receive damages such as noise and vibration impacts, and some impacts on social infrastructures and services, livelihood and water usage, while in the former case, they may enjoy the benefit from the HSR service and related opportunities of businesses. |
| | Local conflicts of interest | C- | C- | C- | P/C/O: Local conflicts of interest are expected among local peoples, especially between beneficiaries and project affected peoples for land acquisition and inconveniences during construction and operation. |

| Nghe An | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | Further examination would be necessary in case that unequal distribution of benefit and damage is expected to be crucial issues. |
| | Water Usage, Water Rights and Communal Rights | C- | C- | C- | P: Some impacts on water usage for the resettled houses/peoples are expected by land acquisition and resettlement. However, further examination would be necessary for water rights and communal rights. |
| | | | | | C: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses by the construction activities are small and temporal. However, further examination would be necessary for water rights and communal rights. |
| | | | | | O: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses are expected by the existence of the HSR structures. However, further examination would be necessary for disturbance by the structures. |
| | Cultural and Historical Heritages | D | C- | C- | P: National cultural and historical heritages are not found within a distance of 100m from the alignment of HSR. Thus, no impact is expected. |
| | | | | | C: Though not directly affected, heritages may exist near the alignment. These may be affected by the noise and vibration, and the traffic congestions caused by vehicles for the construction. Further confirmation is required. |
| | | | | | O: The heritages mainly within 100m from the alignment may suffer the impact of noise and vibration to some extent. |
| | Religious Facilities | C- | C- | C- | P: Though the well known religious places are not directly affected, small scale village level religious facilities may be relocated. |
| | | | | | C/O: No pagodas and temples are found along the HSR within a distance less than 200m, and further examination is required. |
| | Sensitive facilities (ex. hospital, school, precision machine factory) | C- | C- | C- | P: No sensitive places along the alignment is found. Further examination is required. |
| | | | | | C: In case school and hospital exist near the alignment, the traffic congestion with heavy vehicles may affect the local peoples' convenience and safety. Further examination is required. |
| | | | | | O: With regard to the schools and hospitals, further examination is required along the alignment |
| | Poor people | C- | B+ | C- | P: Poor people (who have poor household certificates issued by local authorities) stay everywhere. Further examination would be necessary for them because it is more difficult for them to recover their livelihood after land acquisition and resettlement than other PAPs. |
| | | | | | C: There is a possibility that the poor people would also have employment opportunities in construction and its associated business activities. |
| | | | | | O: There is a possibility that the enjoyment of the benefits of the HSR service by the poor people would be difficult. Further examination would be necessary. |
| | Ethnic Minorities/indigenous people | D | D | D | P: Particular distribution of ethnic minorities along the alignment is not reported. Thus, no impact is expected. |
| | | | | | C: No impact is expected. |
| | | | | | O: No impact is expected. |
| | Gender | C- | C- | C- | P: Land acquisition and resettlement are an important incident to a family and some women would have a bigger burden for that. Further examination would be necessary. |
| | | | | | C: Equal employment opportunities for both sexes are required for the construction works. Further examination would be necessary. |
| | | | | | O: The HSR service will be equal to both sexes. On the other hand, equal employment opportunities for both sexes are required for the HSR operation. Further examination would be necessary. |
| | Children's rights | D | D | D | P: No impact is expected. |
| | | | | | C/O. Since employment of children for the construction works is strictly prohibited by Children Protection, Education and Care Law 2004, no impact is expected. |
| | Public Health (sanitation and infectious diseases) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts on public health are expected due to unsanitary conditions caused by the influx of a large number of workers. In addition, increase of risks related to Sexually Transmitted Diseases (STD) or Sexually Transmitted Infections (STI) and HIV/AIDS is expected among the workers and local communities. |
| | | | | | O: Some impacts on public health are expected due to the influx of a large number of passengers (about 30,000 passengers per day at Vinh Station, if Ngoc Hoi - Vinh section is operated in 2030) and business persons around the station area. |
| | Occupational Health and | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts regarding OHS for the construction workers are expected. |

| Nghe An | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | Safety (OHS) | | | | O: Some impacts regarding OHS for the workers for the HSR operation, especially the workers at the track for maintenance and at the depot are expected. |
| Other | Accidents | D | B- | C+/C- | P: No impact is expected. |
| | | | | | C: Increase of risks of accidents associated with construction activities is expected due to the operation of heavy equipment and vehicles. |
| | | | | | O: Increase of risks of accidents associated with the HSR services is expected due to the high speed train operation. On the other hand, positive and/or negative impacts are expected by the modal sift of passengers' transportation to HSR from cars, buses, airs, and existing railway. |
| | Climate Change | D | D | A+/C- | P: No impact is expected. |
| | | | | | C: Although increase of GHGs emission is expected due to operation of heavy equipment and vehicles, the impact is temporal and small. |
| | | | | | O: Overall reduction of GHGs emission is expected by the modal shift of passengers' transportation to the HSR (+31% of the share between Hanoi – Vinh, 2030 projection) from cars (-6%), buses (-19%), airs (-1%), and existing railway (-5%). 63 kt-$CO_2$e/year of GHGs would be reduced by the development of the HSR in the north section.Though alignment avoids the coastal area, Impact by the rise of sea level should be further studied. |

Source: JICA Study Team

# APPENDIX 4D

# Result of Rating (City/Province)

# (South Section)

### Table 4D.1 Result of Rating (Ho Chi Minh Section)

| Ho chi Minh | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| Natural Environment | Climate / Meteorological Phenomena | D | D | D | P: No impact is expected. |
| | | | | | C/O: Although the elevated structures such as viaduct of the HSR track and station building will be constructed, the impacts on micro-climate and micro meteorological phenomena are negligible because these structures would not disturb wind path. |
| | Topography | D | D | D | P: No impact is expected. |
| | | | | | C/O: Topography in this section is generally flat. In addition, the HSR alignment is proposed adjacent to the expressway, i.e. the HCMC-Long Than- Dau Giay expressway and the HSR structures will be constructed mainly on the leveled ground by the expressway. Therefore, impact by HSR on topographic features is small. |
| | | | | | O: Completing construction, topography would be stable. No impact is expected |
| | Geology | D | D | D | P: No impact is expected. |
| | | | | | C: Although there are some soft soil areas and soil improvement works will be done there for the constructions, it is not a scale that changes geological features. |
| | | | | | O: No impact is expected. |
| | Soil Erosion | D | B- | D | P: No impact is expected. |
| | | | | | C: By the earth work, especially when it is raining, some soil erosion is expected. |
| | | | | | O: There is no embankment or cut section, thus no impact is expected. |
| | Hydrology | D | D | B- | P: No impact is expected. |
| | | | | | C: In the elevated structure section, construction works would cause little impacts on the hydrological cycle or regimes. They are not scale that change hydrological regime. |
| | | | | | O: There is no embankment section, thus hydrological situation would not be affected by the structures. The elevated section will have less and minor impact on the hydrological conditions. |
| | Ground water | D | D | D | P: No impact is expected. |
| | | | | | C: Ground water in Mekong River Delta is generally abundant due to many canal/rivers and its low altitude. In addition, ground water utilization by the construction works is not a scale that changes ground water flow. |
| | | | | | O: Utilizing ground water by HSR is not a scale that can change ground water level. |
| | Ecosystem<br>Flora, Fauna and Biodiversity | D | B- | B- | P: No impact is expected. |
| | | | | | C: Most of the area along the alignment is already developed area including residential and agricultural areas. The affected flora, fauna and biodiversity along the alignment are considered to be not critical, while the construction work may interfere with the habitat of flora and fauna. |
| | | | | | O: Existence of the HSR structure and HSR operation may cause negative impact on the ecosystem. |
| | Protected Areas/Forest | D | D | D | P: Though there is special-use forest (protected areas) in Ho Chi Minh city, those areas are located too far from the planned alignment (more than 10km) to be affected. Protection forests and production forests are not affected by the alignment either. |
| | | | | | C: No impact is expected. |
| | | | | | O: No impact is expected. |
| | Coastal zone | D | D | D | P/C/O: The closest distance to the alignment from the coastal line is over 35 km and no mudflats or no mangrove areas are affected. Thus, no impact is expected. |
| | Landscape | D | D | B+/B- | P: No impact is expected. |
| | | | | | C: Change of landscape is temporary and limited during the construction. |

| Ho chi Minh | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | O: By the structures such as viaduct, embankment and station buildings, both positive and negative impacts on landscape are expected. |
| | Natural disasters | D | B- | B- | P: No impact is expected. |
| | | | | | C: Civil work in landslide/ erosion prone areas (5 communes) may trigger landslide. |
| | | | | | O: Flood prone area (3 communes) and landslide area (5 communes) are reported from the areas where alignment is planned. |
| Living Environment | Air Pollution | D | B- | A+/B- | P: No impact is expected. |
| | | | | | C: Some negative impact is expected due to operation of many equipments and vehicles, dust incidental to earth work especially in dry season, although these impacts are temporal and limited. |
| | | | | | O: Overall reduction of air pollutants' emission is expected by the modal shift of passengers' transportation to the HSR (+55%) from cars (-13%), buses (-38%), airs (-3%), and existing railway (-1%) (Example of HCMC-Nha Trang Section, 2030). 1,122 t-NOx/year of air pollutants would be reduced by the development of the HSR in the south section. On the other hand, increase in air pollutants from increased access of cars and buses around the station are expected. |
| | Offensive Odor | D | D | D | P/C/O: No impact is expected. |
| | Water Pollution | D | B- | B- | P: No impact is expected. |
| | | | | | C: Turbid water by bridge piers' construction work (2 bridges over rivers are planned), and wastewater effluents from construction works' camps/yards are expected to pollute the surrounding rivers/canals water to some extent. |
| | | | | | O: Wastewater effluents from passengers at the station and maintenance activities in the depot are expected. Some impacts on water quality in surrounding water bodies are expected due to discharged polluted water. |
| | Bottom Sediment Contamination | D | D | D | P: No impact is expected. |
| | | | | | C: Although some construction materials such as cement and sand are expected to be washed out mainly by the rain, the impacts on bottom sediment by them are small. |
| | | | | | O: Although some impact is expected on bottom sediment by deposition of pollutants from the wastewater discharged from maintenance activities in the depot in Thu Thiem, the impact is small. |
| | Soil Contamination | D | C- | B- | P: No impact is expected. |
| | | | | | C: Although some impact on soil is expected by deposition of pollutants from construction materials and vehicles, the impacts are small. On the other hand, in case the soil at construction sites is already contaminated by other reasons, some impacts are expected by the construction activity. Thus, further study is necessary. |
| | | | | | O: Some impact may be expected on soil by deposition of pollutants from maintenance activities in the depot in Thu Thiem. |
| | Ground Subsidence | D | D | D | P: No impact is expected. |
| | | | | | C: Ground water utilization by the construction works is not a scale that changes ground water flow. Thus, no ground subsidence is expected. |
| | | | | | O: Geological condition along alignment in HCMC is soft soil layers. As viaduct section is planned to be applied in such area, no impact is expected. |
| | Noise/vibration | D | B- | A- | P: No impact is expected. |
| | | | | | C: There are 1 religious facility, 3 schools and 0 hospital within 200m from the alignment. Noise and vibration generated by operation of heavy equipment and vehicles, although they are temporary, may affect the residential areas and such facilities/places which require quietness. |
| | | | | | O: There are 1 religious facility, 3 schools and 0 hospital within 200m from the alignment. Noise and vibration generated by movement of high speed trains may affect the residential areas and such facilities/places which require quietness. Maintenance of ballast track would also cause noise. |
| | Low frequency noise/micro-pressure wave | D | D | D | P: No impact is expected. |
| | | | | | C: Construction activities will not cause low frequency noise/micro-pressure wave. |
| | | | | | O: There is no tunnel which may cause low frequency/micro-pressure wave. Low frequency noise from the train passing an open section is small. |
| | Wave Obstruction | D | D | B- | P: No impact is expected. |

| Ho chi Minh | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | C: No wave obstruction is expected by the construction work. |
| | | | | | O: Radio waves would be disturbed by movement of high speed trains and some impacts such as flutter and pulse interferences on TV are expected. In addition, since the elevated structures such as viaduct and Thu Thiem station building will be developed (total: 14.4 km, of which 12.5 km is with noise barrier), some impacts by wave disturbed by these structures are expected. |
| | Sunshine Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No sunshine obstruction is expected by the construction works. |
| | | | | | O: There will be elevated structures such as viaduct and station buildings development (total: 14.4 km, of which 12.5 km is with noise barrier); some impacts are expected by shade created by these structures. |
| | Wastes/Hazardous waste | D | B- | B- | P: No impact is expected. |
| | | | | | C: A certain amount of construction and demolition wastes which may include hazardous materials, and waste from construction workers' camps is expected to be generated. |
| | | | | | O: A certain amount of wastes from passengers at the station and maintenance works at Thu Thiem depot is expected to be generated. |
| Social Environment | Involuntary resettlement | A- | B- | D | P: About 90 ha of land would be necessary for development of the HSR structures (viaduct, station, depot, etc.) in this section. In addition, about 90 buildings and 350 households would be affected either by land acquisition or resettlement although the alignment is planned to avoid the land acquisition and resettlement as much as possible though alternative analysis. |
| | | | | | C: Land acquisition and resettlement activities are expected to be continued even during construction stage. Temporal relocation is also required for setting up of construction yards and workers' camps for the construction activities. |
| | | | | | O: No impact is expected. |
| | Land use | B- | B- | A+ | P: The current land use needs to be changed by land acquisition and resettlement in accordance with the planned alignment and station location. |
| | | | | | C: Land clearance for construction yards and workers' camps is temporary. The land use around the construction site may be changed by doing business with construction workers without control. |
| | | | | | O: The HSR station will be developed together around the station areas as an integrated development. In addition, land use is expected to be changed gradually for further development mainly around the station in accordance with a provincial/city plan and private investments. |
| | Utilization of local resources | D | B- | D | P: No impact is expected. |
| | | | | | C: Using a large amount of local resources such as sand and quarry for the construction activities would obstruct its utilization by local people for other purposes. |
| | | | | | O: No impact is expected because the HSR would not use much local resources. |
| | General, regional /city plans | B+/B- | D | B+ | P: HSR will require changing land use purpose. While Thu Thiem Station area and section along the express way is kept for future HSR purpose, current general plan and/or regional/city plan of City needs to be updated in accordance with the planned alignment and station location. |
| | | | | | C: No impact is expected (updating plans may continue). |
| | | | | | O: In accordance with the HSR development including development of station area, further general plan/city plans which include further development plan are expected to be prepared in all city/provinces. |
| | Social institutions and local decision - making institutions | B- | C- | C- | P: Some impact on social institutions local decision making institutions is expected by land acquisition and resettlement. However further examination is necessary. |
| | | | | | C: Some impact on social institutions and local decision making institutions is expected by inflow of many construction workers and other relating peoples from outside the area. However further examination is necessary. |
| | | | | | O: Some impact on social institutions and local decision making institutions is expected by disturbing movement of local people by the HSR structures. However further examination is necessary. |
| | Social Infrastructures and Services | B- | B- | B+/B- | P: By land acquisition and resettlement, some impacts on social infrastructure and services such as resettlement of community facility (village hall, etc.) are expected. Binh Khanh Market and District 2 People's Committee may be affected. |
| | | | | | C: Though temporal, impacts on social infrastructures and services by setting up of construction yards and workers' camps are expected. Especially, impacts on social infrastructures and services are expected by disturbance and interruption of their utilization by the construction activities such as relocation of public |

| Ho chi Minh | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | utilities and local roads. |
| | | | | | O: Development of the HSR station together with its surrounding areas would improve social infrastructures and services in the area and the country. On the other hand, some impacts on social infrastructures and services by the existence of the HSR structures are expected. |
| | Local economy and livelihood | B- | B+ | A+/B- | P: Some negative impacts on the local economy and livelihood are expected because of losses of employment opportunities and income sources by land acquisition and resettlement. |
| | | | | | C: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the construction activities. |
| | | | | | O: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the HSR project, especially around the station and employment of the workers for track maintenance, etc.<br>On the other hand, some negative impacts are also expected after the completion of the construction activities because of termination of temporary employment opportunities of local workers. |
| | Unequal Distribution of Benefit and Damage | B- | B- | B- | P: Unequal situations are expected among the project affected households/peoples and not affected households/peoples. |
| | | | | | C: Some unequal situations are expected among the local peoples between those who receive any benefit and those who receive any damage from the constriction activities, e.g. some affected households need to be relocated far away, while their neighbors not affected can do business with construction workers. |
| | | | | | O: Some unequal situations are expected among the local peoples between those who live near the station and those who live far from the station, especially in the latter case, they have a possibility to receive damages such as noise and vibration impacts, and some impacts on social infrastructures and services, livelihood and water usage, while in the former case, they may enjoy the benefit from the HSR service and related opportunities of businesses. |
| | Local conflicts of interest | C- | C- | C- | P/C/O: Local conflicts of interest are expected among local peoples, especially between beneficiaries and project affected peoples for land acquisition and inconveniences during construction and operation. Further examination would be necessary in case that unequal distribution of benefit and damage is expected to be crucial issues. |
| | Water Usage, Water Rights and Communal Rights | C- | C- | C- | P: Some impacts on water usage for the resettled houses/peoples are expected by land acquisition and resettlement. However, further examination would be necessary for water rights and communal rights. |
| | | | | | C: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses by the construction activities are small and temporal. However, further examination would be necessary for water rights and communal rights. |
| | | | | | O: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses are expected by the existence of the HSR structures. However, further examination would be necessary for disturbance by the structures. |
| | Cultural and Historical Heritages | D | C- | C- | P: National or city cultural and historical heritages are not found within a distance of 100m from the alignment of HSR. Thus, no impact is expected. |
| | | | | | C: Though not directly affected, heritages may exist near the alignment. These may be affected by the noise and vibration, and the traffic congestions caused by vehicles for the construction. Further confirmation is required. |
| | | | | | O: The heritages mainly within 100m from the alignment may suffer the impact of noise and vibration to some extent. |
| | Religious Facilities | C- | B- | B- | P: The well known religious places are not directly affected and small scale village level religious facilities may be relocated. |
| | | | | | C/O: 1 religious facility are found along the HSR within a distance less than 200m, So impacts such as noise and vibration are expected during the construction and operational phases. |
| | Sensitive facilities (ex. hospital, school, precision machine factory) | B- | B- | B- | P: It finds some sensitive places as three schools near Thu Thiem station area around 30m away and these places may be relocated. Further examination is required. |
| | | | | | C: Especially regarding three schools near Thu Thiem station, the traffic congestion with heavy vehicles affect the local peoples' convenience and safety. |
| | | | | | O: Especially with regard to the 3 schools and 0 hospital along the alignment, noise and vibration caused by HSR may affect the peoples' comfort. |

| Ho chi Minh | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | Poor people | C- | B+ | C- | P: Poor people (who have poor household certificates issued by local authorities) stay everywhere. Further examination would be necessary for them because it is more difficult for them to recover their livelihood after land acquisition and resettlement than other PAPs. |
| | | | | | C: There is a possibility that the poor people would also have employment opportunities in construction and its associated business activities. |
| | | | | | O: There is a possibility that the enjoyment of the benefits of the HSR service by the poor people would be difficult. Further examination would be necessary. |
| | Ethnic Minorities/indigenous people | D | D | D | P: A little Chinese (0.3%) and Kho Me (0.3%) people are distributed in this section. Significant impact is not expected since their lifestyle is similar to Khin people especially in the city area. |
| | | | | | C: Considering the size of ethnic minority population (and Chinese is now similar to Khin people), significant impact is not expected. |
| | | | | | O: Considering the size of ethnic minority population (and Chinese is now similar to Khin people), significant impact is not expected. |
| | Gender | C- | C- | C- | P: Land acquisition and resettlement are an important incident to a family and some women would have a bigger burden for that. Further examination would be necessary. |
| | | | | | C: Equal employment opportunities for both sexes are required for the construction works. Further examination would be necessary. |
| | | | | | O: The HSR service will be equal to both sexes. On the other hand, equal employment opportunities for both sexes are required for the HSR operation. Further examination would be necessary. |
| | Children's rights | D | D | D | P: No impact is expected. |
| | | | | | C/O. Since employment of children for the construction works is strictly prohibited by Children Protection, Education and Care Law 2004, no impact is expected. |
| | Public Health (sanitation and infectious diseases) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts on public health are expected due to unsanitary conditions caused by the influx of a large number of workers. In addition, increase of risks related to Sexually Transmitted Diseases (STD) or Sexually Transmitted Infections (STI) and HIV/AIDS is expected among the workers and local communities. |
| | | | | | O: Some impacts on public health are expected due to the influx of a large number of passengers (about 50,000 passengers per day at Thu Thiem Station, if Thu Thiem - Nha Trang section is operated in 2030) and business persons around the station area. |
| | Occupational Health and Safety (OHS) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts regarding OHS for the construction workers are expected. |
| | | | | | O: Some impacts regarding OHS for the workers for the HSR operation, especially the workers at the track for maintenance and at the depot are expected. |
| Other | Accidents | D | B- | C+/C- | P: No impact is expected. |
| | | | | | C: Increase of risks of accidents associated with construction activities is expected due to the operation of heavy equipment and vehicles. |
| | | | | | O: Increase of risks of accidents associated with the HSR services is expected due to the high speed train operation. On the other hand, positive and/or negative impacts are expected by the modal sift of passengers' transportation to HSR from cars, buses, airs, and existing railway. |
| | Climate Change | D | D | A+ | P: No impact is expected. |
| | | | | | C: Although increase of GHGs emission is expected due to operation of heavy equipment and vehicles, the impact is temporal and small. |
| | | | | | O: Overall reduction of GHG emission is expected by the modal shift of passengers' transportation to the HSR (+55% of the share between HCMC – Nha Trang, 2030 projection) from cars (-13%), buses (-38%), airs (-3%), and existing railway (-1%). 72 kt-CO2e/year of GHGs would be reduced by the development of the HSR in the south section.<br>Though alignment avoids the coastal area, Impact by the rise of sea level should be further studied. |

Source: JICA Study Team

## Table 4D.2 Result of Rating (Dong Nai Section)

| Dong Nai | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| Natural Environment | Climate / Meteorological Phenomena | D | D | D | P: No impact is expected. |
| | | | | | C/O: Although the elevated structures such as viaduct of the HSR track and station building will be constructed, the impacts on micro-climate and micro meteorological phenomena are negligible because these structures would not disturb wind path. |
| | Topography | D | C- | D | P: No impact is expected. |
| | | | | | C: It is rather flat along the alignment, in addition, the HSR alignment is proposed adjacent to the expressway up to Long Thanh station, i.e. the HCMC-Long Than- Dau Giay expressway and the HSR structures will be constructed mainly on the leveled ground by the expressway. On the other hand, about 35 km of cut section may affect the topography to some extent |
| | | | | | O: Completing construction, topography would be stable. No impact is expected |
| | Geology | D | D | D | P: No impact is expected. |
| | | | | | C: Although there are some soft soil areas and soil improvement works will be done there for the constructions, it is not a scale that changes geological features. |
| | | | | | O: No impact is expected. |
| | Soil Erosion | D | B- | B- | P: No impact is expected. |
| | | | | | C: By the earth work, especially when it is raining, some soil erosion is expected. |
| | | | | | O: Embankment or cut section is about 66.9 km, where new surface may be washed by rain water. |
| | Hydrology | D | D | B- | P: No impact is expected. |
| | | | | | C: In the elevated structure section, construction works would cause little impacts on the hydrological cycle or regimes. In embankment or cut section, piled up soil may cause minor and temporal impact on hydrological cycle or regimes. They are not scale that change hydrological regime. |
| | | | | | O: In the embankment section of about 31.9 km, hydrological situation would be affected by the structures. The elevated section will have less and minor impact on the hydrological conditions. |
| | Ground water | D | D | D | P: No impact is expected. |
| | | | | | C: Ground water in Red River Delta is generally abundant due to many canal/rivers and its low altitude. In addition, ground water utilization by the construction works is not a scale that changes ground water flow. |
| | | | | | O: Utilizing ground water by HSR is not a scale that can change ground water level. |
| | Ecosystem Flora, Fauna and Biodiversity | D | B- | B- | P: No impact is expected. |
| | | | | | C: Most of the area along the alignment is already developed area including residential and agricultural areas. The affected flora, fauna and biodiversity along the alignment are considered to be not critical, while the construction work may interfere with the habitat of flora and fauna. |
| | | | | | O: Existence of the HSR structure and HSR operation may cause negative impact on the ecosystem. |
| | Protected Areas/Forest | B- | B- | B- | P: Though there are special-use forests (protected areas), they are too far from the planned alignment (more than 10km) to be affected. Protection forests are not affected and production forests (26.5ha) are affected by the alignment. |
| | | | | | C: The construction machines could damage the vegetation. Activities of construction workers may also be the pressure on forest. |
| | | | | | O: By the structure of HSR, some of the forest area is opened, so that more sunshine will be led inside the vegetation, which would affect the edge of the forest area. |
| | Coastal zone | D | D | D | P/C/O: The closest distance to the alignment from the coastal line is nearly 25 km and no mudflats or no mangrove areas are affected. Thus, no impact is expected. |
| | Landscape | D | D | B+/B- | P: No impact is expected. |
| | | | | | C: Change of landscape is temporary and limited during the construction. |
| | | | | | O: By the structures such as viaduct, embankment and station buildings, both positive and negative impacts on landscape are expected. |
| | Natural disasters | D | C- | B- | P: No impact is expected. |
| | | | | | C: While there is no landslide/ erosion prone areas information, riverbank could be eroded due to construction. |
| | | | | | O: Flood prone area (2 communes) and tornado area (2 communes) are reported from the areas where alignment is planned. |
| Living Environment | Air Pollution | D | B- | A+/B- | P: No impact is expected. |
| | | | | | C: Some negative impact is expected due to operation of many equipments and vehicles, dust incidental to earth work especially in dry season, although these impacts are temporal and limited. |
| | | | | | O: Overall reduction of air pollutants' emission is expected by the modal shift of passengers' transportation to the HSR (+55%) from cars (-13%), buses (-38%), airs (-3%), and existing railway (-1%) |

| Dong Nai | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | (Example of HCMC-Nha Trang Section, 2030). 1,122 t-NOx/year of air pollutants would be reduced by the development of the HSR in the south section.On the other hand, increase in air pollutants from increased access of cars and buses around the station are expected. |
| | Offensive Odor | D | D | D | P/C/O: No impact is expected. |
| | Water Pollution | D | B- | B- | P: No impact is expected. |
| | | | | | C: Turbid water by the earth work (31.9 km of embankment and 35.1 km of cut) and bridge piers' construction work (3 bridges over rivers are planned), and wastewater effluents from construction works' camps/yards are expected to pollute the surrounding rivers/canals water to some extent. |
| | | | | | O: Wastewater effluents from passengers at the station and maintenance activities in the depot are expected. Some impacts on water quality in surrounding water bodies are expected due to discharged polluted water. |
| | Bottom Sediment Contamination | D | D | D | P: No impact is expected. |
| | | | | | C: Although some construction materials such as cement and sand are expected to be washed out mainly by the rain, the impacts on bottom sediment by them are small. |
| | | | | | O: No impact is expected. |
| | Soil Contamination | D | C- | D | P: No impact is expected. |
| | | | | | C: Although some impact on soil is expected by deposition of pollutants from construction materials and vehicles, the impacts are small. On the other hand, in case the soil at construction sites is already contaminated by other reasons, some impacts are expected by the construction activity. Thus, further study is necessary. |
| | | | | | O: No impact is expected. |
| | Ground Subsidence | D | D | D | P: No impact is expected. |
| | | | | | C: Ground water utilization by the construction works is not a scale that changes ground water flow. Thus, no ground subsidence is expected. |
| | | | | | O: Geological condition along alignment in Dong Nai is soft soil layers. As viaduct section is planned to be applied in such area, no impact is expected. |
| | Noise/vibration | D | B- | A- | P: No impact is expected. |
| | | | | | C: There are 4 religious facilities, 1 school and 0 hospitals within 200m from the alignment. Noise and vibration generated by operation of heavy equipment and vehicles, although they are temporary, may affect the residential areas and such facilities/places which require quietness. |
| | | | | | O: There are 4 religious facilities, 1 schools and 0 hospital within 200m from the alignment. Noise and vibration generated by movement of high speed trains may affect the residential areas and such facilities/places which require quietness. Maintenance of ballast track would also cause noise. |
| | Low frequency noise/micro-pressure wave | D | D | D | P: No impact is expected. |
| | | | | | C: Construction activities will not cause low frequency noise/micro-pressure wave. |
| | | | | | O: There is no tunnel which may cause low frequency/micro-pressure wave. Low frequency noise from the train passing an open section is small. |
| | Wave Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No wave obstruction is expected by the construction work. |
| | | | | | O: Radio waves would be disturbed by movement of high speed trains and some impacts such as flutter and pulse interferences on TV are expected. In addition, since the elevated structures such as viaduct will be developed (total: 12.4 km, of which 4.0 km is with noise barrier), some impacts by wave disturbed by these structures are expected. |
| | Sunshine Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No sunshine obstruction is expected by the construction works. |
| | | | | | O: There will be elevated structures such as viaduct and station buildings development (total: 12.4 km, of which 4.0 km is with noise barrier); some impacts are expected by shade created by these structures. |
| | Wastes/Hazardous waste | D | B- | B- | P: No impact is expected. |
| | | | | | C: A certain amount of construction and demolition wastes which may include hazardous materials, and waste from construction workers' camps is expected to be generated. |
| | | | | | O: A certain amount of wastes from passengers at the station is expected to be generated. |
| Social Environment | Involuntary resettlement | A- | B- | D | P: About 360 ha of land would be necessary for development of the HSR structures (viaduct, station, depot, etc.) in this section. In addition, about 130 buildings and 1,200 households would be affected either by land acquisition or resettlement although the alignment is planned to avoid the land acquisition and resettlement as much as possible though alternative analysis. |
| | | | | | C: Land acquisition and resettlement activities are expected to be continued even during construction stage. Temporal relocation is also required for setting up of construction yards and workers' camps for the construction activities. |
| | | | | | O: No impact is expected. |

| Dong Nai | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | Land use | B- | B- | A+ | P: The current land use needs to be changed by land acquisition and resettlement in accordance with the planned alignment and station location. |
| | | | | | C: Land clearance for construction yards and workers' camps is temporary. The land use around the construction site may be changed by doing business with construction workers without control. |
| | | | | | O: The HSR station will be developed together around the station areas as an integrated development. In addition, land use is expected to be changed gradually for further development mainly around the station in accordance with a provincial/city plan and private investments. |
| | Utilization of local resources | D | B- | D | P: No impact is expected. |
| | | | | | C: Using a large amount of local resources such as sand and quarry for the construction activities would obstruct its utilization by local people for other purposes. |
| | | | | | O: No impact is expected because the HSR would not use much local resources. |
| | General, regional /city plans | B+/B- | D | B+ | P: HSR will require changing land use purpose. While section along the express way is kept for future HSR purpose, current general plan and/or regional/city plan of City needs to be updated in accordance with the planned alignment and station location. |
| | | | | | C: No impact is expected (updating plans may continue). |
| | | | | | O: In accordance with the HSR development including development of station area, further general plan/city plans which include further development plan are expected to be prepared in all city/provinces. |
| | Social institutions and local decision - making institutions | B- | C- | C- | P: Some impact on social institutions local decision making institutions is expected by land acquisition and resettlement. However further examination is necessary. |
| | | | | | C: Some impact on social institutions and local decision making institutions is expected by inflow of many construction workers and other relating peoples from outside the area. However further examination is necessary. |
| | | | | | O: Some impact on social institutions and local decision making institutions is expected by disturbing movement of local people by the HSR structures. However further examination is necessary. |
| | Social Infrastructures and Services | C- | B- | B+/B- | P: By land acquisition and resettlement, some impacts on social infrastructure and services such as resettlement of community facility (village hall, etc.) are expected. |
| | | | | | C: Though temporal, impacts on social infrastructures and services by setting up of construction yards and workers' camps are expected. Especially, impacts on social infrastructures and services are expected by disturbance and interruption of their utilization by the construction activities such as relocation of public utilities and local roads. |
| | | | | | O: Development of the HSR station together with its surrounding areas would improve social infrastructures and services in the area and the country. On the other hand, some impacts on social infrastructures and services by the existence of the HSR structures are expected. |
| | Local economy and livelihood | B- | B+ | A+/B- | P: Some negative impacts on the local economy and livelihood are expected because of losses of employment opportunities and income sources by land acquisition and resettlement. |
| | | | | | C: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the construction activities. |
| | | | | | O: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the HSR project, especially around the station and employment of the workers for track maintenance, etc.<br>On the other hand, some negative impacts are also expected after the completion of the construction activities because of termination of temporary employment opportunities of local workers. |
| | Unequal Distribution of Benefit and Damage | B- | B- | B- | P: Unequal situations are expected among the project affected households/peoples and not affected households/peoples. |
| | | | | | C: Some unequal situations are expected among the local peoples between those who receive any benefit and those who receive any damage from the constriction activities, e.g. some affected households need to be relocated far away, while their neighbors not affected can do business with construction workers. |
| | | | | | O: Some unequal situations are expected among the local peoples between those who live near the station and those who live far from the station, especially in the latter case, they have a possibility to receive damages such as noise and vibration impacts, and some impacts on social infrastructures and services, livelihood and water usage, while in the former case, they may enjoy the benefit from the HSR service and related opportunities of businesses. |
| | Local conflicts of interest | C- | C- | C- | P/C/O: Local conflicts of interest are expected among local peoples, especially between beneficiaries and project affected peoples for land acquisition and inconveniences during construction and operation. Further examination would be necessary in case that unequal distribution of benefit and damage is expected to be crucial issues. |
| | Water Usage, Water Rights and | C- | C- | C- | P: Some impacts on water usage for the resettled houses/peoples are expected by land acquisition and resettlement. However, further examination would be necessary for water rights and communal rights. |

| Dong Nai | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | Communal Rights | | | | C: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses by the construction activities are small and temporal. However, further examination would be necessary for water rights and communal rights. |
| | | | | | O: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses are expected by the existence of the HSR structures. However, further examination would be necessary for disturbance by the structures. |
| | Cultural and Historical Heritages | D | C- | C- | P: National or provincial cultural and historical heritages are not found within a distance of 100m from the alignment of HSR. Thus, no impact is expected. |
| | | | | | C: Though not directly affected, heritages may exist near the alignment. These may be affected by the noise and vibration, and the traffic congestions caused by vehicles for the construction. Further confirmation is required. |
| | | | | | O: The heritages mainly within 100m from the alignment may suffer the impact of noise and vibration to some extent. |
| | Religious Facilities | B- | B- | B- | P: Though the well known religious places are not directly affected, small scale village level religious facilities may be relocated (ex. Village 11 Cemetery on the alignment and Minh Hiep Pagoda, 25m from the alignment). |
| | | | | | C/O: 4 religious facilities are found along the HSR within a distance less than 200m, So impacts such as noise and vibration are expected during the construction and operational phases. |
| | Sensitive facilities (ex. hospital, school, precision machine factory) | A- | B- | B- | P: It finds a sensitive place as Mac Dinh Chi Elementary School on the alignment and this place may be relocated. Further examination is required. |
| | | | | | C: Especially regarding Mac Dinh Chi Elementary School on the alignment (if it is not relocated), the traffic congestion with heavy vehicles affect the local peoples' convenience and safety. |
| | | | | | O: Especially regarding Mac Dinh Chi Elementary School on the alignment (if it is not relocated) and 0 hospital, noise and vibration caused by HSR may affect the peoples' comfort. |
| | Poor people | C- | B+ | C- | P: Poor people (who have poor household certificates issued by local authorities) stay everywhere. Further examination would be necessary for them because it is more difficult for them to recover their livelihood after land acquisition and resettlement than other PAPs. |
| | | | | | C: There is a possibility that the poor people would also have employment opportunities in construction and its associated business activities. |
| | | | | | O: There is a possibility that the enjoyment of the benefits of the HSR service by the poor people would be difficult. Further examination would be necessary. |
| | Ethnic Minorities/indigenous people | D | D | D | P: Chinese people (3.4%) are distributed in this section. However, their economic condition is as good as or better than Khin people with similar lifestyle. Nung (0.9%) and Tay (0.6%) people may be also affected by HSR Projects. |
| | | | | | C: Considering the size of ethnic minority population (Chinese lifestyle is now similar to Khin people), significant impact is not expected. |
| | | | | | O: Considering the size of ethnic minority population (Chinese lifestyle is now similar to Khin people), significant impact is not expected. |
| | Gender | C- | C- | C- | P: Land acquisition and resettlement are an important incident to a family and some women would have a bigger burden for that. Further examination would be necessary. |
| | | | | | C: Equal employment opportunities for both sexes are required for the construction works. Further examination would be necessary. |
| | | | | | O: The HSR service will be equal to both sexes. On the other hand, equal employment opportunities for both sexes are required for the HSR operation. Further examination would be necessary. |
| | Children's rights | D | D | D | P: No impact is expected. |
| | | | | | C/O. Since employment of children for the construction works is strictly prohibited by Children Protection, Education and Care Law 2004, no impact is expected. |
| | Public Health (sanitation and infectious diseases) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts on public health are expected due to unsanitary conditions caused by the influx of a large number of workers. In addition, increase of risks related to Sexually Transmitted Diseases (STD) or Sexually Transmitted Infections (STI) and HIV/AIDS is expected among the workers and local communities. |
| | | | | | O: Some impacts on public health are expected due to the influx of a large number of passengers (about 15,000 passengers per day at Long Thanh Station, if Thu Thiem - Nha Trang section is operated in 2030) and business persons around the station area. |
| | Occupational Health and | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts regarding OHS for the construction workers are expected. |

| Dong Nai | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | Safety (OHS) | | | | O: Some impacts regarding OHS for the workers for the HSR operation, especially the workers at the track for maintenance and at the depot are expected. |
| Other | Accidents | D | B- | C+/C- | P: No impact is expected. |
| | | | | | C: Increase of risks of accidents associated with construction activities is expected due to the operation of heavy equipment and vehicles. |
| | | | | | O: Increase of risks of accidents associated with the HSR services is expected due to the high speed train operation. On the other hand, positive and/or negative impacts are expected by the modal sift of passengers' transportation to HSR from cars, buses, airs, and existing railway. |
| | Climate Change | D | D | A+ | P: No impact is expected. |
| | | | | | C: Although increase of GHGs emission is expected due to operation of heavy equipment and vehicles, the impact is temporal and small. |
| | | | | | O: Overall reduction of GHG emission is expected by the modal shift of passengers' transportation to the HSR (+55% of the share between HCMC – Nha Trang, 2030 projection) from cars (-13%), buses (-38%), airs (-3%), and existing railway (-1%).72 kt-CO2e/year of GHGs would be reduced by the development of the HSR in the south section.<br>Though alignment avoids the coastal area, Impact by the rise of sea level should be further studied. |

Source: JICA Study Team

## Table 4D.3 Result of Rating (Binh Thuan Section)

| Binh Thuan | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| Natural Environment | Climate / Meteorological Phenomena | D | D | D | P: No impact is expected. |
| | | | | | C/O: Although the elevated structures such as viaduct of the HSR track and station building will be constructed, the impacts on micro-climate and micro meteorological phenomena are negligible because these structures would not disturb wind path. |
| | Topography | D | B- | D | P: No impact is expected. |
| | | | | | P: Cut section of 44 km may have impacts on topography. There is a long tunnel in the border with neighboring province (13,610 m in Binh Thuan / Ninh Thuan boarder.) |
| | | | | | O: Completing construction, topography would be stable. No impact is expected |
| | Geology | D | D | D | P: No impact is expected. |
| | | | | | C: Although there are some soft soil areas including sand dunes and soil improvement works will be done there for the constructions, it is not a scale that changes geological features. |
| | | | | | O: No impact is expected. |
| | Soil Erosion | D | B- | B- | P: No impact is expected. |
| | | | | | C: By the earth work, especially when it is raining, some soil erosion is expected especially in sandy areas. |
| | | | | | O: Embankment or cut section is about 131.8 km, where new surface may be washed by rain water. |
| | Hydrology | D | D | B- | P: No impact is expected. |
| | | | | | C: In the elevated structure section, construction works would cause little impacts on the hydrological cycle or regimes. In embankment or cut section, piled up soil may cause minor and temporal impact on hydrological cycle or regimes. They are not scale that change hydrological regime. |
| | | | | | O: In the embankment section of about 87.5 km, hydrological situation would be affected by the structures. The elevated section will have less and minor impact on the hydrological conditions. |
| | Ground water | D | B- | B- | P: No impact is expected. |
| | | | | | C: Ground water utilization by the construction works is not a scale that changes ground water flow. However, there may be impact on the ground water flow by construction activities of tunnels. |
| | | | | | O: Utilizing ground water by HSR is not a scale that can change ground water level. However, in the tunnel section, there may be impact on the ground water flow by the structure. |
| | Ecosystem | D | B- | B- | P: No impact is expected. |

| Binh Thuan | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | Flora, Fauna and Biodiversity | | | | C: Most of the area along the alignment is already developed area including residential and agricultural areas. The affected flora, fauna and biodiversity along the alignment are considered to be not critical, while the construction work may interfere with the habitat of flora and fauna. |
| | | | | | O: Existence of the HSR structure and HSR operation may cause negative impact on the ecosystem. |
| | Protected Areas/Forest | B- | B- | B- | P: There are special-use forests (protected areas) in Binh Thuan province, and Ta Kou Nature Reserve is about 3 km from away from the planned alignment and it will not be affected directly. Protection forests (49.5ha) and production forests (6.2ha) are to be affected by the alignment. |
| | | | | | C: The construction machines could damage the vegetation. Activities of construction workers may also be the pressure on forest. |
| | | | | | O: By the structure of HSR, some of the forest area is opened, so that more sunshine will be led inside the vegetation, which would affect the edge of the forest area. |
| | Coastal zone | D | D | D | P/C/O: The closest distance to the alignment from the coastal line is about 3 km (near Phan Thiet), and 1.5 km (near Tuy Phong) and no mudflats or no mangrove areas are affected. Thus, no impact is expected. |
| | Landscape | D | D | B+/B- | P: No impact is expected. |
| | | | | | C: Change of landscape is temporary and limited during the construction. |
| | | | | | O: By the structures such as viaduct, embankment and station buildings, both positive and negative impacts on landscape are expected. |
| | Natural disasters | D | C- | B- | P: No impact is expected. |
| | | | | | C: While there is no landslide/ erosion prone areas information, riverbank could be eroded due to construction. |
| | | | | | O: Flood prone area (4 communes) and typhoon prone area (9 communes) are reported from the areas where alignment is planned. |
| Living Environment | Air Pollution | D | B- | A+/B- | P: No impact is expected. |
| | | | | | C: Some negative impact is expected due to operation of many equipments and vehicles, dust incidental to earth work especially in dry season, although these impacts are temporal and limited. |
| | | | | | O: Overall reduction of air pollutants' emission is expected by the modal shift of passengers' transportation to the HSR (+55%) from cars (-13%), buses (-38%), airs (-3%), and existing railway (-1%) (Example of HCMC-Nha Trang Section, 2030). 1,122 t-NOx/year of air pollutants would be reduced by the development of the HSR in the south section. On the other hand, increase in air pollutants from increased access of cars and buses around the station are expected. |
| | Offensive Odor | D | D | D | P/C/O: No impact is expected. |
| | Water Pollution | D | B- | B- | P: No impact is expected. |
| | | | | | C: Turbid water by the earth work (87.5 km of embankment and 44.3 km of cut) and bridge piers' construction work (9 bridges over rivers are planned), and wastewater effluents from construction works' camps/yards are expected to pollute the surrounding rivers/canals water to some extent. |
| | | | | | O: Wastewater effluents from passengers at the station and maintenance activities in the depot are expected. Some impacts on water quality in surrounding water bodies are expected due to discharged polluted water. |
| | Bottom Sediment Contamination | D | D | D | P: No impact is expected. |
| | | | | | C: Although some construction materials such as cement and sand are expected to be washed out mainly by the rain, the impacts on bottom sediment by them are small. |
| | | | | | O: No impact is expected. |
| | Soil Contamination | D | C- | D | P: No impact is expected. |
| | | | | | C: Although some impact on soil is expected by deposition of pollutants from construction materials and vehicles, the impacts are small. On the other hand, in case the soil at construction sites is already contaminated by other reasons, some impacts are expected by the construction activity. Thus, further study is necessary. |
| | | | | | O: No impact is expected. |
| | Ground Subsidence | D | D | D | P: No impact is expected. |
| | | | | | C: Ground water utilization by the construction works is not a scale that changes ground water flow. Thus, no ground subsidence is expected. |
| | | | | | O: Geological condition along alignment in Binh Thuan is soft soil layers. As viaduct section is planned to be applied in such area, no impact is expected. |
| | Noise/vibration | D | B- | A- | P: No impact is expected. |

| Binh Thuan | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | C: There are 7 religious facilities, 3 school and 0 hospitals within 200m from the alignment. Noise and vibration generated by operation of heavy equipment and vehicles, although they are temporary, may affect the residential areas and such facilities/places which require quietness. |
| | | | | | O: There are 7 religious facilities, 3 schools and 0 hospital within 200m from the alignment. Noise and vibration generated by movement of high speed trains may affect the residential areas and such facilities/places which require quietness. Maintenance of ballast track would also cause noise. |
| | Low frequency noise/micro-pressure wave | D | D | C- | P: No impact is expected. |
| | | | | | C: Construction activities will not cause low frequency noise/micro-pressure wave. |
| | | | | | O: There is no tunnel which may cause low frequency/micro-pressure wave. One long tunnel of 13.6 km exists in the boarder of Binh Thuan and Ninh Thuan, however, there is no building near the exit of the tunnel within 200m. Low frequency noise from the train passing an open section is small. |
| | Wave Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No wave obstruction is expected by the construction work. |
| | | | | | O: Radio waves would be disturbed by movement of high speed trains and some impacts such as flutter and pulse interferences on TV are expected. In addition, since the elevated structures such as viaduct and Phan Thiet station building will be developed (total: 20.9 km, of which 19.3 km is with noise barrier), some impacts by wave disturbed by these structures are expected. |
| | Sunshine Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No sunshine obstruction is expected by the construction works. |
| | | | | | O: There will be elevated structures such as viaduct and station buildings development(total: 20.9 km, of which 19.3 km is with noise barrier); some impacts are expected by shade created by these structures. |
| | Wastes/Hazardous waste | D | B- | B- | P: No impact is expected. |
| | | | | | C: A certain amount of construction and demolition wastes which may include hazardous materials, and waste from construction workers' camps is expected to be generated. |
| | | | | | O: A certain amount of wastes from passengers at the station is expected to be generated. |
| Social Environment | Involuntary resettlement | A- | B- | D | P: About 750 ha of land would be necessary for development of the HSR structures (viaduct, station, depot, etc.) in this section. In addition, about 480 buildings and 2,700 households would be affected either by land acquisition or resettlement although the alignment is planned to avoid the land acquisition and resettlement as much as possible though alternative analysis. |
| | | | | | C: Land acquisition and resettlement activities are expected to be continued even during construction stage. Temporal relocation is also required for setting up of construction yards and workers' camps for the construction activities. |
| | | | | | O: No impact is expected. |
| | Land use | B- | B- | A+ | P: The current land use needs to be changed by land acquisition and resettlement in accordance with the planned alignment and station location. |
| | | | | | C: Land clearance for construction yards and workers' camps is temporary. The land use around the construction site may be changed by doing business with construction workers without control. |
| | | | | | O: The HSR station will be developed together around the station areas as an integrated development. In addition, land use is expected to be changed gradually for further development mainly around the station in accordance with a provincial/city plan and private investments. |
| | Utilization of local resources | D | B- | D | P: No impact is expected. |
| | | | | | C: Using a large amount of local resources such as sand and quarry for the construction activities would obstruct its utilization by local people for other purposes. |
| | | | | | O: No impact is expected because the HSR would not use much local resources. |
| | General, regional /city plans | B+/B- | D | B+ | P: HSR requires changing land use purpose in the province. Current general plan and/or regional/city plan of Province needs to be updated in accordance with the planned alignment and station location. |
| | | | | | C: No impact is expected (updating plans may continue). |
| | | | | | O: In accordance with the HSR development including development of station area, further general plan/city plans which include further development plan are expected to be prepared in all city/provinces. |
| | Social institutions and local decision - making institutions | B- | C- | C- | P: Some impact on social institutions local decision making institutions is expected by land acquisition and resettlement. However further examination is necessary. |
| | | | | | C: Some impact on social institutions and local decision making institutions is expected by inflow of many construction workers and other relating peoples from outside the area. However further examination is necessary. |
| | | | | | O: Some impact on social institutions and local decision making institutions is expected by disturbing movement of local people by the HSR structures. However further examination is necessary. |
| | Social Infrastructures | B- | B- | B+/B- | P: By land acquisition and resettlement, some impacts on social infrastructure and services such as resettlement of community facility (village hall, etc.) are expected. Song Phan People's Committee may |

| Binh Thuan | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | and Services | | | | be affected. |
| | | | | | C: Though temporal, impacts on social infrastructures and services by setting up of construction yards and workers' camps are expected. Especially, impacts on social infrastructures and services are expected by disturbance and interruption of their utilization by the construction activities such as relocation of public utilities and local roads. |
| | | | | | O: Development of the HSR station together with its surrounding areas would improve social infrastructures and services in the area and the country. On the other hand, some impacts on social infrastructures and services by the existence of the HSR structures are expected. |
| | Local economy and livelihood | B- | B+ | A+/B- | P: Some negative impacts on the local economy and livelihood are expected because of losses of employment opportunities and income sources by land acquisition and resettlement. |
| | | | | | C: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the construction activities. |
| | | | | | O: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the HSR project, especially around the station and employment of the workers for track maintenance, etc.<br>On the other hand, some negative impacts are also expected after the completion of the construction activities because of termination of temporary employment opportunities of local workers. |
| | Unequal Distribution of Benefit and Damage | B- | B- | B- | P: Unequal situations are expected among the project affected households/peoples and not affected households/peoples. |
| | | | | | C: Some unequal situations are expected among the local peoples between those who receive any benefit and those who receive any damage from the constriction activities, e.g. some affected households need to be relocated far away, while their neighbors not affected can do business with construction workers. |
| | | | | | O: Some unequal situations are expected among the local peoples between those who live near the station and those who live far from the station, especially in the latter case, they have a possibility to receive damages such as noise and vibration impacts, and some impacts on social infrastructures and services, livelihood and water usage, while in the former case, they may enjoy the benefit from the HSR service and related opportunities of businesses. |
| | Local conflicts of interest | C- | C- | C- | P/C/O: Local conflicts of interest are expected among local peoples, especially between beneficiaries and project affected peoples for land acquisition and inconveniences during construction and operation. Further examination would be necessary in case that unequal distribution of benefit and damage is expected to be crucial issues. |
| | Water Usage, Water Rights and Communal Rights | C- | C- | C- | P: Some impacts on water usage for the resettled houses/peoples are expected by land acquisition and resettlement. However, further examination would be necessary for water rights and communal rights. |
| | | | | | C: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses by the construction activities are small and temporal. However, further examination would be necessary for water rights and communal rights. |
| | | | | | O: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses are expected by the existence of the HSR structures. However, further examination would be necessary for disturbance by the structures. |
| | Cultural and Historical Heritages | D | C- | C- | P: National or provincial cultural and historical heritages are not found within a distance of 100m from the alignment of HSR. Thus, no impact is expected. |
| | | | | | C: Though not directly affected, heritages may exist near the alignment. These may be affected by the noise and vibration, and the traffic congestions caused by vehicles for the construction. Further confirmation is required. |
| | | | | | O: The heritages mainly within 100m from the alignment may suffer the impact of noise and vibration to some extent. |
| | Religious Facilities | B- | B- | B- | P: Though the well known religious places are not directly affected, small scale village level religious facilities may be relocated (ex. Pho Quang Pagoda on the alignment, KimBinh Village Temple, 18 m from the alignment and Kim Linh Pagoda, 25 m from the alignment). |
| | | | | | C/O: 7 religious facilities are found along the HSR within a distance less than 200m, So impacts such as noise and vibration are expected during the construction and operational phases. |
| | Sensitive facilities (ex. hospital, school, precision machine factory) | A- | B- | B- | P: It finds some sensitive places as Hong Son 4 Elementary School located at the distance of 30 m away from planned alignment and those places may be relocated. Further examination is required. |
| | | | | | C: Especially regarding the schools (such as Ham Minh Elementary School located at the distance of 46 m away from planned alignment), the traffic congestion with heavy vehicles affect the local peoples' convenience and safety. |

| Binh Thuan | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | O: Especially with regard to the 3 schools and 0 hospital along the alignment, noise and vibration caused by HSR may affect the peoples' comfort. |
| | Poor people | C- | B+ | C- | P: Poor people (who have poor household certificates issued by local authorities) stay everywhere. Further examination would be necessary for them because it is more difficult for them to recover their livelihood after land acquisition and resettlement than other PAPs. |
| | | | | | C: There is a possibility that the poor people would also have employment opportunities in construction and its associated business activities. |
| | | | | | O: There is a possibility that the enjoyment of the benefits of the HSR service by the poor people would be difficult. Further examination would be necessary. |
| | Ethnic Minorities/indigenous people | A- | B- | B- | P: Cham (2.2%), Ra Glai (0.7%), Chinese (0.7%), Co Ho (0.5%) are the major ethnic minorities distributed in this section. Appropriate considerations are required in case there is resettlement of such people. |
| | | | | | C: Cham (2.2%) and Ra Glai (0.7%) people have traditional lifestyle, which can be affected by the outsiders. Thus, the considerations and monitoring may be required. |
| | | | | | O: Impact on traditional people is expected especially in Cham and Ra Glai traditional communities. |
| | Gender | C- | C- | C- | P: Land acquisition and resettlement are an important incident to a family and some women would have a bigger burden for that. Further examination would be necessary. |
| | | | | | C: Equal employment opportunities for both sexes are required for the construction works. Further examination would be necessary. |
| | | | | | O: The HSR service will be equal to both sexes. On the other hand, equal employment opportunities for both sexes are required for the HSR operation. Further examination would be necessary. |
| | Children's rights | D | D | D | P: No impact is expected. |
| | | | | | C/O. Since employment of children for the construction works is strictly prohibited by Children Protection, Education and Care Law 2004, no impact is expected. |
| | Public Health (sanitation and infectious diseases) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts on public health are expected due to unsanitary conditions caused by the influx of a large number of workers. In addition, increase of risks related to Sexually Transmitted Diseases (STD) or Sexually Transmitted Infections (STI) and HIV/AIDS is expected among the workers and local communities. |
| | | | | | O: Some impacts on public health are expected due to the influx of a large number of passengers (about 5,000 passengers per day at Phan Thiet Station and 2,000 passengers per day at Tuy Phong Station, if Thu Thiem - Nha Trang section is operated in 2030) and business persons around the station area. |
| | Occupational Health and Safety (OHS) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts regarding OHS for the construction workers are expected. |
| | | | | | O: Some impacts regarding OHS for the workers for the HSR operation, especially the workers at the track for maintenance and at the depot are expected. |
| Other | Accidents | D | B- | C+/C- | P: No impact is expected. |
| | | | | | C: Increase of risks of accidents associated with construction activities is expected due to the operation of heavy equipment and vehicles. |
| | | | | | O: Increase of risks of accidents associated with the HSR services is expected due to the high speed train operation. On the other hand, positive and/or negative impacts are expected by the modal sift of passengers' transportation to HSR from cars, buses, airs, and existing railway. |
| | Climate Change | D | D | A+ | P: No impact is expected. |
| | | | | | C: Although increase of GHGs emission is expected due to operation of heavy equipment and vehicles, the impact is temporal and small. |
| | | | | | O: Overall reduction of GHG emission is expected by the modal shift of passengers' transportation to the HSR (+55% of the share between HCMC – Nha Trang, 2030 projection) from cars (-13%), buses (-38%), airs (-3%), and existing railway (-1%). 72 kt-CO2e/year of GHGs would be reduced by the development of the HSR in the south section.<br>Though alignment avoids the coastal area, Impact by the rise of sea level should be further studied. |

Source: JICA Study Team

## Table 4D.4 Result of Rating (Ninh Thuan Section)

| Ninh Thuan | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| Natural Environment | Climate / Meteorological Phenomena | D | D | D | P: No impact is expected. |
| | | | | | C/O: Although the elevated structures such as viaduct of the HSR track and station building will be constructed, the impacts on micro-climate and micro meteorological phenomena are negligible because these structures would not disturb wind path. |
| | Topography | D | B- | D | P: No impact is expected. |
| | | | | | P: Cut section of 14 km may have impacts on topography. There is a long tunnel in the border with neighboring province (13,610 m in Binh Thuan / Ninh Thuan boarder and 3,710m in Ninh Thuan and Khanh Hoa border). |
| | | | | | O: Completing construction, topography would be stable. No impact is expected |
| | Geology | D | D | D | P: No impact is expected. |
| | | | | | C: Soft soil areas are limited and no impact is expected. |
| | | | | | O: No impact is expected. |
| | Soil Erosion | D | B- | B- | P: No impact is expected. |
| | | | | | C: By the earth work, especially when it is raining, some soil erosion is expected. |
| | | | | | O: Embankment or cut section is about 43.2 km, where new surface may be washed by rain water. |
| | Hydrology | D | D | B- | P: No impact is expected. |
| | | | | | C: In the elevated structure section, construction works would cause little impacts on the hydrological cycle or regimes. In embankment or cut section, piled up soil may cause minor and temporal impact on hydrological cycle or regimes. They are not scale that change hydrological regime. |
| | | | | | O: In the embankment section of about 29.4 km, hydrological situation would be affected by the structures. The elevated section will have less and minor impact on the hydrological conditions. |
| | Ground water | D | B- | B- | P: No impact is expected. |
| | | | | | C: Ground water utilization by the construction works is not a scale that changes ground water flow. However, there may be impact on the ground water flow by construction activities of tunnels. |
| | | | | | O: Though utilizing ground water by HSR is not a scale that can change ground water level, the average rainfall of major towns is 650-800mm/year, and ground water resources are limited. Thus, even small impact may cause more serious issues in such area. In the tunnel section, there may be impact on the ground water flow by the structure as well. |
| | Ecosystem Flora, Fauna and Biodiversity | D | B- | B- | P: No impact is expected. |
| | | | | | C: Besides two plots of protection forest to be affected, most of the area along the alignment is already developed area including residential and agricultural areas. The affected flora, fauna and biodiversity along the alignment are considered to be not critical, while the construction work may interfere with the habitat of flora and fauna. |
| | | | | | O: Existence of the HSR structure and HSR operation may cause negative impact on the ecosystem. |
| | Protected Areas/Forest | B- | B- | B- | P: There are special-use forests (protected areas) in Ninh Thuan province, and Nui Chua National Park is about 2 km from away from the planned alignment and it will not be affected directly. Protection forests (20.5ha) are to be affected and production forests (0ha) are not to be affected by the alignment. |
| | | | | | C: The construction machines could damage the vegetation. Activities of construction workers may also be the pressure on forest. |
| | | | | | O: By the structure of HSR, some of the forest area is opened, so that more sunshine will be led inside the vegetation, which would affect the edge of the forest area. |
| | Coastal zone | D | D | D | P/C/O: The closest distance to the alignment from the coastal line is nearly 30 km and no mudflats or no mangrove areas are affected. Thus, no impact is expected. |
| | Landscape | D | D | B+/B- | P: No impact is expected. |
| | | | | | C: Change of landscape is temporary and limited during the construction. |
| | | | | | O: By the structures such as viaduct, embankment and station buildings, both positive and negative impacts on landscape are expected. |
| | Natural disasters | D | B- | B- | P: No impact is expected. |
| | | | | | C: Civil work in landslide/ erosion prone areas (2 communes) may trigger landslide. |
| | | | | | O: Flood prone area (2 communes), landslide/erosion prone area (2 communes) and typhoon prone area (7 communes) are reported from the areas where alignment is planned. |
| Living Environment | Air Pollution | D | B- | A+/B- | P: No impact is expected. |
| | | | | | C: Some negative impact is expected due to operation of many equipments and vehicles, dust incidental to earth work especially in dry season, although these impacts are temporal and limited. |

| Ninh Thuan | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | O: Overall reduction of air pollutants' emission is expected by the modal shift of passengers' transportation to the HSR (+55%) from cars (-13%), buses (-38%), airs (-3%), and existing railway (-1%) (Example of HCMC-Nha Trang Section, 2030). 1,122 t-NOx/year of air pollutants would be reduced by the development of the HSR in the south section. On the other hand, increase in air pollutants from increased access of cars and buses around the station are expected. |
| | Offensive Odor | D | D | D | P/C/O: No impact is expected. |
| | Water Pollution | D | B- | B- | P: No impact is expected. |
| | | | | | C: Turbid water by the earth work (29.4 km of embankment and 13.8 km of cut) and bridge piers' construction work (10 bridges over rivers are planned), and wastewater effluents from construction works' camps/yards are expected to pollute the surrounding rivers/canals water to some extent. |
| | | | | | O: Wastewater effluents from passengers at the station and maintenance activities in the depot are expected. Some impacts on water quality in surrounding water bodies are expected due to discharged polluted water. |
| | Bottom Sediment Contamination | D | D | D | P: No impact is expected. |
| | | | | | C: Although some construction materials such as cement and sand are expected to be washed out mainly by the rain, the impacts on bottom sediment by them are small. |
| | | | | | O: No impact is expected. |
| | Soil Contamination | D | C- | D | P: No impact is expected. |
| | | | | | C: Although some impact on soil is expected by deposition of pollutants from construction materials and vehicles, the impacts are small. On the other hand, in case the soil at construction sites is already contaminated by other reasons, some impacts are expected by the construction activity. Thus, further study is necessary. |
| | | | | | O: No impact is expected. |
| | Ground Subsidence | D | D | D | P: No impact is expected. |
| | | | | | C: Ground water utilization by the construction works is not a scale that changes ground water flow. Thus, no ground subsidence is expected. |
| | | | | | O: Geological condition along alignment in Ninh Thuan is rather stable and ground subsidence is not expected. |
| | Noise/vibration | D | B- | A- | P: No impact is expected. |
| | | | | | C: There are 5 religious facilities, 2 schools and 1 hospitals within 200m from the alignment. Noise and vibration generated by operation of heavy equipment and vehicles, although they are temporary, may affect the residential areas and such facilities/places which require quietness. |
| | | | | | O: There are 5 religious facilities, 2 schools and 1 hospital within 200m from the alignment. Noise and vibration generated by movement of high speed trains may affect the residential areas and such facilities/places which require quietness. Maintenance of ballast track would also cause noise. |
| | Low frequency noise/micro-pressure wave | D | D | C- | P: No impact is expected. |
| | | | | | C: Construction activities will not cause low frequency noise/micro-pressure wave. |
| | | | | | O: Significant low frequency/micro-pressure wave at long tunnel sub-sections is expected. Long tunnel of 13.6 km exists in the boarder of Binh Thuan and Ninh Thuan and 3.7 km in Ninh Thuan and Khanh Hoa, however, there is no building near the exit of the tunnel within 200m. Low frequency noise from the train passing an open section is small. |
| | Wave Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No wave obstruction is expected by the construction work. |
| | | | | | O: Radio waves would be disturbed by movement of high speed trains and some impacts such as flutter and pulse interferences on TV are expected. In addition, since the elevated structures such as viaduct and Thap Cham station building will be developed (total: 4.6 km, of which 4.0 km is with noise barrier), some impacts by wave disturbed by these structures are expected. |
| | Sunshine Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No sunshine obstruction is expected by the construction works. |
| | | | | | O: There will be elevated structures such as viaduct development (total: 4.6 km, of which 4.0 km is with noise barrier); some impacts are expected by shade created by these structures. |
| | Wastes/Hazardous waste | D | B- | B- | P: No impact is expected. |
| | | | | | C: A certain amount of construction and demolition wastes which may include hazardous materials, and waste from construction workers' camps is expected to be generated. |
| | | | | | O: A certain amount of wastes from passengers at the station is expected to be generated. |
| Social Environm | Involuntary resettlement | A- | B- | D | P: About 230 ha of land would be necessary for development of the HSR structures (viaduct, station, depot, etc.) in this section. In addition, about 210 buildings and 950 households would be affected either by land acquisition or resettlement although the alignment is planned to avoid the land acquisition and |

| Ninh Thuan | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | resettlement as much as possible though alternative analysis. |
| | | | | | C: Land acquisition and resettlement activities are expected to be continued even during construction stage. Temporal relocation is also required for setting up of construction yards and workers' camps for the construction activities. |
| | | | | | O: No impact is expected. |
| | Land use | B- | B- | A+ | P: The current land use needs to be changed by land acquisition and resettlement in accordance with the planned alignment and station location. |
| | | | | | C: Land clearance for construction yards and workers' camps is temporary. The land use around the construction site may be changed by doing business with construction workers without control. |
| | | | | | O: The HSR station will be developed together around the station areas as an integrated development. In addition, land use is expected to be changed gradually for further development mainly around the station in accordance with a provincial/city plan and private investments. |
| | Utilization of local resources | D | B- | D | P: No impact is expected. |
| | | | | | C: Using a large amount of local resources such as sand and quarry for the construction activities would obstruct its utilization by local people for other purposes. |
| | | | | | O: No impact is expected because the HSR would not use much local resources. |
| | General, regional /city plans | B+/B- | D | B+ | P: HSR requires changing land use purpose in the province. Current general plan and/or regional/city plan of Province needs to be updated in accordance with the planned alignment and station location. |
| | | | | | C: No impact is expected (updating plans may continue). |
| | | | | | O: In accordance with the HSR development including development of station area, further general plan/city plans which include further development plan are expected to be prepared in all city/provinces. |
| | Social institutions and local decision - making institutions | B- | C- | C- | P: Some impact on social institutions local decision making institutions is expected by land acquisition and resettlement. However further examination is necessary. |
| | | | | | C: Some impact on social institutions and local decision making institutions is expected by inflow of many construction workers and other relating peoples from outside the area. However further examination is necessary. |
| | | | | | O: Some impact on social institutions and local decision making institutions is expected by disturbing movement of local people by the HSR structures. However further examination is necessary. |
| | Social Infrastructures and Services | B- | B- | B+/B- | P: By land acquisition and resettlement, some impacts on social infrastructure and services such as resettlement of community facility (village hall, etc.) are expected. Irrigation canal of Nha Trinh-Lam Cam and Puoc Hau People's Committee may be affected. |
| | | | | | C: Though temporal, impacts on social infrastructures and services by setting up of construction yards and workers' camps are expected. Especially, impacts on social infrastructures and services are expected by disturbance and interruption of their utilization by the construction activities such as relocation of public utilities and local roads. |
| | | | | | O: Development of the HSR station together with its surrounding areas would improve social infrastructures and services in the area and the country. On the other hand, some impacts on social infrastructures and services by the existence of the HSR structures are expected. |
| | Local economy and livelihood | B- | B+ | A+/B- | P: Some negative impacts on the local economy and livelihood are expected because of losses of employment opportunities and income sources by land acquisition and resettlement. |
| | | | | | C: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the construction activities. |
| | | | | | O: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the HSR project, especially around the station and employment of the workers for track maintenance, etc.<br>On the other hand, some negative impacts are also expected after the completion of the construction activities because of termination of temporary employment opportunities of local workers. |
| | Unequal Distribution of Benefit and Damage | B- | B- | B- | P: Unequal situations are expected among the project affected households/peoples and not affected households/peoples. |
| | | | | | C: Some unequal situations are expected among the local peoples between those who receive any benefit and those who receive any damage from the constriction activities, e.g. some affected households need to be relocated far away, while their neighbors not affected can do business with construction workers. |
| | | | | | O: Some unequal situations are expected among the local peoples between those who live near the station and those who live far from the station, especially in the latter case, they have a possibility to receive damages such as noise and vibration impacts, and some impacts on social infrastructures and services, livelihood and water usage, while in the former case, they may enjoy the benefit from the HSR service and related opportunities of businesses. |

| Ninh Thuan | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | Local conflicts of interest | C- | C- | C- | P/C/O: Local conflicts of interest are expected among local peoples, especially between beneficiaries and project affected peoples for land acquisition and inconveniences during construction and operation. Further examination would be necessary in case that unequal distribution of benefit and damage is expected to be crucial issues. |
| | Water Usage, Water Rights and Communal Rights | C- | C- | C- | P: Some impacts on water usage for the resettled houses/peoples are expected by land acquisition and resettlement. However, further examination would be necessary for water rights and communal rights. |
| | | | | | C: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses by the construction activities are small and temporal. However, further examination would be necessary for water rights and communal rights. |
| | | | | | O: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses are expected by the existence of the HSR structures. However, further examination would be necessary for disturbance by the structures. |
| | Cultural and Historical Heritages | D | C- | C- | P: National or provincial cultural and historical heritages are not found within a distance of 100m from the alignment of HSR. Thus, no impact is expected. |
| | | | | | C: Though not directly affected, heritages may exist near the alignment. These may be affected by the noise and vibration, and the traffic congestions caused by vehicles for the construction. Further confirmation is required. |
| | | | | | O: The heritages mainly within 100m from the alignment may suffer the impact of noise and vibration to some extent. |
| | Religious Facilities | C- | B- | B- | P: Though the well known religious places are not directly affected, small scale village level religious facilities may be relocated (ex. Mat Quy Cemetery on the alignment and Long Phuoc Pagoda, 20 m from the alignment). |
| | | | | | C/O: 5 religious facilities are found along the HSR within a distance less than 200m, So impacts such as noise and vibration are expected during the construction and operational phases. |
| | Sensitive facilities (ex. hospital, school, precision machine factory) | C- | C- | C- | P: It finds some sensitive places as Thanh Son Elementary School located at the distance of 36 m away from planned alignment and those places may be relocated. Further examination is required. |
| | | | | | C: Especially regarding the schools and the hospitals (such as Thap Cham Transport Hospital located at the distance of 196 m away from planned alignment), the traffic congestion with heavy vehicles affect the local peoples' convenience and safety. |
| | | | | | O: With regard to the 2 schools and 1 hospital along the alignment, further examination is required along the alignment |
| | Poor people | C- | B+ | C- | P: Poor people (who have poor household certificates issued by local authorities) stay everywhere. Further examination would be necessary for them because it is more difficult for them to recover their livelihood after land acquisition and resettlement than other PAPs. |
| | | | | | C: There is a possibility that the poor people would also have employment opportunities in construction and its associated business activities. |
| | | | | | O: There is a possibility that the enjoyment of the benefits of the HSR service by the poor people would be difficult. Further examination would be necessary. |
| | Ethnic Minorities/indigenous people | A- | A- | A- | P: Cham (13.7%), Ra Glai (6.0%), Chinese (0.3%), are the major ethnic minorities distributed in this section. Appropriate considerations are required in case there is resettlement of such people. |
| | | | | | C: Cham (13.7%) and Ra Glai (6.0%) people have traditional lifestyle, which can be affected by the outsiders especially if there is community of them along the alignment. Considerations and monitoring are required. |
| | | | | | O: Impact on traditional people is expected especially in Cham and Ra Glai traditional communities. |
| | Gender | C- | C- | C- | P: Land acquisition and resettlement are an important incident to a family and some women would have a bigger burden for that. Further examination would be necessary. |
| | | | | | C: Equal employment opportunities for both sexes are required for the construction works. Further examination would be necessary. |
| | | | | | O: The HSR service will be equal to both sexes. On the other hand, equal employment opportunities for both sexes are required for the HSR operation. Further examination would be necessary. |
| | Children's rights | D | D | D | P: No impact is expected. |
| | | | | | C/O. Since employment of children for the construction works is strictly prohibited by Children Protection, Education and Care Law 2004, no impact is expected. |
| | Public Health (sanitation and infectious diseases) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts on public health are expected due to unsanitary conditions caused by the influx of a large number of workers. In addition, increase of risks related to Sexually Transmitted Diseases (STD) or Sexually Transmitted Infections (STI) and HIV/AIDS is expected among the workers and local communities. |

| Ninh Thuan | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | O: Some impacts on public health are expected due to the influx of a large number of passengers (about 12,000 passengers per day at Thap Cham Station, if Thu Thiem - Nha Trang section is operated in 2030) and business persons around the station area. |
| | Occupational Health and Safety (OHS) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts regarding OHS for the construction workers are expected. |
| | | | | | O: Some impacts regarding OHS for the workers for the HSR operation, especially the workers at the track for maintenance and at the depot are expected. |
| Other | Accidents | D | B- | C+/C- | P: No impact is expected. |
| | | | | | C: Increase of risks of accidents associated with construction activities is expected due to the operation of heavy equipment and vehicles. |
| | | | | | O: Increase of risks of accidents associated with the HSR services is expected due to the high speed train operation. On the other hand, positive and/or negative impacts are expected by the modal sift of passengers' transportation to HSR from cars, buses, airs, and existing railway. |
| | Climate Change | D | D | A+ | P: No impact is expected. |
| | | | | | C: Although increase of GHGs emission is expected due to operation of heavy equipment and vehicles, the impact is temporal and small. |
| | | | | | O: Overall reduction of GHG emission is expected by the modal shift of passengers' transportation to the HSR (+55% of the share between HCMC – Nha Trang, 2030 projection) from cars (-13%), buses (-38%), airs (-3%), and existing railway (-1%). 72 kt-CO2e/year of GHGs would be reduced by the development of the HSR in the south section.<br>Though alignment avoids the coastal area, Impact by the rise of sea level should be further studied. |

Source: JICA Study Team

## Table 4D.5 Result of Rating (Khanh Hoa Section)

| Khanh Hoa | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| Natural Environment | Climate / Meteorological Phenomena | D | D | D | P: No impact is expected. |
| | | | | | C/O: Although the elevated structures such as viaduct of the HSR track and station building will be constructed, the impacts on micro-climate and micro meteorological phenomena are negligible because these structures would not disturb wind path. |
| | Topography | D | B- | D | P: No impact is expected. |
| | | | | | P: Cut section of 10 km in the mountainous area may have impacts on topography. There are 7 tunnels in the province and 1 tunnel in the border with neighboring provinces (3,710m in Ninh Thuan and Khanh Hoa border) |
| | | | | | O: Completing construction, topography would be stable. No impact is expected |
| | Geology | D | D | D | P: No impact is expected. |
| | | | | | C: Soft soil areas are limited and no impact is expected. |
| | | | | | O: No impact is expected. |
| | Soil Erosion | D | B- | B- | P: No impact is expected. |
| | | | | | C: By the earth work, especially when it is raining, some soil erosion is expected. |
| | | | | | O: Embankment or cut section is about 30.5 km, where new surface may be washed by rain water. |
| | Hydrology | D | D | B- | P: No impact is expected. |
| | | | | | C: In the elevated structure section, construction works would cause little impacts on the hydrological cycle or regimes. In embankment or cut section, piled up soil may cause minor and temporal impact on hydrological cycle or regimes. They are not scale that change hydrological regime. |
| | | | | | O: In the embankment section of about 20.7 km, hydrological situation would be affected by the structures. The elevated section will have less and minor impact on the hydrological conditions. |
| | Ground water | D | B- | B- | P: No impact is expected. |

| Khanh Hoa | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | C: Ground water utilization by the construction works is not a scale that changes ground water flow. However, there may be impact on the ground water flow by construction activities of tunnels. |
| | | | | | O: Utilizing ground water by HSR is not a scale that can change ground water level. However, in the tunnel section, there may be impact on the ground water flow by the structure. |
| | Ecosystem Flora, Fauna and Biodiversity | D | B- | B- | P: No impact is expected. |
| | | | | | C: Besides 13 plots of protection forest to be affected, most of the area along the alignment is already developed area including residential and agricultural areas. The affected flora, fauna and biodiversity along the alignment are considered to be not critical, while the construction work may interfere with the habitat of flora and fauna. |
| | | | | | O: Existence of the HSR structure and HSR operation may cause negative impact on the ecosystem. |
| | Protected Areas/Forest | B- | B- | B- | P: There are special-use forests (protected areas) in Khanh Hoa province, however those areas are located too far from the planned alignment (about 4km) to be affected. Protection forests (21.7ha) and production forests (31.5 ha) are affected by the alignment. |
| | | | | | C: The construction machines could damage the vegetation. Activities of construction workers may also be the pressure on forest. |
| | | | | | O: By the structure of HSR, some of the forest area is opened, so that more sunshine will be led inside the vegetation, which would affect the edge of the forest area. |
| | Coastal zone | D | D | D | P/C/O: The closest distance to the alignment from the coastal line is about 13 km and no mudflats or no mangrove areas are affected. Thus, no impact is expected. |
| | Landscape | D | D | B+/B- | P: No impact is expected. |
| | | | | | C: Change of landscape is temporary and limited during the construction. |
| | | | | | O: By the structures such as viaduct, embankment and station buildings, both positive and negative impacts on landscape are expected. |
| | Natural disasters | D | B- | B- | P: No impact is expected. |
| | | | | | C: Civil work in landslide/ erosion prone areas (2 communes) may trigger landslide. |
| | | | | | O: Flood prone area (2 communes), landslide/erosion prone area (2 communes) and typhoon prone area (7 communes) are reported from the areas where alignment is planned. |
| Living Environment | Air Pollution | D | B- | A+/B- | P: No impact is expected. |
| | | | | | C: Some negative impact is expected due to operation of many equipments and vehicles, dust incidental to earth work especially in dry season, although these impacts are temporal and limited. |
| | | | | | O: Overall reduction of air pollutants' emission is expected by the modal shift of passengers' transportation to the HSR (+55%) from cars (-13%), buses (-38%), airs (-3%), and existing railway (-1%) (Example of HCMC-Nha Trang Section, 2030). 1,122 t-NOx/year of air pollutants would be reduced by the development of the HSR in the south section. On the other hand, increase in air pollutants from increased access of cars and buses around the station are expected. |
| | Offensive Odor | D | D | D | P/C/O: No impact is expected. |
| | Water Pollution | D | B- | B- | P: No impact is expected. |
| | | | | | C: Turbid water by the earth work (20.7 km of embankment and 9.7 km of cut) and bridge piers' construction work (11 bridges over rivers are planned), and wastewater effluents from construction works' camps/yards are expected to pollute the surrounding rivers/canals water to some extent. |
| | | | | | O: Wastewater effluents from passengers at the station and maintenance activities in the depot are expected. Some impacts on water quality in surrounding water bodies are expected due to discharged polluted water. |
| | Bottom Sediment Contamination | D | D | D | P: No impact is expected. |
| | | | | | C: Although some construction materials such as cement and sand are expected to be washed out mainly by the rain, the impacts on bottom sediment by them are small. |
| | | | | | O: Although some impact is expected on bottom sediment by deposition of pollutants from the wastewater discharged from maintenance activities in the depot in Nha Trang, the impact is small. |
| | Soil Contamination | D | C- | B- | P: No impact is expected. |
| | | | | | C: Although some impact on soil is expected by deposition of pollutants from construction materials and vehicles, the impacts are small. On the other hand, in case the soil at construction sites is already contaminated by other reasons, some impacts are expected by the construction activity. Thus, further study is necessary. |
| | | | | | O: No impact is expected. |
| | Ground Subsidence | D | D | D | P: No impact is expected. |
| | | | | | C: Ground water utilization by the construction works is not a scale that changes ground water flow. Thus, no ground subsidence is expected. |

| Khanh Hoa | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | | | | | O: Geological condition along alignment in Khanh Hoa Thuan is rather stable and ground subsidence is not expected. |
| | Noise/vibration | D | B- | A- | P: No impact is expected. |
| | | | | | C: There are 9 religious facilities, 1 school and 0 hospitals within 200m from the alignment. Noise and vibration generated by operation of heavy equipment and vehicles, although they are temporary, may affect the residential areas and such facilities/places which require quietness. |
| | | | | | O: There are 9 religious facilities, 1 schools and 0 hospital within 200m from the alignment. Noise and vibration generated by movement of high speed trains may affect the residential areas and such facilities/places which require quietness. Maintenance of ballast track would also cause noise. |
| | Low frequency noise/micro-pressure wave | D | D | A- | P: No impact is expected. |
| | | | | | C: Construction activities will not cause low frequency noise/micro-pressure wave. |
| | | | | | O: Significant low frequency/micro-pressure wave at long tunnel sub-sections is expected. 8 tunnels exist and 5 of them are more than 1km long. Buildings are located within 200m from 2 exits of long tunnels, while many buildings are located near the exits of shorter tunnels of 291m and 415m. Negative impacts are expected. Low frequency noise from the train passing an open section is small. |
| | Wave Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No wave obstruction is expected by the construction work. |
| | | | | | O: Radio waves would be disturbed by movement of high speed trains and some impacts such as flutter and pulse interferences on TV are expected. In addition, since the elevated structures such as viaduct and Nha Trang station building will be developed (total: 5.5 km, of which 4.5 km is with noise barrier), some impacts by wave disturbed by these structures are expected. |
| | Sunshine Obstruction | D | D | B- | P: No impact is expected. |
| | | | | | C: No sunshine obstruction is expected by the construction works. |
| | | | | | O: There will be elevated structures such as viaduct and station buildings development (total: 5.5 km, of which 4.5 km is with noise barrier); some impacts are expected by shade created by these structures. |
| | Wastes/Hazardous waste | D | B- | B- | P: No impact is expected. |
| | | | | | C: A certain amount of construction and demolition wastes which may include hazardous materials, and waste from construction workers' camps is expected to be generated. |
| | | | | | O: A certain amount of wastes from passengers at the station and maintenance works at Nha Trang depot is expected to be generated. |
| Social Environment | Involuntary resettlement | A- | B- | D | P: About 260 ha of land would be necessary for development of the HSR structures (viaduct, station, depot, etc.) in this section. In addition, about 330 buildings and 950 households would be affected either by land acquisition or resettlement although the alignment is planned to avoid the land acquisition and resettlement as much as possible though alternative analysis. |
| | | | | | C: Land acquisition and resettlement activities are expected to be continued even during construction stage. Temporal relocation is also required for setting up of construction yards and workers' camps for the construction activities. |
| | | | | | O: No impact is expected. |
| | Land use | B- | B- | A+ | P: The current land use needs to be changed by land acquisition and resettlement in accordance with the planned alignment and station location. |
| | | | | | C: Land clearance for construction yards and workers' camps is temporary. The land use around the construction site may be changed by doing business with construction workers without control. |
| | | | | | O: The HSR station will be developed together around the station areas as an integrated development. In addition, land use is expected to be changed gradually for further development mainly around the station in accordance with a provincial/city plan and private investments. |
| | Utilization of local resources | D | B- | D | P: No impact is expected. |
| | | | | | C: Using a large amount of local resources such as sand and quarry for the construction activities would obstruct its utilization by local people for other purposes. |
| | | | | | O: No impact is expected because the HSR would not use much local resources. |
| | General, regional /city plans | B+/B- | D | B+ | P: HSR requires changing land use purpose in the province. Current general plan and/or regional/city plan of Province needs to be updated in accordance with the planned alignment and station location. |
| | | | | | C: No impact is expected (updating plans may continue). |
| | | | | | O: In accordance with the HSR development including development of station area, further general plan/city plans which include further development plan are expected to be prepared in all city/provinces. |
| | Social institutions and local decision - making | B- | C- | C- | P: Some impact on social institutions local decision making institutions is expected by land acquisition and resettlement. However further examination is necessary. |
| | | | | | C: Some impact on social institutions and local decision making institutions is expected by inflow of many construction workers and other relating peoples from outside the area. However further examination is |

| Khanh Hoa | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | institutions | | | | necessary. |
| | | | | | O: Some impact on social institutions and local decision making institutions is expected by disturbing movement of local people by the HSR structures. However further examination is necessary. |
| | Social Infrastructures and Services | C- | B- | B+/B- | P: By land acquisition and resettlement, some impacts on social infrastructure and services such as resettlement of community facility (village hall, etc.) are expected. |
| | | | | | C: Though temporal, impacts on social infrastructures and services by setting up of construction yards and workers' camps are expected. Especially, impacts on social infrastructures and services are expected by disturbance and interruption of their utilization by the construction activities such as relocation of public utilities and local roads. |
| | | | | | O: Development of the HSR station together with its surrounding areas would improve social infrastructures and services in the area and the country. On the other hand, some impacts on social infrastructures and services by the existence of the HSR structures are expected. |
| | Local economy and livelihood | B- | B+ | A+/B- | P: Some negative impacts on the local economy and livelihood are expected because of losses of employment opportunities and income sources by land acquisition and resettlement. |
| | | | | | C: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the construction activities. |
| | | | | | O: Some positive impact on the local economy is expected because of possible increment of business/employment opportunities generated by the HSR project, especially around the station and employment of the workers for track maintenance, etc.<br>On the other hand, some negative impacts are also expected after the completion of the construction activities because of termination of temporary employment opportunities of local workers. |
| | Unequal Distribution of Benefit and Damage | B- | B- | B- | P: Unequal situations are expected among the project affected households/peoples and not affected households/peoples. |
| | | | | | C: Some unequal situations are expected among the local peoples between those who receive any benefit and those who receive any damage from the constriction activities, e.g. some affected households need to be relocated far away, while their neighbors not affected can do business with construction workers. |
| | | | | | O: Some unequal situations are expected among the local peoples between those who live near the station and those who live far from the station, especially in the latter case, they have a possibility to receive damages such as noise and vibration impacts, and some impacts on social infrastructures and services, livelihood and water usage, while in the former case, they may enjoy the benefit from the HSR service and related opportunities of businesses. |
| | Local conflicts of interest | C- | C- | C- | P/C/O: Local conflicts of interest are expected among local peoples, especially between beneficiaries and project affected peoples for land acquisition and inconveniences during construction and operation. Further examination would be necessary in case that unequal distribution of benefit and damage is expected to be crucial issues. |
| | Water Usage, Water Rights and Communal Rights | C- | C- | C- | P: Some impacts on water usage for the resettled houses/peoples are expected by land acquisition and resettlement. However, further examination would be necessary for water rights and communal rights. |
| | | | | | C: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses by the construction activities are small and temporal. However, further examination would be necessary for water rights and communal rights. |
| | | | | | O: Impacts on water usage such as obstruction of accessibility of water sources for domestic and irrigation uses are expected by the existence of the HSR structures. However, further examination would be necessary for disturbance by the structures. |
| | Cultural and Historical Heritages | D | B- | C- | P: National or provincial cultural and historical heritages are not found within a distance of 100m from the alignment of HSR. Thus, no impact is expected. |
| | | | | | C: Together with above mentioned, many heritages are found near the alignment. These may be affected by the noise and vibration, and the traffic congestions caused by vehicles for the construction. Followings are the examples of heritages near the alignment.<br>Phu Vinh Temple (Provincial heritage, 135m) and Lien Hoa Tu Temple (Provincial heritage, 126m) |
| | | | | | O: The heritages mainly within 100m from the alignment may suffer the impact of noise and vibration to some extent. |
| | Religious Facilities | C- | B- | B- | P: Though the well known religious places are not directly affected, small scale village level religious facilities may be relocated (ex. Go Cay Coc Cemetery on the alignment and Cam Hoa Cemetery on the alignment) |
| | | | | | C/O: 9 religious facilities are found along the HSR within a distance less than 200m, So impacts such as noise and vibration are expected during the construction and operational phases. |
| | Sensitive facilities (ex. | A- | B- | B- | P: It finds a sensitive place as Ha Huy Tap High School located at the distance of 30 m away from planned alignment and this place may be relocated. Further examination is required. |

| Khanh Hoa | | | | | |
|---|---|---|---|---|---|
| Category | Items | Result of Rating | | | |
| | | Pre-construction | Construction | Operation | Rating Basis |
| | hospital, school, precision machine factory) | | | | C: Especially regarding Ha Huy Tap High School (if it is not relocated), the traffic congestion with heavy vehicles affect the local peoples' convenience and safety. |
| | | | | | O: Especially with regard to 1 school (if it is not relocated) and 0 hospital along the alignment, noise and vibration caused by HSR may affect the peoples' comfort. |
| | Poor people | C- | B+ | C- | P: Poor people (who have poor household certificates issued by local authorities) stay everywhere. Further examination would be necessary for them because it is more difficult for them to recover their livelihood after land acquisition and resettlement than other PAPs. |
| | | | | | C: There is a possibility that the poor people would also have employment opportunities in construction and its associated business activities. |
| | | | | | O: There is a possibility that the enjoyment of the benefits of the HSR service by the poor people would be difficult. Further examination would be necessary. |
| | Ethnic Minorities/indigenous people | C- | C- | C- | P: Mnong (2.1%), Chinese (0.3%), Tay (0.1%) and Nung (0.1%) are the major ethnic minorities distributed in this section. Appropriate considerations are required in case there is resettlement of such people. |
| | | | | | C: Mnong (2.1%) people have traditional lifestyle, which can be affected by the outsiders. Thus, the considerations and monitoring may be required. |
| | | | | | O: Impact on Mnong people may be expected. |
| | Gender | C- | C- | C- | P: Land acquisition and resettlement are an important incident to a family and some women would have a bigger burden for that. Further examination would be necessary. |
| | | | | | C: Equal employment opportunities for both sexes are required for the construction works. Further examination would be necessary. |
| | | | | | O: The HSR service will be equal to both sexes. On the other hand, equal employment opportunities for both sexes are required for the HSR operation. Further examination would be necessary. |
| | Children's rights | D | D | D | P: No impact is expected. |
| | | | | | C/O. Since employment of children for the construction works is strictly prohibited by Children Protection, Education and Care Law 2004, no impact is expected. |
| | Public Health (sanitation and infectious diseases) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts on public health are expected due to unsanitary conditions caused by the influx of a large number of workers. In addition, increase of risks related to Sexually Transmitted Diseases (STD) or Sexually Transmitted Infections (STI) and HIV/AIDS is expected among the workers and local communities. |
| | | | | | O: Some impacts on public health are expected due to the influx of a large number of passengers (about 40,000 passengers per day at Nha Trang Station, if Thu Thiem - Nha Trang section is operated in 2030) and business persons around the station area. |
| | Occupational Health and Safety (OHS) | D | B- | B- | P: No impact is expected. |
| | | | | | C: Some impacts regarding OHS for the construction workers are expected. |
| | | | | | O: Some impacts regarding OHS for the workers for the HSR operation, especially the workers at the track for maintenance and at the depot are expected. |
| Other | Accidents | D | B- | C+/C- | P: No impact is expected. |
| | | | | | C: Increase of risks of accidents associated with construction activities is expected due to the operation of heavy equipment and vehicles. |
| | | | | | O: Increase of risks of accidents associated with the HSR services is expected due to the high speed train operation. On the other hand, positive and/or negative impacts are expected by the modal sift of passengers' transportation to HSR from cars, buses, airs, and existing railway. |
| | Climate Change | D | D | A+ | P: No impact is expected. |
| | | | | | C: Although increase of GHGs emission is expected due to operation of heavy equipment and vehicles, the impact is temporal and small. |
| | | | | | O: Overall reduction of GHG emission is expected by the modal shift of passengers' transportation to the HSR (+55% of the share between HCMC – Nha Trang, 2030 projection) from cars (-13%), buses (-38%), airs (-3%), and existing railway (-1%). 72 kt-CO2e/year of GHGs would be reduced by the development of the HSR in the south section.<br>Though alignment avoids the coastal area, Impact by the rise of sea level should be further studied. |

Source: JICA Study Team

# APPENDIX 7A

# Market Value Survey Result

JICA Study Team conducted the market price survey at all districts in the project area to obtain the latest market price of land, structures and trees as described the survey methodology in Chapter 11 of Vol. II A and B and Chapter 7 in Vol. III respectively. The market price survey results are shown in the Tables 7A.1 to 7A.6.

**Table 7A.1 Comparision of Unit Price on Agriculture and Residential Land at the North Section**

(Unit: VND//m2)

| Province | District | Agriculture Land | | | Residential Land | | |
|---|---|---|---|---|---|---|---|
| | | Official Rate (a) | Market Price (b) | Magnification Ratio (b/a) | Official Rate (a) | Market Price (b) | Magnification Ratio (b/a) |
| Hanoi | Phu Xuyen | 135,000 | 622,000 | 4.61 | 1,168,000 | 6,600,000 | 5.65 |
| | Thanh Tri | 135,000 | 890,000 | 6.59 | 9,298,000 | 34,500,000 | 3.71 |
| | Thuong Tin | 135,000 | 723,000 | 5.36 | 2,697,000 | 14,167,000 | 5.25 |
| | Average | 135,000 | 745,000 | 5.52 | 4,387,667 | 18,422,333 | 1.00 |
| Ha Nam | Binh Luc | 40,000 | 170,000 | 4.25 | 1,417,000 | 3,925,000 | 2.77 |
| | Duy Tien | 40,000 | 200,000 | 5.00 | 1,942,000 | 6,617,000 | 3.41 |
| | Thanh Lim | 40,000 | 168,000 | 4.20 | 1,347,000 | 3,017,000 | 2.24 |
| | Average | 40,000 | 179,333 | 4.48 | 1,568,667 | 4,519,667 | 2.88 |
| Nam Dinh | My Loc | 50,000 | 240,000 | 4.80 | 1,908,000 | 5,000,000 | 2.62 |
| | Y Yen | 50,000 | 225,000 | 4.50 | 1,658,000 | 4,533,000 | 2.73 |
| | Vu Ban | 50,000 | 230,000 | 4.60 | 1,361,500 | 4,366,000 | 3.21 |
| | Nam Dinh | 55,000 | 273,000 | 4.96 | 3,682,000 | 11,092,000 | 3.01 |
| | Average | 51,250 | 242,000 | 4.72 | 2,152,375 | 6,247,750 | 2.90 |
| Ninh Binh | Hoa Lu | 46,000 | 267,000 | 5.80 | 4,217,000 | 14,450,000 | 3.43 |
| | Yen Khanh | 42,000 | 190,000 | 4.52 | 1,320,000 | 3,600,000 | 2.73 |
| | Yen Mo | 41,000 | 168,000 | 4.10 | 1,347,000 | 3,017,000 | 2.24 |
| | Tam Diep | 45,000 | 170,000 | 3.78 | 1,417,000 | 3,925,000 | 2.77 |
| | Ninh Binh | 63,000 | 303,000 | 4.81 | 2,183,000 | 7,583,000 | 3.47 |
| | Average | 47,400 | 219,600 | 4.63 | 2,096,800 | 6,515,000 | 3.11 |
| Than Hoa | Dong Son | 44,000 | 213,000 | 4.84 | 1,917,000 | 4,265,000 | 2.22 |
| | Ha Trung | 40,000 | 185,000 | 4.63 | 2,025,000 | 4,917,000 | 2.43 |
| | Hau Loc | 40,000 | 185,000 | 4.63 | 1,750,000 | 4,267,000 | 2.44 |
| | Hoang Hoa | 45,000 | 200,000 | 4.44 | 2,125,000 | 4,733,000 | 2.23 |
| | Nong Cong | 35,000 | 168,000 | 4.80 | 1,750,000 | 3,875,000 | 2.21 |
| | Quang Xuong | 42,000 | 193,000 | 4.60 | 2,133,000 | 5,450,000 | 2.56 |
| | Tieu Hoa | 40,000 | 148,000 | 3.70 | 7,858,000 | 13,791,667 | 1.76 |
| | Tinh Gia | 35,000 | 157,000 | 4.49 | 1,700,000 | 3,942,000 | 2.32 |
| | Bim Son | 50,000 | 242,000 | 4.84 | 2,792,000 | 7,033,333 | 2.52 |
| | Than Hoa City | 58,000 | 187,000 | 3.22 | 12,508,000 | 18,375,000 | 1.47 |
| | Average | 42,900 | 187,800 | 4.38 | 3,655,800 | 7,064,900 | 1.93 |
| Nghe An | Dien Chau | 58,000 | 200,000 | 3.45 | 1,825,000 | 4,558,000 | 2.50 |
| | Nghi Loc | 58,000 | 200,000 | 3.45 | 1,625,000 | 4,158,000 | 2.56 |
| | Quynh Luu | 58,000 | 190,000 | 3.28 | 5,050,000 | 5,200,000 | 1.03 |
| | Hung Nguyen | 85,000 | 278,000 | 3.27 | 2,433,000 | 7,450,000 | 3.06 |
| | Vinh | 93,000 | 414,000 | 4.45 | 4,500,000 | 14,100,000 | 3.13 |
| | Average | 70,400 | 256,400 | 3.64 | 3,086,600 | 7,093,200 | 2.30 |

Source: JICA Study Team based on results of interview to real estate and provincial decision at each city/province in 2011 listed in Appendix 1C in Vol. III

## Table 7A.2 Comparision of Unit Price on Agriculture and Residential Land at the South Section

(Unit: VND//m2)

| Province | District | Agriculture Land | | | Residential Land | | |
|---|---|---|---|---|---|---|---|
| | | Official Rate | Market Price | Magnification Ratio (b/a) | Official Rate | Market Price | Magnification Ratio (b/a) |
| HCMC | District 2 | 130,000 | 199,000 | 1.53 | 4,933,000 | 44,000,000 | 8.92 |
| | District 9 | 101,000 | 182,000 | 1.80 | 1,967,000 | 15,300,000 | 7.78 |
| | Average | 115,500 | 190,500 | 1.65 | 3,450,000 | 29,650,000 | 8.59 |
| Dong Nai | Cam My | 35,000 | 48,000 | 1.37 | 313,000 | 1,110,000 | 3.55 |
| | Long Thanh | 93,000 | 127,000 | 1.37 | 473,000 | 920,000 | 1.95 |
| | Nhoc Trach | 70,000 | 102,000 | 1.46 | 512,000 | 978,000 | 1.91 |
| | Xuan Loc | 30,000 | 47,000 | 1.57 | 573,000 | 1,352,000 | 2.36 |
| | Long Khanh | 62,000 | 93,000 | 1.50 | 567,000 | 956,000 | 1.69 |
| | Average | 58,000 | 83,400 | 1.44 | 487,600 | 1,063,200 | 2.18 |
| Binh Thuan | Bac Binh | 39,000 | 122,000 | 3.13 | 580,000 | 1,363,000 | 2.35 |
| | Ham Tan | 17,000 | 73,000 | 4.29 | 502,000 | 671,000 | 1.34 |
| | Ham Thuan Bac | 40,000 | 158,000 | 3.95 | 700,000 | 1,698,000 | 2.43 |
| | Ham Thuan Nam | 35,000 | 60,000 | 1.71 | 738,000 | 2,154,000 | 2.92 |
| | Tuy Phong | 42,500 | 100,000 | 2.35 | 583,000 | 1,210,000 | 2.08 |
| | Phan Thiet | 25,000 | 37,000 | 1.48 | 2,008,000 | 4,140,000 | 2.06 |
| | Average | 33,083 | 91,667 | 2.77 | 851,833 | 1,872,667 | 2.20 |
| Ninh Thuan | Ninh Hai | 39,000 | 97,000 | 2.49 | 178,000 | 773,000 | 4.34 |
| | Ninh Phuoc | 45,000 | 132,000 | 2.93 | 166,000 | 530,000 | 3.19 |
| | Thuan Bac | 36,000 | 88,000 | 2.44 | 118,000 | 253,000 | 2.14 |
| | Phan Rang | 52,000 | 169,000 | 3.25 | 397,000 | 1,402,000 | 3.53 |
| | Average | 43,000 | 121,500 | 2.83 | 214,750 | 739,500 | 3.44 |
| Khan Hoa | Cam Lam | 7,000 | 282,000 | 40.29 | 543,000 | 1,434,000 | 2.64 |
| | Cam Ranh | 16,000 | 368,000 | 23.00 | 816,000 | 2,033,000 | 2.49 |
| | Nha Trang | 18,000 | 253,000 | 14.06 | 4,034,000 | 20,087,000 | 4.98 |
| | Average | 13,667 | 301,000 | 22.02 | 1,797,667 | 7,851,333 | 4.37 |

Source: JICA Study Team based on results of interview to real estate and provincial decision at each city/province in 2011 listed in Appendix 1C in Vol. III

**Table 7A.3 Unit Price Other Land in Market Price at the North Section**

(Unit: VND//m2)

| Province | District | Vacant Land | Commercial Land |
|---|---|---|---|
| Hanoi | Phu Xuyen | 6,600,000 | 3,300,000 |
| | Thanh Tri | 34,500,000 | 17,250,000 |
| | Thuong Tin | 14,167,000 | 7,084,000 |
| | Average | 18,422,333 | 9,211,333 |
| Ha Nam | Binh Luc | 3,925,000 | 2,355,000 |
| | Duy Tien | 6,617,000 | 3,970,000 |
| | Thanh Lim | 3,017,000 | 1,810,000 |
| | Average | 4,519,667 | 2,711,667 |
| Nam Dinh | My Loc | 5,000,000 | 2,750,000 |
| | Y Yen | 4,533,000 | 2,493,000 |
| | Vu Ban | 4,366,000 | 2,401,000 |
| | Nam Dinh | 11,092,000 | 6,101,000 |
| | Average | 6,247,750 | 3,436,250 |
| Ninh Binh | Hoa Lu | 14,450,000 | 10,115,000 |
| | Yen Khanh | 3,600,000 | 2,520,000 |
| | Yen Mo | 3,017,000 | 2,112,000 |
| | Tam Diep | 3,925,000 | 2,748,000 |
| | Ninh Binh | 7,583,000 | 5,308,000 |
| | Average | 6,515,000 | 4,560,600 |
| Than Hoa | Dong Son | 4,265,000 | 2,986,000 |
| | Ha Trung | 4,917,000 | 3,442,000 |
| | Hau Loc | 4,267,000 | 2,986,000 |
| | Hoang Hoa | 4,733,000 | 3,313,000 |
| | Nong Cong | 3,875,000 | 2,713,000 |
| | Quang Xuong | 5,450,000 | 3,815,000 |
| | Tieu Hoa | 13,791,667 | 9,654,000 |
| | Tinh Gia | 3,942,000 | 2,759,000 |
| | Bim Son | 7,033,333 | 4,923,000 |
| | Than Hoa City | 18,375,000 | 12,863,000 |
| | Average | 7,064,900 | 4,945,400 |
| Nghe An | Dien Chau | 4,558,000 | 2,279,000 |
| | Nghi Loc | 4,158,000 | 2,079,000 |
| | Quynh Luu | 5,200,000 | 2,600,000 |
| | Hung Nguyen | 7,450,000 | 3,725,000 |
| | Vinh | 14,100,000 | 7,050,000 |
| | Average | 7,093,200 | 3,546,600 |

Source: JICA Study Team

**Table 7A.4 Unit Price Other Land in Market Price at the South Section**

(Unit: VND//m2)

| Province | District | Vacant Land | Commercial Land |
|---|---|---|---|
| HCMC | District 2 | 44,000,000 | 26,400,000 |
| | District 9 | 15,300,000 | 9,180,000 |
| | Average | 29,650,000 | 17,790,000 |
| Dong Nai | Cam My | 1,110,000 | 555,000 |
| | Long Thanh | 920,000 | 460,000 |
| | Nhoc Trach | 978,000 | 489,000 |
| | Xuan Loc | 1,352,000 | 676,000 |
| | Long Khanh | 956,000 | 478,000 |
| | Average | 1,063,200 | 531,600 |
| Binh Thuan | Bac Binh | 1,363,000 | 954,000 |
| | Ham Tan | 671,000 | 470,000 |
| | Ham Thuan Bac | 1,698,000 | 1,189,000 |
| | Ham Thuan Nam | 2,154,000 | 1,508,000 |
| | Tuy Phong | 1,210,000 | 847,000 |
| | Phan Thiet | 4,140,000 | 2,898,000 |
| | Average | 1,872,667 | 1,311,000 |
| Ninh Thuan | Ninh Hai | 773,000 | 618,000 |
| | Ninh Phuoc | 530,000 | 424,000 |
| | Thuan Bac | 253,000 | 202,000 |
| | Phan Rang | 1,402,000 | 1,122,000 |
| | Average | 739,500 | 591,500 |
| Khan Hoa | Cam Lam | 1,434,000 | 717,000 |
| | Cam Ranh | 2,033,000 | 1,017,000 |
| | Nha Trang | 20,087,000 | 10,044,000 |
| | Average | 7,851,333 | 3,926,000 |

Source: JICA Study Team

**Table 7A.5 Comparision of Unit Price on Structure at the North and South Section**

(Unit: VND/m2)

| Province | House Type | Official Rate (a) | Market Price (b) | Magnification Ratio (b/a) |
|---|---|---|---|---|
| Hanoi | 1 Floor house | 3,200,000 | 3,520,000 | 1.10 |
| | 2 Floor house | 5,167,000 | 5,942,000 | 1.15 |
| | Temperate house | 936,000 | 1,011,000 | 1.08 |
| Nam Dinh | 1 Floor house | 2,890,000 | 3,150,000 | 1.09 |
| | 2 Floor house | 3,400,000 | 3,842,000 | 1.13 |
| | Temperate house | 850,000 | 901,000 | 1.06 |
| Ha Nam | 1 Floor house | 2,965,000 | 3,173,000 | 1.07 |
| | 2 Floor house | 3,560,000 | 3,987,000 | 1.12 |
| | Temperate house | 875,000 | 963,000 | 1.10 |
| Ninh Binh | 1 Floor house | 2,908,000 | 3,286,000 | 1.13 |
| | 2 Floor house | 3,498,000 | 4,023,000 | 1.15 |
| | Temperate house | 787,000 | 858,000 | 1.09 |
| Thanh Hoa | 1 Floor house | 2,650,000 | 2,915,000 | 1.10 |
| | 2 Floor house | 3,780,000 | 4,309,000 | 1.14 |
| | Temperate house | 750,000 | 810,000 | 1.08 |
| Nghe An | 1 Floor house | 2,830,000 | 3,056,000 | 1.08 |
| | 2 Floor house | 3,600,000 | 4,068,000 | 1.13 |
| | Temperate house | 870,000 | 957,000 | 1.10 |

Source: JICA Study Team based on results of interview to real estate and provincial decision at each city/province in 2011 listed in Appendix C in Vol. III

(Unit: VND/m2)

| Province | House Type | Official Rate (a) | Market Price (b) | Magnification Ratio (b/a) |
|---|---|---|---|---|
| Ho Chi Minh | 1 Floor house | 2,400,000 | 2,736,000 | 1.14 |
| | 2 Floor house | 3,000,000 | 3,510,000 | 1.17 |
| | Temperate house | 650,000 | 715,000 | 1.10 |
| Dong Nai | 1 Floor house | 2,320,000 | 2,529,000 | 1.09 |
| | 2 Floor house | 3,273,000 | 3,666,000 | 1.12 |
| | Temperate house | 659,000 | 712,000 | 1.08 |
| Binh Thuan | 1 Floor house | 2,290,000 | 2,519,000 | 1.10 |
| | 2 Floor house | 3,160,000 | 3,602,000 | 1.14 |
| | Temperate house | 540,000 | 583,000 | 1.08 |
| Ninh Thuan | 1 Floor house | 2,350,000 | 2,609,000 | 1.11 |
| | 2 Floor house | 3,200,000 | 3,680,000 | 1.15 |
| | Temperate house | 500,000 | 535,000 | 1.07 |
| Khanh Hoa | 1 Floor house | 2,317,000 | 2,618,000 | 1.13 |
| | 2 Floor house | 3,190,000 | 3,700,000 | 1.16 |
| | Temperate house | 424,000 | 454,000 | 1.07 |

Source: JICA Study Team based on results of interview to real estate and provincial decision at each city/province in 2011 listed in Appendix C in Vol. III

**Table 7A.6 Unit Price of Trees and Crops in Market Priceat the Nort and South Section**

| Items | Forest Tree | Fruit Tree | Crop (Rice) | Crop (Aquaculture) | Crop (Others) |
|---|---|---|---|---|---|
| Unit | No. | No. | m2 | m2 | m2 |
| 1. North Section | | | | | |
| Hanoi | 0 | 500,000 | 8,000 | 2,400 | 12,000 |
| Nam Dinh | 80,000 | 500,000 | 6,000 | 2,400 | 5,100 |
| Ha Nam | 100,000 | 350,000 | 6,000 | 2,400 | 5,500 |
| Ninh Binh | 100,000 | 350,000 | 5,000 | 2,400 | 6,000 |
| Thanh Hoa | 150,000 | 350,000 | 4,000 | 2,400 | 6,000 |
| Nghe An | 120,000 | 350,000 | 3,500 | 2,400 | 6,000 |
| 2. South Section | | | | | |
| HCMC | 4,499 | 429,000 | 4,000 | 2,400 | 4,000 |
| Dong Nai | 4,499 | 306,000 | 3,000 | 2,400 | 3,000 |
| Binh Thuan | 40,500 | 303,000 | 3,700 | 2,400 | 5,000 |
| Ninh Thuan | 12,000 | 300,000 | 3,000 | 2,400 | 2,500 |
| Khanh Hoa | 3,780 | 300,000 | 6,000 | 2,400 | 4,000 |

Source: JICA Study Team

# APPENDIX 7B

# Compensation Cost

Breakdown of compensation cost at province-wise and section-wise in the North and South sections are shown in Table 7B.1 to Table 7B.20.

### Table 7B.1 Compensation Cost for Land at Province-Wise in the North Section

(Unit: VND)

| | Location | Agriculture Land | Residential Land | Commercial Land | Vacant Land | Total |
|---|---|---|---|---|---|---|
| 1 | Hanoi | 750,706,118,000 | 843,644,327,000 | 136,585,500,000 | 11,631,107,000 | 1,742,567,052,000 |
| 2 | Ha Nam | 140,679,264,000 | 732,126,214,000 | 100,024,195,000 | 0 | 972,829,673,000 |
| 3 | Nam Dinh | 192,338,474,000 | 782,742,613,000 | 173,263,363,000 | | 1,148,344,450,000 |
| 4 | Ninh Binh | 114,764,330,000 | 466,340,807,000 | 8,444,520,000 | 50,939,028,000 | 640,488,685,000 |
| 5 | Thanh Hoa | 395,558,478,000 | 5,745,254,529,000 | 1,160,104,703,000 | 740,818,983,000 | 8,041,736,693,000 |
| 6 | Nghe An | 535,516,374,000 | 4,502,523,034,000 | 467,818,000,000 | 179,770,270,000 | 5,685,627,678,000 |
| Total | | 2,129,563,038,000 | 13,072,631,524,000 | 2,046,240,281,000 | 983,159,388,000 | 18,231,594,231,000 |

Source: JICA Study Team

### Table 7B.2 Compensation Cost for Land at Section-Wise in the North Section

(Unit: VND)

| | Location | Agriculture | Residential | Commercial | Vacant | Total |
|---|---|---|---|---|---|---|
| 1 | Ngoc Hoi Sta. | 29,646,790,000 | 0 | 95,099,250,000 | 0 | 124,746,040,000 |
| 2 | Km 0.308 – 45.215 | 806,065,648,000 | 1,266,074,512,000 | 105,038,560,000 | 11,631,107,000 | 2,188,809,827,000 |
| 3 | Phu Ly Sta. | 4,079,544,000 | 0 | 0 | 0 | 4,079,544,000 |
| 4 | Km 45.865 – 67.339 | 63,325,080,000 | 533,831,029,000 | 36,471,885,000 | 0 | 633,627,994,000 |
| 5 | Nam Dinh Sta. | 5,565,120,000 | 21,950,000,000 | 0 | 0 | 27,515,120,000 |
| 6 | Km 67.989 – 103.056 | 224,881,758,000 | 877,316,221,000 | 181,707,883,000 | 0 | 1,283,905,862,000 |
| 7 | Ninh Bih Sta. | 6,468,336,000 | 13,458,837,000 | 0 | 0 | 19,927,173,000 |
| 8 | Km 103.706 – 153.326 | 219,633,822,000 | 3,662,441,896,000 | 938,005,383,000 | 722,135,076,000 | 5,542,216,177,000 |
| 9 | Than Hoa Sta. | 1,930,845,000 | 94,115,755,000 | 37,050,288,000 | 9,216,665,000 | 142,313,553,000 |
| 10 | Km 154.326 – 282.970 | 708,793,347,000 | 3,651,033,424,000 | 297,645,732,000 | 240,176,540,000 | 4,897,649,043,000 |
| 11 | Vinh Sta. | 59,172,748,000 | 2,952,409,850,000 | 355,221,300,000 | 0 | 3,366,803,898,000 |
| Total | | 2,129,563,038,000 | 13,072,631,524,000 | 2,046,240,281,000 | 983,159,388,000 | 18,231,594,231,000 |

Source: JICA Study Team

### Table 7B.3 Compensation Cost for Structure at Province-Wise in the North Section

(Unit: VND)

| | Location | Temporary House | 1st Floor House | 2nd Floor House | Grave | Total |
|---|---|---|---|---|---|---|
| 1 | Ngoc Hoi Sta. | 0 | 0 | 0 | 0 | 0 |
| 2 | Km 0.308 – 45.215 | 1,095,384,600 | 20,179,969,600 | 2,052,806,100 | 661,800,000 | 23,989,960,300 |
| 3 | Phu Ly Sta. | 0 | 0 | 0 | 0 | 0 |
| 4 | Km 45.865 – 67.339 | 594,439,220 | 10,767,550,800 | 1,201,308,800 | 77,760,000 | 12,641,058,820 |
| 5 | Nam Dinh Sta. | 50,456,000 | 957,600,000 | 153,680,000 | 0 | 1,161,736,000 |
| 6 | Km 67.989 – 103.056 | 771,170,320 | 17,006,854,440 | 2,694,165,100 | 327,180,000 | 20,799,369,860 |
| 7 | Ninh Bih Sta. | 19,974,240 | 497,237,520 | 78,046,200 | 0 | 595,257,960 |
| 8 | Km 103.706 – 153.326 | 2,906,530,200 | 54,857,970,650 | 14,203,470,970 | 232,440,000 | 72,200,411,820 |
| 9 | Than Hoa Sta. | 0 | 0 | 0 | 0 | 0 |
| 10 | Km 154.326 – 282.970 | 4,163,074,680 | 86,546,898,900 | 20,774,831,740 | 1,966,920,000 | 113,451,725,320 |
| 11 | Vinh Sta. | 1,842,435,540 | 40,769,158,800 | 9,255,757,680 | 937,140,000 | 52,804,492,020 |
| Total | | 11,443,464,800 | 231,583,240,710 | 50,414,066,590 | 4,203,240,000 | 297,644,012,100 |

Source: JICA Study Team

## Table 7B.4 Compensation Cost for Structure at Section-Wise in the North Section

(Unit: VND)

| | Location | Temporal House | 1st Floor House | 2nd Floor House | Grave | Total |
|---|---|---|---|---|---|---|
| 1 | Hanoi | 934,467,300 | 17,352,192,000 | 1,830,730,200 | 320,520,000 | 20,437,909,500 |
| 2 | Ha Nam | 526,664,700 | 9,255,006,400 | 726,830,100 | 419,040,000 | 10,927,541,200 |
| 3 | Nam Dinh | 649,494,860 | 12,326,706,000 | 1,978,245,800 | 327,180,000 | 15,281,626,660 |
| 4 | Ninh Binh | 683,860,320 | 15,728,636,160 | 2,789,548,200 | 0 | 19,202,044,680 |
| 5 | Thanh Hoa | 4,300,695,000 | 80,702,503,750 | 21,244,447,250 | 1,938,180,000 | 108,185,826,000 |
| 6 | Nghe An | 4,348,282,620 | 96,218,196,400 | 21,844,265,040 | 1,198,320,000 | 123,609,064,060 |
| Total | | 11,443,464,800 | 231,583,240,710 | 50,414,066,590 | 4,203,240,000 | 297,644,012,100 |

Source: JICA Study Team

## Table 7B.5 Compensation Cost for Trees and Crops at Province-Wise in the North Section

(Unit: VND)

| | Location | Forest Tree | Fruit Tree | Crop (Rice) | Crop (Aquaculture) | Crop (Others) | Total |
|---|---|---|---|---|---|---|---|
| 1 | Ngoc Hoi Sta. | 0 | 0 | 167,200,000 | 186,165,000 | 0 | 353,365,000 |
| 2 | Km 0.308 – 45.215 | 0 | 11,200,000 | 10,347,138,000 | 493,275,000 | 387,361,200 | 11,238,974,200 |
| 3 | Phu Ly Sta. | 0 | 0 | 145,698,000 | 0 | 0 | 145,698,000 |
| 4 | Km 45.865 – 67.339 | 0 | 16,000,000 | 1,937,322,000 | 260,737,500 | 33,397,000 | 2,247,456,500 |
| 5 | Nam Dinh Sta. | 0 | 0 | 127,866,000 | 12,200,500 | 0 | 140,066,500 |
| 6 | Km 67.989 – 103.056 | 0 | 0 | 4,496,187,000 | 246,844,000 | 740,293,500 | 5,483,324,500 |
| 7 | Ninh Bih Sta. | 0 | 0 | 192,510,000 | 0 | 0 | 192,510,000 |
| 8 | Km 103.706 – 153.326 | 6,840,000,000 | 490,000,000 | 4,300,161,000 | 185,643,000 | 675,240,000 | 12,491,044,000 |
| 9 | Than Hoa Sta. | 0 | 0 | 36,260,000 | 0 | 0 | 36,260,000 |
| 10 | Km 154.326 – 282.970 | 9,831,000,000 | 2,142,000,000 | 11,380,187,500 | 120,300,000 | 2,002,716,000 | 25,476,203,500 |
| 11 | Vinh Sta. | 0 | 0 | 405,559,000 | 129,190,000 | 33,420,000 | 568,169,000 |
| Total | | 16,671,000,000 | 2,659,200,000 | 33,536,088,500 | 1,634,355,000 | 3,872,427,700 | 58,373,071,200 |

Source: JICA Study Team

## Table 7B.6 Compensation Cost for Trees and Crops at Section-Wise in the North Section

(Unit: VND)

| | Location | Forest Tree | Fruit Tree | Crop (Rice) | Crop (Aquaculture) | Crop (Others) | Total |
|---|---|---|---|---|---|---|---|
| 1 | Hanoi | 0 | 0 | 8,399,584,000 | 447,720,000 | 96,804,000 | 8,944,108,000 |
| 2 | Ha Nam | 0 | 27,200,000 | 3,938,886,000 | 471,300,000 | 310,319,700 | 4,747,705,700 |
| 3 | Nam Dinh | 0 | 0 | 3,909,096,000 | 273,214,500 | 649,264,000 | 4,831,574,500 |
| 4 | Ninh Binh | 120,000,000 | 308,000,000 | 2,409,220,000 | 174,830,500 | 104,664,000 | 3,116,714,500 |
| 5 | Thanh Hoa | 14,007,000,000 | 406,000,000 | 7,874,896,000 | 69,335,000 | 1,887,870,000 | 24,245,101,000 |
| 6 | Nghe An | 2,544,000,000 | 1,918,000,000 | 7,004,406,500 | 197,955,000 | 823,506,000 | 12,487,867,500 |
| Total | | 16,671,000,000 | 2,659,200,000 | 33,536,088,500 | 1,634,355,000 | 3,872,427,700 | 58,373,071,200 |

Source: JICA Study Team

## Table 7B.7 Allowance at Province-Wise in the North Section

(Unit: VND)

| | Location | Relocation Household | Vulnerable Household | Job Training | Business | Other Assistance | Total |
|---|---|---|---|---|---|---|---|
| 1 | Hanoi | 197,500,000 | 6,201,500 | 360,975,360 | 184,800,000 | 750,500,000 | 1,499,976,860 |
| 2 | Ha Nam | 199,500,000 | 21,306,600 | 256,000,000 | 191,520,000 | 758,100,000 | 1,426,426,600 |
| 3 | Nam Dinh | 267,500,000 | 22,202,500 | 277,600,000 | 262,200,000 | 1,016,500,000 | 1,846,002,500 |
| 4 | Ninh Binh | 230,000,000 | 21,670,000 | 205,600,000 | 201,600,000 | 874,000,000 | 1,532,870,000 |
| 5 | Thanh Hoa | 1,821,500,000 | 370,021,050 | 828,000,000 | 1,743,840,000 | 6,921,700,000 | 11,685,061,050 |
| 6 | Nghe An | 1,814,500,000 | 340,944,550 | 892,000,000 | 1,761,600,000 | 6,895,100,000 | 11,704,144,550 |
| Total | | 4,530,500,000 | 782,346,200 | 2,820,175,360 | 4,345,560,000 | 17,215,900,000 | 29,694,481,560 |

Source: JICA Study Team

## Table 7B.8 Allowance at Province-Wise in the North Section

(Unit: VND)

| | Location | Relocation Household | Vulnerable Household | Job Training | Business | Other Assistance | Total |
|---|---|---|---|---|---|---|---|
| 1 | Ngoc Hoi Sta. | 0 | 0 | 10,659,520 | 0 | 0 | 10,659,520 |
| 2 | Km 0.308 – 45.215 | 260,500,000 | 12,929,900 | 492,428,800 | 245,280,000 | 989,900,000 | 2,001,038,700 |
| 3 | Phu Ly Sta. | 0 | 0 | 7,770,560 | 0 | 0 | 7,770,560 |
| 4 | Km 45.865 – 67.339 | 231,000,000 | 22,421,700 | 129,012,480 | 221,760,000 | 877,800,000 | 1,481,994,180 |
| 5 | Nam Dinh Sta. | 17,500,000 | 1,452,500 | 8,620,160 | 27,000,000 | 66,500,000 | 121,072,660 |
| 6 | Km 67.989 – 103.056 | 288,000,000 | 25,957,750 | 323,620,800 | 262,080,000 | 1,094,400,000 | 1,994,058,550 |
| 7 | Ninh Bih Sta. | 10,000,000 | 0 | 12,320,640 | 0 | 38,000,000 | 60,320,640 |
| 8 | Km 103.706 – 153.326 | 1,190,000,000 | 233,198,000 | 462,765,440 | 1,142,400,000 | 4,522,000,000 | 7,550,363,440 |
| 9 | Than Hoa Sta. | 0 | 0 | 2,900,800 | 0 | 0 | 2,900,800 |
| 10 | Km 154.326 – 282.970 | 1,812,500,000 | 350,910,450 | 1,273,505,920 | 1,730,400,000 | 6,887,500,000 | 12,054,816,370 |
| 11 | Vinh Sta. | 721,000,000 | 135,475,900 | 96,570,240 | 716,640,000 | 2,739,800,000 | 4,409,486,140 |
| Total | | 4,530,500,000 | 782,346,200 | 2,820,175,360 | 4,345,560,000 | 17,215,900,000 | 29,694,481,560 |

Source: JICA Study Team

## Table 7B.9 Other Cost Province-Wise in the North Section

(Unit: VND)

| | | RAP Preparation | Monitoring | Administration | Contingency |
|---|---|---|---|---|---|
| 1 | Hanoi | 629,051,508 | 151,543,882 | 93,150,988,664 | 186,301,977,329 |
| 2 | Ha Nam | 870,486,253 | 209,485,942 | 128,903,045,506 | 257,806,091,013 |
| 3 | Nam Dinh | 612,725,318 | 147,625,750 | 90,733,379,532 | 181,466,759,064 |
| 4 | Ninh Binh | 430,266,576 | 103,837,375 | 63,714,586,908 | 127,429,173,815 |
| 5 | Thanh Hoa | 2,138,475,868 | 513,791,476 | 316,669,046,831 | 633,338,093,662 |
| 6 | Nghe An | 1,616,658,495 | 388,560,233 | 239,397,466,418 | 478,794,932,837 |
| Total | | 6,297,664,019 | 1,514,844,658 | 932,568,513,860 | 1,865,137,027,720 |

Source: JICA Study Team

## Table 7B.10 Other Cost at Section-Wise in the North Section

(Unit: VND)

| | Location | RAP Preparation | Monitoring | Administration | Contingency |
|---|---|---|---|---|---|
| 1 | Ngoc Hoi Sta. | 13,628,429 | 3,278,192 | 2,018,120,398 | 4,036,240,796 |
| 2 | Km 0.308 – 45.215 | 997,202,157 | 239,867,728 | 147,667,346,225 | 295,334,692,450 |
| 3 | Phu Ly Sta. | 14,404,031 | 3,464,756 | 2,132,972,779 | 4,265,945,557 |
| 4 | Km 45.865 – 67.339 | 475,864,869 | 114,464,880 | 70,466,857,619 | 140,933,715,237 |
| 5 | Nam Dinh Sta. | 14,404,031 | 3,464,756 | 2,132,972,779 | 4,265,945,558 |
| 6 | Km 67.989 – 103.056 | 777,086,401 | 186,920,925 | 115,072,240,668 | 230,144,481,337 |
| 7 | Ninh Bih Sta. | 14,404,031 | 3,464,756 | 2,132,972,779 | 4,265,945,558 |
| 8 | Km 103.706 – 153.326 | 1,099,581,578 | 264,494,148 | 162,827,860,437 | 325,655,720,875 |
| 9 | Than Hoa Sta. | 22,160,048 | 5,330,394 | 3,281,496,583 | 6,562,993,166 |
| 10 | Km 154.326 – 282.970 | 2,850,757,205 | 685,723,200 | 422,144,846,395 | 844,289,692,790 |
| 11 | Vinh Sta. | 18,171,239 | 4,370,923 | 2,690,827,198 | 5,381,654,396 |
| Total | | 6,297,664,019 | 1,514,844,658 | 932,568,513,860 | 1,865,137,027,720 |

Source: JICA Study Team

## Table 7B.11 Compensation Cost for Land at Province-Wise in the South Section

(Unit: VND)

| | Location | Agriculture Land | Residential Land | Commercial Land | Vacant Land | Total |
|---|---|---|---|---|---|---|
| 1 | HCMC | 98,010,272,000 | 5,464,082,000,000 | 0 | 0 | 5,562,092,272,000 |
| 2 | Dong Nai | 165,412,373,000 | 160,806,074,000 | 16,410,500,000 | 0 | 342,628,947,000 |
| 3 | Binh Thuan | 554,997,361,000 | 607,058,542,000 | 261,840,256,000 | 80,525,626,000 | 1,504,421,785,000 |
| 4 | Ninh Thuan | 274,066,318,000 | 49,140,256,000 | 16,191,932,000 | 16,204,932,000 | 355,603,438,000 |
| 5 | Khan Hoa | 353,010,633,000 | 3,767,538,062,000 | 17,797,197,000 | 234,426,981,000 | 4,372,772,873,000 |
| Total | | 1,445,496,957,000 | 10,048,624,934,000 | 312,239,885,000 | 331,157,539,000 | 12,137,519,315,000 |

Source: JICA Study Team

## Table 7B.12 Compensation Cost for Land at Section-Wise in the South Section

(Unit: VND)

| | Location | Agriculture | Residential | Commercial | Vacant | Total |
|---|---|---|---|---|---|---|
| 1 | Thu Thiem Sta | 0 | 3,189,208,000,000 | 0 | 0 | 3,189,208,000,000 |
| 2 | Km 0.250 – 35.8 | 146,364,564,000 | 2,312,257,346,000 | 6,290,040,000 | 0 | 2,464,911,950,000 |
| 3 | Long Thanh Sta | 0 | 0 | 0 | 0 | 0 |
| 4 | Km 36.3 - 152.95 | 269,767,680,000 | 242,602,441,000 | 14,127,098,000 | 0 | 526,497,219,000 |
| 5 | Phan Thiet Sta | 830,502,000 | 41,474,520,000 | 31,124,520,000 | 0 | 73,429,542,000 |
| 6 | Km 153.45 – 220.20 | 316,504,860,000 | 363,818,659,000 | 208,499,502,000 | 13,510,986,000 | 902,334,007,000 |
| 7 | Tuy Phong Sta | 2,070,600,000 | 23,690,590,000 | 0 | 0 | 25,761,190,000 |
| 8 | Km 220.70 – 283.35 | 182,957,377,000 | 124,613,034,000 | 19,897,392,000 | 79,362,670,000 | 406,830,473,000 |
| 9 | Thap Cham Sta | 0 | 14,467,238,000 | 15,396,084,000 | 14,020,000 | 29,877,342,000 |
| 10 | Km 283.85 – 361.85 | 456,680,305,000 | 2,923,090,128,000 | 16,905,249,000 | 180,057,737,000 | 3,576,733,419,000 |
| 11 | Nha Trang Sta | 70,321,069,000 | 813,402,978,000 | 0 | 58,212,126,000 | 941,936,173,000 |
| Total | | 1,445,496,957,000 | 10,048,624,934,000 | 312,239,885,000 | 331,157,539,000 | 12,137,519,315,000 |

Source: JICA Study Team

## Table 7B.13 Compensation Cost for Structure at Province-Wise in the South Section

(Unit: VND)

| | Location | Temperate House | 1st Floor House | 2nd Floor House | Grave | Total |
|---|---|---|---|---|---|---|
| 1 | HCMC | 186,615,000 | 2,142,288,000 | 14,657,760,000 | 0 | 16,986,663,000 |
| 2 | Dong Nai | 722,502,000 | 13,686,948,000 | 1,240,024,500 | 0 | 15,649,474,500 |
| 3 | Binh Thuan | 1,966,482,320 | 38,042,139,520 | 36,449,070,240 | 567,540,000 | 77,025,232,080 |
| 4 | Ninh Thuan | 559,165,950 | 16,361,091,180 | 28,022,500,800 | 495,720,000 | 45,438,477,930 |
| 5 | Khan Hoa | 601,813,320 | 14,459,868,500 | 56,403,429,000 | 1,160,820,000 | 72,625,930,820 |
| Total | | 4,036,578,590 | 84,692,335,200 | 136,772,784,540 | 2,224,080,000 | 227,725,778,330 |

Source: JICA Study Team

## Table 7B.14 Compensation Cost for Structure at Section-Wise in the South Section

(Unit: VND)

| | Location | Temporal House | 1st Floor House | 2nd Floor House | Grave | Total |
|---|---|---|---|---|---|---|
| 1 | Thu Thiem Sta | 3,753,750 | 43,092,000 | 294,840,000 | 0 | 341,685,750 |
| 2 | Km 0.250 – 35.8 | 335,158,050 | 4,984,279,200 | 14,624,305,800 | 0 | 19,943,743,050 |
| 3 | Long Thanh Sta | 0 | 0 | 0 | 0 | 0 |
| 4 | Km 36.3 - 152.95 | 1,080,887,200 | 22,120,963,360 | 13,622,867,340 | 117,660,000 | 36,942,377,900 |
| 5 | Phan Thiet Sta | 235,100,580 | 5,171,406,240 | 4,357,627,560 | 0 | 9,764,134,380 |
| 6 | Km 153.45 – 220.20 | 948,931,610 | 20,873,240,080 | 17,588,602,020 | 306,840,000 | 39,717,613,710 |
| 7 | Tuy Phong Sta | 77,020,130 | 1,694,178,640 | 1,427,580,660 | 0 | 3,198,779,430 |
| 8 | Km 220.70 – 283.35 | 608,753,180 | 10,876,712,280 | 23,022,404,160 | 469,980,000 | 34,977,849,620 |
| 9 | Thap Cham Sta | 103,699,050 | 3,034,214,820 | 5,196,859,200 | 0 | 8,334,773,070 |
| 10 | Km 283.85 – 361.85 | 332,139,760 | 8,418,549,580 | 27,477,331,800 | 1,329,600,000 | 37,557,621,140 |
| 11 | Nha Trang Sta | 311,135,280 | 7,475,699,000 | 29,160,366,000 | 0 | 36,947,200,280 |
| Total | | 4,036,578,590 | 84,692,335,200 | 136,772,784,540 | 2,224,080,000 | 227,725,778,330 |

Source: JICA Study Team

## Table 7B.15 Compensation Cost for Trees and Crops at Province-Wise in the South Section

(Unit: VND)

| | Location | Forest Tree | Fruit Tree | Crop (Rice) | Crop (Aquaculture) | Crop (Others) | Total |
|---|---|---|---|---|---|---|---|
| 1 | HCMC | 0 | 9,033,024,000 | 0 | 26,604,000 | 0 | 9,059,628,000 |
| 2 | Dong Nai | 212,982,660 | 25,331,112,000 | 1,566,378,900 | 0 | 964,635,000 | 28,075,108,560 |
| 3 | Binh Thuan | 444,690,000 | 20,015,400,000 | 4,551,620,350 | 290,901,600 | 10,323,062,900 | 35,625,674,850 |
| 4 | Ninh Thuan | 105,840,000 | 4,096,320,000 | 3,335,368,350 | 288,376,800 | 3,220,163,500 | 11,046,068,650 |
| 5 | Khan Hoa | 178,945,200 | 2,556,000,000 | 716,400,000 | 0 | 2,550,360,000 | 6,001,705,200 |
| Total | | 942,457,860 | 61,031,856,000 | 10,169,767,600 | 605,882,400 | 17,058,221,400 | 89,808,185,260 |

Source: JICA Study Team

## Table 7B.16 Compensation Cost for Trees and Crops at Section-Wise in the South Section

(Unit: VND)

| | Location | Forest Tree | Fruit Tree | Crop (Rice) | Crop (Aquaculture) | Crop (Others) | Total |
|---|---|---|---|---|---|---|---|
| 1 | Thu Thiem Sta | 0 | | | | | 0 |
| 2 | Km 0.250 – 35.8 | 67,215,060 | 12,143,040,000 | 894,939,000 | 26,604,000 | | 13,131,798,060 |
| 3 | Long Thanh Sta | 0 | | | | | 0 |
| 4 | Km 36.3 - 152.95 | 247,827,600 | 36,934,776,000 | 1,237,956,150 | 247,082,400 | 4,314,991,950 | 42,982,634,100 |
| 5 | Phan Thiet Sta | 0 | 242,400,000 | | | 3,495,000 | 245,895,000 |
| 6 | Km 153.45 – 220.20 | 342,630,000 | 4,108,680,000 | 2,871,822,150 | 43,819,200 | 6,017,328,900 | 13,384,280,250 |
| 7 | Tuy Phong Sta | 0 | | 0 | | 116,597,400 | 116,597,400 |
| 8 | Km 220.70 – 283.35 | 0 | 3,810,960,000 | 1,720,795,100 | 59,875,200 | 2,547,418,550 | 8,139,048,850 |
| 9 | Thap Cham Sta | 0 | | | | | 0 |
| 10 | Km 283.85 – 361.85 | 178,945,200 | 3,672,000,000 | 1,824,483,200 | 228,501,600 | 4,055,584,000 | 9,959,514,000 |
| 11 | Nha Trang Sta | 105,840,000 | 120,000,000 | 1,619,772,000 | 0 | 2,805,600 | 1,848,417,600 |
| Total | | 942,457,860 | 61,031,856,000 | 10,169,767,600 | 605,882,400 | 17,058,221,400 | 89,808,185,260 |

Source: JICA Study Team

## Table 7B.17 Allowance at Province-Wise in the South Section

(Unit: VND)

| | Location | Relocation Household | Vulnerable Household | Job Training | Business | Other Assistance | Total |
|---|---|---|---|---|---|---|---|
| 1 | HCMC | 315,000,000 | 29,040,000 | 226,692,480 | 309,200,000 | 1,197,000,000 | 2,076,932,480 |
| 2 | Dong Nai | 355,000,000 | 12,395,000 | 872,800,000 | 347,200,000 | 1,349,000,000 | 2,936,395,000 |
| 3 | Binh Thuan | 1,695,000,000 | 170,715,000 | 1,900,800,000 | 1,626,400,000 | 6,441,000,000 | 11,833,915,000 |
| 4 | Ninh Thuan | 750,000,000 | 139,650,000 | 622,400,000 | 727,000,000 | 2,850,000,000 | 5,089,050,000 |
| 5 | Khan Hoa | 1,250,000,000 | 117,800,000 | 578,400,000 | 1,232,000,000 | 4,750,000,000 | 7,928,200,000 |
| Total | | 4,365,000,000 | 469,600,000 | 4,201,092,480 | 4,241,800,000 | 16,587,000,000 | 29,864,492,480 |

Source: JICA Study Team

## Table 7B.18 Allowance at Section-Wise in the South Section

(Unit: VND)

| | Location | Relocation Household | Vulnerable Household | Job Training | Business | Other Assistance | Total |
|---|---|---|---|---|---|---|---|
| 1 | Thu Thiem Sta | 15,000,000 | 0 | 800,000 | 18,000,000 | 57,000,000 | 90,800,000 |
| 2 | Km 0.250 – 35.8 | 375,000,000 | 31,815,000 | 362,061,440 | 369,600,000 | 1,425,000,000 | 2,563,476,440 |
| 3 | Long Thanh Sta | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | Km 36.3 - 152.95 | 915,000,000 | 71,700,000 | 1,517,216,960 | 862,400,000 | 3,477,000,000 | 6,843,316,960 |
| 5 | Phan Thiet Sta | 180,000,000 | 18,180,000 | 19,982,720 | 179,200,000 | 684,000,000 | 1,081,362,720 |
| 6 | Km 153.45 – 220.20 | 780,000,000 | 77,265,000 | 821,462,720 | 739,200,000 | 2,964,000,000 | 5,381,927,720 |
| 7 | Tuy Phong Sta | 60,000,000 | 9,620,000 | 10,625,920 | 56,000,000 | 228,000,000 | 364,245,920 |
| 8 | Km 220.70 – 283.35 | 675,000,000 | 113,770,000 | 550,822,080 | 663,200,000 | 2,565,000,000 | 4,567,792,080 |
| 9 | Thap Cham Sta | 45,000,000 | 6,650,000 | 3,200,000 | 55,000,000 | 171,000,000 | 280,850,000 |
| 10 | Km 283.85 – 361.85 | 770,000,000 | 88,350,000 | 743,368,320 | 761,600,000 | 2,926,000,000 | 5,289,318,320 |
| 11 | Nha Trang Sta | 550,000,000 | 52,250,000 | 171,552,320 | 537,600,000 | 2,090,000,000 | 3,401,402,320 |
| Total | | 4,365,000,000 | 469,600,000 | 4,201,092,480 | 4,241,800,000 | 16,587,000,000 | 29,864,492,480 |

Source: JICA Study Team

## Table 7B.19 Other Cost at Province-Wise in the South Section

(Unit: VND)

| | | RAP Preparation | Monitoring | Administration | Contingency |
|---|---|---|---|---|---|
| 1 | HCMC | 320,055,000 | 59,129,213 | 24,589,278,199 | 49,178,556,398 |
| 2 | Dong Nai | 1,802,415,000 | 332,990,831 | 138,476,461,436 | 276,952,922,873 |
| 3 | Binh Thuan | 3,593,600,000 | 663,906,952 | 276,090,141,181 | 552,180,282,364 |
| 4 | Ninh Thuan | 1,305,375,200 | 241,164,200 | 100,289,743,784 | 200,579,487,561 |
| 5 | Khan Hoa | 1,204,529,800 | 222,533,312 | 92,541,964,194 | 185,083,928,395 |
| Total | | 8,225,975,000 | 1,519,724,508 | 631,987,588,795 | 1,263,975,177,591 |

Source: JICA Study Team

## Table 7B.20 Other Cost at Section-Wise in the South Section

(Unit: VND)

| | | RAP Preparation | Monitoring | Administration | Contingency |
|---|---|---|---|---|---|
| 1 | Thu Thiem Sta | 11,230,000 | 2,052,295 | 853,460,620 | 1,706,921,239 |
| 2 | Km 0.250 – 35.8 | 798,453,000 | 145,918,180 | 60,681,050,052 | 121,362,100,104 |
| 3 | Long Thanh Sta | 11,230,000 | 2,052,295 | 853,460,620 | 1,706,921,239 |
| 4 | Km 36.3 - 152.95 | 2,619,959,000 | 478,800,443 | 199,112,362,547 | 398,224,725,094 |
| 5 | Phan Thiet Sta | 11,230,000 | 2,052,295 | 853,460,620 | 1,706,921,239 |
| 6 | Km 153.45 – 220.20 | 1,499,205,000 | 273,981,393 | 113,936,992,713 | 227,873,985,427 |
| 7 | Tuy Phong Sta | 11,230,000 | 2,052,295 | 853,460,620 | 1,706,921,239 |
| 8 | Km 220.70 – 283.35 | 1,407,119,000 | 273,570,934 | 113,766,300,589 | 227,532,601,179 |
| 9 | Thap Cham Sta | 11,230,000 | 2,052,295 | 853,460,620 | 1,706,921,239 |
| 10 | Km 283.85 – 361.85 | 1,833,859,000 | 335,139,787 | 139,370,119,177 | 278,740,238,353 |
| 11 | Nha Trang Sta | 11,230,000 | 2,052,295 | 853,460,620 | 1,706,921,239 |
| Total | | 8,225,975,000 | 1,519,724,507 | 631,987,588,798 | 1,263,975,177,591 |

Source: JICA Study Team