Federal Democratic Republic of Nepal
Ministry of Physical Infrastructure and Transport
Department of Roads

Federal Democratic Republic of Nepal

Preparatory Survey for the Project for the Sindhuli Road Earthquake Rehabilitation

FINAL REPORT

July, 2018

Japan International Cooperation Agency (JICA)

Nippon Koei Co., Ltd.

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to Nippon Koei Co., Ltd..

The survey team held a series discussions with the officials concerned of the Government of Federal Democratic Republic of Nepal, and conducted field investigations. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Federal Democratic Republic of Nepal for their close cooperation extended to the survey team.

July, 2018

Itsu Adachi
Director General
Infrastructure and Peacebuilding Department
Japan International Cooperation Agency

SUMMARY

1 Outline of the Country

The Federal Democratic Republic of Nepal, with an area of approximately 147,000 km2, is a landlocked Himalayan country in Southwest Asia. It is bordered by China in the north and by India on the remaining three directions. The capital of Nepal is Kathmandu located in the Kathmandu Valley, which has a size of about 25 km from east to west and about 20 km from south to north. The total population of Nepal is about 26.49 million as of 2011 according to the Central Bureau of Statistics. Out of this population, the Kathmandu Valley has about 2.51 million. The Terai Plain located along India's border is a major farm production area.

According to the latest data from the Ministry of Finance (MOF), Nepal's nominal gross domestic product (GDP) for the year 2016/2017 is around US$24.3 billion and per-capita nominal GDP is around US$848. Primary industries such as agriculture cover 31.8% of the GDP.

The period between late May and early October falls under the monsoon season. The study area has an average annual rainfall of about 1,850 mm.

The road subsector has the lead role in the national transport system of Nepal. The development of road network started in the 1924. However, the road network development in Nepal still has a long way to go since 12 among 75 districts of the entire nation still do not have a motorable roadway at all. Moreover, the service level of the road is insufficient since about 50% of the network is unpaved and the road network is weak against sediment-related disasters.

2 Background and Outline of the Project

The Sindhuli Road, with a total length of 160 km, connects Kathmandu City, the capital of the country, with the East Terai region by crossing the Mahabharata Range which is comprised of mountains over 2,000 m and separates the capital from the Terai region in the south. The construction of the Sindhuli Road started with the Japanese grant aid in the 1995 and was completed in March 2015. As of June 2015, after the construction completion, the traffic volume on the road has increased significantly from 1,764 vehicles per day in 2011 to, on average, 4,297 vehicles per day. The travel time has also been shortened from 9 hours to 5 hours. Therefore, the Sindhuli Road is a very important road for the country that supports the movement of people and goods between Kathmandu and the East Terai region.

A magnitude 7.8 earthquake occurred in Nepal on April 25, 2015, immediately after the completion of Sindhuli Road. Because the earthquake intensity has exceeded the designed earthquake resistance standards, damaged by this earthquake, road subsidence, cracks and slope failures have arisen at about 24 locations in the road, though the road had been properly maintained. After the earthquake, emergency rehabilitation work was conducted preferentially on 12 damaged locations with the support of Japan International Cooperation Agency (JICA). Though the emergency rehabilitation work, such as waterproof measurement and detour setting up have been taken to prevent hindrance to the traffic temporarily, the road may still collapse within several years due to erosion induced by heavy rainfall if without a permanent

countermeasure. Therefore, for a full-fledged rehabilitation work, the preparatory survey for the Project for the Sindhuli Road Earthquake Rehabilitation has been conducted.

3 Outline of Preparatory Survey and Main Features of Project Facilities

The 1st field survey was conducted from 16th July, 2017 to 30th August. The 2nd field survey was conducted from 1st November, 2017 to 24th December. The explanation on draft final report was conducted from 12th to 23th April, 2018.

(1) Contents of the Request for the Project

Contents of the requests are as below:

- Implementation of permanent countermeasure to Sindhuli Road damaged due to large earthquake in Nepal
- Implementation of permanent countermeasure to Section II Sta. 17+400

(2) Results of Field Survey

The JICA Survey team conducted following field surveys in this preparatory survey.

- 1st Screening
- Detail Inspection including cross section survey on gabion walls
- Stability calculation of gabion wall
- Monitoring using measurement pins
- 2D seismic response analysis
- Topographical survey, geological survey and monitoring by equipments

As a result of the consideration, it was judged that it is desirable that four sites of gabion wall and one site of natural slope are implemented by Japan's grant aid. In addition,

(3) Outline of the Project Facilities

The outline of the proposed countermeasures for each site is shown in Table 1.

Table 1 General Outline of Countermeasures

Site	Countermeasure	Quantity
Sta.17+400 Section II	Ground anchors	Ground anchor, 158 pieces
	Crib works F500	A=1,270 m^2, Shotcrete in the frame A= 860 m^2
	Crib works F300	A=1,060 m^2, Shotcrete in the frame A= 710 m^2
	Rock bolts	L=3 m/each, 300 pieces
	Excavation works	V=370 m^3
	High intensity net	High intensity net, A=2,800 m^2 Rock bolts, L=3 m/each, 1,240 pieces
	Vegetation works	Vegetation bags, 4,140 pieces
	Gabion check dams	V=350 m^3
	Asphalt pavements	A=420 m^2
Sta.33+440 Section II	Ground anchors	Ground anchor 32 pieces
	Anchor plates	32 nos.

	H beam installation	Shotcrete A=160 m^2, H beams 32 pieces, Concrete V=25 m^3
	Restoration of side ditch	L=43 m
	Asphalt pavements	A=200 m^2
Sta.33+695 Section II	Ground anchors	Ground anchor 18 pieces
	Anchor plates	18 nos.
	H beam installation	Shotcrete A=95 m^2, H beams 18 pieces, Concrete V=19 m^3
	Restoration of side ditch	L=45 m
	Asphalt pavements	A=150 m^2
Sta.11+620 Section III	Ground anchors	Ground anchor 20 pieces
	Anchor plates	20 nos.
	H beam installation	Shotcrete A=90 m^2, H beams 10 pieces, Concrete V=10 m^3
	Side ditch	L=12 m
Sta.15+520 Section III	Ground anchors	Ground anchor, 40 pieces
	Anchor plates	40 nos.
	H beam installation	Shotcrete A=250 m^2, H beams 40 pieces, Concrete V=50 m^3
	High intensity net	High intensity net, A=2,500 m^2 Rock bolts, L=3 m/each, 1,100 pieces
	Asphalt pavements	A=210 m^2

Source: JICA Survey Team

4 Construction Period and Estimated Project Cost

The estimated duration for the detailed design and tendering processes will be 6 months. After issuance of notice to proceed (N/P), construction will commence. The estimated duration for construction stage of the project would be 16 months in total.

The cost to be shouldered by the Nepalese side, separate from Japan's grant aid, is estimated at about NRs 4.0 million, which includes compensation of using private lands, relocation of water supply facilities, landslides monitoring, environmental monitoring including initial environmental examination, etc.

5 Project Evaluation

(1) Relevance

As shown below, the validity of this project is high and it can be judged effective.

Table 2 Project Evaluation

Item of Evaluation	Relevance
1. Consistent with long-term development plan	The 13th plan (2013/14 - 2015/16) of the national development plan in Nepal has set the goal of developing a safe and reliable transportation network for the social and economic development of the whole country. The 14th plan (2016/17 - 2018/19) is also extension of sustainable and secure road network expansion. In the priority investment plan (2007 - 2016), which is the basic policy of the road development of GON, the following policies are mentioned. The road maintenance management work shall be continuously carried out based on the classification of road maintenance management tasks.

	This project aims to reinforce the vulnerable part on Sindhuli Road against earthquakes in order to ensure safe and smooth traffic of Sindhuli Road, which is one of the important arterial roads. This content is consistent with the policy of the road sector of GON.
2. Consistency with the Japanese aid policy	In the National Development Cooperation Policy and Business Development Plan of GOJ for Nepal, the following are listed as priority areas: I. Reconstruction by hard and soft countermeasures against earthquakes and disaster risk reduction; and II. Improve social and economic infrastructure directly linked to economic growth and improvement of people's lives. By making Sindhuli Road a strong road to the earthquake, it is possible to secure a stable logistics even in the event of a disaster, contributing to creating a country that is resistant to disasters. It is also expected to make a great contribution to securing stable logistics of the Kathmandu Valley and the Terai region in the south, promoting industry and revitalizing the regional economy, and improving the lives of local people living along the roadside. The purpose of this project is consistent with Japan's aid policy.
3. Advantage of Japanese technology	In Japan, torrential rains occur frequently and the geology is weak, therefore, road disaster prevention inspection and conservation technology have been developed to conserve the highly developed road network. Anchor work, which is the main construction method applied to this project, is not Japanese original technology. In applying to road slope countermeasures, it has been improved by Japanese technology as the capacity to realizes reliable disaster prevention, reduction of negative impact on the environment, reduction of life cycle cost including construction cost and maintenance cost. In this project, Japanese standards are adopted for the design and construction of slope countermeasures. Furthermore, for the purpose of ensuring construction quality and improving workability, anchor material and anchor plate are procured from Japan.

Source: JICA Survey Team

(2) Effectiveness

1) Quantitative Effect

By implementing countermeasures, restoring the driving speed and Vehicle Operation Cost (VOC) to a healthy state and eliminate traffic hindrance losses may occur in the future. In addition, the future elimination of traffic hindrance, caused by road damage and road closure due to road disaster will bring stable traffic volume and growth of passenger number, cargo volume. Base lines and target value are as shown in Table 3.

Table 3 Base lines and Target

Indicators		Original (Yr 2017)	Target (Yr 2023)
Annual Passenger (Persons/year)	Khurkot	6,006,205	8,048,000
	Singhuli Madi	5,847,170	7,835,000
Annual Cargo volume (ton/Year)	Khurkot	359,896	482,000
	Singhuli Madi	492,042	659,000

*1 Raised the 2017 value at an annual rate of 5%

Source: JICA Survey Team

2) Qualitative Effect

In the disaster prevention project like this project, there are few parts that directly contribute to improving transportation services that road users can feel, such as an increase in traffic capacity and speed improvement. On the other hand, the effect of this project is to reduce the risk of loss expansion due to sediment-related disasters such as traffic blockade and road disaster. Qualitative effects indicators are as follows:

- Reduction of road traffic disturbance loss
- Contribution to other development projects
- Role in wide area road network

Federal Democratic Republic of Nepal
Preparatory Survey for the Project for the Sindhuli Road Earthquake Rehabilitation

Final Report

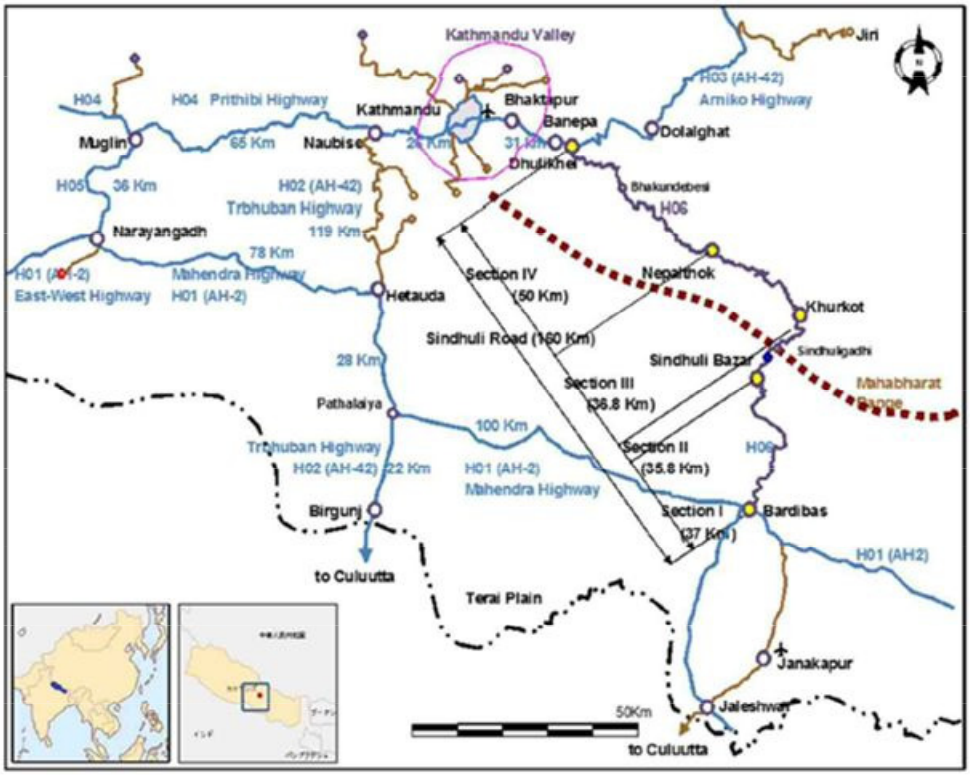
TABLE OF CONTENTS

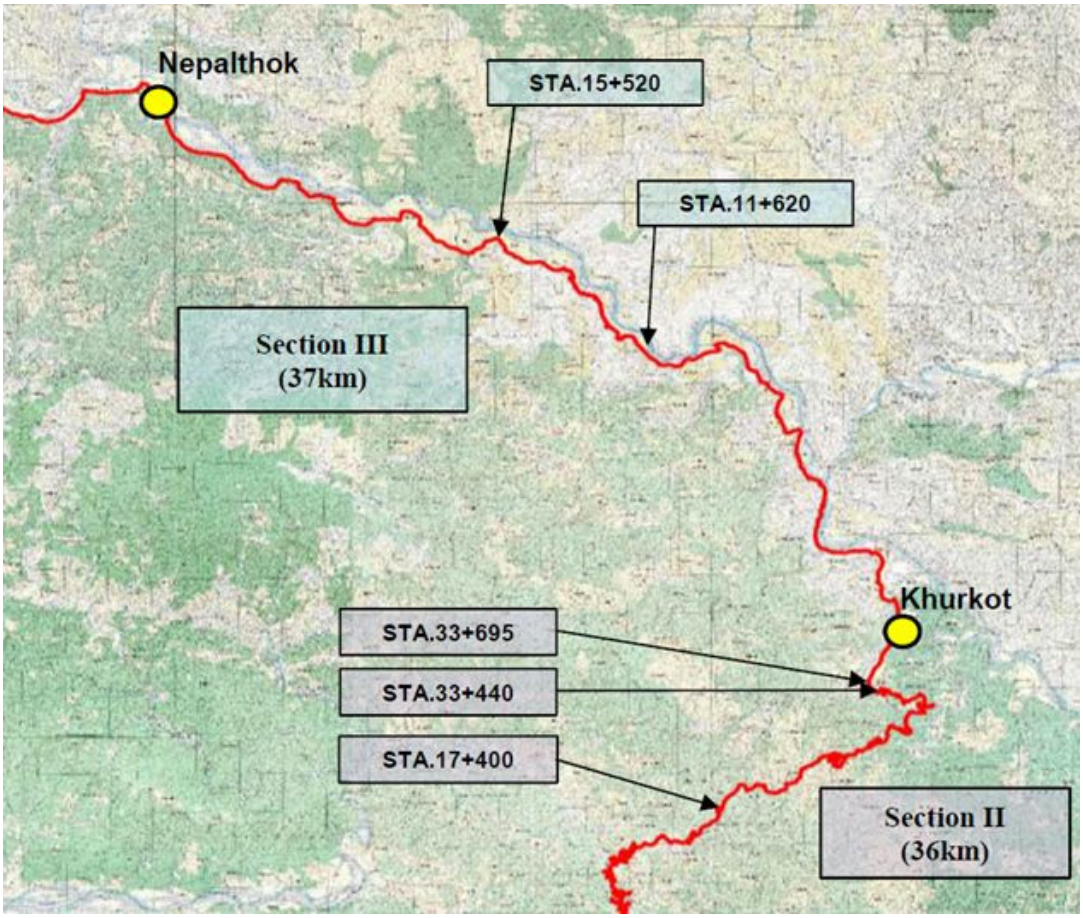
CHAPTER 1 BACKGROUND OF THE PROJECT 1-1
1.1 backgroud of the project 1-1
1.2 OUTLINE OF THE PROJECT 1-1
1.2.1 purpose of the survey and overall goal 1-1
1.2.2 Outline of The Proposed Countermeasures 1-2
1.3 RESULT OF FIELD SURVEY 1-2
1.3.1 TOPOGRAPHICAL SURVEY 1-2
1.3.2 GEOLOGICAL SURVEY 1-3
1.3.3 Monitoring by Equipments 1-3
1.4 Environmental and Social Considerations 1-6
1.4.1 purposes of the considerations 1-6
1.4.2 General Requirement of the JICA Guidelines 1-6
1.4.3 Environmental and Social Conditions Relevant to the Project 1-7
1.4.4 Environmental management system in nepal 1-25
1.4.5 requirements on environmental and social considerations for the project 1-30
1.4.6 IEE and stakeholder meeting to be done by Dor 1-31
1.4.7 Gap between environmental management systems of nepal and the jica guidelines 1-33
1.4.8 Land Acquisitions and Resettlement 1-38
1.4.9 Examination on Environmental and Social Impact 1-38
1.4.10 Environmental Checklist (Draft Final) 1-62
1.4.11 Recommendations 1-63
CHAPTER 2 CONTENTS OF THE PROJECT 2-1
2.1 BASIC CONCEPT OF THE PROJECT 2-1
2.1.1 Current situation 2-1
2.1.2 overall goal and project goal 2-1
2.1.3 outline of the project 2-1
2.2 Outline Design of the japanese assistance 2-2
2.2.1 design policy 2-2
2.2.2 basic plan (construction plan/equipment plan) 2-14
2.2.3 outline design drawing 2-33
2.2.4 implementation plan 2-48
2.3 obligations of recipient country 2-55
2.3.1 Common Items of Japan's Aid Scheme 2-55
2.3.2 Special Items of the Project 2-56
2.3.3 Expenses borne by the recipient country 2-56
2.4 project operation plan 2-57
2.4.1 Operation and maintenance system 2-57
2.4.2 Maintenance method 2-57
2.5 project cost estimation 2-57
2.5.1 initial cost estimation 2-57
2.5.2 operation and maintenance cost 2-58

CHAPTER 3 PROJECT EVALUATION 3-1
3.1 Preconditions 3-1
3.2 NECESSARY INPUTS BY RECIPIENT COUNTY 3-1
3.3 important assumptions 3-1
3.4 project evaluation 3-1
3.4.1 Relevance 3-1
3.4.2 effectiveness 3-2

Appendices

1. Member List of the Study Team
2. Study Schedule
3. List of Parties Concerned in the Recipient Country
4. Minutes of Discussions
5. Other Relevant Data





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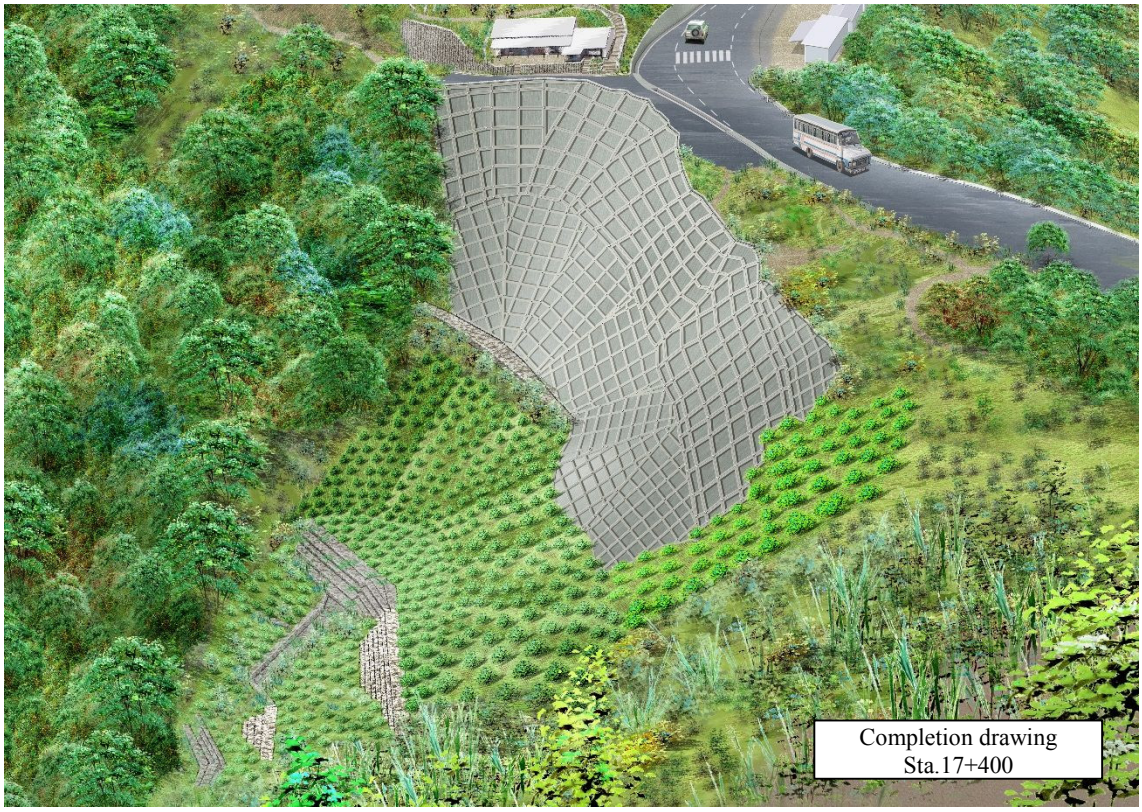
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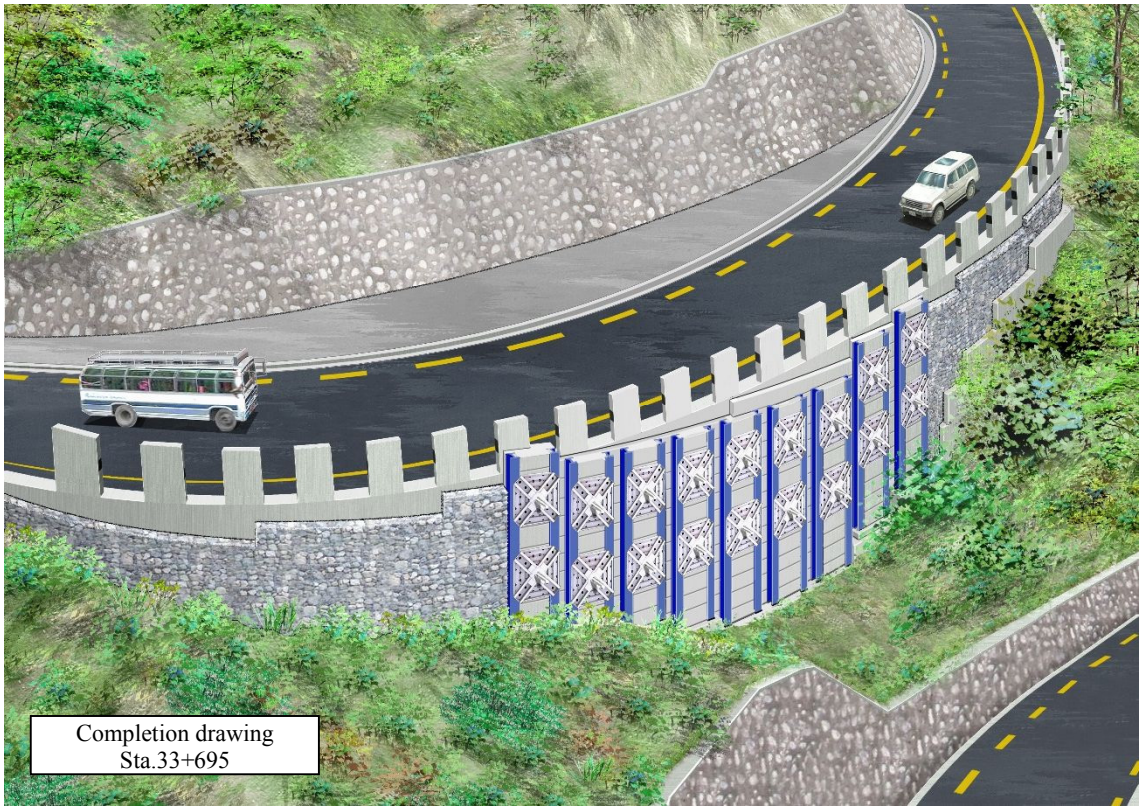
Sta.17+400


Completion drawing
Sta.33+440


Completion drawing
Sta.33+695


Completion drawing
Sta.11+620


Completion drawing
Sta.15+520

LIST OF TABLES

Table 1.2.1 General Outline of Countermeasures 1-2
Table 1.3.1 Purpose and Quantity of Topographical Survey 1-3
Table 1.3.2 Quantity of Geological Survey 1-3
Table 1.3.3 Quantity of Monitoring by Equipment 1-3
Table 1.4.1 Project Category in the JICA Guidelines 1-6
Table 1.4.2 IEE defined by the JICA Guidelines 1-7
Table 1.4.3 Reviewed Items for the Environmental and Social Conditions 1-7
Table 1.4.4 Air Pollution Conditions in Nepal 1-7
Table 1.4.5 Water Quality Around Section IV of Sindhuli Road 1-8
Table 1.4.6 Average Household Wastes Generation and Composition (%) 1-9
Table 1.4.7 Traffic Noise in Banepa Along the Main Road (Arniko Highway) 1-9
Table 1.4.8 National Ambient Sound Quality Standard of Nepal (2012) and IFC Standard 1-10
Table 1.4.9 Precipitation Data in Sindhuli Gadhi 1-11
Table 1.4.10 Monthly Rainfall in Sindhuli Bazar 1-11
Table 1.4.11 Protected Areas of Nepal 1-11
Table 1.4.12 Endemic and Protected Species Around Sections II and III 1-12
Table 1.4.13 Flora and Fauna around Station 17 + 400 (2012) 1-12
Table 1.4.14 Major River Basins of Nepal 1-13
Table 1.4.15 Number of Lakes in Sindhuli District by Height (in 2009) 1-14
Table 1.4.16 Physiographical Regions of Nepal 1-14
Table 1.4.17 Physiographic Region of Sindhuli District 1-15
Table 1.4.18 Topographical and Geological Features of Section II and Section III 1-16
Table 1.4.19 Major Earthquakes in Nepal 1-16
Table 1.4.20 Population, Households and Population Density of Sindhuli District (2011) 1-17
Table 1.4.21 Population by Type of Usual Activity in Sindhuli District (2011) 1-18
Table 1.4.22 Distribution of Population by Religion in Sindhuli District (2011) 1-18
Table 1.4.23 Distribution of Population by Caste / Ethnicity of Sindhuli District (2011) 1-18
Table 1.4.24 New Local Public Body and Previous VDC along Sections II and III 1-19
Table 1.4.25 Land Use Pattern in Sindhuli District (area in Hectare) 1-24
Table 1.4.26 World Heritage Sites in Nepal 1-24
Table 1.4.27 Temples/Archaeological Site along Section II and III 1-24
Table 1.4.28 Constitution, Policy, Act and Regulation on Environmental Management 1-25
Table 1.4.29 Guidelines Which are Subject to Road Development Projects in Nepal 1-26
Table 1.4.30 Environmental Requirement and Approval in Road Sector 1-27
Table 1.4.31 Screening Criteria by Project Type 1-29
Table 1.4.32 Screening Criteria by Environmentally Sensitive Area 1-30
Table 1.4.33 EA Requirement for the Project 1-31
Table 1.4.34 IEE/EIA Reports on Sindhuli Road Projects Prepared/to be Prepared by DOR 1-31
Table 1.4.35 Proposed Work Schedule for Conducting IEE Study 1-32
Table 1.4.36 Draft Schedule of SHMs for Five Project Stations 1-32
Table 1.4.37 Summary of SHMs held by DOR Initiative 1-33
Table 1.4.38 Gap Between Nepal Environmental Management Systems and JICA Guidelines 1-34
Table 1.4.39 Outline of the Project Location (Station) and Damage 1-39

Table 1.4.40 Outline of the Countermeasure (Project Components) 1-39
Table 1.4.41 Alternative Comparison for the Project in Terms of Technical and Environmental Aspects... 1-41
Table 1.4.42 Scoping Results 1-43
Table 1.4.43 TOR for Environmental and Social Considerations Study 1-45
Table 1.4.44 Construction Period and Construction Equipment Input for Each Station 1-45
Table 1.4.45 Workers and Laborers Necessary for the Construction of Each Station 1-46
Table 1.4.46 Domestic Solid Waste 1-47
Table 1.4.47 Commercial Activities and Traffic Management on the Section 1-49
Table 1.4.48 HIV Estimates in Nepal (2016) 1-49
Table 1.4.49 Estimation of HIV Positive Workers in Each Station 1-49
Table 1.4.50 Summary of Phase 1 SHM for surrounding community of Sta.11+620&Sta.15+520 1-50
Table 1.4.51 Summary of Phase 2 SHM for surrounding community of Sta.11+620&Sta.15+520 1-51
Table 1.4.52 Summary of Phase 3 SHM for surrounding community of Sta.11+620&Sta.15+520 1-51
Table 1.4.53 Summary of Phase 3 SHM for surrounding community of Sta. 33+440&Sta.33+695 1-52
Table 1.4.54 Summary of Phase 2 SHM for surrounding community of Sta. 33+440&Sta.33+695 1-52
Table 1.4.55 Summary of Phase 3 SHM for surrounding community of Sta. 33+440&Sta.33+695 1-53
Table 1.4.56 Summary of Phase 1 SHM for surrounding community of Sta. 17+400 1-54
Table 1.4.57 Summary of Phase 2 SHM for surrounding community of Sta. 17+400 1-55
Table 1.4.58 Summary of Phase 3 SHM for surrounding community of Sta. 17+400 1-55
Table 1.4.59 Environmental and Social Impact Examination 1-56
Table 1.4.60 Countermeasures (Proposed EMP) 1-58
Table 1.4.61 Monitoring Plan (Draft) 1-61
Table 1.4.62 Basic Features of DOR's Grievance Redress Mechanism (GRM) 1-64
Table 2.1.1 General Outline of Countermeasures 2-2
Table 2.2.1 Target Sections of the Japanese Assistance 2-2
Table 2.2.2 Monthly Rainfall (From 2010 to 2016) 2-8
Table 2.2.3 Maintenance Budget for Sindhuli Road 2-12
Table 2.2.4 List of Adopted Standards 2-13
Table 2.2.5 Standard of Road Design 2-13
Table 2.2.6 Area of Construction Works 2-15
Table 2.2.7 Assumed Damage and Failure Mechanism 2-16
Table 2.2.8 Consideration Points for Countermeasure Planning 2-16
Table 2.2.9 Classification of Countermeasures against Slope Failure 2-17
Table 2.2.10 Applicability of Each Countermeasure to Sta.17+400 2-18
Table 2.2.11 Classification of Reinforcement Countermeasures for Retaining Wall 2-19
Table 2.2.12 Applicability of Each Countermeasures to Target Sites 2-19
Table 2.2.13 Countermeasure Comparative Analysis Chart for Sta.17+400 2-21
Table 2.2.14 Countermeasure Comparative Analysis Chart for Sta.15+200 (only for gabion wall) 2-22
Table 2.2.15 Countermeasure Comparative Analysis Chart for Sta.33+695 2-23
Table 2.2.16 Results of Stability Analysis for Upper Slope of Sta17+400 2-25
Table 2.2.17 Conditions for Ground Anchors Design 2-25
Table 2.2.18 Recommended Skin Frictional Resistance of Anchors 2-26
Table 2.2.19 Recommended Allowable Adhesive Stresses 2-27
Table 2.2.20 Allowable Bearing Capacity 2-27

Table 2.2.21 Selection of Bearing Plate....2-28
Table 2.2.22 Specifications of Designed Ground Anchors....2-28
Table 2.2.23 Results of Calculation of Earth Pressure during Earthquake....2-29
Table 2.2.24 Arranged Ground Anchors....2-29
Table 2.2.25 Arranged Ground Anchors....2-30
Table 2.2.26 Grade of Tendon....2-30
Table 2.2.27 Determined Skin Frictional Resistance of Anchors....2-30
Table 2.2.28 Comparison of Precast Bearing Plate....2-31
Table 2.2.29 Specifications of Designed Ground Anchors for Sta.33+440....2-31
Table 2.2.30 Specifications of Designed Ground Anchors for Sta.33+695....2-31
Table 2.2.31 Specifications of Designed Ground Anchors for Sta.11+620....2-32
Table 2.2.32 Specifications of Designed Ground Anchors for Sta.15+520....2-32
Table 2.2.33 Responsibilities of Each Countries....2-51
Table 2.2.34 List of Items for the Quality Control Plan....2-52
Table 2.2.35 Procurement Plan of Major Construction Materials....2-53
Table 2.2.36 Procurement Plan of Major Construction Equipment....2-54
Table 2.2.37 Tentative Implementation Schedule....2-55
Table 2.3.1 Estimated Initial Costs of Obligations of the Recipient Country....2-56
Table 2.4.1 Assumed Maintenance Method....2-57
Table 2.5.1 Initial Project Cost Undertaken by the Japanese Government....2-58
Table 2.5.2 O&M Costs for the Entire Sindhuli Road....2-58
Table 3.4.1 Base lines and Target....3-60

LIST OF FIGURES

Figure 1.3.1 Geological Cross Section of Sta.17+400....1-4
Figure 1.3.2 Geological Cross Section of Sta.11+600....1-4
Figure 1.3.3 Geological Cross Section of Sta.33+440....1-5
Figure 1.3.4 Geological Cross Section of Sta.33+695....1-5
Figure 1.3.5 Geological Cross Section of Sta.15+520....1-6
Figure 1.4.1 Spatial Distribution of Annual Average Temperature in Nepal....1-10
Figure 1.4.2 Spatial Distribution of Average Annual Precipitation....1-10
Figure 1.4.3 Average Temperature in Sindhuli Gadhi....1-11
Figure 1.4.4 Shake Map in Nepal....1-17
Figure 1.4.5 Active Faults in Nepal....1-17
Figure 1.4.6 Present Conditions Around Station 15+520 (Section III)....1-21
Figure 1.4.7 Present Conditions Around Station 11+620 (Section III)....1-21
Figure 1.4.8 Present Conditions Around Station 33+695 (Section III)....1-22
Figure 1.4.9 Present Conditions Around Station 33+440 (Section III)....1-23
Figure 1.4.10 Station 17 +400 and the Surroundings (Section II)....1-24
Figure 1.4.11 Remains of Sindhuli Gadhi....1-25
Figure 1.4.12 Operational Structure of GESU....1-26
Figure 1.4.13 Approval Process of Environment Assessment Report in Nepal....1-28
Figure 1.4.14 Project Area Map....1-38
Figure 1.4.15 Project Station Map....1-39

Figure 1.4.16 GESU Administrative Structure....1-64
Figure 2.2.1 Location Map of the Target Sites....2-3
Figure 2.2.2 Site Investigation Map of Sta. 17+400....2-4
Figure 2.2.3 Geological Cross Section of Sta. 17+400....2-5
Figure 2.2.4 Site Investigation Map of Sta. 33+440....2-5
Figure 2.2.5 Site Investigation Map of Sta. 33+695....2-6
Figure 2.2.6 Site Investigation Map of Sta. 11+620....2-6
Figure 2.2.7 Site Investigation Map of Sta. 15+520....2-7
Figure 2.2.8 Average Monthly Rainfall....2-8
Figure 2.2.9 Annual Rainfall....2-8
Figure 2.2.10 Average Temperature in Sindhuli Gadhi....2-9
Figure 2.2.11 Distribution of Earthquakes in the World....2-10
Figure 2.2.12 Seismic Intensity Distribution Map in the Gorkha Earthquake....2-10
Figure 2.2.13 Estimated Maximum Acceleration Contour of the Gorkha Earthquake by USGS and Point of Consideration....2-11
Figure 2.2.14 Flow Chart for Selection of Countermeasures....2-18
Figure 2.2.15 Flow Chart for Selection of Middle and Lower Parts of the Sta. 17+400 Slope....2-24
Figure 2.2.16 Calculus Method of Ground Anchors....2-26
Figure 2.2.17 Functional Description of an Anchor....2-26
Figure 2.2.18 Plan of Slope Protection Works of Sta.17+400 (Non-Scale)....2-34
Figure 2.2.19 General Cross Section of Sta.17+400 (Non-Scale)....2-35
Figure 2.2.20 Plan of Slope Protection Works of Sta.33+440 (Non-Scale)....2-36
Figure 2.2.21 General Cross Section of Sta.33+440 (Non-Scale)....2-37
Figure 2.2.22 Elevation View for Anchor Plates of Sta.33+440 (Non-Scale)....2-38
Figure 2.2.23 Plan of Slope Protection Works of Sta.33+695 (Non-Scale)....2-39
Figure 2.2.24 General Cross Section of Sta.33+695 (Non-Scale)....2-40
Figure 2.2.25 Elevation View for Anchor Plates of Sta.33+695 (Non-Scale)....2-41
Figure 2.2.26 Plan of Slope Protection Works of Sta.11+620 (Non-Scale)....2-42
Figure 2.2.27 General Cross Section of Sta.11+620 (Non-Scale)....2-43
Figure 2.2.28 Elevation View for Anchor Plates of Sta.11+620 (Non-Scale)....2-44
Figure 2.2.29 Plan of Slope Protection Works of Sta.15+520 (Non-Scale)....2-45
Figure 2.2.30 General Cross Section of Sta.15+520 (Non-Scale)....2-46
Figure 2.2.31 Elevation View for Anchor Plates of Sta.15+520 (Non-Scale)....2-47
Figure 2.2.32 Construction Process....2-49

TABLE OF ABBREVIATIONS

ADB	The Asian Development Bank
A/P	Authorization to Pay
ARMP	Annual Road Maintenance Plan
B/A	Banking Arrangement
O/D	Outline Design
DDC	District Development Committee
DFID	Department for International Development
DHM	Department of Hydrology and Meteorology
DOR	Department of Roads
EIA	Environmental Impact Assessment
E/N	Exchange of Notes
EPA	Environmental Protection Act
EPR	Environmental Protection Rules
Fs	Safety Factor
G/A	Grant Agreement
GESU	Geo-Environment and Social Unit
GOJ	Government of Japan
GTZ	German Technical Cooperation
H01～H06	National Highway
IEE	Initial Environmental Examination
IUCN	International Union for Conservation of Nature and Natural Resources
JICA	Japan International Cooperation Agency
JIS	Japanese Industrial Standards
m	meter
m^2	square meter
m^3/s	Cubic meter per second
MBT	Main Boundary Fault
MoD	Minute of Discussion
MOPIT	Ministry of Physical Infrastructure and Transport
NRs	Nepal Rupee
PAPs	Project Affected Peoples
ROW	Right of Way
SDC	Swiss Agency for Development and Cooperation
SHMs	Stake holder meeting
SMDP	Strengthened Maintenance Division Program
SPAPs	Special Project Affected Persons
Sta.	Station
SRN	Strategic Road Network
ToR	Terms of Reference
USD	American Doller
VDC	Village Development Committee

CHAPTER 1 BACKGROUND OF THE PROJECT

1.1 BACKGROUD OF THE PROJECT

The Sindhuli Road (National Highway No.6) is one of the most important roads in Nepal that link Kathmandu City, the capital of the country, with Terai Plain area in the south. The construction of the Sindhuli Road, with a total length of 160 km, started with the Japanese grant aid in the 1996 and was completed in March 2015.

Although the Project was completed successfully in March 2015, the Sindhuli Road got damaged in more than 24 places by a major earthquake on 25 April 2015 as well as a major aftershock on 12 May 2015 in Nepal. The damage caused by the earthquake were restored immediately by the enforcement of "urgent recovery work" of Pilot Project 2 under the Japan International Cooperation Agency (JICA). Technical Assistant Program and the road became drivable. However, the urgent recovery work was done only as temporary work aiming at opening the traffic but not total recovery of the Sindhuli Road.

Since the Sindhuli Road may not bear a future aftershock, the traffic on Sindhuli Road may be stopped for the long term unless an appropriate permanent measure that resists an earthquake is taken timely. In order to maintain the sustainability of the Sindhuli Road, the early enforcement of the permanent countermeasure against an earthquake is essential.

Without proper countermeasure, the said damages caused by the earthquake may induce more severe problems. Thus, the Government of Nepal (GON) officially requested to conduct the Sindhuli Road earthquake rehabilitation to the Government of Japan (GOJ).

Considering the above situation, GOJ decided to conduct the "Preparatory Survey for the Project for the Sindhuli Road Earthquake Rehabilitation."

1.2 OUTLINE OF THE PROJECT

1.2.1 PURPOSE OF THE SURVEY AND OVERALL GOAL

The general objective of the Preparatory Survey for the Project for the Sindhuli Road Earthquake Rehabilitation (hereinafter referred to as "the Project") is to prepare a plan for the construction of countermeasures against damage sites due to 2015 earthquake. The following studies were carried out:

1. Risk assessment for Sindhuli Road (160km) and detailed investigation for the 24 proposed sites.
2. Priority for the countermeasure, which will be evaluated for Japanese grant aid.
3. Verification on the technical effectiveness and economical validity of implementing the countermeasures.
4. The design of reasonable permanent countermeasures to prevent disaster occurrences that will affect sustainable and safe traffic at target sites.
5. Planning of the countermeasure construction project and introducing advanced construction technology considering the socio-environmental aspects, technical capacity of the construction industry in Nepal, and the implementation capability of the Nepalese government.
6. Estimation of project costs.
7. Preliminary environmental and social consideration studies on project implementation.
8. Recommendations on key considerations on project implementation and road maintenance.
9. Proposal of the undertaking of the Nepalese government in the Project.

The overall goal of the survey is to secure sustainable and safe traffic along Sindhuli Road through the construction of countermeasures, which will formulate in the preparatory study.

1.2.2 OUTLINE OF THE PROPOSED COUNTERMEASURES

Considering topographical and geological conditions, failure mechanisms, and road alignment situations of each site, permanent countermeasures were planned and designed through the introduction of advanced technology that can sufficiently protect the target sections for a long period. The outline of the proposed countermeasures for each site is shown in **Table 1.2.1**.

Detailed description on the design of countermeasures and plan of the Project are described in CHAPTER 2-2 CONTENTS OF THE PROJECT

Table 1.2.1 General Outline of Countermeasures

Site	Countermeasure	Quantity
Sta.17+400 Section II	Ground anchors	Ground anchor, 158 pieces
	Crib works F500	A=1,270 m^2, Shotcrete in the frame A= 860 m^2
	Crib works F300	A=1,060 m^2, Shotcrete in the frame A= 710 m^2
	Rock bolts	L=3 m/each, 300 pieces
	Excavation works	V=370 m^3
	High intensity net	High intensity net, A=2,800 m^2 Rock bolts, L=3 m/each, 1,240 pieces
	Vegetation works	Vegetation bags, 4,140 pieces
	Gabion check dams	V=350 m^3
	Asphalt pavements	A=420 m^2
Sta.33+440 Section II	Ground anchors	Ground anchor 32 pieces
	Anchor plates	32 nos.
	H beam installation	Shotcrete A=160 m^2, H beams 32 pieces, Concrete V=25 m^3
	Restoration of side ditch	L=43 m
	Asphalt pavements	A=200 m^2
Sta.33+695 Section II	Ground anchors	Ground anchor 18 pieces
	Anchor plates	18 nos.
	H beam installation	Shotcrete A=95 m^2, H beams 18 pieces, Concrete V=19 m^3
	Restoration of side ditch	L=45 m
	Asphalt pavements	A=150 m^2
Sta.11+620 Section III	Ground anchors	Ground anchor 20 pieces
	Anchor plates	20 nos.
	H beam installation	Shotcrete A=90 m^2, H beams 10 pieces, Concrete V=10 m^3
	Side ditch	L=12 m
Sta.15+520 Section III	Ground anchors	Ground anchor, 40 pieces
	Anchor plates	40 nos.
	H beam installation	Shotcrete A=250 m^2, H beams 40 pieces, Concrete V=50 m^3
	High intensity net	High intensity net, A=2,500 m^2 Rock bolts, L=3 m/each, 1,100 pieces
	Asphalt pavements	A=210 m^2

Source: JICA Survey Team

1.3 RESULT OF FIELD SURVEY

1.3.1 TOPOGRAPHICAL SURVEY

The plan and cross section survey were conducted. The purpose and quantity of the survey are as shown in **Table 1.3.1**.

Table 1.3.1 Purpose and Quantity of Topographical Survey

Items	Unit	Sta.					Purpose
		Section II			Section III		
		17+400	33+440	33+695	11+620	15+520	
Plan (Scale 1/500)	km^2	0.022	-	-	-	-	- Understanding of planar figure of slope failure - Outline design
Cross section	m	2,142	320	480	790	560	- Understanding of road cross section - Outline design

Source: JICA Survey Team

1.3.2 GEOLOGICAL SURVEY

The drilling survey and standard penetration test were conducted at Sta.17+400 of Section II and Sta.11+600 of Section III. **Figure 1.3.1** and **Figure 1.3.2** show the geological cross section near the road for Sta.17+400 and Sta.11+620. The boring logs are provided in the APPENDIX 5.1. The survey was not allowed at the other sites because of the steep slope condition. The geological condition of the sites was determined by the results of site reconnaissance's and existing photos during road construction.

Table 1.3.2 Quantity of Geological Survey

Items	Unit	Sta.17+400	Sta.11+620
Drilling Survey	m	20 (1 hole)	10 (1 hole)
Standard Penetration Test	time	20	10
Installation of Pipe Strain Gauge	m	20	-
Installation of PVC pipes for Groundwater Level	m	-	10

Source: JICA Survey Team

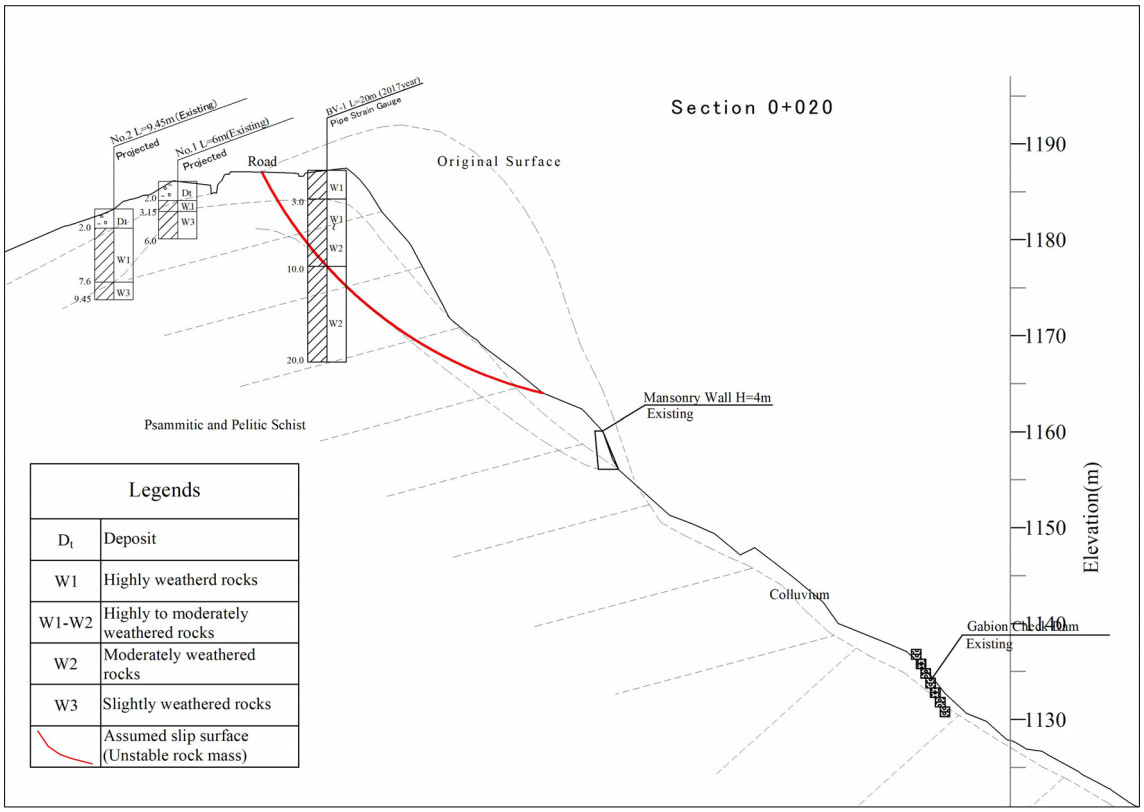
1.3.3 MONITORING BY EQUIPMENTS

The monitoring by equipment was conducted as following table. The results of the monitoring are provided in the APPENDIX 5.1.

Table 1.3.3 Quantity of Monitoring by Equipment

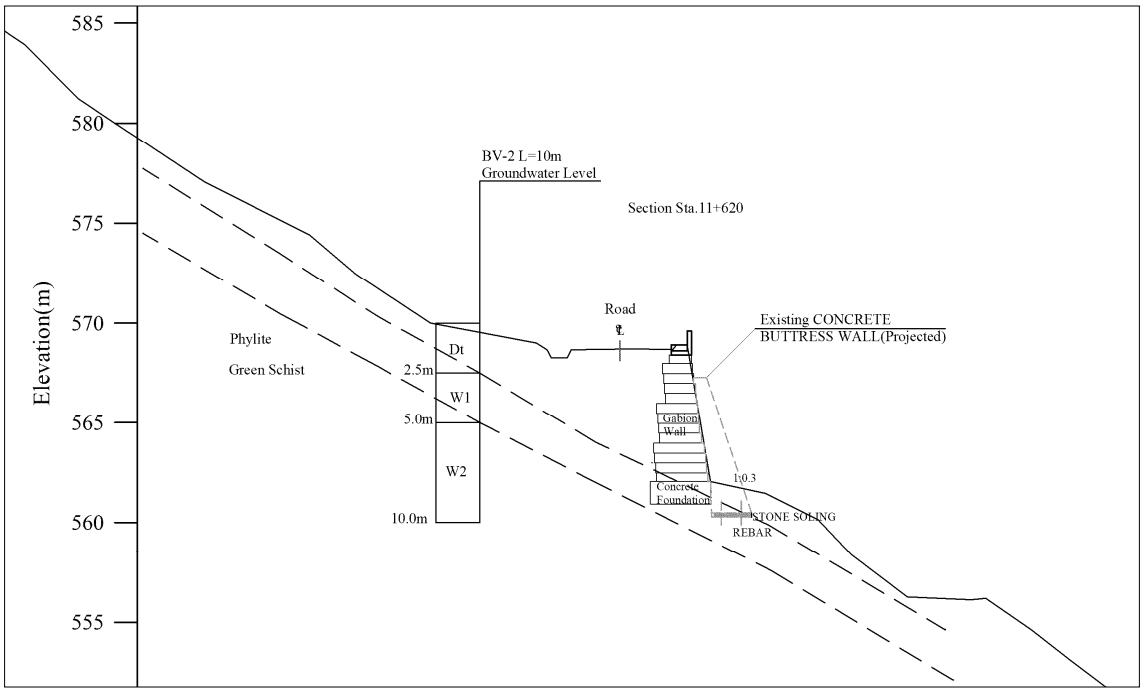
Items	Quantity
Pipe strain gauge	BV-1 at Sta.17+400
Groundwater level	BV-1 at Sta.17+400 and BV-2 at Sta.11+620
Fixed points survey	70 m at Sta.15+520 and 60 m at Sta.11+620

Source: JICA Survey Team



Source: JICA Survey Team

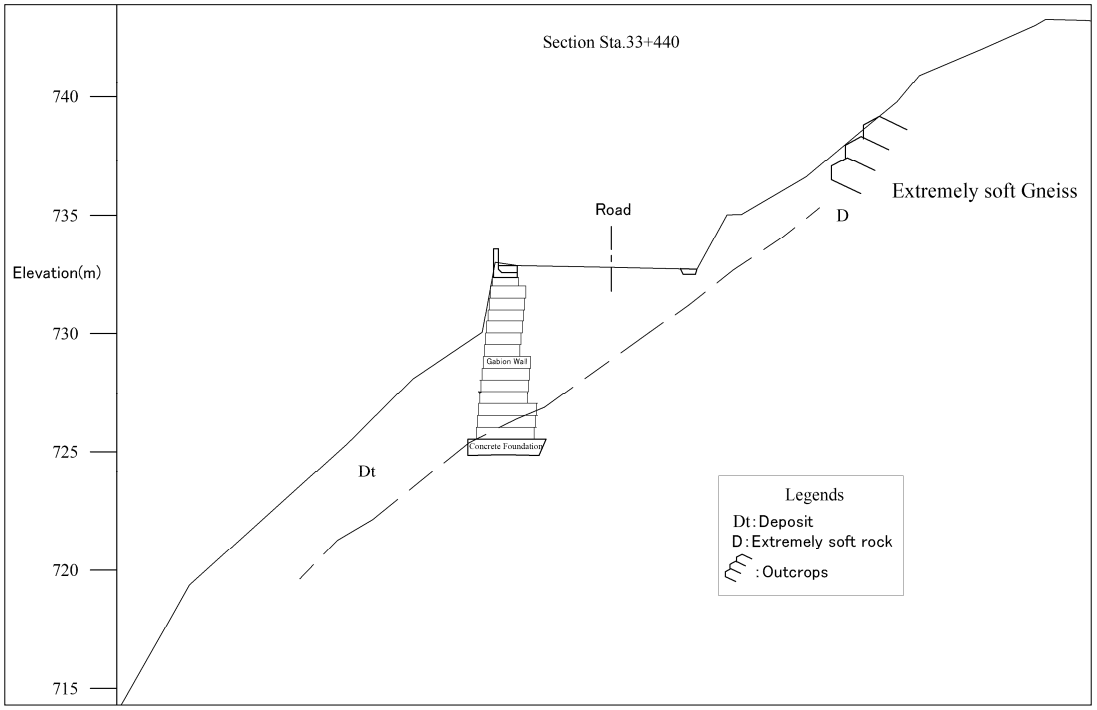
Figure 1.3.1 Geological Cross Section of Sta.17+400



Source: JICA Survey Team

Figure 1.3.2 Geological Cross Section of Sta.11+600

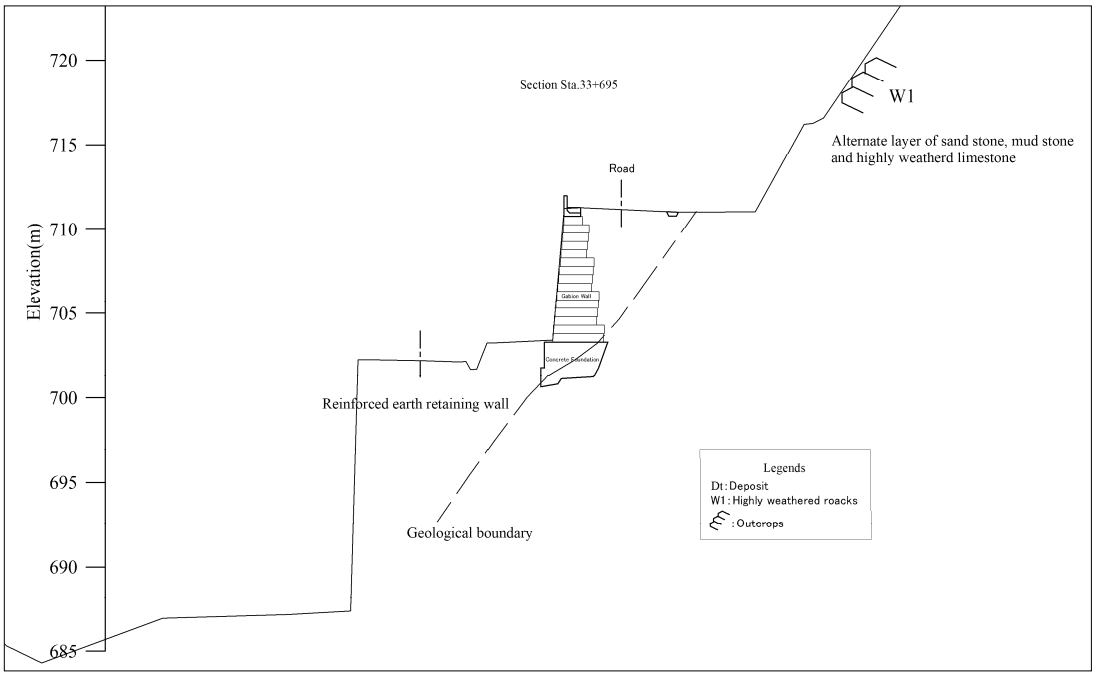
Geological cross section of Sta.33+440 was assumed from the distribution of extremely weathered outcrops of gneiss at the upper of target section and past construction photos of gabion wall foundation.



Source: JICA Survey Team

Figure 1.3.3 Geological Cross Section of Sta.33+440

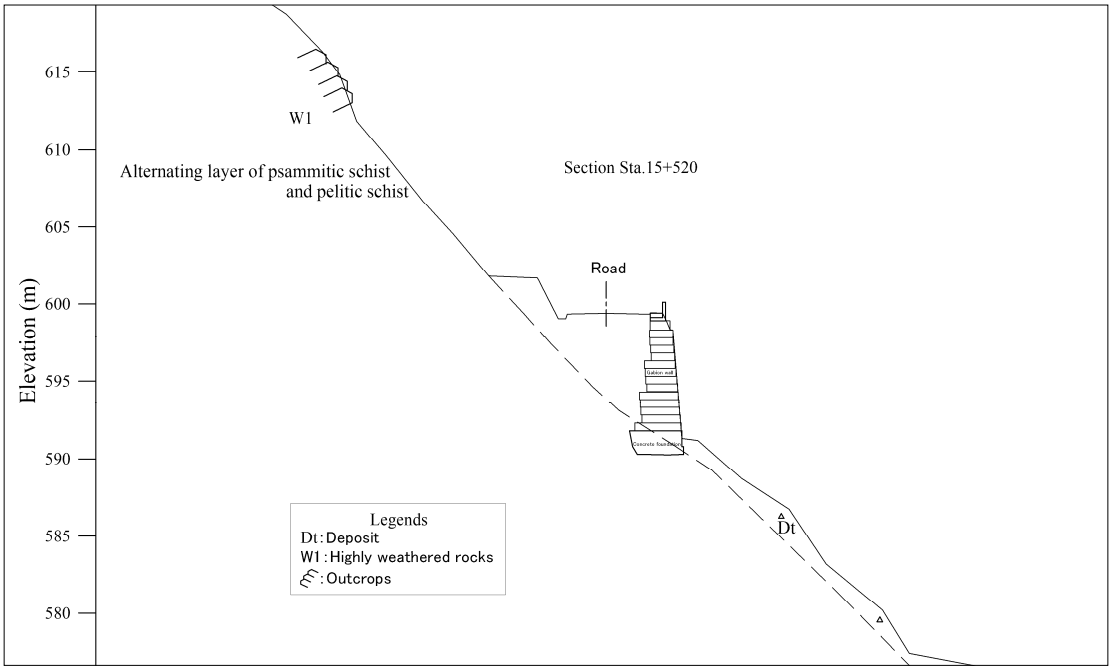
Geological cross section of Sta.33+695 was assumed from the distribution of highly weathered outcrops of an alternate layer of sand stone and mud stone at the upper of target section and the photos.



Source: JICA Survey Team

Figure 1.3.4 Geological Cross Section of Sta.33+695

Geological cross section of Sta.15+520 was assumed from the distribution of highly weathered outcrops of an alternate layer of psammitic and pelitic shist at the upper of target section and the photos.



Source: JICA Survey Team

Figure 1.3.5 Geological Cross Section of Sta.15+520

1.4 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

1.4.1 PURPOSES OF THE CONSIDERATIONS

With regard to environmental and social considerations, any project to be financed by the JICA assistance is required to comply with the JICA Guidelines for Environmental and Social Considerations (April 2010) (hereinafter referred to as "the JICA Guidelines") in addition to any existing laws and regulations in the recipient country. The environmental and social considerations in the Survey are to examine if the Project complies or will comply with all the Japanese and Nepal requirements. Furthermore, if any deficiency is found, the JICA Survey Team will support the executing agency of the project in compliance with the entire requirements of the JICA Guidelines by proposing relevant actions to be taken by the executing agency.

1.4.2 GENERAL REQUIREMENT OF THE JICA GUIDELINES

(1) Project Category by the JICA Guidelines

The requirement of the JICA Guidelines are dependent on "project categorization" of projects, which is stipulated in the JICA Guidelines as shown in **Table 1.4.1**. Currently, the Project for the Sindhuli Road Earthquake Rehabilitation (the Project) has been classified as "Category B" by JICA. However, if the Project is likely to have any significant adverse impacts on the environment and society in the Survey, the Project may be recategorized as "Category A".

Table 1.4.1 Project Category in the JICA Guidelines

Category	Description
A	Proposed projects are classified as "Category A" if they are likely to have significant adverse impacts on the environment and society. Projects with complicated or unprecedented impacts that are difficult to assess, or projects with a wide range of impacts or irreversible impacts, are also classified as "Category A". These impacts may affect an area broader than the sites or facilities subject to physical construction. "Category A", in principle, includes projects in sensitive sectors, projects that have characteristics that are liable to cause adverse environmental impacts, and projects located in or near sensitive areas.
B	Proposed projects are classified as "Category B" if their potential adverse impacts on the environment and society are less adverse than those of "Category A" projects. Generally, they are

	site-specific; few if any are irreversible; and in most cases, normal mitigation measures can be designed more readily.
C	Proposed projects are classified as "Category C" if they are likely to have minimal or little adverse impact on the environment and society.

Source: JICA Guidelines for Environmental and Social Considerations (April 2010)

(2) Required Study for "Category B" Project

For a project classified in "Category B" by the JICA Guidelines, an "Initial Environmental Examination (IEE) level study" is required as shown in **Table 1.4.2**.

Table 1.4.2 IEE defined by the JICA Guidelines

Item	Definition
IEE	The Initial Environmental Examination (IEE) level study includes an analysis of alternative plans, a prediction and assessment of environmental impacts, and a preparation of mitigation measures and monitoring plans based on easily available information including existing data and simple field surveys.

Source: JICA Guidelines for Environmental and Social Considerations (April 2010)

1.4.3 ENVIRONMENTAL AND SOCIAL CONDITIONS RELEVANT TO THE PROJECT

To have a basic understanding on the present environmental and social conditions in and around the project sites of the 24 damaged areas, as well as, Nepal as a whole, the JICA Survey Team reviewed the reports on the Project for Sindhuli Road Construction (from Sections II to IV), and Project for Countermeasure Construction for the Landslide on Sindhuli Road (Section II), EIA reports (Sections II and III), IEE report (the Landslide on Sindhuli Road (Section II)), and other relevant documents as well as conducted site reconnaissance.

Based on the JICA Guidelines, **Table 1.4.3** shows a list of the review items for environmental and social conditions, which are summarized below.

Table 1.4.3 Reviewed Items for the Environmental and Social Conditions

Category	Items Reviewed	
Pollution	(1) Air Pollution	(3) Waste
	(2) Water Pollution	(4) Noise
Natural Conditions	(1) Climate	(4) Hydrology
	(2) Protected Areas	(5) Topography and Geology
	(3) Ecosystem	(6) Earthquake
Social Conditions	(1) Demographic Situation and Community	(3) Archaeological and Cultural site
	(2) Land Use	-

Source: JICA Survey Team

1.4.3.1 GENERAL REQUIREMENT OF THE JICA GUIDELINES

(1) Air Pollution

With regard to the ambient air quality conditions, other than Kathmandu, limited data are available in Nepal. Therefore, by using available data, the air pollutions in Nepal can be summarized as shown in **Table 1.4.4**.

Table 1.4.4 Air Pollution Conditions in Nepal

Monitoring Location			TSP	PM_{10}	SO_2	NO_2
Province	Description	Location	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
No.3	Sindhuli Road Section IV	Kavre Bhanjang	167.0	48.3	< 25	< 15
No.3	Sindhuli Road Section IV	Bhakunde Beshi	66.0	40.0	< 25	< 15
No.4	Capital City of the Province	Pokhara	874.4	839.9	98.23	11.34
No.2	Largest City in the Province	Birgunj	705.86	664.5	85.13	23.20
No.1	Capital City of the Province	Biratnagar	723.06	661.46	55.08	19.53
No.2	Capital City of the Province	Janakpur*	1,406.1	1,298.06	71.7	20.3
No.3	SASEC Road Starting Point	Nayanghat**	658.5	572.93	81.02	17.61
No.5	SASEC Road Ending Point	Butwal*	1,158.83	1,066.89	133.1	23.96
No.5	Capital City of the Province	Bhairahawa***	840.76	776.59	106.8	22.68
No.5	Main City of Banke District	Nepalgunji	1,529.21	1,448.20	68.19	16.41
No.7	Western edge of Nepal	Mahendra Nagar	736.25	687.5	59.66	19.84

WHO Guidelines	150-230	70	100-150	100
NAAQS	230	120	70	80
* Capital City of Each Province, ** Part of Bharatpur of Capital City of the Province, *** Former name of "Siddharthanagar"				
SASEC: South Asia Sub-regional Economic Cooperation Road Improvement Project, ADB NAAQS: National Ambient Air Quality Standards for Nepal				

Source:
Data of Sindhuli Road Section IV:
-Updated Report on EIA Study of Nepalthok – Khurkot Section of Banepa- Sindhuli-Bardibas Road Project, Jun. 2008 DOR
Data of Other Locations:
- Country Synthesis Report on Urban Air Quality Management, Nepal Discussion Draft, Dec. 2006 ADB
- EIA (Draft) NEP: SASEC Roads Improvement Project, Jun 2016 DOR, MoPIT, for ADB

- The air pollution monitoring in Section IV of Sindhuli Road was conducted for three years after the start of Section IV operation of vehicular traffic (See data in the first line and second line from above of Table 1.4.4). The project is located at Section II and Section III of Sindhuli Road, however, air pollution data on these sections have not been confirmed in the Survey.
- Even though those data of Section IV are a decade ago, the data can be referred as baseline in consideration of the facts that increase in the numbers of new vehicles passing through the road is thinkable at present, traffic volumes in Section II and III are low compared to the volume in Section IV and are located in mountainous areas.
- Based on Table 1.4.4, it is evaluated that air quality in Section IV in the operation phase were under NAAQS (National Ambient Air Quality Standards). On the other hand, reasons for data at other locations which show higher values than NAAQS can be considered that the monitoring locations were local principal towns such as provincial capital, and therefore traffic volumes in the locations were high.
- Generally, in the rainy season, rainfall lowers the concentration of dust, so the concentration tends to improve in the rainy season.
- Data of South Asia Sub-Regional Economic Cooperation (SASEC) Road starting and ending points can be referred as baseline for road related projects in rural areas of Nepal (See data in other than the first line and second line from above of Table 1.4.4).

(2) Water Pollution

Table 1.4.5 shows the water qualities of the Sunkoshi River (two samples) and its tributaries (seven samples) and a spring source (one sample) along Section IV of Sindhuli Road. Two among five stations of the project are located on right bank of Sunkoshi River.

Table 1.4.5 Water Quality Around Section IV of Sindhuli Road

Sampling Position No.	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	WHO
1. Physical Parameter											
pH	8.3	8.4	8.5	8	8.5	8.2	8.3	8.3	8.1	8.3	6.5-8.5
Turbidity (NTU)	200	4	3	5	6	>461	>461	>461	314	>461	5
EC (μS/cm)	93	308	325	163	290	162	194	262	82	194	
2. Chemical Parameter											
T Alkalinity (mg/l as $CaCO_3$)	44	155	158	94	151	86	103	138	39	93	500
Bicarbonate (mg/l as HCO_3)	53	189	189	115	180	105	125	168	47	113	
CO_3 (mg/l)	Nil	Nil	4	Nil	4	Nil	Nil	Nil	Nil	Nil	
OH (mg/l)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	
Cl (mg/l)	1.1	3.3	4.3	2.2	4.3	1.1	2.2	4.3	2.2	3.3	250
T-P (mg/l as PO_4)	0.02	0.04	<0.01	<0.01	<0.01	0.18	0.16	0.4	0.06	0.05	
Ammonia (mg/l as N)	0.1	<0.01	<0.01	<0.01	<0.01	>0.01	0.03	0.2	0.3	0.1	1.5
T Hardness (mg/l as $CaCO_3$)	52	158	191	90	149	81	100	130	40	100	
Ca (mg/l)	14	45	50	13	45	26	30	3	11	32	
Mg (mg/l)	4	11	16	14	9	4	6	11	3	5	
Noncarbonate Hardness (mg/l as $CaCO_3$)	8	3	33	Nil	Nil	Nil	Nil	Nil	1	7	
Fe (mg/l)	0.08	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	<0.01	0.3
Mn (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.5
R1: Sunkoshi River, Khalte, sampled on 28 July 2005, R2: Nigule Khola, sampled on 28 July 2005, R3: Chainpur Khola, sampled on 28 July 2005, R4: Ghate Kuwa, Trikoni Ban, sampled on 28 July 2005, R5:Bhote Khola, sampled on 28 July 2005, R6: Gangate Khola, sampled on 29 July 2005, R7: Dhamile Khola, sampled on 29 July 2005, R8: Sadhi Khola sampled on 29 July 2005, R9: Sunkoshi, Gajulidaha sampled on 29 July 2005, R10:Gangate Khola, sampled on 29 July 2005											

Source: Updated Report on EIA Study of Nepalthok – Khurkot Sectio of Banepa- Sindhuli-Bardibas Road Project, Jun. 2008 DOR

- Some of the turbidity data in Table 1.4.5 show higher values than the WHO standard. It is considered that the river water containing deposited sand from the upstream during the rainy season in June and July may have influenced the turbidity due to the differences in river structure and flow rate. Namely the surrounding geology is weak against erosion, so the turbidity tents to be high at the time of rain. In the dry season there is no rain, so the turbidity tends to be low.
- Water quality of Sunkoshi river, several positions of which turbidity values exceeded the WHO standards as mentioned above, is considered to have no particular problem as far as the other parameters (hardness, chlorine, etc.) in the table are concerned.

(3) Waste

Table 1.4.6 shows the data on solid waste generation/household and its compositions per municipalities in ecological regions of Nepal. Since the Sindhuli Road Construction Project has not implemented a monitoring on waste, observational data on waste in the ecological regions is referred as baseline as shown in below.

- More than half of the solid waste is organic waste.
- According to "Population of 753 Local Unit, Central Bureau of Statistics of Nepal", the number of family member in one household of Sindhuli District is around five persons/household (=296,192 people/57,581 households), so that daily generation of solid waste in Sindhuli District (as hill municipality) is about 0.14 kg/person.

Table 1.4.6 Average Household Wastes Generation and Composition (%)

Parameter		Ecological Regions		
		Mountain Municipality	Hill Municipality	Terai Municipality
Average daily waste generation (kg/household)		0.49	0.72	0.88
Composition (%)	Organic waste	51	65	69
	Plastics	11	13	10
	Paper and paper products	11	9	9
	Glass	3	4	2
	Metals	3	2	2
	Textiles	4	3	2
	Rubber and leather	1	1	1
	Others	16	3	6
Original Data Source: Solid Waste Management in Nepal, Current Status and Policy Recommendations, 2013 ADB				

Source: Compendium of Environment Statistics Nepal 2015, Jan. 2016, Central Bureau of Statistics, NPCS

(4) Noise

Traffic noise levels in Banepa located on the Kathmandu side at about 5 km before Dhulikhel, bifurcation town between Arniko Highway and Sindhuli Road (Banepa-Sindhuli-Bardibas Road), are shown in **Table 1.4.7**. Arniko Highway has traffic volume of about 10,000 orders and has a traffic volume of 3 to 4 times compared to the project stations on Sindhuli Road. In addition, the population in Banepa is also grately lager than that along each station. Therefor it is considered that higher noise values than that of Sindhuli Road were observed in Banepal.

Table 1.4.7 Traffic Noise in Banepa Along the Main Road (Arniko Highway)

Location	N	Sound Pressure Levels (dB (A))	
		Min	Max
Bus Park, Entry Point of Main (Ward 10)	12	68.0	110.2
Central Junction (Tribhuwan Chowk)	18	65.5	107.2
In front of Banepa Bit	12	61.2	102.5
Pulbazzar (Chowki Area)	12	63.2	101.3
Tindobato (Bajaj Showroom)	12	62.2	99.9
Pubazzar (Pragati Prawat High School)	9	60.1	99.4
Exit Point of Main Bus Park (Ward 6)	12	60.5	99.3
Bus Stop (Chardobato)	15	67.3	98.6
Rainbow Photo Studio	12	67.7	98.3
Ganesh Bazzar	12	62.1	95.0
Note: N = number of observations, Original Data Source: Murthy et al. (2007)			

Source: Profile on Environmental and Social Considerations in Nepal, January 2013 JICA

With regard to noise level standards, the National Ambient Sound Quality Standard of Nepal 2012 (NASQS) and Noise Standards of IFC are summarized in **Table 1.4.8**. The data shown in **Table 1.4.8** seems to be equivalent to the "Commercial" area. However, it is considered that reasons for noise levels which shown higher values than the standard is that Banana is a densely populated and heavy

traffic volume area. In general, it is considered that there is no difference with regard to noise levels along roads between rainy season and dry season.

Table 1.4.8 National Ambient Sound Quality Standard of Nepal (2012) and IFC Standard

Nepal (NASQS) 2012			IFC		
Area	Sound limit Leq (dBA)		Receptor	One Hour LAeq (dBA)	
	Daytime	Nighttime		Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Industrial	75	70	Industrial, commercial	70	70
Commercial	65	55			
Rural Residential	45	40	Residential, institutional, educational	55	45
Urban Residential	55	50			
Mixed Residential	63	55			
Peace Area	50	40	-	-	-
Household Appliance	Optimum limit (dBA)		-		
Water Pump	65				
Diesel Generator	90				
Entertainment Goods	70				

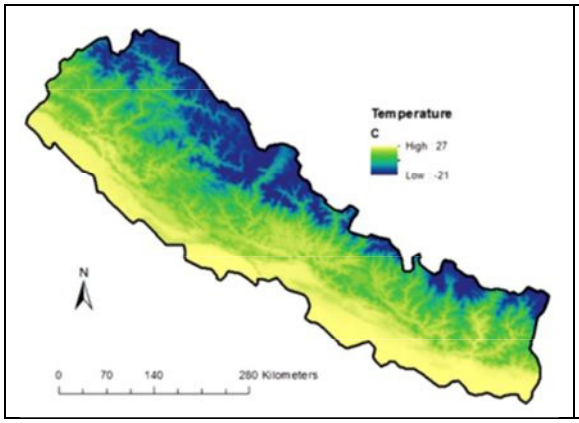
Source: - Environmental Statistics of Nepal 2013 Central Bureau of Statistics (CBS), NPCS, GoN, - Environmental, Health, and Safety (EHS) Guidelines GENERAL EHS GUIDELINES: ENVIRONMENTAL NOISE MANAGEMENT 2007 IFC

1.4.3.2 NATURAL CONDITIONS

(1) Climate

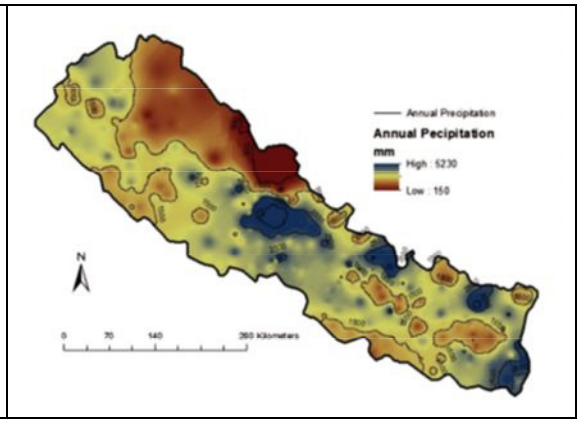
The Compendium of Environment Statistics Nepal 2015, CBS summarizes the climate of Nepal as follows (See **Figure 1.4.1** and **Figure 1.4.2)**.

- Based on the Koppen climatic classification, 70 % of Nepal lies in the humid subtropical region with distinctly dry winter, temperature of the warmest month exceeds 22 ℃ (Sharma, 2014).
- Dry winter with cool summer (temperature below 22 ℃) dominates in 10% of Nepal occupied by mountainous region.
- Elevation between 4,000 m and 6,000 m, which is about 19% of the area in Nepal experiences polar type of climate, frost, and snow covering the remaining area (9%) above 6,000 m.



Source: Compendium of Environment Statistics Nepal 2015

Figure 1.4.1 Spatial Distribution of Annual Average Temperature in Nepal

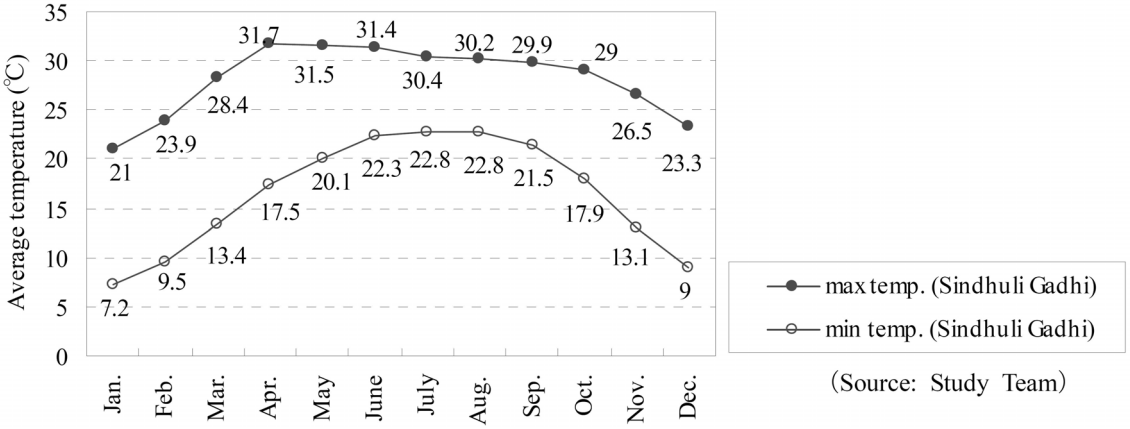


Source: Compendium of Environment Statistics Nepal 2015

Figure 1.4.2 Spatial Distribution of Average Annual Precipitation

The following figure and tables show the climate data (temperature and rainfall) at Meteorological Weather Station of Sindhuli Gadhi and Sindhuli Bazar.

With regard to precipitation, two different data sources (**Table 1.4.9** and **Table 1.4.10**) were used as baseline to comprehend trends of rainfall on approximately annual, monthly, and seasons around the project location. In addition, these two data sources are listed together so that they can be referred to as mutually complementary because some data are missing. The Meteorological Weather Stations are located in about 4 km in straight distance.



Source: Preparatory Survey Report on the Project for Countermeasure Construction for the Landslides on Sindhuli Road (Section II), March 2012, JICA

Figure 1.4.3 Average Temperature in Sindhuli Gadhi

Table 1.4.9 Precipitation Data in Sindhuli Gadhi

Precipitation	1971 -2000	Annual	Monsoon	Winter	Pre-Monsoon	Post-Monsoon
	mm	2,827.2	2,232.2	50.7	368.8	175.6

Annual Rainfall	Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
	mm	2,787	2,919	2,617	NA	NA	NA	1,711	1,279	1,543	NA	2,263	1,822

Source: Environmental Statistics of Nepal 2013 Central Bureau of Statistics (CBS), NPCS, GoN,

Table 1.4.10 Monthly Rainfall in Sindhuli Bazar

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2003						197.5	457.5	291.0	328.5	44.5	0.0	0.0	
2004	0.0	0.0	0.0	36.0	105.5	207.5	764.0	216.5	264.0	129.5	0.0	0.0	1,723.0
2005	0.0	0.0	0.0	0.0	56.0	86.5	362.5	746.0	239.5	142.0	0.0	0.0	1,632.5
2006	0.0	0.0	0.0	0.0	323.5	556.5	281.5	243.0	534.5	26.5	0.0	0.0	1,965.5
2007	0.0	0.0	0.0	59.5	190.5	546.0	796.0	465.0	540.0	217.5	0.0	0.0	2,814.5
2008	0.0	0.0	0.0	14.0	205.0	554.5	540.5	475.0	339.5	138.0	0.0	0.0	2,266.5
2009	0.0	0.0	0.0	15.0	120.0	87.0	352.5	295.5			0.0	0.0	
2010	0.0	0.0	0.0			15.5	439.5	478.0	377.0	74.5	0.0	0.0	
Average	0.0	0.0	0.0	20.8	166.8	281.4	499.3	401.3	374.7	110.4	0.0	0.0	2,080.4

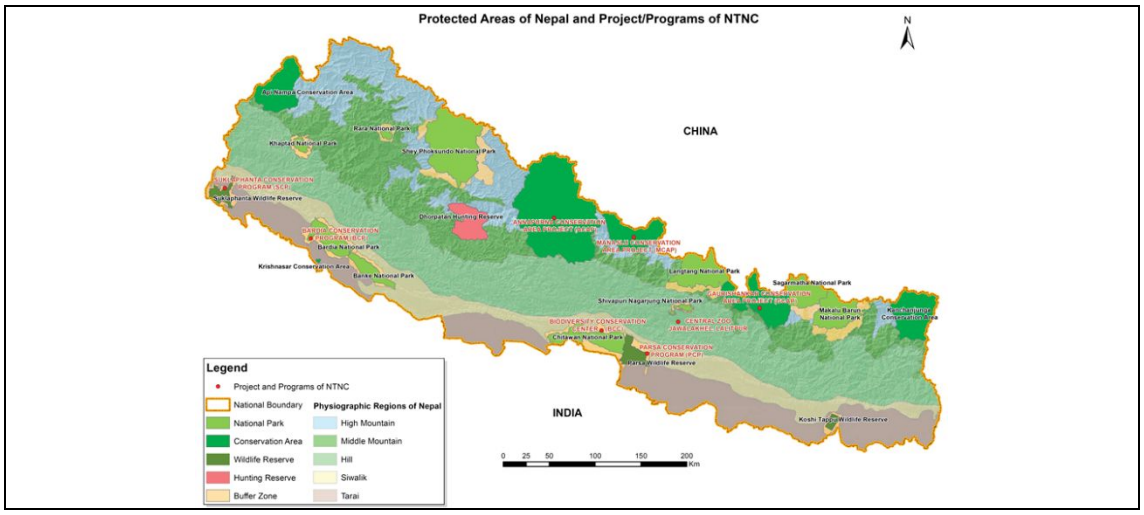
Source: IEE for Countermeasure construction of Landslides in Sindhuli Road (Section II) of Sindhuli Road Project, 2012, DOR

(2) Protected Areas

Protected areas of Nepal are summarized in **Table 1.4.11**. The project sites do not lie on and touch such protected areas of Nepal at all.

Table 1.4.11 Protected Areas of Nepal

Category	Protected Area (km^2)	
National Park (NP)	Chitwan NP (932 km^2)	Khaptad NP (225km^2)
	Langtang NP (1,710 km^2)	Bardia NP (968 km^2)
	Sagarmatha NP (1,148 km^2)	Makalu Barun NP (1,500 km^2)
	Rara NP (106 km^2)	Shivapuri Nagarjun NP (159 km^2)
	Shey Phoksundo NP (3,555 km^2)	Banke NP (550 km^2)
Conservation Area (CA)	Annapurna CA (7,629 km^2)	Manaslu CA (1,663 km^2)
	Gaurishankar CA (2,179 km^2)	-
	Kanchanjunga CA (2,035 km^2)	Api Nampa CA (1,903 km^2)
	Black Buck CA (15.95 km^2)	-
Wildlife Reserve (WR)	Shukla Phanta WR (305 km^2)	Koshi Tappu WR (175 km^2)
	Parsa WR (499 km^2)	-
Hunting Reserve (HR)	Dhorpatan HR (1,325 km^2)	-



Source: NGIIP ATLAS 2011 National Parks and Other Designated Areas, ANNUAL REPORT 2016 National Trust for Nature Conservation (NTNC)

(3) Ecosystem

According to the EIA of Section II and the Updated Report of EIA (Section III), endemic and protected flora and fauna are summarized as shown in **Table 1.4.12**.

Table 1.4.12 Endemic and Protected Species Around Sections II and III

Section	Description
II	• No endemic plant species and wildlife were reported in the study area. • Sal is the only plant species which is legally protected as per Forest Act, 1992 and Forest Rules, 195. • Sal is reported in the number of sample plots and is a dominant species in the Jaldevi community forests. • Of the reported wild animals, the tiger is legally protected and is included in CITES Appendix-I and the Jungle Cat in CITES Appendix III. • However, only Sal will be directly affected during the road construction.
III	• No specific endangered plant and animal species are observed along the proposed road alignment. • Because there is an existing road along the proposed alignment and human activities have influenced the wildlife's habitat for years.
Note: Sal (*Shorea robusta, IUCN Red List Category and Criteria: Lower Risk/Least Concern, Cultural Aspect: The tree of Sal is one of the three holy trees of Buddhism)*	

- EIA, Section II Sindhuli Bazar-Khurkot, Draft Report Oct. 1999 DOR. - Updated Report on EIA Study of Nepalthok - Khurkot Section of Banepa- Sindhuli-Bardibas Road Project, Jun. 2008 DOR (Modified and Tabulated by JICA Survey Team)

In addition, **Table 1.4.13** shows a list of flora and fauna identified around Station 17 + 400 of Section II by the IEE study in 2012 for Countermeasure Construction of Landslides in Sindhuli Road (Section II) of Sindhuli Road Project.

Aquila heliaca (birds) classified as VU of IUCN category as described in **Table 1.4.13** is considered to be based on sighting information of the surrounding people. In this regard, as a result of reconnaissance survey and interviews with residents, it was confirmed that there was no important natural habitat in the project site.

Table 1.4.13 Flora and Fauna around Station 17 + 400 (2012)

Category		Local Name	Scientific Name	IUCN Red List Category and Criteria	Remarks
Flora	Tree	Arkhu	*Acacia pennata*	Least Concern	
		Patake or tate siris	*Albizzia lucida*	N/A	
		Katus	*Castanopsis indica*	N/A	
		Khanayo	*Ficus cunia*	N/A	
		Kutmero	*Litsea monopelata*	N/A	
		Bilaune	*Litsea* sp.	N/A	
		Bakaino	*Melia azedarach*	N/A	
		Chilaune	*Schima wallichii*	N/A	
		Sal	*Shorea robusta*	Lower Risk/least concern	protected by Forest Act, 1992 and Forest Rules, 195
		Harro	*Terminalia chebula*	N/A	

Category		Local Name	Scientific Name	IUCN Red List Category and Criteria	Remarks
		Salla	*Pinus Roxburgii*	Least Concern	
	Shrub	Vanmara	*Eupatorium adenophorum*	N/A	
		Tite pati	*Artimisia vulgaris*	N/A	
		Badal pate	*Stephania sp*	N/A	
		Paleti	*Ardisia solanacea*	N/A	
		Gayo	*Bridelia retusa*	N/A	
		Aiselu	*Rubus ellipticus*	N/A	
		Maidal Kandha	*Xrromphis spinasa*	N/A	
		Sajiwan	*Jatropha curcas*	N/A	
		Dahichamal	*Callicarpa macrophylla*	N/A	
		Dhayaro	*Woodfordia fruticosa*	Lower Risk/least concern	
		Dhursul	*Colebrookea oppositifolia*	N/A	
		Sisnu	*Urtica dioica*	Least Concern	
	Herb	Siru	*Imperata cylindrical*	N/A	
		Kans	*Saccharum spontaneum*	Least Concern	
		Banso	*Eragrostis* sp.	N/A	
		Dubo	*Cynodon dactylon*	N/A	
		Chariamilo	*Oxalis corniculata*	N/A	
		Chariamilo	*Oxalis acetosella*	N/A	
		Pani amala	*Phyllanthus uninaria*	N/A	
		Kurkure Jhar	*Equisetum* sp.	N/A	
		Ghandhe	*Ageratum* sp.	N/A	
Fauna	Animal	Syal	*Canis aureus*	Least Concern	
		Bandar (monkey)	*Macaca mulatta*	Least Concern	
		Langure Bander	*Presbytis entellus*	N/A	
		Ban Biralo	*Felis chaus*	Least Concern	
		Nauri Musa (Mongoose)	*Herpestes edwardsii*	Least Concern	
		Musa (Mouse)	*Rattus rattus*	Least Concern	
	Birds	Chil	*Aquila heliaca*	Vulnerable C2a (ii)	
		Bakulla (Cattle egret)	*Bubulcus ibis*	Least Concern	
		Bhangera	*Passer domesticus*	Least Concern	
		Kaag (Crow)	*Corvus macrorhynchos*	Least Concern	
		Dhukur	*Streptopelia* sp.	N/A	
		Jureli	*Pycnonotus* sp.	N/A	
		Chibe	*Dicrurus hottentottus*	Least Concern	

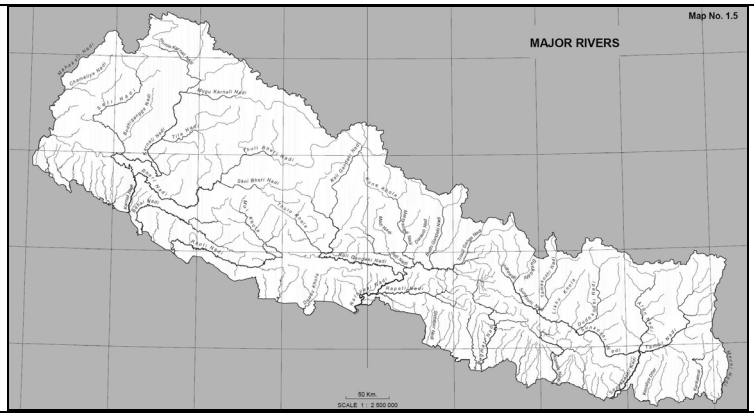
Source:
- IEE study for Countermeasure Construction of Landslides in Sindhuli Road (Section II) of Sindhuli Road Project, 2012 DOR
- The IUCN Red List of Threatened Species(tm) 2017-3 (http://www.iucnredlist.org/search) (Amended by the JICA Survey Team)

(4) Hydrology

River systems of Nepal consist of three major drainage basins namely “Koshi”, “Gandaki”, and “Karnali” as summarized in **Table 1.4.14**. The Project sites are basically located along the right bank of the Sunkoshi River of the Koshi River Basin in the Eastern Nepal.

Table 1.4.14 Major River Basins of Nepal

River Basin	Location	Description
Koshi	East	River Sapta Koshi in Eastern Nepal, along with its tributaries like the Tamor, Arun, Dudh Koshi, Likhu Khola, Tama Koshi, Sunkoshi and Indrawati constitute the biggest river system of the country.
Gandaki	Central	River Sapta Gandaki (Narayani) with its tributaries like the Kali Gandaki, Madi, Seti, Marsyangdi, Daraundi, Budhi Gandaki and Trishuli drain the central Nepal between Goshainthan Himal and Dhaulagiri Himal.
Karnali	West	The territory west of Dhaulagiri Himal is drained by the River Karnali and its tributaries like Humla Karnali, Mugu Karnali, Seti and Bheri. The Mahakali, which constitutes the western border of the country joins the River Karnali in the Indian territory.



Note: Text Source: 1. Statistical Year Book, CBS, 1995. 2. Nepal: Atlas of Economic Development, National Council for Science and Technology, HMG Nepal, 1980, Map produced by the National Geographic Information Infrastructure Project, Survey Department.
Source: Population and Socio-Economic Atlas of Nepal 2011, Ministry of Land Reform and Management

Table 1.4.15 shows the number of lakes in Sindhuli District.

Table 1.4.15 Number of Lakes in Sindhuli District by Height (in 2009) (m)

District	Total	<100	100-499	500-1,999	2,000 -2,999	3,000-4,999	≥5,000
Sindhuli	9	0	4	5	0	0	0

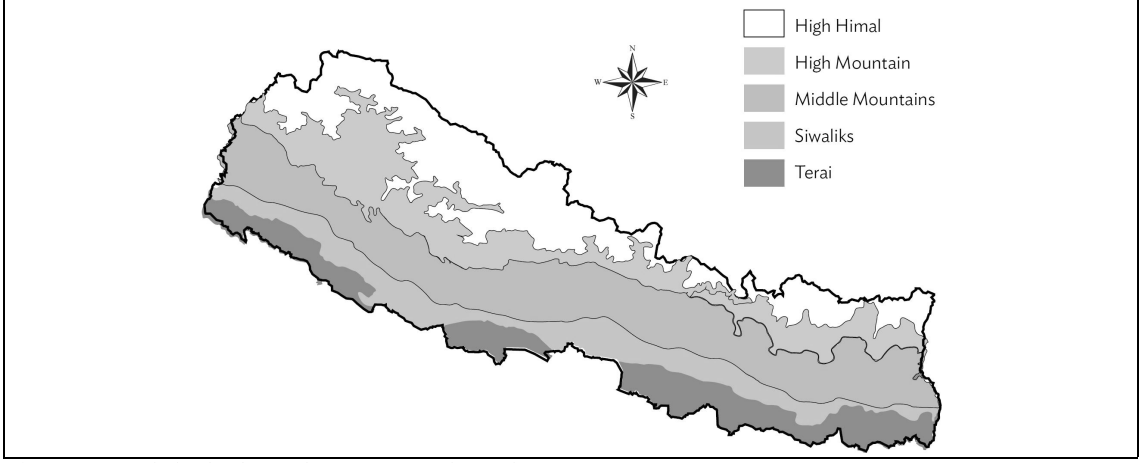
Source: Environmental Statistics of Nepal 2013 Central Bureau of Statistics (CBS), NPCS, GoN

(5) Topography and Geology
As summarized in **Table 1.4.16**, Nepal has five physiographical regions.

Table 1.4.16 Physiographical Regions of Nepal

Region	Elevation	Description*
Terai Flatlands	below 500 m	・ Terai Region of Nepal is an extension of the Gangetic Plain of India and lies at altitudes of about 60 m to 200 m. ・ It is traversed by all major rivers of Nepal.
Lower Hills (Chure or Siwalik)	500 m - 1,000 m	・ The outmost Himalayan foothills, parallel to Terai, are known as the Siwaliks. ・ There are a number of Terai-like valleys lying between the Siwaliks and the foot of the Mahabharat, commonly called Dun Valleys. ・ The Siwaliks reach an altitude of 1,800 m in some places, but in most places, it ranges between 300 m and 1,500 m.
Middle Mountains	1,000 m -3,000 m	・ The region includes areas within the Mahabharat range and is characterized by moderately high mountains (peaks of 1,500 to 2,500 m) and steep, narrow valleys. ・ The main rivers crossing the region are Karnali, Bheri, Western Seti and Mahakali.
High Mountains	3000 m - 5,000 m	・ The region is characterized by high mountains with steep slopes and narrow valleys. ・ Elevation of the river valleys is usually over 2,000 m, with mountain tops commonly above 4,000 m.
High Himalaya (Himal)	above 5,000 m	・ The region is characterized by steep mountains covered by snow throughout the year and the terrain is usually above 5,000 m. ・ This region is famous for high mountain peaks like Sagarmatha (Mt. Everest, 8,848 m.), Makalu (8,463 m.), Kanchanjangha (8,586 m), Annapurna I (8,091 m), Lhotse (8,516 m), Manaslu (8,163 m) etc. ・ Most of the perennial rivers originate from this region.

Region	Elevation	Description*



* Note: Description by the Land Resource Mapping Project: Summary Report, 1986
Map originally prepared by the Soil Science Division, NARC
Source: Country Environment Note Nepal 2014 ADB, Population and Socio-Economic Atlas of Nepal 2011 Survey Department, Ministry of Land Reform and Management (Tabulated by the JICA Survey Team)

The project sites in Sindhuli District are located in the Hill Ecological Belt or the Siwaliks and the Middle Mountain Physiographic Regions as shown in **Table 1.4.17.**

Table 1.4.17 Physiographic Region of Sindhuli District (Ha)

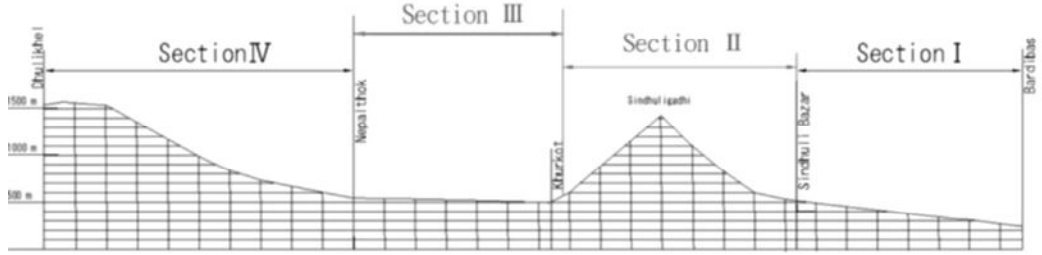
Eco. Belt	District	Physiographic Region					Total
		Terai	Siwalik	Middle Mountain	High Mountain	High Himal	
Hill	Sindhuli	0	154,061.5	93,647.5	0	0	247,709

Note: LRMP Land Systems Report, 1985
Source: Asia-pacific network on Integrated Plant Nutrient Management (APIPNM)
http://www.apipnm.org/swlwpnr/reports/y_sa/z_np/nptb212.htm

In addition, the project area is located in the Mahabharata Mountain range situated along the west-northwest to east-southeast direction and is made up by successive geo-tectonic movement in the tertiary.

Topographical and geological features of Sections II and III can be summarized as shown in **Table 1.4.18.**

Table 1.4.18 Topographical and Geological Features of Section II and Section III

	Section II (Sindhuli Bazaar – Khurkot)	Section III (Khurkot – Nepalthok)
Topographical Feature	• Section II starts from the northern part of Sindhuli Bazaar (500 m AMSL) and ascends to Sindhuli Gadi (1,400 m AMSL) where the road descents to Khurkot (about 469 m AMSL), and the road crosses the stream valleys, hills and flat lands. • Approximately the first 6 km consists of landscape mostly of sloped hilly terrain with terrace of Siwalik range towards north of which the road passes from steep slopes of the Mahabharat range. • The road crosses the two main drainage systems (Gwang Khola towards south which finally drains into Kamala River and Andhri Khola which drains into the Sunkoshi River near Khurkot).	• Section III starts from Khurkot (about 469 m AMSL) which follows the right bank of the Sunkoshi River and ascends to 55m at 3+320 and then descends at moderate to steep grade till Khalte Bazaar/Nigule khola (485 AMSL). • After Khalte, the Section makes gentle to moderate ascend till St. 7+840 (618 AMSL) onward until it descends at moderate grade to reach Khahare Khola (488 AMSL) from which it makes a steep ascend till 13+680 (649.5 AMSL) and then descends to a moderate grade to reach Mulkot, Pashupati nagar (489.4 AMSL). • The section follows a gentle grade crossing Bhote Khola till St. 18+200 and then makes a moderate to steep ascend to reach Ramtar (573 m AMSL) and then descends till Sadhi Khola (533.9 m AMSL), • The section then follows the right bank of Sunkoshi River through a gently slope till Nepalthok (552 m AMSL).
Geological Feature	• Three geological groups of the middle Siwalik layer of the Miocene to Pleistocene extending from Shindhuli Bazaar to Chiyabari area, Nuwakot group of Paleozoic to Pre-Cambrian extending from Main Boundary Thrust (MBT) to Main Central Thrust (MCT) and Bhimphedi group of Pre-Cambrians from MCT to Khurkot Bazaar have been reported. • The middle Siwalik group consists of Sandstone and conglomerate. • Nuwakot group consists of pelitic schist and calcareous schist layers while the Bhimphedi group consists of granitic schist and pelitic schist layer. • The geological strike of this region is basically along the west to northwest to east – southeast axis parallel to Mahabharat range and Sunkoshi river.	• Section III lies on the Kuncha Formation of the Lower Nawakot Group and the Benighat Slate of the upper Nawakot Group but the section passes through alluvium, colluvium and the bedrock of the rock units • The rock of the Kuncha Formation comprised greenish grey to grey phyllite to gritty phyllite intercalated with fin-grained, grey quartzite. • This formation is mostly exposed in Nepalthok - Khurkot area along the section of the Sunkoshi River. • The Benighat Slate is represented by presence of monotonous dark grey to black slate intercalated with limestone. • The rocks are fresh to slightly weathered in condition in general.
		

Note: Longitudinal Section prepared by the JICA Survey Team

Source: - EIA, Section II Sindhuli Bazar-Khurkot, Draft Report Oct. 1999 DOR. - Updated Report on EIA Study of Nepalthok – Khurkot Section of Banepa- Sindhuli-Bardibas Road Project, Jun. 2008 DOR (Modified and Tabulated by the JICA Survey Team)

(6) Earthquake

The National Seismological Centre (NSC) under the Department of Mines and Geology at the Ministry of Industry has summarized past major earthquake events occurred in Nepal as shown in **Table 1.4.19**.

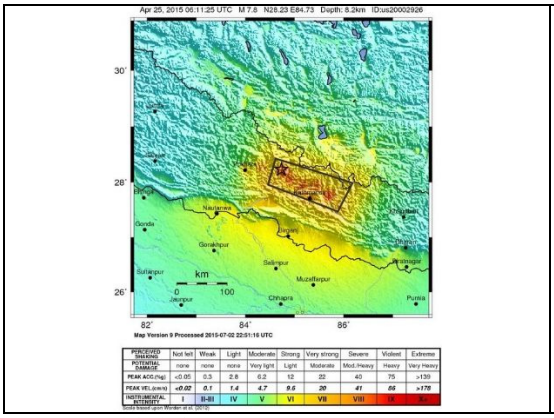
Table 1.4.19 Major Earthquakes in Nepal

Year (AD)	Description
1255	• The earthquake has been reported to destroy many houses and temples and killing one-third to one-fourth of the population in Kathmandu Valley. • The assigned intensity is about X in MM scale (Chitrakar and Pandey, 1986).
1408	• The earthquake has been reported to destroy the Machhendra Nath Temple of Patan.
1681	• Earthquakes in 1681 and in 1810 have been reported to occur but the exact location of these earthquakes are not known.
1810	

1833	• Recent research on historical data is well constrained on the source size, magnitude, and possible location of the 1833 event (R.Bilham,1995) which devastated Kathmandu Valley. • Its magnitude is reported to be of Mb=7.8 with possible rupture length of more than 70 km and the event is located at 50 km north to north-east of Kathmandu.
1934	• This is the most devastating earthquake ever occurred in the territory of Nepal with casualties of more than 16,000 people including from Nepal and India combined. • The rupture length is estimated to be 100 km - 200 km (Molnar and Pandey, 1994).
2015	• On 25th of April 2015, right at 11:56 (NST) Mid-Nepal was rattled by a deadly earthquake of Local magnitude (ML) 7.6 (Mw 7.8). • The shaking of this earthquake remains around one minute in Kathmandu. • The epicenter of this earthquake was around Barpak village of Gorkha district, 85 Km north-west of Kathmandu, hence named as Gorkha earthquake 2015. • Barpak as well as the Laprak village in Gorkha district was completely collapsed or destroyed. • The focal depth of the earthquake was about 15 Km. • The rupture of this earthquake propagate towards east. • So the damage was more in the east than in the west of epicenter. • 14 districts are severely affected by this earthquake. • This is the biggest earthquake after 1934 Bihar-Nepal earthquake that occurred within Nepal.

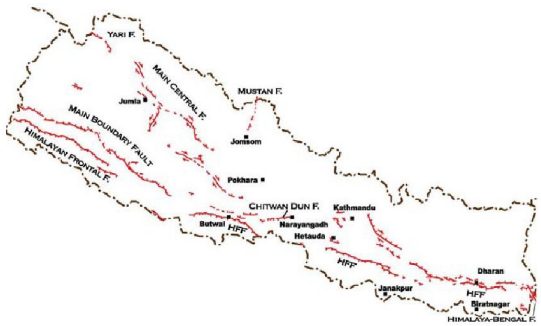
Source: National Seismological Centre (NSC) http://seismonepal.gov.np/index.php?linkId=128

- The Sindhuli road has been partially damaged by the Gorkha earthquake in 2015 of which intensity in Nepal is shown in **Figure 1.4.4**.
- With regard to earthqueak, active faults observed in Nepal are shown in **Figure 1.4.5**.



Source: US Giological Suvery (USGS)
https://earthquake.usgs.gov/earthquakes/eventpage/us20002926#shakemap

Figure 1.4.4 Shake Map in Nepal



Map: based on the work of Nakata, 1982,Nakata et al.,1984 and Nakata& Kumahara, 2000

Source: Paleoseismological study in the Nepal Himalaya - Present status, 2007, B.N. UPRETI, Y. KUMAHARA and T. NAKATA,
https://www.researchgate.net/publication/267373671_Paleoseismological_study_in_the_Nepal_Himalaya-Present_status

Figure 1.4.5 Active Faults in Nepal

1.4.3.3 SOCIAL CONDITIONS

(1) Demographic Situation and Community

Table 1.4.20 shows the demographic profile of Sindhuli District where 296,192 people with annual growth rate of 0.57% live as of 2011.

Table 1.4.20 Population, Households and Population Density of Sindhuli District (2011)

Population 2011			Annual Growth Rate (%)	Sex Ratio	Number of Household	Average Household Size	Area in Sq.km.	Population Density (persons/ km^2)
Total	Male	Female						
296,192	142,123	154,069	0.57	92	57,581	5.14	2,491	119
Original Data: Population and Housing Census (PHC), 2011.								

Source: Compendium of Environment Statistics Nepal 2015, Central Bureau of Statistics (CBS), NPCS, GoN

Economic activities in Sindhuli District are summarized in **Table 1.4.21**. That is to say that half (50%) of the population aged ten years and above are engaged in agricultural activities.

Table 1.4.21 Population by Type of Usual Activity in Sindhuli District (2011)

TPOP	OA(%)	WS (%)	ON (%)	EE (%)	SJ (%)	HC (%)	ST (%)	NA (%)	AN (%)
224,757	50.0	12.1	7.3	14.7	3.7	35.6	31.6	9.9	0.6
TPOP: Total Population Aged Ten Years and Above, OA: Own Agriculture, WS: Wage/salary Earning, ON: Own Non-agricultural, EE: Extended Economic, SJ: Seeking Job, HC: Household Chores, ST: Study, NA: None of Activity, AN: Activity Not Stated									
Data: Survey Department and Central Bureau of Statistics, Government of Nepal.									

Source: Population and Socio-Economic Atlas of Nepal 2011, Survey Department, Ministry of Land Reform and Management

Religious status of Sindhuli District is summarized in **Table 1.4.22**. Based on the table the predominant religion in the district is Hinduism (64.469%) followed by Buddhism (30.432%). That is to say those two religions cover more than 94% of the total population of the district in 2011.

Table 1.4.22 Distribution of Population by Religion in Sindhuli District (2011)

Total Population	Hinduism	Buddhism	Islam	Kirat	Christianity	Prakriti	Bon	Others
296,192	190,952	90,136	179	1,024	2,897	9,736	3	1,265
%	64.469	30.432	0.060	0.346	0.978	3.287	0.001	0.427
Others: Jainism, Bahai, Sikhism And Undefined								
Original Data: Survey Department & Central Bureau of Statistics, Government of Nepal.								

Source: Population and Socio-Economic Atlas of Nepal 2011, Survey Department, Ministry of Land Reform and Management

With regard to caste and ethnicity, a total of 126 castes/ethnicities have been identified in the Sindhuli District as shown in **Table 1.4.23**. Therefore, it can be understood that the predominant caste of the District is Tamang (TAM) of 26.871% followed by Magar (MGR) of 14.905% and Chhetree (CHH) of 13.66 %.

Table 1.4.23 Distribution of Population by Caste / Ethnicity of Sindhuli District (2011)

Caste	Population	%	Caste	Population	%	Caste	Population	%	Caste	Population	%
CHH	40,459	13.660	RAJ	14	0.005	DHI	1	0.000	HKR	3	0.001
BRH	23,077	7.791	SHE	44	0.015	YAK	19	0.006	BYA	0	0.000
MGR	44,146	14.905	DHO	29	0.010	GHA	49	0.017	AMT	0	0.000
THA	282	0.095	TAT	28	0.009	TAJ	1	0.000	THL	0	0.000
TAM	79,590	26.871	LOH	33	0.011	KHA	1	0.000	LEP	1	0.000
NEW	18,602	6.280	KHT	4	0.001	DAR	1	0.000	PTK	13	0.004
KAM	13,551	4.575	SUD	826	0.279	MAL	8	0.003	MEB	0	0.000
MUS	179	0.060	DAN	17,236	5.819	DHU	0	0.000	BAH	1	0.000
YDV	176	0.059	HAL	118	0.040	PAH	782	0.264	NAT	1	0.000
RAI	3,035	1.025	MAJ	10,279	3.470	RDB	0	0.000	HAY	1,682	0.568
GUR	508	0.172	BAR	21	0.007	BHO	198	0.067	DKK	0	0.000
DAM	9,155	3.091	BIN	5	0.002	DOM	64	0.022	LHP	0	0.000
THK	1,736	0.586	NUN	13	0.004	TKL	2	0.001	MUN	2	0.001
LIM	76	0.026	CHP	16	0.005	KOR	0	0.000	DEV	0	0.000
SAR	10,519	3.551	SON	275	0.093	CNT	0	0.000	DND	0	0.000
TEL	344	0.116	KHR	2	0.001	HYO	0	0.000	KMR	0	0.000
CHR	29	0.010	SUN	8,085	2.730	BOT	1	0.000	KIS	2	0.001
KOI	73	0.025	BAS	6	0.002	RBH	0	0.000	SMP	0	0.000
MSH	1861	0.628	KAH	7	0.002	BRM	3	0.001	KOC	0	0.000
KUR	17	0.006	SAS	9	0.003	PUS	0	0.000	LHO	1	0.000
SAD	1625	0.549	MAR	7	0.002	NAC	0	0.000	KLG	1	0.000
DHA	80	0.027	KAY	94	0.032	YAM	1	0.000	TOP	6	0.002
DPP	17	0.006	RPT	58	0.020	GAI	0	0.000	CHI	0	0.000
MLH	27	0.009	BAD	96	0.032	CML	0	0.000	WAL	0	0.000
KEW	13	0.004	JHD	0	0.000	ATH	0	0.000	LHR	0	0.000
KTB	122	0.041	GAN	3	0.001	JIR	7	0.002	KAL	0	0.000
BRT	477	0.161	LOD	15	0.005	DUR	2	0.001	RAU	0	0.000
KLW	364	0.123	BHD	5	0.002	SRB	0	0.000	NUR	0	0.000
KAN	46	0.016	THM	825	0.279	MEC	0	0.000	KUS	1	0.000
KUM	21	0.007	KUL	0	0.000	BTB	12	0.004	OTH	270	0.091
GRB	4,526	1.528	BAN	2	0.001	RJI	0	0.000	Tota1	296,192	100.000
HJT	167	0.056	GDB	1	0.000	DOL	0	0.000			

CHH - Chhetree; BRH - Brahman - Hill; MGR - Magar; THA - Tharu; TAM - Tamang; NEW - Newar; KAM - Kami; MUS - Musalman; YDV - Yadav; RAI - Rai; GUR - Gurung; DAM - Damai/dholi; THK - Thakuri; LIM - Limbu; SAR - Sarki; TEL - Teli; CHR - Chamar/harijan/ram; KOI - Koiri/kushwaha; MSH - Musahar; KUR - Kurmi; SAD - Sanyasi/dashnami; DHA - Dhanuk; DPP - Dusadh/pasawan/pasi; MLH - Mallaha; KEW - Kewat; KTB - Kathbaniyan; BRT - Brahman - Tarai; KLW - Kalwar; KAN - Kanu; KUM - Kumal; GRB - Gharti/bhujel; HJT - Hajam/thakur; RAJ - Rajbansi; SHE - Sherpa; DHO - Dhobi; TAT - Tatma/tatwa; LOH - Lohar; KHT - Khatwe; SUD - Sudhi; DAN - Danuwar; HAL - Haluwai; MAJ - Majhi; BAR - Baraee; BIN - Bin; NUN - Nuniya; CHP - Chepang/praja; SON - Sonar; KHR - Kumhar; SUN - Sunuwar; BAS - Bantar/sardar; KAH - Kahar; SAS - Satar/santhal; MAR - Marwadi; KAY - Kayastha; RPT - Rajput; BAD - Badi; JHD - Jhangad/Dhagar; GAN - Gangai; LOD - Lodh; BHD - Badhaee; THM - Thami; KUL - Kulung; BAN - Bangali; GDB - Gaderi/Bhedhar; DHI - Dhimal; YAK - Yakkha; GHA - Ghale; TAJ - Tajpuriya; KHA - Khawas; DAR - Darai; MAL - Mali; DHU - Dhunia; PAH - Pahari; RDB - Rajdhob; BHO - Bhote; DOM - Dom; TKL - Thakali; KOR - Kori; CNT - Chhantyal/chhantel; HYO - Hyolmo; BOT - Bote; RBH - Rajbhar; BRM - Brahmu/Baramo; PUS - Punjabi/Shikh; NAC - Nachhiring; YAM - Yamphu; GAI - Gaine; CML - Chamling; ATH - Aathpariya; JIR - Jirel; DUR - Dura; SRB - Sarbaria; MEC - Meche; BTB - Bantaba; RJI - Raji; DOL - Dolpo; HKR - Halkhor; BYA - Byasi/sanka; AMT - Amat; THL - Thulung; LEP - Lepcha; PTK - Pattharkatta/kushwadiya; MEB - Mewahang Bala; BAH - Bahing; NAT - Natuwa; HAY - Hayu; DKK - Dhankar/kharikar; LHP - Lhopa; MUN - Munda; DEV - Dev; DND - Dhandi; KMR - Kamar; KIS - Kisan; SMP - Samgpang; KOC - Koche; LHO - Lhomi; KLG - Khaling; TOP - Topkegola; CHI - Chidimar; WAL - Walung; LHR - Loharung; KAL - Kalar; RAU - Raute; NUR - Nurang; KUS - Kusunda; OTH - Dalit, Janajati, Terai, Undefined,

Foreigner
Data: Survey Department and Central Bureau of Statistics, Government of Nepal.

Source: Population and Socio-Economic Atlas of Nepal 2011, Survey Department, Ministry of Land Reform and Management

In accordance with the administrative boundary reforms by the Nepalese Government in 2015, the present local public bodies along Sections II and III can be summarized in **Table 1.4.24**. However, due to lack of data and information on the reforms, there were difficulties to comprehend the details of such new local public bodies, especially the previous Village Development Committees (VDCs) along Sections II and III.

Table 1.4.24 New Local Public Body and Previous VDC along Sections II and III

No	District	Present Municipalities		Previous VDCs			Remarks
		Name	Ward No	Name	Ward No.	Population after EQ-15*	
1	Sindhuli	Sunkosi Rural Municipality	1	Kusheshwar Dumja	2	635	
					3	480	
					4	495	
					5	809	
					9	1251	
			2	Kusheshwar Dumja	1	742	
					6	951	
					7	753	
					8	573	
			3	Jhangajholi Ratmata	1	545	
					2	934	
					3	1036	
					4	960	
					5	835	
			4	Jhangajholi Ratmata	6	765	
					7	1092	
					8	501	
					9	1455	
			5	Purano Jhangajholi	1	440	
					2	541	
					3	884	
					4	1609	
					5	666	
					6	862	
					7	842	
					8	642	
					9	933	
			6	Shitalpati	1	352	15+520 and 11+620 of Section III (to be Confirmed)
					2	414	
					3	546	
					4	960	
					5	918	
					6	714	
					7	416	
					8	544	
					9	769	
			7	Majhuwa	1	313	
					2	386	
					3	523	
					4	574	
					5	435	
					6	266	
					7	285	
					8	530	
					9	201	
2	Sindhuli	Golanjor Rural Municipality	7	Bhimeswor	1	370	33+695 and 33+400 of Section II (to be Confirmed)
					2	443	
					3	391	
					4	448	
					5	226	
					6	145	
					7	342	
					8	180	
					9	348	
			5	Ratanchura	1	581	
					2	350	
					3	246	
					4	180	
					5	241	
					6	297	

No	District	Present Municipalities		Previous VDCs			Remarks
					7	553	
					8	487	
					9	477	
3	Sindhuli	Kamala Mai Municipality	2	Bhadrakali	1	626	17+400 of Section II Land slide at Dhungre Bhanjyang
					2	777	
					3	544	
					4	973	
					5	497	
					6	289	
					7	267	
					8	623	
					9	624	

EQ-15*: Nepal Earthquake 2015
Source: https://docs.google.com/spreadsheets/d/10zeskVMj-qx5u-HclKKk4e9NrHz4r90Wm5OOEfJ5vj0/edit?ts=5a2cb796#gid=0

In order to figure out social conditions around the five project sites, reconnaissance and interview survey were conducted by the JICA Survey Team in cooperation with the Department of Roads (DOR) staff of which results are summarized as shown below.

- It is generally confirmed that there is a change in the social situation such as an increase in population along roadside after the construction of Sindhuli Road, especially around the local urban areas along the roadside are remarkable.
- On the other hand, all of the five project stations are located in mountainous areas, and development is delayed compared to other urban areas along the road, therefore it has been confirmed that changes in the social environment such as increase in the surrounding population are not larger than before the earthquake disaster.

1) Station 15+520 (Section III)

The following summarizes the social conditions around Station 15+520 (approximately 590 m ASL) on Section III:

- The nearest settlement area, Mulkot (approximately 500 m ASL) along the right bank of the Sunkoshi River lies down vertically about 100 m and horizontally about 350 m north downward from the station.
- In addition, some settlements on a mountain ridge (approximately 882 m ASL) exist vertically about 400 m and horizontally about 900 m southeast direction from the station.
- Some footpaths exist in right of way (ROW) of the road where it is a steep downhill (northeast side) from the station, which may be used by local people as a short pass of the hairpin curves around the station of the road.
- There are no settlements immediately on the downward and upward sides of the station at all.
- Utility poles and road water drainage facility are set up along the station.


Present condition of damaged road of Station 15+520


Settelements along the Sunkoshi River lie below Station 15+520


Footpath lies below Station 15+520


Water dranage facility lies below Station 15+520


Utility pole on the mountain side above Station 15+520


No settelements on the mountain side above Station 15+520

Source JICA Survey Team

Figure 1.4.6 Present Conditions Around Station 15+520 (Section III)

2) Station 11+620 (Section III)

The following summarizes the social conditions around Station 11+620 (approximately 520 m ASL) on Section III:

- The nearest settlement areas (approximately 700 m ASL) on the mountain surface exist vertically about 200 m and horizontally about 500 m north-west upward from the station.
- DOR has recently maintained the settlements near the road by adding some additional thickness of pavement in order to facilitate traffic through the station, which is a temporary type of measure for smooth traffic flow.
- An unpaved road that runs down into the right bank of the Sunkoshi River exists on the downhill (northeast side) from the station.
- According to DOR, the unpaved road was set up and used for the Sindhuli Road construction for traffic diversion.
- There are no settlements immediately on the downward and upward sides of the station at all.
- Utility poles are set up along the station.


Present condition of damaged Road of Station 11+620


No settelements along the Sunkoshi River lie below Station 11+620


No settlement on the mountain side above Station 11+620


No settlements around Station 11+620 (Distant view)


Unpaved road and utility pole lie below Station 11+620


Entrance of unpaved road in the vicinity Station 11+620

Source JICA Survey Team

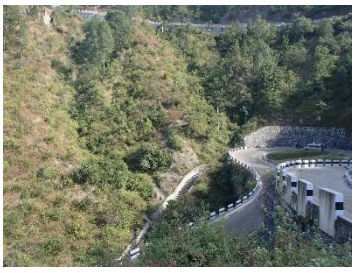
Figure 1.4.7 Present Conditions Around Station 11+620 (Section III)

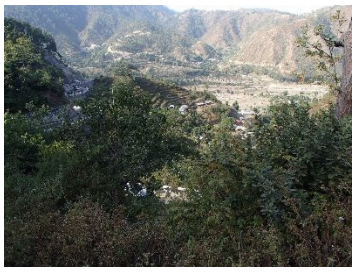
3) Station 33+695 (Section II)

The following summarizes the social conditions around Station 33+695 (approximately 700 m ASL) on Section II.

- The nearest settlement area (approximately 640 m ASL) lies down vertically about 140 m and horizontally about 350 m north downward from the station.
- Some footpaths exist in ROW of the road where a steep downhill (northeast side) from the station, which may be used by local people as a short pass of the hairpin curves around the station of the road.
- In addition, a step way shape structure exists in ROW on the east side of the station which has been constructed for drainage safe passage to control erosion.
- There are no settlements immediately on the downward and upward sides of the station at all.


Present condition of damaged road of Station 33+695


Surroundings of damaged road Station 33+695 (Distant View)


Settlements/paddy field lie below Station 33+695(Distant View)


Settlements lie below Station 33+695(Closeup View)


Footpath lies below Station 33+695


No settlements on the mountain side above Station 33+695

Source JICA Survey Team

Figure 1.4.8 Present Conditions Around Station 33+695 (Section III)

4) Station 33+440 (Section II)

The following summarizes the social conditions around Station 33+440 (approximately 730 m ASL) on Section II:

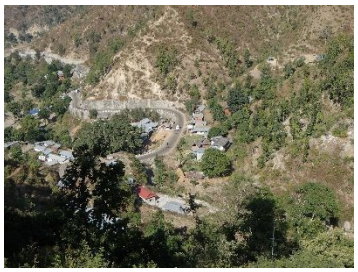
- The nearest settlement area (approximately 640 m ASL) lies down vertically about 170 m and horizontally about 350 m north downward from the station.
- There are no settlements immediately on the downward and upward sides of the Station at all.

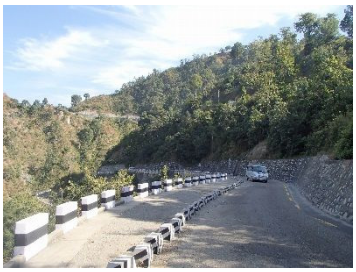

Present condition 1 of damaged road of Station 33+440


Present condition 2 of damaged road of Station 33+440


Surrounding 1 of damaged road Station 33+440 (Distant View)


Surrounding 2 of damaged road Station 33+440 (Distant View)


Settlements lie below Station 33+440 (Distant View)


No settlements in the mountain side above Station 33+440

Source JICA Survey Team

Figure 1.4.9 Present Conditions Around Station 33+440 (Section III)

5) Station 17+400 (Section II)

The following summarizes the social conditions around Station 17+400 (approximately 1,184 m ASL) on Section II:

- There are about 25 households in Dhungre Bhanjyang (located at Station 17+400), about 13 households in Khopikharka (approximately 1,110m ASL) located vertically about 74 m downward and horizontally about 350 m south from the station, as well as nine households in Damar (located further east from Khopikharka), in the vicinity of the proposed site having a population of about 250 in total. The nearest house from the slope at Station 17+400 is located on about 5 m from the slope. An interview with surrounding local people including family member of the house held at the location identified their positive opinions.
- There is basically a mix population with majority of Newar and Magar.
- In Dhungre Bhanjyang, there is one primary school with 50 students and one bus stop.
- The local people needs to go to Sindhulimadi for their daily needs.
- There is one Hindu temple (more than 250 years old) about 360 m west from the station.
- No other government offices or service centers like health post and agriculture center are available.

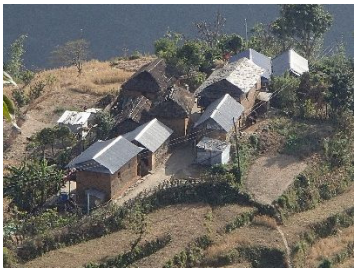

Sation 17+400 and Dhungre Bhanjyang Village


Primary School in Dhungre Bhanjyang Village


Community Water Tap of Dhungre Bhanjyang Village


Water Pipes from the Surrounding Mountain (Set up by DOR)


Footpath from Station 17+400 to Khopikharka


Khopikharka Settlement


Surrounding Shop and Hotel


Entrance of Hindu Temple


Interview Survey with Local People

Source: JICA Survey Team

Figure 1.4.10 Station 17 +400 and the Surroundings (Section II)

(2) Land Use

According to the "Compendium of Environment Statistics Nepal 2015, CBS", land use pattern in Nepal is mostly divided into seven categories, namely: 1. cultivated land, 2. non-cultivated land, 3. forest, 4. shrub land, 5. grass land, 6. other land, and 7. water/lake. Land use pattern in Sindhuli District is shown in **Table 1.4.25**.

Table 1.4.25 Land Use Pattern in Sindhuli District (area in Hectare)

Total Forest Area	Shrub	Agricultural Land/Grass	Water Bodies	Barren Land	Snow	Others	Total
136,302	25,708	71,842	1,268	8,442	0	0	243,562

Source: Compendium of Environment Statistics Nepal 2015, Central Bureau of Statistics (CBS), NPCS, GoN

(3) Archaeological and Cultural Site

In Nepal, four world heritage sites have been inscribed by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as shown in **Table 1.4.26**. However, the project area of Sections II and III of Sindhuli Road do not go through and touch those sites at all.

Table 1.4.26 World Heritage Sites in Nepal

Criteria	Heritage Site	Province	District	Description	Inscription
Cultural	Kathmandu Valley	No.3	- Kathmandu - Lalitpur (Patan) - Bhaktapur	The Kathmandu Valley consists of the following seven sites: • Durbar Square (Kathmandu), • Durbar Square (Patan) • Durbar Square (Bhaktapur) • Swayambhu (Buddhist stupa in Kathmandu) • Bauddhanath(Buddhist stupa in Kathmandu) • Pashupatinath (Hindu temple in Kathmandu) • Changu Narayan (Hindu temple)	1979
	Lumbini	No.5	Rupandehi	The birthplace of the Lord Gautama Buddha	1997
Natural	Chitwan National Park	No.3	Chitwan	Located in 'Terai' Region that has natural ecosystem (existing single-horned Asiatic rhinoceros and Bengal tigers).	1984
	Sagarmatha National Park	No.1	Solukhumbu	Areas of Himalayan mountains dominated by Mt. Everest (8,848 m), the highest peak in the world	1979

Source: Department of Archaeology Ministry of Culture, Tourism and Civil Aviation, UNESCO, JICA Survey Team

According to the EIA of Section II and the Updated Report of EIA (Section III) several temples were identified along the proposed alignment of the road at the time of EIA studies as summarized in **Table 1.4.27**.

Table 1.4.27 Temples/Archaeological Site along Section II and III

Section	Temples/Achaelogical Sites	Conditions and Impacts
II	14 temples are located along the proposed road corridor in the study area.	A few of them will likely be indirectly affected by the road construction activities.
III	Eight temples and nine archaeological sites are identifed in the surrounding areas of Sindhuli road	Among those, 16 sites are not in the ROW located in the settelement area, no need to dismantle/rehabilitate. One site of Sital Pati is adjacent to the road, alignment has been modified during the basic design to protect this Pati.

Source: Banepa -Sindhuli-Bardibas Road Project, EIA, Section II Draft Report, Oct. 1999, DOR
Updated Report on EIA Study of Nepalthok- Khurkot Section of Banapa-Sindhuli-Bardiba Road Project Jun. 2008, DOR

A historical fort of Sindhuli Gadhi site (approximately 1,440 m ASL) is situated on a mountain near

the existing road alignment of Section II, which was some kind of fort used earlier. From the archaeological viewpoints, many remains of old structures can still be seen at present. The direct distance from the Sindhuli Gadhi site to the entrance gate for the site located in the road is about 270 m, to Station 17+400 is about 1.4 km, and to Station 33+440 and Station 33+695 is about 5 km.

Source: JICA Survey Team

Figure 1.4.11 Remains of Sindhuli Gadhi

1.4.4 ENVIRONMENTAL MANAGEMENT SYSTEM IN NEPAL

1.4.4.1 LEGAL FRAMEWORK

(1) Constitution, Policy, Act and Regulation

Table 1.4.28 shows a list of the national constitution, policies, acts and regulations on environment management for road developments in Nepal.

Table 1.4.28 Constitution, Policy, Act and Regulation on Environmental Management

Category	Description
Constitution	· Constitution of Nepal, 2015
Policy	· Public Infrastructure Built and Operate Policy, 2000 · National Transport Policy, DOR, 2001 · Land Infrastructure Development Policy, 2004 · Policy Document, Environmental Assessment in Road Sector of Nepal, GUE/DOR, 2000 · Strategic Road Network (SRN), DOR, 2009/10
Act	· Explosive Material Act, 1961 · National Parks and Wildlife Conservation Act, 1973 · Public Road Act 1974 · Land Revenue Act, 1977 · Land Acquisition Act, 1978 · Nature Conservation Trust Act, 1982 · Soil and Watershed Conservation Act, 1982 · Solid Waste (Management & Resource Mobilization) Act, 1987 · Labour Act 2074 (2017) · Forest Act, 1993 · Environmental Protection Act (EPA), 1997 · Local Self Governance Act, 1998 · Child Labour Act, 2001
Rule	· Environment Protection Rules (EPR), 1997 (amended in 1999 and 2008) · Nature Conservation Trust Rules, 1984 · Solid Waste (Management and Resource Mobilization) Rules, 1989 · Forest Rules, 1994

Source: JICA Survey Team

(2) International Convention, Agreement, Treaty and Protocol in Environment

Nepal participates in more than 20 international conventions, agreements, treaties and protocols related to environmental conservation participated by Nepal (See APPENDIX 5.2.1).

(3) Guidelines on Environmental Management for Road Development Projects in Nepal

Table 1.4.29 shows a list of relevant guidelines which are subject to road development projects in Nepal.

Table 1.4.29 Guidelines Which are Subject to Road Development Projects in Nepal

Guidelines	Organization Published	Year
National Environmental Impact Assessment Guidelines	NPC	1993
Environmental Management Guidelines	GEU/DOR	1999
Bio-Engineering Information (Rate Analysis Norms)	GEU/DOR	1999
Public Road Management and Land Acquisition Directives	DOR	2002
Environmental and Social Management Framework	DOR	2007
Interim Guidelines for Enhancing Poverty Reduction Impact of Road Projects (Draft)	GUSE/DOR	2007

Note: NPA: National Planning Commission, GEU: Geo-Environment Unit, GESU: Geo-Environment and Social Unit, DOR: Department of Road
Source: MoSTE, DOR/MoPIT

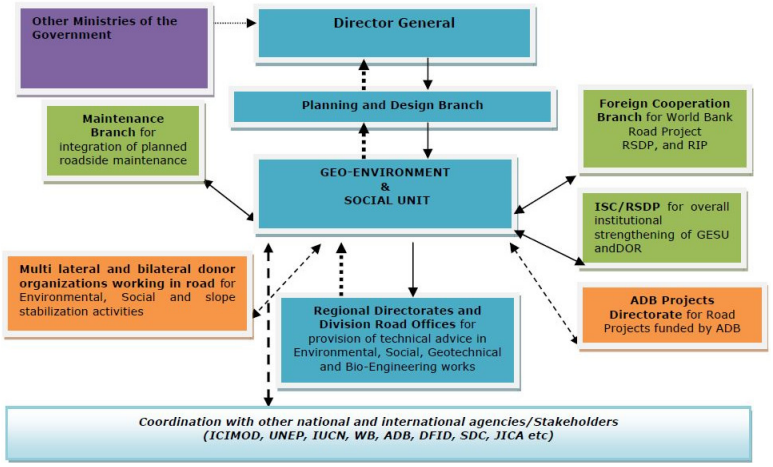
1.4.4.2 INSTITUTIONAL FRAMEWORK ON ENVIRONMENTAL MANAGEMENT FOR ROAD PROJECTS

(1) Ministry of Science, Technology and Environment (MoSTE)

MoSTE is the nodal governmental body of Nepal responsible for the environmental management of the country. In the case of an EIA study, Rule 5 of Section 2 of EPR 1997 (amended in 1999 and 2008) requires approval of the ToR for EIA and the EIA report lies with MoSTE.

(2) Geo-Environment and Social Unit (GESU) under the Department of Road (DOR)

The Department of Road (DOR) established the "Environmental Management Unit" in 1988 which was made a permanent cell under the Planning and Design Branch and was renamed as "Geo-Environment Unit (GEU)" in 1994 by DOR. In 2005, GEU's role was further strengthened and the unit was renamed "Geo-Environment and Social Unit (GESU)" to cover social aspects in road construction and maintenance. **Figure 1.4.12** shows the operational structure of GESU and its functional relationship with other units of DOR and external entities.



Source: GESU Business Plan (2069/2070 - 2071/2072), GESU/DOR, July 2013

Figure 1.4.12 Operational Structure of GESU

A circular issued by the Director General on 2069 (in year of 2012)-6-22 has clarified the role of GESU in the social and environmental assessment of all construction projects under the DOR and has specifically directed other units of the DOR to comply with the mandate of the GESU.

At present GESU consists of one Senior Divisional Engineer, two Civil Engineers, one Environmental Expert and one Sociologist.

1.4.4.3 ENVIRONMENTAL APPROVAL SYSTEM IN NEPAL

Sections 3, 4, and 5 of the Environmental Protection Act (EPA) 1997 stipulate the environmental requirements of IEE and/or EIA for projects which shall be approved from the concerned agency (e.g., MoPIT in terms of road development projects) and/or the MoSTE.

In addition, Schedule 1 and Schedule 2 of the Environmental Protection Rules (EPR) 1997 (amended in 1999 and 2008) give the lists of project sectors requiring IEE and/or EIA studies.

Based on the EPA and EPR, road sector stipulated in Schedules 1 and 2, requirement and approval of IEE and/or EIA for projects related to roads in Nepal can be summarized as tabulated in **Table 1.4.30**.

Table 1.4.30 Environmental Requirement and Approval in Road Sector

Item	Schedule 1	Schedule 2
Road Sector	· Construction of (a) district roads, (b) urban roads, (c) rural roads, (d) small feeder roads · Construction of 1 to 5 km long ropeway · Construction of 1 to 5 km long cable car routes · Construction of major bridges · Constructions of tunnels · Improvement, up grading and reconstruction of national highways and feeder roads.	· Construction of (a) national highways, (b) main feeder roads. · Construction of more than 5 km long ropeway. · Construction of more than 5 km long cable car routes.
Requirement	IEE	EIA
Approval	by MoPIT (concerned agency)	by MoSTE

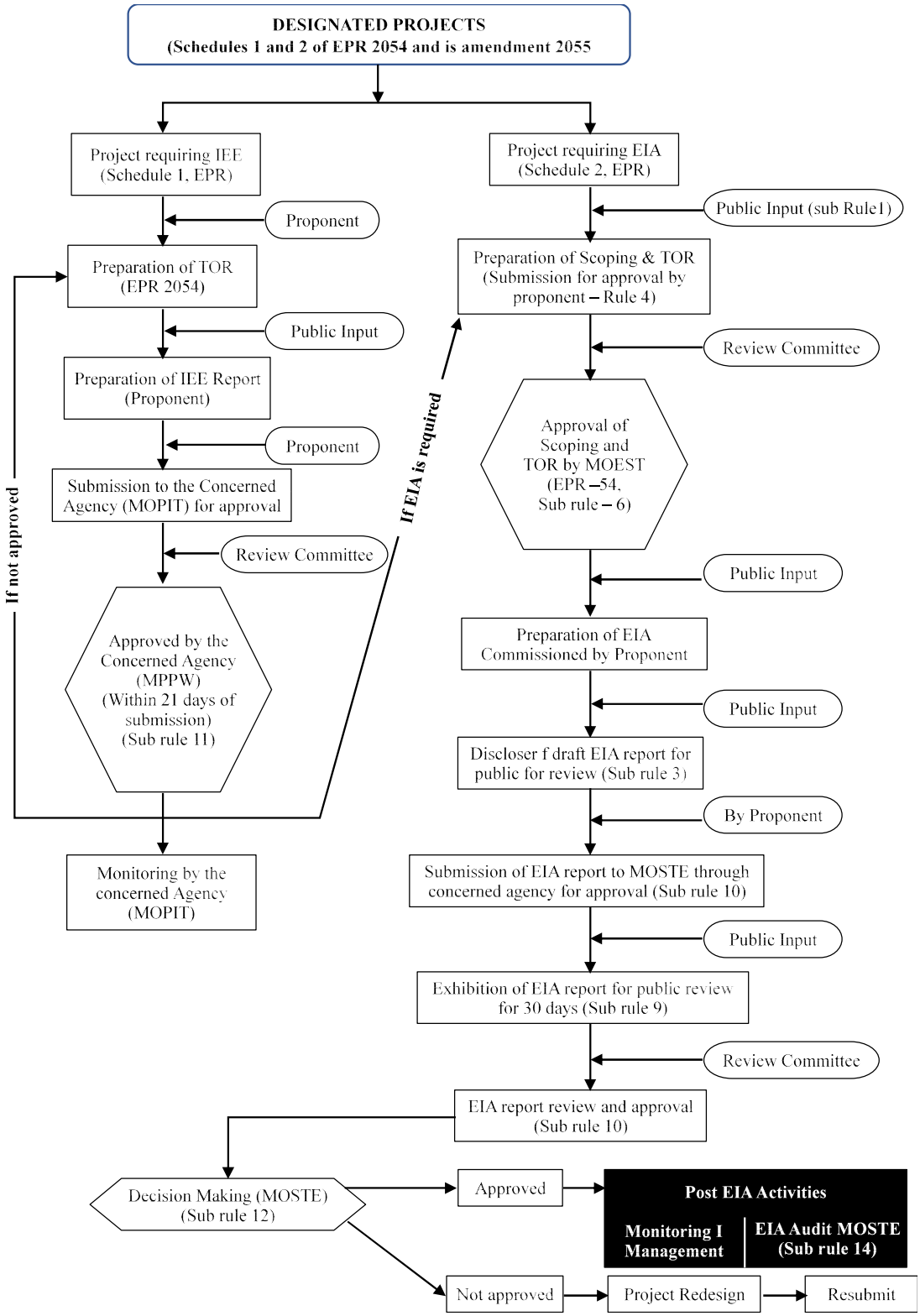
Source: EPA 1997 and EPR 1997 (amended in 1999 and 2008)

More specifically, according to Chapter 2 of EPR 1997 (amended in 1999 and 2008), for projects requiring an IEE, the proponent shall prepare the Terms of Reference (ToR) for the IEE study and submit to the concerned agency through the concerned department. The concerned agency has the responsibility for the final approval of the ToR and the IEE report. In cases of road development projects, DOR and MoPIT have responsibilities for IEE as follows:

- A ToR for the IEE study and the IEE report for any projects related to roads shall be prepared and submitted by DOR to the MoPIT through the Geo-Environment and Social Unit (GESU).
- The MoPIT is responsible for the approval of the ToR and IEE reports for the projects.

In addition, the EPA stipulates that while examining the IEE report of the proposal, it is found necessary also to carry out an EIA, and the concerned agency may issue order to carry out an EIA.

Overall, IEE and EIA approval processes in Nepal are shown in **Figure 1.4.13**.



Source: Environmental and Social Management Framework, DOR 2007 (modified and updated by the JICA Survey Team)

Figure 1.4.13 Approval Process of Environment Assessment Report in Nepal

1.4.4.4 SCREENING PROCESS FOR ROAD PROJECTS

The screening process for road projects to be done by DOR consists of two stages: Stage 1: project type and Stage 2: environmentally sensitive areas.

(1) Stage 1

The Stage 1 of screening is based on the project type as shown in **Table 1.4.31** in which comparison of requirements of environmental assessment (EA) prescribed by the EPR 1997 (amended in 1999 and 2008) and the World Bank (WB) category are specified.

Table 1.4.31 Screening Criteria by Project Type

Type of Project	Type of EA required	EA Category as per WB
Construction of National Highways	EIA	A
Construction of Major Feeder Roads	EIA	A
Construction of Minor Feeder Roads	IEE	B
Construction of District Roads	IEE	B
Construction of Urban Roads	IEE	B
Construction of Rural Roads	IEE	B
Construction of 1 to 5 km long Ropeways	IEE	B
Construction of more than 5 km long Ropeways	EIA	A
Construction of 1 to 5 km long Cable Car	IEE	B
Construction of more than 5 km long Cable Car	EIA	A
Construction of Major Bridges	IEE	B
Construction of Minor or Medium Bridges	Exempted	C
Construction of Tunnels	IEE	B
Routine, Recurrent, Periodic, and Emergency Maintenance	Exempted	C
Upgrading, Rehabilitation and Reconstruction of National Highways and Feeder Roads	IEE	B
Any Project which requires Deforestation, Clearance Felling or Rehabilitation of National Forest of an Area up to 5 hectares	IEE	B
Any Project which requires Deforestation, Clearance Felling or Rehabilitation of National Forest of an Area more than 5 hectares	EIA	A
Any Projects which is to be constructed within the Sensitive Area (Historical, Cultural and Archaeological; Ecologically Sensitive and Wetland Area; National Park, Wildlife Sanctuaries and Conservation Area; Semi-arid, Mountainous and Himalayan Regions; Flood-Prone and other Dangerous Areas; Residential, School and Hospital Areas; Areas that are Main Source of Public Water Supply)	EIA	A
Project with investment cost of NPRs 10 million to 100 million	IEE	B
Project with investment cost of over NRs 100 million	EIA	A
Project which involves the extraction of boulders, gravel, sand or soil from national forest areas	IEE	B
Project which involves the extraction of boulders, gravel, sand or soil from river beds with volume of over 50 tons or 50 m^3 per day	EIA	A
Project which involves the extraction of boulders, gravel, sand or soil from river beds with volume of less than 50 tons or 50 m^3 per day	IEE	
Project which involves the extraction of construction materials from medium to large quarries	EIA	
Stone crushing plants	IEE	
Mechanical workshops with area of over 3 hectares	EIA	
Mechanical workshops with area of 1 to 3 hectares	IEE	

Source: Policy Document, Environmental Assessment in Road Sector of Nepal, GUE/DOR, 2000, Environmental & Social Management Framework DOR2007 (amended by the JICA Survey Team)

(2) Stage 2

The "Policy Document, Environmental Assessment in Road Sector of Nepal, GUE/DOR, 2000" noted the screening Stage 2 as follows:

- Road projects either exempted or requiring an IEE must be subject to the second level of screening.
- This states that any road running through an environmentally sensitive area must be subject to a full EIA.

Table 1.4.32 lists the current list of environmentally sensitive areas for the whole Nepal.

Table 1.4.32 Screening Criteria by Environmentally Sensitive Area

Type of area	Defined Areas
National parks	· Royal Chitwan National Park · Sagamatha National Park · Langtang National Park · Rara National Park · Shey-Phoksundo National Park · Khaptad National Park · Royal Bardia National Park · Makalu-Barun National Park
Wildlife reserves	· Royal Shukla Phanta Wildlife Reserve · Koshi Tappu Wildlife Reserve · Parsa Wildlife Reserve · Dhorpatan Hunting Reserve · Shivapuri Watershed and Wildlife Reserve
Conservation areas	· Annapurna Conservation Area · Makalu-Barun Conservation Area
Wetland areas (other than those covered by defined areas above)	· Lake Gosainkund, Lake Bhairabkund and Panch Pokhari catchments · Lake Taudaha and Basant Gaon Pokhari catchments · Phewatal, Rupatal and Begnastal catchments · Lake Tilicho catchment · Lake Gokyo and Panch Pokhari catchments · Rapi, Riu and Narayani floodplains · Lake Gaidhawa and Jagdishpur reservoir catchments · Kamali floodplain · Lake Ghoda Ghodi catchment
World heritage sites	· Kathmandu Durbar Square · Patan Durbar Square · Bhaktapur Durbar Square · Swayambhunath · Baudhanath · Pashupatinath · Changu Narayan · Lumbini · Panauti
Other areas	· Known religious sites (*e.g.,* temple areas) · Known archaeological sites (*e.g.,* ruined rajas' durbars) · Nationally renowned forest areas (*e.g.,* Milke Danda, Mai Pokhari) · Drinking water supply catchments for hill towns with populations greater than 10,000 · Hospital compounds

Source: Policy Document, Environmental Assessment in Road Sector of Nepal, GUE/DOR, 2000

1.4.5 REQUIREMENTS ON ENVIRONMENTAL AND SOCIAL CONSIDERATIONS FOR THE PROJECT

Environmental assessment (EA) requirements of the Nepal side for the Project, which were discussed by DOR members. Study Team also discussed with Mr. Manoj Aryal (Environmental Inspector from DOR) in August 2017 considered the screening criteria and the project characteristics as the existing

road rehabilitation and EIA studies were already conducted for Sections II and III in which the project sections are located as well as the JICA Guidelines. The discussion result is shown in **Table 1.4.33**.

Table 1.4.33 EA Requirement for the Project

Project Component	Earthquake Rehabilitation	Slope Protection
Nepal EA requirement	IEE	Exempted
JICA Guidelines	IEE level Study	

Source: DOR and JICA Survey Team

- Accordingly, DOR shall initiate an IEE study as per the EPA 1997 and EPR 1997 (amended in 1999 and 2008), and relevant guidelines (See **Table 1.4.34**) and based on engineering and technical results from the feasibility study (F/S) of the JICA survey.
- In addition to the Nepalese side requirements, the projects shall also satisfy the JICA guidelines. According to JICA Guideline the Project has been categorized as "B" (See Section 1.4.6).
- Therefore, an IEE level study is required to be conducted in the JICA Preparatory Survey (See Section 1.4.6) in which stakeholder meetings (SHMs) are requested to be held and initiated by the DOR.
- **Table 1.4.34** summarizes IEE/EIA reports relevant to the Sindhuli Road projects including this Earthquake Rehabilitation Project.

Table 1.4.34 IEE/EIA Reports on Sindhuli Road Projects Prepared/to be Prepared by DOR

Section No.	Name of Road Section	Length (km)	IEE/EIA			
			Construction Project	Countermeasure Construction against the Landslide	Earthquake Rehabilitation Project (to be prepared)	
						Total No. of Project Stations
I	Bardibas – Sindhuli Bazaar	37	No[1)]	-	-	0
II	Sindhuli Bazaar – Khurkot	39	EIA[2)]	IEE[3)]	IEE[4)]	2
III	Khurkot – Nepalthok	32	EIA[2)]	-		3
IV	Nepalthok - Dhulikhel	50	No[1)]	-		0

Notes:
1) No Environmental Assessment, either EIA or IEE, was legally required at the period of the project implementation,
2) EIA for the road construction project was completed and approved
3) IEE for the countermeasure construction against the landslide was approved
4) IEE for the earthquake rehabilitation shall be prepared by DOR and approved by MoPIT by the tender schedule (to be incorporated in tender documents)
Source: DOR and JICA Survey Team

1.4.6 IEE AND STAKEHOLDER MEETING TO BE DONE BY DOR

1.4.6.1 DRAFT TOR AND SCHEDULE FOR IEE

In accordance with EPA 1997 and EPR 1997 (amended in 1999 and 2008), and relevant guidelines, a draft ToR for the IEE study for the Project has been prepared by DOR in cooperation with the JICA Survey Team (Draft ToR: See APPENDIX 5.2.2).

- **Table 1.4.35** shows a possible work schedule for the IEE study as per the requirements in EPR 1997 (amended in 1999 and 2008).
- Thus, a total of 15 weeks will be necessary for the IEE study and its approval by MoPIT.
- In addition, the procurement procedures including budgeting for a qualified local consultant for IEE shall officially be carried out by DOR for which approximately one month is required.
- Therefore, it can be considered that a total of about five months will be required for the IEE study and approval.
- As of December 2017, DOR initiated the necessary procedures for IEE so that the IEE study and approval will be finished by the end of June 2018.

Table 1.4.35 Proposed Work Schedule for Conducting IEE Study

No.	Activity	Week														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Desk study and review															
2	Field study and investigation															
3	Interaction with stakeholders and collection of suggestions															
4	Analysis and prediction of impacts															
5	Development of mitigation and preparation of monitoring plan															
6	Draft report preparation															
7	Publication of 15 days public notice															
8	Comments on draft report															
9	Collection of recommendation from local bodies															
10	Preparation and submission of final report															
11	Approval of the final report															

Source: Draft ToR for IEE

1.4.6.2 DRAFT PLAN AND SUMMARY OF SHM

As per discussions between DOR and the JICA Survey Team, DOR prepared a draft plan and schedule for SHMs to be held and initiated by DOR as follows:

- A total of nine times (three times in three local bodies) SHMs are planned to be held by DOR considering the boundaries of the local bodies (LBs) where five project stations of Section II and Sections III of Sindhuli Road are located.
- **Table 1.4.36** shows the SHMs schedule to be held in parallel with the IEE study.

Table 1.4.36 Draft Schedule of SHMs for Five Project Stations

Action (2018)	Jan				Feb			
	1st week	2nd week	3rd week	4th week	1st week	2nd week	3rd week	4th week
Prepare for stakeholders meeting plan by DoR/MoPIT								
Preparation of the 1st Meeting								
1st Meeting								
Summarization of1st Meeting and Preparation for 2nd meeting								
2nd Meeting								
Summarization of 2nd Meeting and Preparation for 3rd meeting								
3rd Meeting								
Summarization of 3rd Meeting								

Source: DOR

- As per the SHM DOR held a total of nine SHMs from January to March 2018 as summarized in **Table 1.4.47**.
- Nine SHMs were held in three Municipalities, each project station is located, in accordance with the following three stepwise approaches (phases) with the DOR idea.
  - 1st Phase SHM: Major target groups of the 1st Phase SHM are representatives and teachers etc. in the Municipalities and Districts of the project stations with purposes to share the project components, SHM plan and possible impacts arouse from the project with those target groups.

- 2nd Phase SHM: Major target groups of the 2nd Phase SHM are representatives and local people in the Municipalities and Districts of the project stations with purposes to share results of the 1st Phase SHM and discuss opinions and request from those local people with those target groups.
- 3rd Phase SHM: Major target groups of the 3rd Phase SHM are representatives in the Municipalities and Districts of the project stations with purposes to reaffirm all results of the 1st Phase and 2nd Phase SHMs with the target groups.

All results of SHMs are shown in (11) of Section 1.4.9.3 below.

Table 1.4.37 Summary of SHMs held by DOR Initiative

Project		Stakholder Meeting								
Section	Station	Phase	Purpose of each Phase	Main Target Grop	Date	Start Time	End Time	Venue	Target Community	Total Number of Praticipant
III	11+620 15+520	1	Explanation of project Plans, and SHMs as well as examination of possible Impacts	Municipality and Ward representatives and prominent figures such as school teacher	26th Jan.	13:00	15:00	Municipality Office	Sunkoshi Rural Municipality	11
II	33+440 33+695				26th Jan.	10:00	11:00	Municipality Office	Golanjor Rual Municipality	9
II	17+400				25th Jan.	13:00	15:00	Shree Primary School	Dhungre Bhanjyang, Kamala Mai Municipality	18
III	11+620 15+520	2	Explanation on the 1st Meeting results and Opinion Collection from local people	Municipality and Ward representatives and local people	6th Mar.	13:00	15:30	Municipality Office	Sunkoshi Rural Municipality	14
II	33+440 33+695				6th Mar.	10:00	12:00	Puspa Lower Secondary School, Barah	Golanjor Rual Municipality	19
II	17+400				5th Mar.	13:00	15:30	Shree Primary School	Dhungre Bhanjyang, Kamala Mai Municipality	21
III	11+620 15+520	3	Reaffirmation of all results of 1st and 2nd Phase SHMs	Municipality and Ward representatives and prominent figures	20th Mar.	11:00	12:00	Municipality Office	Sunkoshi Rural Municipality	6
II	33+440 33+695				20th Mar.	14:00	15:00	Municipality Office	Golanjor Rual Municipality	5
II	17+400				21st Mar.	14:30	16:00	Municipality Office	Kamala Mai Municipality,	8

Source: JICA Survey Team and DOR

1.4.7 GAP BETWEEN ENVIRONMENTAL MANAGEMENT SYSTEMS OF NEPAL AND THE JICA GUIDELINES

As a JICA grant aid is expected, the Project shall satisfy both the environmental management systems of Nepal and the JICA Guidelines.

- **Table 1.4.38** summarizes the consistency between the environmental management systems of Nepal and the JICA Guidelines.
- The table include actions to be taken to fill the gaps between the two different systems.

Table 1.4.38 Gap Between Nepal Environmental Management Systems and JICA Guidelines

Item	JICA Guidelines	Environmental Management Systems of Nepal	Gap Evaluation (✓) and Actions to be Taken to Fill the Gap (➢)
Principles	- Environmental impacts that may be caused by projects must be assessed and examined in the earliest possible planning stage. - Alternatives or mitigation measures to avoid or minimize adverse impacts must be examined and incorporated into the project plan. (Appendix 1 JICA Guidelines)	- Provision 3 of EPA (1997) stipulates environmental requirements of IEE and/or EIA for projects. - Schedule 1 and 2 of EPR (1997 amended in 1999 and 2008) gives lists of project sectors requiring IEE and/or EIA studies. - The Environmental and Social Management Framework 2007 DOR provides guidelines on the integration of the environmental and social assessment process in road project cycles.	✓ There is basically no gap. ➢ As the result of a screening made by DOR in cooperation with JICA Survey Team on Aug. 2017, an IEE study is required for this Project. ➢ As of Dec. 2017, DOR initiated preparation of a draft ToR, allocation of budget and procurement of a local consultant for the IEE study. ➢ The JICA Survey Team will monitor the progress of the IEE study preparation and implementation.
Disclosure of Information	- EIA reports (which may be referred to differently in different systems) must be written in the official language or in a language widely used in the country in which the project is to be implemented. - When explaining projects to local residents, written materials must be provided in a language and form understandable to them; - EIA reports are required to be made available to the local residents of the country in which the project is to be implemented. - The EIA reports are required to be available at all times for perusal by project stakeholders such as local residents and copying must be permitted; (Appendix 2 JICA Guidelines)	- Rule 7 of EPR (1997 amended in 1999 and 2008) stipulates disclosure of information which can be summarized and explained below. • The proponent (DOR in case of SRN) shall inform the VDCs/Municipalities, DDCs and other important stakeholders, individual or organizations concerned the implementation of the project and its impacts through a 15-day notice to be published in a national daily newspaper and notified at VDC/Municipality, DDC, school, hospital/health post. • While preparing EIA report, proponent shall organize a public hearing at the concerned VDC or Municipality to collect opinions and suggestions. • Comments and suggestions received through such a notice needs to be included in the IEE/EIA. • 15 Copies of IEE or EIA reports with the recommendations of concerned VDC or Municipality shall be submitted to the concerned body for the approval. - For approval of EIA report, a public notice will be issued in daily newspapers by MoSTE for 30 days to general public to make a copy of the report or to study it for offering opinions and suggestions on it for 30 days and the within 60 days, MoSTE will grant its approval.	✓ There is basically no gap. ➢ The official language of Nepal is Nepali language so that public notice, invitation and agenda, minutes of discussion and other documents are prepared in Nepali which are translated into English as common language of Nepal depending on circumstances. ➢ As regards environmental assessment studies, IEE/EIA reports are basically prepared in English especially for foreign donor's assistance projects. ➢ According to DOR, as far as IEE concerned, the reports can be prepared in both languages of Nepali and English if necessary. ➢ With regard to disclosure of information on this project to stakeholders, SHMs and IEE study to be done by DOR will be conducted (See the column of "Public Consultation/Meeting below)

Item	JICA Guidelines	Environmental Management Systems of Nepal	Gap Evaluation (✓) and Actions to be Taken to Fill the Gap (➢)
Public Consultation / Meeting	- For projects with a potentially large environmental impact, especially, sufficient consultations with local stakeholders, such as local residents, must be conducted via disclosure of information at an early stage, at which time alternatives for project plans may be examined. The outcome of such consultations must be incorporated into the contents of project plans. (Social Acceptability1, Appendix 1 of JICA Guidelines) - In preparing EIA reports, consultations with stakeholders, such as local residents, must take place after sufficient information has been disclosed. Records of such consultations must be prepared; - Consultations with relevant stakeholders, such as local residents, should take place if necessary throughout the preparation and implementation stages of a project. Holding consultations is highly desirable, especially when the items to be considered in the EIA are being selected, and when the draft report is being prepared. (Appendix 2, JICA Guidelines)	- Community Participation for EIA process is specified in the National EIA Guidelines 1993 which can be summarized below. • Time for Community Participation (a) Project Identification, feasibility and scoping. (b) IEE. (c) Detailed EIA study. (d) Monitoring, evaluation and auditing. • Individuals, Groups and Agencies to be Involved. (a) Local beneficiaries, target group, users groups, affected groups special interest groups (such as women). (b) Relevant government and private sector agencies. (c) Local leaders and academic groups. (d) Recognized experts. • Methods to Involve the Public (a) Community meetings and exchange of information. (b) Inter-personal contact. (c) Dialogue with user groups and local leaders. (d) Questionnaire, interviews, surveys (e) Reviews of the draft EIA report and monitoring/evaluation results by local community (f) Panels comprising representatives of concerned organizations and local people.	✓ There is basically no gap. ➢ A total of 9 times stakeholder meetings (SHMs) at three (3) Local Bodies (LBs) concerned in the five (5) Stations of the rehabilitation Projects of Sindhuli Road has been planned by DOR in cooperation with JICA Survey Team. ➢ Those SHMs are scheduled to be held by DOR initiative from Jan to Feb 2018 in parallel with the IEE study. ➢ Necessary documents on the SHMs (such as Invitation letters, agenda, participant lists and minutes of meetings and others) are prepared by DOR in the local language of Nepali.

Item	JICA Guidelines	Environmental Management Systems of Nepal	Gap Evaluation (✓) and Actions to be Taken to Fill the Gap (➢)
Scope of Impacts to be Assessed	- The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accidents, water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts. These also include social impacts, including migration of population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety. (Scope 1, Appendix 1, JICA Guidelines) - In addition to the direct and immediate impacts of projects, their derivative, secondary, and cumulative impacts as well as the impacts of projects that are indivisible from the project are also to be examined and assessed to a reasonable extent. It is also desirable that the impacts that can occur at any time throughout the project cycle should be considered throughout the life cycle of the project. (Scope 2, Appendix 1, JICA Guidelines)	- Schedule 5 and Schedule 6 of EPR (1997 amended in 1999 and 2008) stipulates "Matter to be mentioned in IEE and EIA report respectively in which impacts to be assessed are specified. The following summarizes Schedule 5 for IEE which is subject to the Project for the Sindhuli Road Earthquake Rehabilitation. • Impact on the social, economic cultural spheres: (i) Impact on human health (ii) Degradation of cultivable land, (iii) Destruction of forests, (iv) Changes in social, cultural and religious norms and value, (v) Others. • Biological Impact: (i) Population, (ii) Flora and fauna. (iii) 'Natural habitat and communities • Physical Impact: (i) Land, (ii) Atmosphere, (iii) Water, (iv) Noise, (v) Man-made objects, (vi) Others - In addition, the Environmental and Social Management Framework 2007 DOR provides guidelines on the integration of the environmental and social assessment process in road project cycles.	✓ There is basically no gap. ➢ In order to fulfill both requirements of Nepal and the JICA Godliness, JICA Survey Team provides necessary advices in the preparation of a Draft ToR for the IEE study, and presents appropriate recommendations to DOR in the environmental and social considerations study to be done by the JICA Survey Team as needed

Item	JICA Guidelines	Environmental Management Systems of Nepal	Gap Evaluation (✓) and Actions to be Taken to Fill the Gap (➢)
Monitoring, grievance adjustment and etc.	- Project proponents etc. should make efforts to make the results of the monitoring process available to local project stakeholders. (Monitoring 3, Appendix 1, JICA Guidelines) - 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 stakeholders' participation in relevant projects. Project proponents etc. should make efforts to reach an agreement on procedures to be adopted with a view to resolving problems. (Monitoring 4, Appendix 1, JICA Guidelines)	- Rule 13 of EPR (1997 amended in 1999 and 2008) stipulates "Monitoring and Evaluation" as shown below. • The concerned body (DOR in terms of road projects) shall monitor and evaluate the impact of the implementation of the proposal on the environment. • In case where it is found that the actual impact is higher than the one specified in the conditions prescribed at the time of approving the proposal, the concerned body shall issue necessary directives to the proponent to adopt measures to reduce or control such impact and it shall be the duty of the concerned proponent to comply with such directives. • The concerned body shall also inform MoSTE about the directives issued to the proponent. - With regard to information disclosure on the monitoring and evaluation, the National EIA Guidelines 1993 specifies as shown in the column of "Public Consultation / Meeting" above.	✓ There is basically no gap. ➢ In order to fulfill both requirements of Nepal and the JICA Godliness, JICA Survey Team provides necessary advices in the preparation of a Draft ToR for the IEE study, and presents appropriate recommendations to DOR in the environmental and social considerations study to be done by the JICA Survey Team as needed.
Ecosystem and Biota, and Protected Areas	- Projects must not involve significant conversion or significant degradation of critical natural habitats, critical forests and protected areas. (JICA Guidelines)	- Provision 10 of EPA (1997) stipulates "Environment Protection Area" as follows. • Government of Nepal may, by a notification in the Nepal Gazette, maintain any place within Nepal containing natural heritage or aesthetic, rare wildlife, biological diversity, plant, and places of historical and cultural importance, which are considered extremely important from viewpoint of environment protection, as an Environment Protection Area. • The activities of any act as prescribed may be prohibited in the Environment Protection Area - In addition, screening process for road projects to be done by DOR consists of two stages of the "Stage 1: Project Type" and the "Stage 2: Environmentally Sensitive Areas by which "significant conversion or significant degradation of critical natural habitats and critical forests" are reviewed for the categorization of EA.	✓ There is basically no gap. ➢ JICA Survey team provides technical advice to the Screening process for the Project done by DOR. ➢ JICA Survey Team provides necessary advices in the preparation of a Draft ToR for the IEE study, and presents appropriate recommendations to DOR in the environmental and social consideration study to be done by the JICA Survey Team as needed.
Indigenous Peoples	- Any adverse impacts that a project may have on indigenous peoples are to be avoided when feasible by exploring all viable alternatives. When, after such an examination, avoidance is proved unfeasible, effective measures must be taken to minimize impacts and to compensate indigenous peoples for their losses. (JICA Guidelines)	- As Nepal is a multiethnic country, the project area of Sindhuli District, 126 such castes/ethnicities have been identified in 2011 (CBS). - Relevant guidelines on environmental and social considerations of DOR such as "Draft Interim Guidelines for Enhancing Poverty Reduction Impact of Road Projects 2007 GESU of DOR at MoPIT" in which issues and countermeasures for poverty reduction, ethnic groups and indigenous peoples are discussed and guided are applied for road projects.	✓ There is basically no gap. ➢ JICA Survey team provides technical advice to the Screening process for the Project done by DOR. ➢ JICA Survey Team provides necessary advices in the preparation of a Draft ToR for the IEE study, and presents appropriate recommendations to DOR in the environmental and social considerations study to be done by the JICA Survey Team as needed.

Source: JICA Guidelines, EPA (1997), EPR (1997 amended in 1999 and 2008), National EIA Guidelines 1993, Environmental and Social Management Framework 2007 DOR and JICA Survey Team

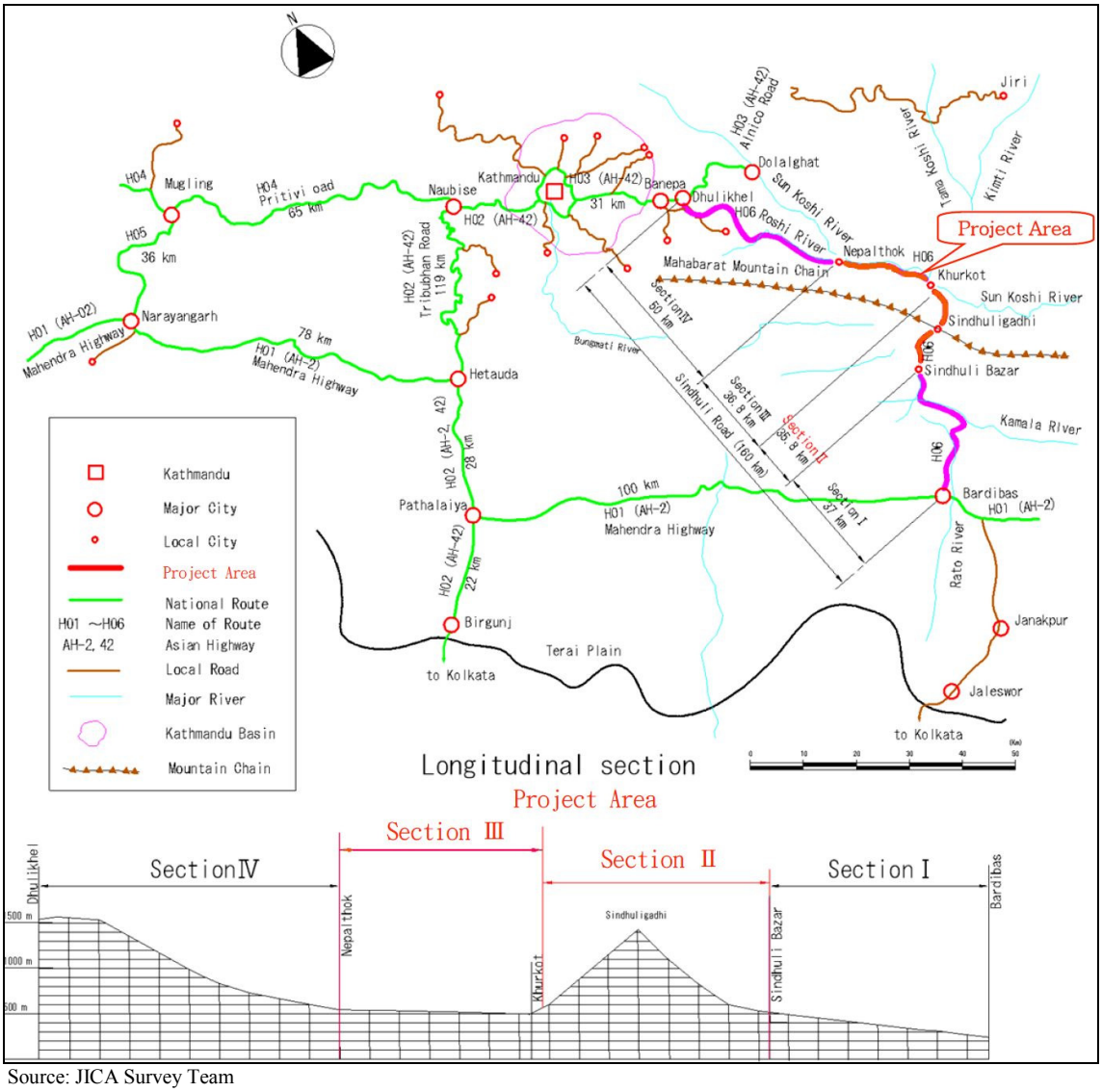
1.4.8 LAND ACQUISITIONS AND RESETTLEMENT

Land acquisition and resettlement for the rehabilitation project of Sindhuli Road will not occur since the rehabilitation project was planned to be conducted within ROW of the Road. It has been confirmed in the field survey that there is no illegal occupation in the ROW of each station subject to the project (See 1) to 3) at Section 1.4.3.3).

1.4.9 EXAMINATION ON ENVIRONMENTAL AND SOCIAL IMPACT

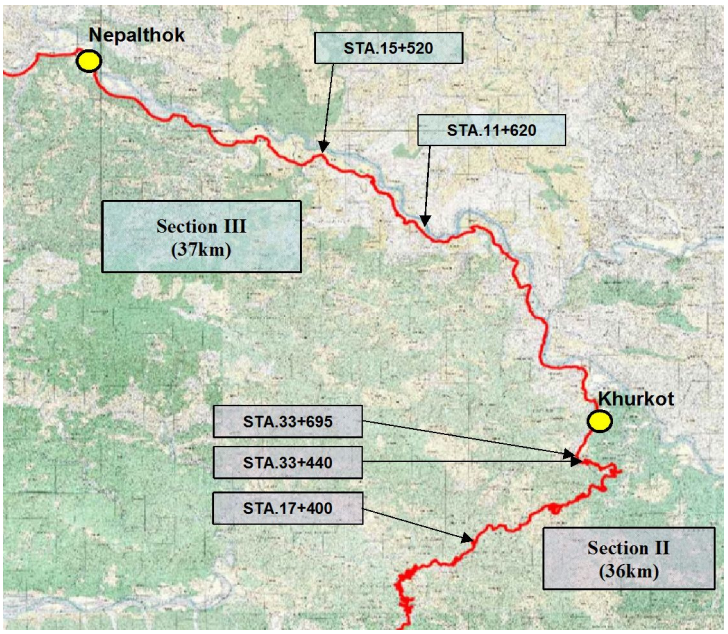
1.4.9.1 PROJECT COMPONENTS

The Project is permanent rehabilitation for the five stations on Sections II and III of the Sindhuli Road, of which area and positions are shown in **Figure 1.4.14** and **Figure 1.4.15**, respectively. The objective of the project is to implement the permanent countermeasures against the damaged stations in order to keep sustainable traffic function of the road.



Source: JICA Survey Team

Figure 1.4.14 Project Area Map



Source: JICA Survey Team

Figure 1.4.15 Project Station Map

The project stations and outline of damage are summarized in **Table 1.4.39** and proposed countermeasures against the damage as the project components are shown in **Table 1.4.40**.

Table 1.4.39 Outline of the Project Location (Station) and Damage

SN.	Sec.	Road Station (Sta.)		Structure	Alignment	Outline of Damage	
		Center	Deformed			Surface	Structure/Slope
9	II	33+440	33+430 - 33+460 (L= 30.0m)	Valley side gabion wall H=6.5m V/H1:0.1	Outer curve	Settlement of road surface, wide opening crack	Deformation of gabion wall
10	II	33+695	33+680 - 33+710 (L=30.0m)	Valley side gabion wall H=7.0m V/H1:0.1	Outer curve	Wide opening crack appeared at road cantor	Slightly heavy deformation of gabion wall
14	III	11+620	11+580 - 11+660 (L=80.0m)	Valley side gabion wall H=6.0m V/H1:0.1	Outer curve	Crack on road and settlement	Deformation of gabion wall
16	III	15+520	15+500 - 15+560 (L=60.0m)	Valley side gabion wall H=6.0m V/H1:0.1	Narrow outer curve	Crack on road and settlement	Deformation of gabion and erosion at the front of base
24	II	17+400	17+360 - 17+450 (L=90.0m)	Valley side Stone pitching	Narrow curve	Pot hole appeared in 2017/8	Progress of slope failure and erosion

Source: JICA Survey Team

Table 1.4.40 Outline of the Countermeasure (Project Components)

SN.	Sec.	Sta.	Actions by DOR	Countermeasures by Project	Remarks
9	II	33+440	Damaged area of the road has been protected by alternative traffic passage	Anchoring method	Traffic control, permanent countermeasure by Japanese grant aid
10	II	33+695	Damaged area of the road has been protected by alternative traffic passage	Anchoring method	Traffic control, Permanent countermeasure by Japanese grant aid
14	III	11+620	Buttress wall has been constructed by DOR	Anchoring method	Permanent countermeasure by Japan grand aid
16	III	15+520	Widening of the road to mountain	Anchoring	Permanent countermeasure

SN.	Sec.	Sta.	Actions by DOR	Countermeasures by Project	Remarks
			side and overlay will be done by DOR	method	by Japanese grant aid
24	II	17+400	In 2013, temporary slope protection by masonry was done by DOR	Concrete flame with ground anchor work	Permanent countermeasure by Japanese grant aid

Source: JICA Survey Team

1.4.9.2 PROJECT ALTERNATIVE STUDIES

In consideration of the characteristics of earthquake rehabilitations, alternative analyses of technical, operational, environmental and social, and financial aspects on the project stations on the Sindhuli Road to be covered by the Project have been compared in the course of the design stage of the Project as summarized in **Table 1.4.41**.

Table 1.4.41 Alternative Comparison for the Project in Terms of Technical and Environmental Aspects

Station	17+400 (Section II)					15+520 (Section III), 11+620 (Section III) and 33+400 (Section II)					33+695 (Section II)				
Counter-measure	1st Option		2nd Option		3rd Option	1st Option		2nd Option			1st Option		2nd Option		3rd Option
	Ground Anchors and Retaining Frame		Steel Piles with Ground Anchors		Bridge	Ground Anchors		Steel Piles with Ground Anchors			Ground Anchors		Steel Piles with Ground Anchors		Buttress Concrete
Stability	Clamping and straining effect by anchor will increase in safety factor of the loose rock mass.	3	Clamping and straining effect by anchor will increase in safety factor of the loose rock mass.	3	If soil erosion and slope failure develop, countermeasure for base of bridge become necessary. 2	Safety factor of earth pressure of gabion wall will increase.	3	Safety factor of earth pressure of gabion wall will increase.	3		Safety factor of earth pressure of gabion wall will increase.	3	Safety factor of earth pressure of gabion wall will increase.	3	Safety factor of filling, sliding, bearing resistance will secure. 2
Workability	Crib works for wide area and scaffolding works require long construction term.	2	Pile works have advantage for workability, but high intensity network for wide area and requires long construction term.	2	This method requires wide construction yard. 1	Using precast steel plates can reduce construction period. The anchor can be fabricated at each site.	3	Workability of installation of piles at steep slope is inferior.	1		Using precast steel plates can reduce construction period. The anchor can be fabricated at each site.	3	Workability of installation of piles at steep slope is inferior.	1	Relatively easy to construct because of the casing by the formwork under the road. 3
Operation and Maintenance (O&M)	Ground anchor with anticorrosion coating is used. Only monitoring of load by using load measure is required for maintenance.	3	Ground anchor with anticorrosion coating is used.	3	Expansion device of bridge is required periodically. 2	Ground anchor with anticorrosion coating is used. Only monitoring of load by using load measure is required for maintenance.	3	Ground anchor with anticorrosion coating is used.	3		Ground anchor with anticorrosion coating is used. Only monitoring of load by using load measure is required for maintenance.	3	Ground anchor with anticorrosion coating is used.	3	Basically, it is maintenance free. 3
Influence on Road	Only occasional one-way closure of road is required for hauling construction materials.	3	Continuous one-way closure of road is required during pile works.	1	Continuous one-way road closure is required during all works. 1	Only occasional one-way closure of road is required for hauling construction materials.	3	Continuous one-way closure of road is required during pile works.	1		Only occasional one-way closure of road is required for hauling construction materials.	3	Continuous one-way closure of road is required during pile works.	1	Basically, it will be work under the road. The road closure (one side) on the current road is limited to primary obstacles such as when transporting materials. 3
Environment and Social	This method has a low impact to environment. Vegetation works is conducted at the lower slope.	3	This method has a low impact to the environment. Vegetation works are conducted at the lower slope.	3	Removal of some houses is required. 1	This method has a low impact to the environment.	3	This method has a low impact to the environment.	3		This method has a low impact to the environment. Construction is in the ROW so that land acquisition and resettlement will not occur.	3	This method has a low impact to the environment. Construction is in the ROW so that land acquisition and resettlement will not occur.	3	This method has a low impact to environment. Construction is in the ROW so that land acquisition and resettlement will not occur. 3
Sub-total	1st Option is ahead of other Options in above viewpoints.	14	2nd option is inferior to the 1st option in the above viewpoints, especially in the influence to road.	12	3rd option is inferior to the 1st option in most of the above viewpoints. 7	1st option is ahead of the 2nd option in the above viewpoints	15	2nd option is inferior to the 1st option in the above viewpoints, especially in workability.	10		1st option is ahead of the other options in the above viewpoints.	15	2nd option is inferior to the 1st option in the above viewpoints, especially in workability.	11	3rd option is inferior to the 1st option in most of the above viewpoints 14
Total Cost (JPY1,000)	257,010		266,446		474,660	83,831		89,168			263,798		266,446		474,660
	Lowest		Second lowest		Highest	Lowest		Highest			Lowest		Second lowest		Highest
Total Evaluation	First Priority		Second Priority		Third Priority	First Priority		Second Priority			First Priority		Second Priority		Third Priority

Note) Rating for Environmental and Social 【1: Involuntary resettlements are predicted, 2: Impacts on existing houses are predicted, 3: No impacts are predicted because that construction is planned in ROW】
Source: JICA Survey Team

1.4.9.3 STUDY ON WITHOUT-THE PROJECT

Consequences for Without-the Project are considered as follows:

- ✓ The damaged road stations will not be permanently enforced of which circumstances will lead to further damages by daily operation of road and/or future possible earthquakes in Nepal, until finally the road cannot be used.
- ✓ Impacts on natural and social environment caused by the construction and operation of the Project will not occur at all (due to the without-the projects).
- ✓ DOR will study and find other technical solutions especially for the damaged stations on the Sindhuli Road to satisfy the growing traffic demands in the regions for which further budgets will be required.

Considering minor environmental and social impacts (discussed below) caused by the Project, and financial and technical constraints of DOR, it is evaluated that the selection of Without-the Project is not realistic.

1.4.9.4 SCOPING RESULTS AND TERMS OF REFERENCE (TOR) FOR THE ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

(1) Scoping Results

The definition of “Scoping” in the environmental and social considerations study according to the JICA Guidelines is “choosing alternatives for analysis, a range of significant and potentially significant impacts, and study methods”. **Table 1.4.42** shows the scoping result for the proposed Project.

Currently Sindhuli Road is in service. In the areas damaged by the earthquake, temporal restorations were carried out by which one-way traffic in several stations are under way at the moment. Those one-way traffic areas are limited to about 200 m out of 160 km of total length of Sindhuli Road.

Vehicle traffic is also used in the construction period for rehabilitation, and since the restoration work is a project to restore the original state (the project stations recovers to the situation before the earthquake). For this reason, it seems that it is not appropriate for this project to distinguish the "Construction Phase" and "Operation Phase" which will be applied to new construction projects.

Therefore, “Con. “and “Construction Phase as well as “Ope.” and “Operation Phase” in **Table 1.4.42**, are considered to be applicable only to this project as follows;

- Con. and Construction Phase: Construction for Restoration Phase (Road traffic in service: Partially one-way traffic)
- Ope. and Operation Phase: Pose-Restoration Phase (Road traffic in service: Fully restoration of traffic before the earthquake)

Table 1.4.42 Scoping Results

Category/ No.		Environmental Item	Rating		Reasons
			Con.	Ope.	
Pollution Control	1	Air Quality	B-	C	Construction Phase: Worsening of surrounding ambient air caused by exhaust gases and dusts emitted from operation of heavy vehicles, equipment and trucks is predicted during construction of each station.
					Operation Phase: The project is the rehabilitation and reinforcement of the five stations damaged by earthquake to restore to the original state of road traffic. However, in general natural increase in car traffic can be considered as a result of surrounding community development and/or population growth.
	2	Water Quality	C	C	Construction Phase: Water pollution caused by construction work, operation of heavy vehicles, equipment and trucks, and wastewater of workers and labors is predicted.
					Operation Phase: The project is the rehabilitation and reinforcement of the five stations damaged by earthquake to restore to the original state of road traffic. However, in general natural increase in car traffic can be considered as a result of surrounding community development and/or population growth.
	3	Wastes	C	C	Construction Phase: Soil and stones generated by the rehabilitation constructions are planned to be backfilled on site. However, litter and rubbish will be discharged by the labors and works employed.
					Operation Phase: The project is the rehabilitation of the road stations damaged by earthquake to restore to the original state of road traffic. However, in general natural increase in car traffic can be considered as a result of surrounding community development and/or population growth. However, in general natural increase in car traffic can be considered as a result of surrounding community development and/or population growth.
	4	Soil Contamination	C	C	Construction Phase: There is possibility of soil contamination due to oil spills from relevant construction vehicles and equipment.
					Operation phase: The project is the rehabilitation and reinforcements of the five stations damaged by earth quake to restore to the original state of road traffic. However, in general natural increase in car traffic can be considered as a result of surrounding community development and/or population growth.
Natural Environment	5	Noise and Vibration	C	C	Construction Phase: Generation of noise caused by construction vehicles and heavy equipment is expected.
					Operation Phase: The project is the rehabilitation and reinforcement of the five stations damaged by earth quake to restore to the original state of road traffic. However, in general natural increase in car traffic can be considered as a result of surrounding community development and/or population growth.
	6	Subsidence	D	D	Since this project is the rehabilitation and reinforcement of the five stations of the existing Sindhuli roads, work and operation that will cause ground subsidence is not expected at all.
	7	Odor	D	D	Since this project is rehabilitations and reinforcements at the five stations of existing Sindhuli Roads, work and operation that will cause generation of bad odor is not expected at all.
	8	Protected Areas	D	D	Protected area and national parks do not exist at all in and around each ROW of the stations of Sindhuli Road to be rehabilitated and reinforced.
	9	Ecosystem	D	D	Rare and protected species and habitats of flora and fauna have not been identified in and around the road stations to be rehabilitated at all.
	10	Hydrology	D	D	Construction Phase: Section III of Sindhuli Road exists along the Sunkoshi River. However, the five stations to be retaliated and reinforced by the project do not get across any river and surface streams at all. Therefore, no impact on hydrology in the road sections for rehabilitations is expected. Operation Phase: No impact on hydrology is expected by the normalization of the road traffic at the five stations to be rehabilitated and reinforced by the project.
	11	Topography and Geology	D	D	Large scale excavation and earth fill are not expected due to rehabilitations and reinforcements of the five stations of Sindhuli Road.
Social Environment	12	Land Acquisition /Resettlement	D	D	The damaged five stations are planned to be rehabilitated and structurally reinforced in ROW of the existing Sindhuli Road. Therefore, no land acquisition and resettlement are predicted.
	13	Impoverished Peoples Ethnic Minorities and Indigenous Peoples	D	D	Nepal is a multiethnic country. According to the Central Bureau of Statistics, in the project area of Sindhuli District, 126 castes/ethnicities have been identified in 2011. However, the project is the rehabilitation and reinforcement of the five stations damaged by earth quake to restore to the original state of road traffic. Therefore, immediate impacts on the ethnic minorities and indigenous people are not predicted. In addition, relevant guidelines on environmental and social considerations of DOR such as the "Draft Interim Guidelines for Enhancing Poverty Reduction Impact of Road Projects 2007 GESU of DOR at MoPIT" in which issues and countermeasures for poverty reduction, ethnic groups and indigenous peoples are discussed and guided are to be applied for road projects.

Category/ No.		Environmental Item	Rating		Reasons
			Con.	Ope.	
	14	Living and Livelihood	B+/-	C	Construction Phase: A temporary and priority employment of the surrounding villagers is expected for the construction work. However, in general natural increase in car traffic can be considered as a result of surrounding community development and/or population growth.
					Operation Phase: The project is the rehabilitation and reinforcement of the five stations damaged by earth quake to restore to original state of the road traffic.
	15	Land use and Regional Resources	D	D	Construction Phase: There is no possibility of negative impact on surrounding land use and regional resources caused by the rehabilitations and reinforcements of the five stations of existing Sindhuli Road.
					Operation Phase: There is no possibility of negative impact on surrounding land use and regional resources caused by the normalization of the road traffic at the five stations of existing Sindhuli Road.
	16	Water Right/Use of Water	D	D	Construction Phase: There is no irrigation channel and surface stream at the five stations of existing Sindhuli Road. As far as construction water concerned, necessary water for each rehabilitation and reinforcement work is planned to be procured by contractor(s) from the Sunkoshi River (average annual flow is 22 x 109 m^3) as one of the large rivers of Nepal.
					Operation Phase: No impact on water right/use of water
	17	Social Infrastructures and Services	B-	D	Construction Phase: Negative impacts on surrounding road traffic congestion by increase in the number of heavy vehicles, equipment and transport trucks are temporally predicted during construction period.
					Operation Phase: No impact on social infrastructure and services is predicted in the operation phase.
	18	Heritage	D	D	Local archeological, historical, cultural, and religious heritages are not existed in ROW of the five stations of existing Sindhuli Road.
	19	Social Capital and Social Organization such as Decision-Making Bodies	D	D	Any impacts on social capital and social organization are not expected by the project.
	20	Damage and Benefit	D	D	The project is rehabilitation and reinforcement for the normalization of the traffic of Sindhuli Road by which such inequality of damage and benefit is not predicted around the project area.
	21	Landscape	D	D	Any negative impacts on the surrounding landscape are not expected by the rehabilitation and reinforcement project for the five stations of existing Sindhuli Road.
	22	Gender Issue	C	D	Gender issues will be considered in accordance with relevant guidelines of DOR as well as DOR policy on non-discriminatory labor employment with regard to gender will be applied to the project. Therefore, any impacts on gender are basically not expected by the project.
	23	Rights of the Child	C	D	Child employment is prohibited for road project in accordance with relevant guidelines on environmental and social consideration of DOR. Any impacts on rights of the child are basically not expected by the project.
	24	Risk of Infectious Diseases such as HIV/AIDS	B-	D	Construction Phase: Temporary influxes of migrant labors increase the risks of STD such as HIV/AIDS during the construction period.
					Operation Phase: The project is rehabilitation and reinforcement of the five stations damaged by earth quake to restore to original state of the road traffic.
	25	Working Conditions/ Work Safety	C	D	Construction Phase: Deterioration of occupational safety and working condition associated with the construction work is anticipated if not properly managed.
					Operation Phase: The project is rehabilitation and reinforcement of the five stations damaged by earth quake to restore to original state of the road traffic.
Others	26	Accidents	C	C	Construction Phase: Accidents associated with construction work is predicted.
					Operation Phase: The project is rehabilitation and reinforcement of the five stations damaged by earth quake to restore to original state of the road traffic. However, in general natural increase in car traffic can be considered as a result of surrounding community development and/or population growth.
	27	Transboundary or Global Issues	D	D	This project is rehabilitation and reinforcement for the five stations of existing Sindhuli Road to restore to original state of the road traffic by which such impacts on transboundary or global issues such as climate change practically are not predicted during construction and operation phases

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.

Note: Con. & Construction Phase: Construction for Rehabilitation Phase,
Ope & Operation Phase.: Post-Rehabilitation Phase

Source: JICA Survey Team

(2) TOR for Environmental and Social Considerations Study

In accordance with the scoping results shown in **Table 1.4.42**, a Terms of Reference (TOR) prepared for the environmental and social considerations study for the Project, to be conducted in the Study, is shown in **Table 1.4.43**.

Table 1.4.43 TOR for Environmental and Social Considerations Study

Environmental Item	Study Item	Study Method
Alternatives	i. Environmental and social conditions around the five damaged stations. ii. Construction options for the rehabilitation and reinforcement iii. Workability, maintenance & operation iv. Total construction cost.	i.–iv. Site reconnaissance, literature reviews and interviews around each site and meetings with relevant officials and engineers. Based on these reviews, meetings, and proposed project components, the most suitable technology for each station is comprehensively evaluated.
Air Pollution	i. Present traffic volume. ii. Air quality in and around the stations. iii. Impact during construction work	i. Review of existing data ii. Review of existing data of EIA reports and others documents as well as site reconnaissance iii. Based on the above studies, simple calculation for necessary numbers of construction vehicles, equipment, and trucks are evaluated.
Water Pollution	i. Water quality in and around the site. ii. Impacts during construction.	i. Review of existing data of EIA reports and others and site reconnaissance. ii. Based on the reviews and reconnaissance as well as construction methods, the impacts during construction are evaluated.
Wastes	i. Domestic solid waste management.	i. Interviews with relevant official entities.
Soil Contamination	i. Construction method to be applied. ii. Construction vehicle and equipment to be used.	i. Site reconnaissance and construction plans. ii. Site reconnaissance and construction plans.
Noise and Vibration	i. Construction method to be applied. ii. Construction vehicle and equipment to be used.	i. Site reconnaissance and construction plans. ii. Site reconnaissance and construction plans.
Living and Livelihood	i. Project policy ii. Impacts on livelihood.	i. Discussion with relevant official entities. ii. Prediction of impacts on livelihood.
Social Infrastructures and Services	i. Present traffic volume. ii. Construction vehicle and equipment to be used.	i. Review of existing data and construction plan. ii. Site reconnaissance and construction plan.
Risk of Infectious Diseases such as HIV/AIDS	i. Health situation in the project area and in India. ii. Health educational activities.	i. Review of relevant documents. ii. Review of relevant laws and regulations.
Working Conditions/Work Safety	i. Occupational safety systems. ii. Relevant to law and regulation.	i. Review of relevant laws and regulations. ii. Review of past EIA and relevant documents.
Accidents	i. Present traffic volume.	i. Review of existing data and interviews.
Stakeholders Meetings	i. Opinions of stakeholders in and around the project site.	i. Meetings/interviews with the following stakeholders to be initiated by DOR: - Communities and village heads and/or people living in the surrounding areas of the five stations.

Source: JICA Survey Team

1.4.9.5 RESULTS OF ENVIRONMENTAL AND SOCIAL CONSIDERATIONS STUDY

(1) Air Pollution

During the construction phase, heavy vehicles and equipment, and trucks to be used in the project site (each station) will generate exhaust gases. **Table 1.4.44** summarizes the total construction period schedule and equipment used for construction at each station.

Table 1.4.44 Construction Period and Construction Equipment Input for Each Station

Station	Construction Period*	Heavy Vehicle and Equipment	Input	(c) Number/day for Each Construction Period (6-day/week and 8-hour/day)
	(a) Month		(b) Total Number	(c) = (b)/(365/12*(a)) *7/6*24/8
33+440	4-month	Boring machine (for anchors)	1	0.03
		Truck-mounted crane	1	0.03
		Spraying machine	1	0.03
33+695	3-month	Boring machine (for anchors)	1	0.04
		Truck-mounted crane	1	0.04
		Spraying machine	1	0.04

Station	Construction Period*	Heavy Vehicle and Equipment	Input	(c) Number/day for Each Construction Period (6-day/week and 8-hour/day)
	(a) Month		(b) Total Number	(c) = (b)/(365/12*(a)) *7/6*24/8
11+620	3-month	Boring machine (for anchors)	1	0.04
		Truck-mounted crane	1	0.04
		Spraying machine	1	0.04
15+520	8-month	Boring machine (for anchors)	1	0.01
		Truck-mounted crane	1	0.01
		Spraying machine	1	0.01
		Drilling machine (for lockbolts) **	1	0.01
17+400	14-month	Boring machine (for anchors)	1	0.01
		Drilling machine (for lockbolts) **	2	0.02
		Rafter truck crane (25ton)	1	0.01
		Spraying machine	1	0.01
		Dump truck (water tank truck) (4 ton)	1	0.01

* 6-day working/week and 8-hour working/day is scheduled for the construction
** combined use
Source: JICA Survey Team

In accordance with **Table 1.4.44**, it is understood that the inputs of heavy vehicles and construction equipment will be limited for each construction period of 3 – 14 months of every stations as discussed below.

- It can be calculated that total numbers of heavy trucks and equipment is less than one/day used for each station in gross.
- Nepal has introduced exhaust standards for new vehicles by applying Euro 3 standards since 2014, and has implemented restrictions on vehicles of which age is more than five years and on imports of used/ restored vehicles to Nepal.

With regard to the construction phases, due to the fact that the project site of each station on the existing Sindhuli Road is an open mountainous land, it is considered that exhaust gases from those trucks and equipment are easily diffused into the surrounding environment.

However, in the dry season, dust of dried sandy soil in each station can easily be stirred up by such trucks and equipment in operation on site, therefore a limited impact on air quality is predicted.

(2) Water Pollution

Construction workers and laborers will generate human waste that will be discharged as wastewater. The total number of construction workers and laborers is estimated at about 576-6,720 persons for the 3- to 14-month construction works at each station by which daily average numbers of such workers and laborers are summarized in **Table 1.4.45**.

Table 1.4.45 Workers and Laborers Necessary for the Construction of Each Station

Station	Total Labor Force (persons)	Construction Period (month)	Daily Average Numbers of Workers/Labors (persons) (6-day/week basis)
33+440	768	4	7.36
33+695	576	3	7.36
11+620	576	3	7.36
15+520	1,664	8	7.98
17+400	6,720	14	18.41

Source: JICA Survey Team

It can be considered that the daily average of such workers and laborers to be mobilized will be approximately eight (persons/day) for the construction work at the stations, except Station 17+400, which will be approximately 19 (persons/day).

The daily amount of human waste from the workers and laborers can be considered at about 8 (L/day) for the construction work at the stations, except for Station 17+400, which is about 19 (L/day), on average on the basis that excretion amount unit of one L/person/day (for eight working hours) is applied.

For the human wastes in the construction works in Nepal, “Labour Act 2074 (2017)”, “Labour Rule

2050 (1993)" and "Environmental and Social Management Framework, 2007 DOR are applied by which necessary sanitation facilities are to be set up in the construction sites.

In general, leaching pit and/or septic tank methods are applied as temporary sanitation facilities.

For the leaching pit method such as simple pit latrines, the World Health Organization (WHO) recommends that those latrines shall be established in the minimum safe distance of at least 30 m from the nearest water source like wells as well as at least 2 m from the groundwater table (in wet season) to prevent possible ground water contamination from the latrines. (Source: Simple pit latrines, WHO, http://www.who.int/water_sanitation_health/hygiene/emergencies/fs3_4.pdf)

With regard to water usage, the nearby source of the Sunkoshi River (one of the major river systems in Nepal of which basin area is about 3,400 km^2 in total, and average annual flow is about 22 *109 m^3) is planned to be used for the construction.

(3) Wastes

Considering the nature of technologies applied to the Project Road, debris and wastes which are generated during the construction work will not be treated as hazardous wastes like toxic chemical substances and radioactive materials but rather as general "construction wastes of stones and soils".

In the Sindhuli Road Construction Project, the soil balance was planned at 1: 1, and no surplus soil emerged on site. In addition, in this project, most of excavated soil is planned to be used for vegetation method.

Table 1.4.46 Domestic Solid Waste

Station	Daily Average Numbers of Workers/Laborers (persons) (6-day/week basis)	Waste Unit (in 2011) (kg/person/day)	Total Waste/Week (kg/week)
33+440	7.36	0.14*	6.2
33+695	7.36		6.2
11+620	7.36		6.2
15+520	7.98		6.7
17+400	18.41		15.5

*See sub-section (3) Waste

Source: JICA Survey Team

- As shown in **Table 1.4.46**, a total of 6.2-15.5 kg/week of domestic solid waste generation can be predicted by each station during the construction phase.
- According to DOR, the domestic solid waste in the construction phase is disposed of by contractor(s) on a weekly basis
- For solid waste management, "Solid Waste Management Act 2068 (2011)" and "Environmental and Social Management Framework, 2007 DOR" shall be the reference.

(4) Soil Contamination

Even though each station is basically paved, soil contamination caused by oil and fuel spills from dump trucks, other trucks and heavy equipment can be predicted during the construction work due to the existence of cracks on the pavement and/or run off of the spills from the pavement surface to unpaved areas. However, it is considered that those spills are temporary troubles, which can be managed by daily visual inspection, stopping lane and load and unload position management, and can be avoided using dump trucks, other trucks and heavy vehicles and equipment maintained properly and periodically.

(5) Noise and Vibration

During the construction work, heavy vehicles and equipment to be used will generate noise with the following circumstances.

- As noted in (1) Air Pollution at Subsection **1.4.9.5,** it can be considered that less than one of heavy vehicle/day and equipment/day/in gross are operated for the 3- to 14-month construction work at the respective Stations.
- As for noise levels from boring and drilling machines to be used for the construction, 78 dB (Rotary Percussion) at the position of 5 m, and from 90.9 dB (A) (Stand Drive Drill without silencing apparatus) as average to 76.8 dB (A) (Stand Drive Drill with silencing apparatus) as average have been reported [1].
- Generally, noise at the construction site can be regarded as a simple sound source whereby noise level will decrease by 6 dB as distance doubles because such noise is inversely proportional to the square of the distance.
- JICA Survey has identified that he nearest house at Section 17+400 is located on the slope in around 5m distance and that houses are located more than 300m at other project sections. Therefore, critical impacts on the houses are not predicted.
- In case where well-maintained vehicles (trucks) and equipment for the construction are used by the contractor(s) and the construction work at each station, it is considered that noise level at each construction period does not exceed the maximum background noise levels of around 100 dB (A) (by reference to "*Table 1.4.7 Traffic Noise in Banepa Along the Main Road (Arniko Highway)*" as only available monitoring data on roadside noise level).
- At Section 14+700, The construction will be under the house and the slope adjacent to the private housed are limited, and the drilling machine gradually moves down the slope, so the noise becomes gradually smaller. If the noise is regarded as large, setting up soundproof nets at the boundary with the private house is planned
- As far as vibration is concerned, "Rotary Percussion" is planned to be utilized as necessary construction equipment for setting up anchors of which vibration level is evaluated below.
- Vibration level discharged by the operation of "Rotary Percussion" is 66 dB at the position of 5 m. Therefore, the vibration of "Rotary Percussion" has a smaller range if compared with Vibro Hammers (4kW and over: approx. 70-92dB), Hydraulic Pile Hammers (8-8.5 t: approx.85-92 dB) and Diesel Pile Hammers (4 t and over: approx.70-92 dB) at the position of 7 m [2].
- When drilling on a slope close to a private house at Section 17+400, rotation torque is reduced as much as possible to mitigate vibration levels. The construction is under the private house, the slope adjacent to the house is limited and the drill gradually moves down the slope, so the vibration gradually becomes smaller.

(6) Living and Livelihood

Work opportunities of nearby villagers along each station of Sindhuli Road are expected in the construction and operation phases by considering the following points.

- Considering the construction techniques applied to the five stations, labors and works who have specific skills and knowledges on the techniques are basically required for the rehabilitation and reinforcement.
- On the other hand, local people can be employed as cleaning staff and/or security guards during construction periods.
- In order to prevent child labor (below 16 years old) and gender inequality, "Labour Act 2074 (2017)", "Labour Rule 2050 (1993)", Child-Related Act 1993 (2048 BS) and Child Labour Act 2001 (2056), "Environmental and Social Management Framework, 2007 DOR" as well as the "Draft Interim Guidelines for Enhancing Poverty Reduction Impact of Road Project, 2007 DOR" shall be applied to for this project

[1] Source: * Results of Noise and Vibration to Construction Works, Annual Report C.E.S.T.C., TMG 2010, ISSN 1884-040X, ** Results of Noise Generation Survey of Stand Drive Drilling Methods, Stand Drive Method Study Society, Kaisyo Inc. Japan.

[2] Source: * The Ministry of the Environment, the Government of Japan, https://www.env.go.jp/air/sindo/const_guide/full.pdf

(7) Social Infrastructures and Services

1) Traffic

As summarized in **Table 1.4.44**, less than one dump trucks and other trucks/day are used in gross for the 3- to 14-month construction periods. Therefore, it is considered that the traffic congestion of each section of Sindhuli Road by increase in numbers of dump trucks and other trucks is minor and limited for the construction phase.

2) Commercial Activities and Road Closings

Table 1.4.47 summarizes the commercial activities at present, and road closing for the construction at each station. Therefore, some minor impacts on traffic (one-way traffic control during construction*) and commercial activities on the surroundings of each station can only be predicted during the construction period only. (*Two-way traffic becomes possible by the construction schedule.)

Table 1.4.47 Commercial Activities and Traffic Management on the Section

Station	Commercial Activities	Closed to Vehicular Traffic During Construction	Possible Impact
33+440	No	No	No
33+695	No	No	No
11+620	No	No	No
15+520	No	No	No
17+400	Bhanjyang Village	No	Construction period only

* At the time of carrying in of construction materials and equipment, temporarily road traffic is closed.
Source: JICA Survey Team

(8) Risk of Infectious Diseases such as HIV/AIDS

It is supposed that migrant workers and laborers with specific skills will be mobilized by contractor(s) for construction. Accordingly, risks of HIV and AIDS for the workers and laborers are considered during the construction work. **Table 1.4.48** shows the HIV estimates in Nepal in 2016.

Table 1.4.48 HIV Estimates in Nepal (2016)

Item		Lower Bound	Estimate	Upper Bound
Adults and children living with HIV (number)	Whole	28,000	32,000	38,000
	Adults (aged 15 and over)	27,000	31,000	36,000
	Women (aged 15 and over)	10,000	12,000	14,000
	Men (aged 15 and over)	17,000	19,000	23,000
	Children (aged 0 to 14)	1,000	1,200	1,400
Adult aged 15 to 49 HIV prevalence rate (%)	Whole	0.1	0.2	0.2
	Women	0.1	0.1	0.2
	Men	0.2	0.2	0.2

Source: Country Fact Sheets Nepal 2016 UNAIDS

A probable number of persons who are HIV positive can be calculated based on a 0.2% (**Table 1.4.48**) among those 576-6,720 construction workers in the five stations who are planned to be mobilized for the construction work (See **Table 1.4.49**).

Namely, it is predicted that a total of 1 to 14 person(s) will be HIV positive during the 3- to 14-month construction period in each station.

Table 1.4.49 Estimation of HIV Positive Workers in Each Station

Station	Total Labor Force (persons)	Construction Period (month)	Simple Prediction (persons)
33+440	768	4	1.54
33+695	576	3	1.15
11+620	576	3	1.15
15+520	1,664	8	3.33
17+400	6,720	14	13.44

Source: JICA Survey Team

(9) Working Conditions/Work Safety

Considering the nature of general construction work and methods, which will be applied to the construction of Sindhuli Road, it seems that working conditions will have nothing special as methods required for high-rise buildings and using toxic chemical substances. Therefore, work conditions and

safety can be managed in compliance with (New) "Labour Act 2074 (2017) *[1]", "Labour Rule 2050 (1993)" and "Environmental and Social Management Framework, 2007 DOR.

Especially, the Chapter XII - Provisions Relating to OHS of "Labour Act 2074 (2017)" clearly stipulates the Construction Workers Safety and Occupational Health and Safety (OHS).

(10) Accidents

The number of trucks used for construction is limited as discussed in (1) of Section 1.4.9.5. Namely several hundreds of trucks are not required for the Project at each station. Therefore, the rapid increase in the number of trucks in the Sindhuli Road is not considered during the construction phase.

(11) Results of Stakeholders Meetings (SHMs)

As summarized in Section 1.4.6.2, a total of nine SHMs were held by the DOR initiative. The results of those SHMs are shown below.

1) Total 3 SHMs for surrounding community of Sta.11+620& Sta.15+520 (Section III)

Table 1.4.50 to Table 1.4.52 show results of Total 3 SHMs for surrounding community of Sta.11+620& Sta.15+520 (Section III). Original attendance (participant) lists for those SHMs are attached to Appendix 5.2.3.

Table 1.4.50 Summary of Phase 1 SHM for surrounding community of Sta.11+620& Sta.15+520

SHM Phase 1	Sta. 11+620 & Sta. 15+520	Section III
Date: 26th Jan. 2018	Time: 13:00-15:00	Venue: Municipality Office

1. Participants

Organization	Name/Title		Total
DOR	- Ms. Srijana Lekhak - Mr. Ramesh Acharya	- Ms. Shila Shrestha	3
Sunkoshi Rural Municipality	- Ms. Dipa Bohora Dahal/Mayor - Mr. Dirba Singh Moktan/Deputy Mayor - Mr. Krishna Raj Dahal/Chief, Ward 5	- Mr. Sambar Bahadur Majhi/Member Ward 5 - Mr. Min Kumar Shrestha - Mr. Om Pakash Jha/Health coordinator	6
JICA Study Team	- Mr. Ramesh P. Koirala		1
Other	- Ms. Sirjana Koirala/ Trainer		1
Total			11

2. Main Discussion Points

Opinion from the Participants	Explanation and response from DOR/JICA Study Team
· The Mayor said that Municipality is always positive to the works and offered her full support to the works on behalf of the Municipality. · The Deputy Mayor suggested to take care of public grievances while maintaining the works. · The meeting decided to hold next meetings among village representatives and village people	· This is the first discussion at local level for sharing information with the representatives in relation to the Plans and Possible Impacts of the Project. · One of the purpose of this meeting is that the outcome of the discussion will be incorporated in the project during planning and formulation as much as practicable to make the project smooth and hassle free in future. · Next two meetings will be carried away among village representatives and village people for collection of their opinion in the large scale · Every Construction Project has both types of impact, beneficial impacts and adverse impacts.

3. Photograph

Representatives of Municipality and DOR

Representatives of Municipality

Source: JICA Study Team and DOR

[1] Note: Labor Act 2048 (1992) has been repealed due to the enactment of the Labor Act 2017 in 2017

Table 1.4.51 Summary of Phase 2 SHM for surrounding community of Sta.11+620& Sta.15+520

SHM Phase 2	Sta. 11+620 & Sta. 15+520	Section III
Date: 6th Mar. 2018	Time: 13:00-15:30	Venue: Municipality Office

	Organization	Name/Title		Total
1. Participants	DOR	- Ms. Srijana Lekhak	- Mr. Ramesh Acharya/SDSBR	2
	Sunkoshi Rural Municipality	- Ms. Dipa Bohara Dahal/Mayor - Mr. Krishna Raj Dahal/Head, Ward 5	- Mr. Shiva Thapa, Member, Ward - 6,	3
	Local Official	- Ms. Mithula Ghimire/Community Health Worker, Sunkhosi-5	-	1
	Local People	- Mr. Umesh Dahal - Mr. Ram Krishna Dahal - Mr. Dil Bahadur Hayu - Mr. Baburam Bhattarai	- Mr. Anil Koirala - Mr. Tanka Bahadur Karki - Mr. Chyaran Koirala	7
	JICA Study Team	- Mr. Ramesh P. Koirala		1
	Total			14

2. Main Discussion Points	Opinion from the Participants	Explanation and response from Municipality and DOR
	· Frequent accidents in the road are serious matter. Pedestrians are facing danger in the bridge due to the missing railings. Priority is to be given for accidents control and mitigation. · The project did not follow the decisions of public consultation in the past. · Locals should get priority for the jobs available by the Project as much as possible · The roads need to be clean, road structures to be well maintained. · Construction of road side station to support local productions is felt necessary.	· The mayor supported all the issues raised by the village people and requested to the DOR (and JST) for considering these issues seriously while formulating the Project. · The mayor assured her full support to the proposed project on behalf of local municipality. · The proposed project is planned to conduct road safety educations, to provide priority local employment and to implement solid waste management during the project. · The proposed project is to rehabilitate damaged stations of 11+620 & 15+520.

3. Photograph	
	
Representatives of Municipality and DOR	Local People of Municipality

Source: JICA Study Team and DOR

Table 1.4.52 Summary of Phase 3 SHM for surrounding community of Sta.11+620& Sta.15+520

SHM Phase 3	Sta. 11+620 & Sta. 15+520	Section III
Date:20th Mar. 2018	Time: 11:00-12:00	Venue: Municipality Office

	Organization	Name/Title		Total
1. Participants	DOR	- Mr. Ramesh Acharya	-	1
	Sunkoshi Rural Municipality	- Mr. Dirba Singh Moktan/Deputy Mayor - Mr. Krishna Raj Dahal/Chief, Ward 5	- Mr. Krishna Raj Dahal, Chief, Ward 5	3
	JICA Study Team	- Mr. Ramesh P. Koirala		1
	Other	- Ms. Sirjana Koirala/ Trainer		1
	Total			6

2. Main Discussion Points	Review of past two SHMs	Explanation and response from Municipality and DOR
	· Brief descriptions of the issues raised by participants during earlier Stakeholders Meeting 1 and 2 were reported one by one. · Brief descriptions of the information given by DOR and JST members earlier to the participants of stakeholders 1 and 2 conducted earlier on January 26, 2018 and March 06, 2018 respectively.	· The representatives from the municipality supported all the issues raised by the village people at earlier SHMs and requested to incorporate them in the project as much as possible within the scope. They also expressed their full support on behalf of this Municipality to the Project if implemented. · DOR explained the following countermeasures that can be applied during various stages within the scope of the Project 1. a) Priority employment to the locals according to their qualification and interest by incorporating some clauses in the documents b) Construction time to be restricted within 8:00 AM to 5:00 PM to avoid noise during night time. · The provision of railings at local bridges is being presently undertaken by the DOR, but, subject to the budget availability · Appropriate road signboards will be provided/ maintained · Awareness campaign will be jointly started for road users as safety requirement · Equal wages will be provided for same works irrespective of

		the gender.
3. Photograph		
	Representatives of Municipality	Final Discussion among the Representatives and DOR

Source: JICA Study Team and DOR

2) Total 3 SHMs for surrounding community of Sta. 33+440 & Sta.33+695 (Section II)

Table 1.4.53 to Table 1.4.55 show results of Total 3 SHMs for surrounding community of Sta. 33+440 & Sta.33+695 (Section II). Original attendance (participant) lists for those SHMs are attached to Appendix 5.2.3.

Table 1.4.53 Summary of Phase 3 SHM for surrounding community of Sta. 33+440 & Sta.33+695

SHM Phase 1	Sta. 33+440 & Sta. 33+695	Section II
Date: 26th Jan. 2018	Time: 10:00-11:00	Venue: Municipality Office

	Organization	Name/Title		Total
1. Participants	DOR	- Ms. Srijana Lekhak - Mr. Ramesh Acharya	- Ms. Shila Shrestha - Mr. Kalidas Basnet	4
	Golanjor Rural Municipality	- Mr. Pushpa Bahadur Karki/Mayor - Mr. Rom Bahadur Devkota/Chief Ward 7	- Mr. Tanka Nath Ghimire/ Chief Admin. - Mr. Kalidas Basnet	3
	JICA Study Team	- Mr. Ramesh P. Koirala		1
	Other	- Ms. Sirjana Koirala/ Trainer		1
	Total			9

2. Main Discussion Points	Opinion from the Participants	Explanation and response from DOR/JICA Study Team
	The Mayor said that there will not be any problem while maintaining the works and further offered his full support to the works on behalf of the Municipality. The Mayor suggested to give employments to the locals as far as practicable. The meeting decided to hold next meetings among village representatives and village people	One of the purpose of this meeting is that the outcome of the discussion will be incorporated in the project during planning and formulation as much as practicable to make the project smooth and hassle free in future. Next two meetings will be carried away among village representatives and village people for collection of their opinion in the large scale Every Construction Project has both types of impact, beneficial impacts and adverse impacts.

3. Photograph		
	Representatives of Municipality and JST	Discussion among Participants

Source: JICA Study Team and DOR

Table 1.4.54 Summary of Phase 2 SHM for surrounding community of Sta. 33+440 & Sta.33+695

SHM Phase 2	Sta. 33+440 & Sta. 33+695	Section II
Date: 6th Mar. 2018	Time: 10:00-12:00	Venue: Puspa Lower Secondary School

	Organization	Name/Title		Total
1. Participants	DOR	- Ms. Shila Shrestha	- Mr. Ramesh Acharya	2
	Golanjor Rural Municipality	- Mr. Ram Bahadur Thapa/Chief Ward 7	-,	1
	Local Official	- Mr. Pradip Kawal, Member of Parliament State 3 - Mr. Madan Kumar Thapa, Chairman, Veterinary Cooperative	- Mr. Gopal B. Shrestha, Chairman, Panchakanya Community Forest	3
	Local People	- Mr. Ram Babu - Mr. Dhana Bahadur Thapa - Mr. Surendra Bahadur Shrestha	- Mr. Rohani Prasad Pokharel - Ms. Kalpana Shrestha - Ms. Manju Achchhami	12

		- Mr. Khadka Bahadur Shrestha - Mr. Nanda Raj Thapa - Mr. Gopal Bahadur Shrestha	- Mr. Kaji Babu Thapa - Ms. Sanu Maiya Shrestha - Mr. Nanda Lal Shrestha	
	JICA Study Team	- Mr. Ramesh P. Koirala		1
	Total			19

2. Main Discussion Points	Opinion from the Participants	Explanation and response from Municipality and DOR
	・ The road has supported to local people with multiple benefits. However, the nearby forest must be protected. Afforestation is needed. ・ Problems felt for the bus stops / parking/ toilets ・ The proposed project must protect existing water sources. Existing drinking water sources are dried up after road construction ・ Locals should get priority for the jobs available by the Project ・ The collective drains constructed by the Road earlier is damaging in the downstream, protection is felt necessary. Mitigate the noise pollution during construction time ・ The Project should not make disturbance to the community forest nearby, but support to it.	・ The representative from local municipality (the ward chairperson) supported all the issues raised by the village people and requested to the DOR (and JST) for considering these issues seriously while formulating the Project. He praised the road project for its positive support to the local community. He assured his full support to the proposed project on behalf of local municipality. ・ Member of Parliament (State 3) requested to the locals to take care of sanitation and road cleanings and to provide their full support to the road projects including the proposed tunnel under study ・ The proposed project is planned to give consideration to all social aspects, to provide priority local employment and to implement solid waste management during the project. ・ The proposed project is to rehabilitate damaged stations including necessary drainage at Sta. 33+440 & Sta. 33+695.
3. Photograph		
	Representatives of Municipality and DOR	Local People of Municipality

Source: JICA Study Team and DOR

Table 1.4.55 Summary of Phase 3 SHM for surrounding community of Sta. 33+440 & Sta.33+695

SHM Phase 3	Sta. 33+440 & Sta. 33+695	Section II
Date:20th Mar. 2018	Time: 14:00-15:00	Venue: Municipality Office

1. Participants	Organization	Name/Title		Total
	DOR	- Mr. Ramesh Acharya	-	1
	Golanjor Rural Municipality	- Mr. Pushpa Bahadur Karki/Mayor	- Mr. Rom Bahadur Devkota/Chief, Ward 7	2
	JICA Study Team	- Mr. Ramesh P. Koirala		1
	Other	- Ms. Sirjana Koirala/ Trainer		1
	Total			5

2. Main Discussion Points	Review of past two SHMs	Explanation and response from Municipality and DOR
	・ Explanation in brief about the activities done so far during previous stakeholders meeting SHM-1 and SHM-2 was made. ・ The information related to the proposed project was disseminated to the stakeholders along with request to propagate further up to the grass root level in order to make aware maximum number of local people about the project and to collect their concerns as much as possible. ・ There were several issues raised by locals which were collected and discussed during previous discussion at SHM-2 at the field level. ・ During the SHMs conducted earlier, the information regarding positive as well as negative impacts of the proposed project to the local were discussed.	・ DOR explained about various countermeasures against the issues/ requests that are raised by participants during the SHMs earlier, the project would try to address these issues appropriately as much as possible during various stages of the Project within its scope ・ The Mayor and the Chief, Ward 7, on behalf of the Rural Municipality requested to address the issues raised during SHM 1 and 2 (local level) as much as possible during project realization. On behalf of the Golanjor Rural Municipality Team, they extend their full support and cooperation to the proposed Project as well to the BP Highway.

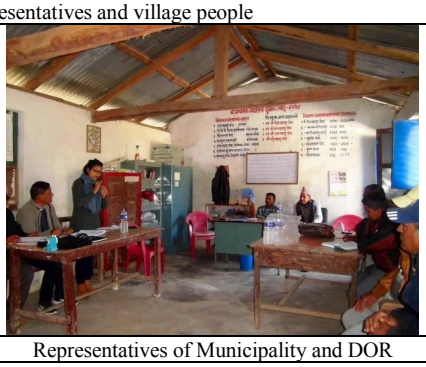
3. Photograph		
	Representatives of Municipality	Final Discussion among the Representatives and DOR

Source: JICA Study Team and DOR

2) Total 3 SHMs for surrounding community of Sta. 17+400 (Section II)

Table 1.4.56 to Table 1.4.58 show results of Total 3 SHMs for surrounding community of Sta. 17+400. Original attendance (participant) lists for those SHMs are attached to Appendix 5.2.3.

Table 1.4.56 Summary of Phase 1 SHM for surrounding community of Sta. 17+400

SHM Phase 1		Sta. 17+400		Section II
Date: 25th Jan. 2018		Time: 13:00-15:00		Venue: Shree Primarily School
1. Participants	Organization	Name/Title		Total
	DOR	- Ms. Srijana Lekhak - Mr. Ramesh Acharya	- Ms. Shila Shrestha	3
	Kamala Mai Municipality	- Mr. Khadga Khatri/Mayor - Mr. Nawaraj Thing/Chief Ward 2 - Mr. Dipesh Baral/Secretariat - Mr. Rajan P. Adhikari/Ward 3 - Mr. Kantha B. Magar/Ward 2	- Mr. Harka Bahadur Magar/Ward 2 - Mr. Ganga B. Gurmachhan/Ward 2 - Mr. Santosh Balal Magar/Ward 2 - Mr. Anjan Kumar Pasa/Ward 2	9
	Local Official	- Mr. Rajang P. Dahal/Ward 2 Teacher - Mr. Dhruba Kumar Basnet/Shree Primary School, Headmaster - Ms. Parbati Dahal/Shree Primary School, Teacher	- Ms. Sushmita Gole/Shree Primary School, Teacher	4
	JICA Study Team	- Mr. Ramesh P. Koirala		1
	Other	- Ms. Sirjana Koirala/ Trainer		1
	Total			19
2. Main Discussion Points	Opinion from the Participants		Explanation and response from DOR/JICA Study Team	
	· The Mayor suggested the Project to consider road accessibility to nearby village next to the proposed land slide protection area. · He further requested to support to the local amenities like School, Temple and other structures which are of cultural importance. · Mr. Navaraj Thing, Head, Ward No. 2 of Kamala Mai Municipality said that locals to get priority in employment as far as practicable. · Due consideration need to be given to the access road to the construction site for transporting equipment during construction would serve to local villagers after completion. · The meeting decided to hold next meetings among village representatives and village people		· One of the purpose of this meeting is that the outcome of the discussion will be incorporated in the project during planning and formulation as much as practicable to make the project smooth and hassle free in future. · This is the first discussion at local level for sharing information with the representatives in relation to the Plans and Possible Impacts of the Project. · Next two meetings will be carried away among village representatives and village people for collection of their opinion in the large scale · Every Construction Project has both types of impact, beneficial impacts and adverse impacts.	
3. Photograph				
	Representatives of Municipality and DOR		Discussion among Participants	

Source: JICA Study Team and DOR

Table 1.4.57 Summary of Phase 2 SHM for surrounding community of Sta. 17+400

SHM Phase 2	Sta. 17+400	Section II
Date: 5th Mar. 2018	Time: 13:00-15:00	Venue: Shree Primarily School

	Organization	Name/Title		Total
1. Participants	DOR	- Ms. Shila Shrestha	- Mr. Ramesh Acharya	2
	Kamala Mai Municipality	- Mr. Nawaraj Thing/Chief, Ward 2	-	1
	Local Official	- Mr. Dhruba K. Basnet/Shree Primar School, Head Master	- Mr. Chhatra B. Shrestha/Chairman, Bhadrakali Community Forest	2
	Local People	- Mr. Abinash Dhakal - Mr. Saroj Dahal - Mr. Binod Kumar Pata Magar - Mr. Rajan P. Adhikari - Mr. Binod Kumar Thapa Magar - Mr. Ajaya Pata Magar - Mr. Ganga Bahadur Gurmachhan - Mr. Purna B. Jarga Magar	- Mr. Prem Bahadur Thapa Magar - Mr. Padam Bahadur Magar - Mr. Man Bahadur Thada Magar - Mr. Kantha Bahadur Magar - Mr. Nara Bahadur Ale Magar - Ms. Tara Magar - Ms. Sajita Jarga Magar	15
	JICA Study Team	- Mr. Ramesh P. Koirala		1
	Total			21

2. Main Discussion Points	Opinion from the Participants	Explanation and response from Municipality and DOR
	· Th road side drain constructed earlier near Dhungre · Bhanjyang was responsible for the land slide. · This landslide has stopped the communication between Dhungre Bhanjyang and Khopikharka · Link Road from BP Highway to Khopikharka is necessary · The proposed project must protect existing water sources · Locals should get priority for the jobs available by the Project · The proposed Project should not make harm to the existing structures · Mitigate the noise pollution during construction time · The Project should not make disturbance to the community forest nearby, but support to it.	· The representative from local municipality (the ward chief) supported all the issues raised by the village people and requested to the DOR (and JST) for considering these issues seriously while formulating the Project.Member of Parliament (State 3) requested to the locals to take care of sanitation and road cleanings and to provide their full support to the road projects including the proposed tunnel under study · The proposed project is planned to give consideration to all social aspects including protection of the footpath on the slope, social and cultural structures around the station, to provide priority local employment and to give consideration to the water resoueces and manege work time to control noise on the night during the project. · The proposed project is to rehabilitate and reinforce for the landslide at the station including necessary drainage.

3. Photograph		
		
	Representatives of Municipality	Discussion with the Local People and DOR

Source: JICA Study Team and DOR

Table 1.4.58 Summary of Phase 3 SHM for surrounding community of Sta. 17+400

SHM Phase 3	Sta. 17+400	Section II
Date:21st Mar. 2018	Time: 14:30-16:00	Venue: Municipality Office

	Organization	Name/Title		Total
1. Participants	DOR	- Mr. Ramesh Acharya	-	1
	Kamala Mai Municipality	- Mr. Khadga Khatri/Mayor - Mr. Nawaraj Thing/Chief, Ward 2	- Mr. Dipesh Baral	3
	Local people	- Mr. Laxman Prasad Dahal	- Mr. Govinda Bhujel	2
	JICA Study Team	- Mr. Ramesh P. Koirala		1
	Other	- Ms. Sirjana Koirala/ Trainer		1
	Total			8

2. Main Discussion Points	Review of past two SHMs	Explanation and response from Municipality and DOR
	· Explanation in brief about the activities done so far during previous stakeholders meeting SHM-1 and SHM-2 was made. · The information related to the proposed project was disseminated to the stakeholders along with request to propagate further up to the grass root level in order to make aware maximum number of local people about the project and to collect their concerns as much as possible. · There were several issues raised by locals which were	· DOR explained about various countermeasures against the issues/ requests that are raised by participants during the SHMs earlier, the project would try to address these issues appropriately as much as possible during various stages of the Project within its scope. · The Mayor and the Chief, Ward 2, on behalf of the Municipality requested to address the issues raised during Stakeholders Meeting 1 and 2 (local level) including foot trail, priority for local employment and drinking water as

	collected and discussed during previous discussion at SHM-2 at the field level. ・ During the SHMs conducted earlier, the information regarding positive as well as negative impacts of the proposed project to the local were discussed.	much as possible during project realization. On behalf of the Kamala Mai Municipality they extend their full support and cooperation to the proposed Project.
3. Photograph		
	Participants	Final Discussion among the Representatives and DOR

Source: JICA Study Team and DOR

1.4.9.6 EXAMINATION ON THE ENVIRONMENT AND SOCIAL IMPACT

Based on the results of the environmental and social consideration study, impacts caused by the project on environment and social are examined as summarized in **Table 1.4.59**.

As specified in (1) at Section 1.4.9.4, "Con. "and "Construction Phase as well as "Ope." and "Operation Phase" in **Table 1.4.59**, are considered to be applicable only to this project as follows;

- Con. and Construction Phase: Construction for Restoration Phase (Road traffic in service: Partially one-way traffic)
- Ope. and Operation Phase: Pose-Restoration Phase (Road traffic in service: Fully restoration of traffic before the earthquake)

Table 1.4.59 Environmental and Social Impact Examination

Category/ No.		Assessment Item	Rating at the Scoping		Impact Assessment by the Study		Reasons
			Con.	Ope.	Con.	Ope.	
Pollution Control	1	Air Quality	B-	C	B-	C	・ Worsening of surrounding ambient air caused by exhaust gases and dusts emitted from operation of heavy vehicles, equipment and trucks as well as natural increase of car traffic after the project is predicted during construction of each station.
	2	Water Quality	C	D	B-	C	・ Water pollution caused by construction work, operation of heavy vehicles, equipment and trucks, and wastewater of workers and labors as well as natural increase of car traffic after the project is predicted.
	3	Wastes	C	D	B-	C	・ Soil and stones generated by the rehabilitation constructions are planned to be backfilled and utilized for vegetation method on site. However, litter and rubbish will be dispensed by the labors and works employed as well as car traffic after the project.
	4	Soil Contamination	C	C	B-	D	・ There is a possibility of soil contamination due to oil spills from relevant construction vehicles and equipment.
	5	Noise and Vibration	C	D	B-	C	・ Generation of noise caused by construction vehicles and heavy equipment is expected.
	6	Subsidence	D	D	N/A	N/A	・ No construction method that causes subsidence is planned.
	7	Odor	D	D	N/A	N/A	・ Construction work and methods as well as project operation which causes bad odor are not envisaged.
Natural Environment	8	Protected Areas	D	D	N/A	N/A	・ National parks, natural reservoirs and ported areas do not fall in each station
	9	Ecosystem	D	D	N/A	N/A	・ No important and endangered ecosystem is found in each station.
	10	Hydrology	D	D	N/A	N/A	・ Construction work and methods as well as project operation, which may damage the hydrology are not envisaged.

Category/ No.		Assessment Item	Rating at the Scoping		Impact Assessment by the Study		Reasons
			Con.	Ope.	Con.	Ope.	
	11	Topography and Geology	D	D	N/A	N/A	· Construction work and methods as well as project operation which may damage the topography and geology are not envisaged.
Social Environment	12	Land Acquisition/ /Resettlement	D	D	N/A	N/A	· Due to rehabilitation project, no land acquisition/resettlement is predicted
	13	Impoverished Peoples, Ethnic Minorities and Indigenous Peoples	D	D	N/A	N/A	· Due to rehabilitation project, there is no possibility of any impact on such people.
	14	Living and Livelihood	B+/-	C	B+/-	B+/-	· Construction Phase: Minor and limited impacts on the commercial activities (small scale retail shops, restaurants and hotels) and public transportation of Dhungre Bhanjyang Village around Station 17+400 caused by the construction (reinforcement) works are predicted which can be managed by contractor(s) under the supervision of DOR. · Construction Phase: As positive impact on living and livelihood, there will be possible employment of local people as security guards and sweepers. · Operation Phase: The south side slope at Section 17+400 is reinforced by the project by which positive /native impact is considered for the daily life and safety of surrounding communities.
	15	Land use and Regional Resources	D	D	N/A	N/A	· There is no possibility of negative impact on surrounding land use and regional resources caused by the project.
	16	Water Right/Use of Water	D	D	N/A	N/A	· Necessary water for the construction is planned to be acquire from a nearby river of Sunkoshi. And there is no water right, surface water and utilization of ground water in each station.
	17	Social Infrastructures and Services	B-	D	B-	N/A	· Minor impact on traffic around each station is considered during the construction periods
	18	Heritage	D	D	N/A	N/A	· No heritages are identified in each station.
	19	Social Capital and Social Organization such as decision making bodies	D	D	N/A	N/A	· No such social capital and organization are present which will be damaged by the construction of the project.
	20	Damage and Benefit	D	D	N/A	N/A	· No damage and benefit are envisaged by the construction and operation of the project.
	21	Landscape	D	D	N/A	N/A	· This project is the rehabilitation and reinforcement of existing road
	22	Gender Issue	C	D	C	N/A	· This project is the rehabilitation and reinforcement of existing road
	23	Rights of the Child	C	D	C	N/A	· This project is the rehabilitation and reinforcement of existing road
	24	Risk of infectious diseases such as HIV/AIDS	B-	D	B-	N/A	· Construction Phase: In Nepal, HIV prevalence rate is estimated at 0.2% of the population. Appropriate education and instruction to the workers and laborers as well as to surrounding villagers on health and sanitation, possibility of outbreak of diseases especially STD like HIV/AIDS are required to be implemented by each contractor under the supervision of DOR. · Operation Phase: Keeping in view the rehabilitation of the Project, it is not predicted that there will be any outbreak of HIV/AIDS by the operation.
	25	Working Conditions/ Work Safety	C	D	B-	N/A	· Construction Phase: Relevant laws and regulations on worker safety for construction work are "Labor Act and Rule on Working Condition and Work Safety in Nepal" which shall be followed by each contractor's responsibility under the supervision of DOR. · Operation Phase: There is no construction work in the operation of the project.

Category/ No.		Assessment Item	Rating at the Scoping		Impact Assessment by the Study		Reasons
			Con.	Ope.	Con.	Ope.	
Others	26	Accidents	C	C	C	C	・ Safety education on traffic accidents, which might be caused by construction trucks and equipment to the drivers and surrounding peoples, are required to be carried out by each contractor under the supervision of DOR. Natural increase of car traffic after the project is predicted.
	27	Transboundary or Global Issues	D	D	N/A	N/A	・ This project is the rehabilitation and reinforcement of existing road.
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.						

Note: Con. & Construction Phase: Construction for Rehabilitation Phase,
Ope & Operation Phase.: Post-Rehabilitation Phase
Source: JICA Survey Team

1.4.9.7 COUNTERMEASURES AND ENVIRONMENTAL MANAGEMENT PLAN (EMP)

In accordance with the environmental and social impact assessment as summarized in **Table 1.4.60** shows the countermeasures, namely the draft of the Environmental Management Plan (EMP) for the Project.

As specified in (1) at Section 1.4.9.4, "Con. "and "Construction Phase as well as "Ope." and "Operation Phase" in Table 1.4.60, are considered to be applicable only to this project as follows:

- Con. and Construction Phase: Construction for Restoration Phase (Road traffic in service: Partially one-way traffic)
- Ope. and Operation Phase: Pose-Restoration Phase (Road traffic in service: Fully restoration of traffic before the earthquake)

Table 1.4.60 Countermeasures (Proposed EMP)

Phase	No.	Impacts	Proposed EMP	Implementing Organization	Responsible Organization	Cost and Others
Construction	1	Air Quality	・ Periodic inspection of exhaust gases of dump trucks, other trucks and heavy equipment to be used. ・ Water spraying for heavy vehicles, equipment and trucks operation on- site in the dry season.	Contractor(s)	Supervised by DOR	Visual inspection. Water for the spraying is procured by contractor(s) from outside.
	2	Water Quality	・ Construction and management of on-site toilets for workers and laborers.	Contractor(s)	Supervised by DOR	Construction water is procured by contractor(s) from out side
	3	Wastes	・ Excavated and surplus soil management (utilization) by back-filling and vegetation method. ・ Waste and debris management. ・ Periodical de-sludge activities for toilets in construction sites by the use of public services or by the service providers. ・ Waste oil (from hydraulic systems and etc.) collection and treatment by waste collection companies.	Contractor(s)	Supervised by DOR	Managed and treated by contractor(s).

Phase	No.	Impacts	Proposed EMP	Implementing Organization	Responsible Organization	Cost and Others
	4	Soil Contamination	· Periodical inspection of trucks and equipment. · Stopping lane and load and unload position management. · Spilled oil and fuel management as waste · For the management of oil spills, relevant guidelines of DOR shall be referred.	Contractor(s)	Supervised by DOR	Visual inspection.
	5	Noise and Vibration	· Periodical inspection of silencers of trucks and equipment. · Use of sound insulation sheet. · Working at low power.	Contractor(s)	Supervised by DOR	Visual inspection (common sensation) by contractor(s).
	14	Living and Livelihood	· Construction management at Station 17+400 for possible impact on surrounding commercial activities and commuting to primary school.	Contractor(s)	Supervised by DOR	Periodic meetings with surrounding communities and grievance redress mechanisms.
	17	Social Infrastructure and Services	· Traffic management at each station during construction · Meetings with surrounding communities and Public Bus Service Companies (at Section 17+400 only) (where necessary).	Contractor(s)	Supervised by DOR	Meetings with surrounding communities, Public Bus Service Companies (at Section 17+400 only and grievance redress mechanisms.
	22	Gender issue	· Compliance with relevant laws, regulation and guidelines on gender issues and non-discrimination employment. · Instruction and education on gender issues to labors · Preparation of women toilet facilities (if women are employed).	DOR and Contractor(s)	Supervised by DOR	Tender documents and contract management and inspection by DOR, Instruction and education to labors as well as setting up women toiles by Contractor(s) (if women are employed).
	23	Rights of Child	· Compliance with relevant laws, regulation and guidelines on prohibition child labors. · Periodical Inspection of child labors	DOR and Contractor(s)	Supervised by DOR	Tender documents and contract management and inspection by DOR
	24	Risk of Infectious Diseases such as HIV/AIDS	· Health and sanitation education, particularly focusing on infectious diseases including STD to workers, laborers and surrounding villagers.	Contractor(s)	Supervised by DOR	Implemented by contractor(s).
	25	Working Conditions/ Work Safety	· Preparation of work safety rules and basic personal protective equipment (PPE) such as gloves, helmets, safety shoes and working uniforms based on the relevant rule and act in Nepal.	Contractor(s)	Supervised by DOR	Provided by contractor(s).
	26	Accidents	· Compliance with national and local traffic rules. · Traffic safety education to the trucks' drivers, and surrounding villagers. · Preparation of relevant warning signboards and notices based on relevant guidelines in Nepal.	Contractor(s)	Supervised by DOR	Implemented by contractor(s)

Phase	No.	Impacts	Proposed EMP	Implementing Organization	Responsible Organization	Cost and Others
Operation	1	Air Quality	· Periodic monitoring of air quality at the five project stations. · at the five project stations. · Instruction to drivers whose vehicles generate black smoke and other offensive exhaust from mufflers. · Interviews on car traffic air pollution with surrounding local people.	DOR	DOR	· Air Quality monitoring cost · Fuel fee of a car and staff per-diem allowance for the observations · Preparation of Instruction documents on vehicle air pollution without periodical car inspections · Preparation of a brief interviews form
	2	Water Quality	· Interviews on water pollution with surrounding local people.	DOR	DOR	· Fuel fee of a car and staff per-diem allowance for the observations · Preparation of a brief interviews form.
	3	Wastes	· Periodic visual inspection on littering from vehicles at the five project stations. · Instruction and setting up sign boards on "No Littering from Vehicles" to drivers. · Interviews on the littering with surrounding local people.	DOR	DOR	· Fuel fee of a car and staff per-diem allowance for the observations · Preparation of Instruction documents and signboards on "Stop littering" · Preparation of a brief interviews form
	4	Soil Contamination	· Periodic visual inspection on oil spills from traffic cars at the five stations. · Instruction to drivers whose vehicles generate oil and/or fuel spills.	DOR	DOR	· Fuel fee of a car and staff per-diem allowance for the observations · Preparation of Instruction documents on oil spills from vehicles and environment
	5	Noise and Vibration	· Periodical visual inspection on silencers of vehicles at the five stations. · Instruction to drivers whose vehicles generate high noise and vibration as well as do not equip with appropriate mufflers. · Interviews on Noise and Vibration by the traffic with surrounding local people.	DOR	DOR	· Fuel fee of a car and staff per-diem allowance for the observations · Preparation of Instruction documents on the traffic noise issues · Preparation of a brief interviews form
	14	Living and Livelihood	· Periodical observation of traffic flow at each station. · Periodical observation of commercial activities, school commuting and public bus services around Station 17+400	DOR	DOR	Fuel fee of a car and staff per-diem allowance for the observations

Note: Construction Phase: Construction for Rehabilitation Phase,
Operation Phase.: Post-Rehabilitation Phase
Source: JICA Survey Team

1.4.9.8 MONITORING PLAN

Table 1.4.61 shows a monitoring plan for the draft EMP which is required to be done by responsible organizations specified in the table in both the construction and operation phases. Environmental and social monitoring form is attached in APPENDIX 5.2.4

Table 1.4.61 Monitoring Plan (Draft)

Phase	Environmental Item	Monitoring Item	Specification	Location	Frequency	Responsible Organization
Construction	Air Pollution	· Implementation of visual inspection on exist gas. · Implementation of Instruction to drivers.	Visual inspection	Construction site	Daily	Contractors
		· Visual inspection on soil dust diffusions in dry season for water spraying.	Visual inspection	Construction site	Daily (Dry Season only)	
		· Implementation of interviews with surrounding local people.	Interview	Nearest Community	Twice/ month	
	Water Quality	· Visual inspection of back (sewage) water leakage (overflow), bad odor, emergence of vector flies and de-sludge activities) for the on-site toilets.	Visual inspection	Construction site	Daily	Contractors
		· Implementation of interviews with surrounding local people.	Interview	Nearest Community	Twice/ month	
	Wastes	· Waste composition, quantity, transportation and treatment methods. · Confirmation of excavated and surplus soil management (utilization).	Compliance with waste management rules Construction method	Construction site	Once/ month	Contractors
		· Implementation of interviews with surrounding local people.	Interview	Nearest Community	Once/ month	
	Soil Contamination	· Visual inspection of leakage conditions of oil and fuel leakages (from Engine, hydraulic power units and fuel tanks) of dump trucks, other trucks and heavy equipment	Visual inspection	Construction site	Daily	Contractors
		· Implementation of interviews with surrounding local people.	Interview	Nearest Community	Twice/ month	
	Noise and Vibration	· Visual inspection (common sensation) of silencer conditions of dump trucks, other trucks and heavy equipment	Visual inspection	Construction site	Daily	Contractors
		· Implementation of interviews with surrounding local people.	Interview	Nearest Community	Twice/mont h	
	Living and Livelihood	· Construction Management	Compliance with construction and safety regulations	Construction site	Daily	Contractors
	Social Infrastructure and Services	· Implementation of construction vehicle management plans · Implementation of commercial area road traffic controls (time restriction) at Station 17+400	Vehicle and heavy equipment operation management	Construction site	Daily	Contractors
		· Implementation of	Discussion	Construction	Where	DOR/

Phase	Environmental Item	Monitoring Item	Specification	Location	Frequency	Responsible Organization
		meetings with communities	with the residents	site and surrounding communities	necessary	Contractors
	Gender Issue	・ Confirmation of tender document and contract clauses on gender issues. ・ Implementation of periodical inspection	Tender document and Contract Management Inspection	DOR and Construction site	At the tendering and contracts	DOR
		・ Implementation of Instruction and education on gender issues to labors ・ Confirmation of construction of appropriate toilet facilities for women (if women are employed).	Education to Labor Setting up toilet for Women	Construction site	Twice/Year	DOR/ Contractors
	Rights of Child	・ Confirmation of tender document and contract clauses on prohibition of employment of child labor.	Tender document and Contract Management	DOR	At the tendering and contracts	DOR
		・ Implementation of periodical inspection	Inspection	Construction site	Twice/Year	
	Risk of infectious diseases such as HIV/AIDS	・ Implementation of Health and Sanitation education on STD.	Health and hygiene education	Construction site and surrounding communities	Once/ year	DOR/ Contractors
	Working Conditions/ Work Safety	・ Implementation of visual inspection on utilization of PPE by workers/labors	Visual inspection	Construction site	Daily	Contractors
	Accidents	・ Implementation of Meeting on Traffic safety education	Traffic Safety Education	Construction site and surrounding communities	Once/ Two Months	DOR/ Contractors
Operation	Air Quality	・ Implementation of Monitoring of Air Quality ・ Implementation of interviews with surrounding local people.	Monitoring Interview	Construction site surrounding communities	Twice/Year	DOR
	Water Quality	・ Implementation of visual inspection ・ Implementation of interviews with surrounding local people.	Visual inspection Interview	Surrounding communities	Twice/Year	DOR
	Noise and Vibration	・ Implementation of Noise Vibration test ・ Implementation of interviews with surrounding local people.	Monitoring Interview	Construction site Surrounding communities	Twice/Year	DOR
	Living and Livelihood	・ Implementation of observation on Commuting and Public Bus Services around Station 17 +400 ・ Implementation of interviews with surrounding local people.	Observation Interview	Construction site Surrounding communities	Twice/Year	DOR

Note: Construction Phase: Construction for Rehabilitation Phase,
Operation Phase.: Post-Rehabilitation Phase

Source: JICA Survey Team

1.4.10 ENVIRONMENTAL CHECKLIST (DRAFT FINAL)

The draft final version of the Environmental Checklist (No. 7. Roads) of the JICA Guidelines was developed which is attached in APPENDIX 5.2.5.

1.4.11 RECOMMENDATIONS

1.4.11.1 CONSTRUCTION FOR REHABILITATION PHASE (CONSTRUCTION PHASE)

A few number of footpaths (pedestrian paths or trails) which are used by people in the surrounding area as shortcuts for the existing Sindhuli Road on ROW around the five stations. It can be considered that using of such footpaths on ROW of Sindhuli Road are unsafe. However, for local convenience, social considerations shall be made on the footpaths by DOR and contractor(s) as follows:

- To provide necessary instructions and educations to the laborers and workers for the construction at each station not to injure those local people as part of safe construction work, stop temporarily the construction during the time that people use the footpaths and if necessary provide some tentative diversions of the footpaths by considering construction methods and schedules.
- To set up signboards on the construction and warning boards in Nepali language as well as illustrations regarding the danger of using the footpaths during construction.
- To deploy security guards at each station.
- Especially, a footpath from the south side slope at Station 17+400 of Sindhuli Road to Khopikharka Settlement which is used by people in the settlement as a community pedestrian path connecting to Dhungre Bhanjyang village where the bus stops is located, an elementary school and small shops exist which shall be protected as well with necessary countermeasures such as construction of diversion routes shall be set up and designed for the construction of the slope protection.
- As there is witness of a bird of Aquilla Helaca categorized by IUCN as VU (Vulnerable) around Station 17+400, contractor(s) shall share information about Aquilla Helaca which is one of the VU species with workers and labors using photographs, sign boards and etc. If sightings and rumors of the bird are confirmed during the construction period, contractor(s) promptly shall notify on the sightings and rumors to tDOR, and it is desirable to temporarily suspend construction until it can be confirmed that there is no impact on the bird.

1.4.11.2 POST-REHABILITATION PHASE (OPERATION PHASE)

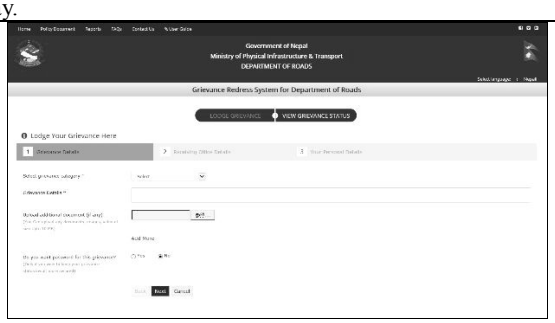
- Restore to original state of each footpath on ROW at each station after constructions for the convenience of surrounding people.
- Special considerations for the footpath on the south side slope at Station 17+400 shall be made on the slope protection structure design for smooth walking of pedestrians between Khopikharka Settlement and Dhungre Bhanjyang Village.
- It is advisable that some warning signboards which intend to explain the danger of using the footpaths on ROW, are set up by DOR.

1.4.11.3 COMPLAINTS AND OPINIONS

DOR has introduced an ICT based grievance redress mechanism (GRM) for DOR called “Grievance Redress System (GRS) as follows (Source: GRS Public User’s Manual 2013, DOR/MoPIT).

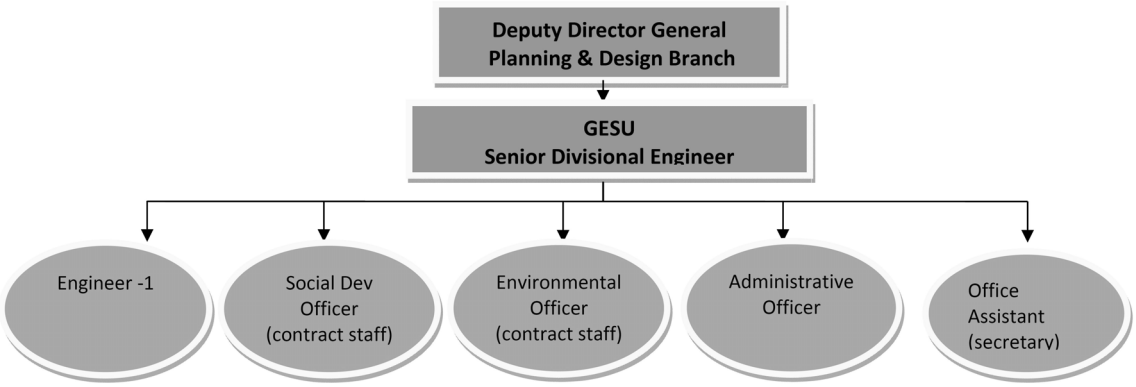
- GRS is the centralized web based system where users can lodge grievances to different offices of DOR with the help of an Internet of which URL is http://dryicesolutions.net/grms/.
- Not only lodge the grievance but uers can also view the status of their grievances with the help of a reference number and can also send a reminder or clarification of the grievance.
- **Table 1.4.62** summarizes some of the basic features of GRM.

Table 1.4.62 Basic Features of DOR's Grievance Redress Mechanism (GRM)

Web-site GRM function	Description
1. Responsive Layout	Users can also use this system on their mobile as it is compatible with mobile browser or any other smart devices like iPad, ThinkPad, etc.
2. Support Dual language	This system is available both in English and Nepali languages
3. Support Multiple File Uploading	This system supports multiple file uploads
4. Email and SMS Notification	The system will send the notification on user's Email and SMS if the email or mobile number is provided.
5. Easy to Use	The system is designed in a very simple way reducing the tedious work for the user. Use of short form, maximum use of select and check option, passed message on tool tips over every links and fields to give the information in a clearer way.
Image of the grievance lodging page on the web-site in English (Nepali language version is also available)	 URL: http://dryicesolutions.net/grms/grievance/lodge

Source: Grievance Redress System (GRS) Public User's Manual 2013, DOR, MoPIT

- It is considered that some of the Project Affected Person (PAPs) living around the five stations may not have ICT devices such as personal computers and/or cell phones, internet connection opportunities as well as enough knowledge and know-how on using such devices because Sindhuli Road is located in rural areas in Nepal.
- Therefore, in addition to the GRS on website, grievance redress mechanisms for the Project shall exclusively be set up in cooperation with the community representative officers, other dominant persons, DOR's local offices, and contractor(s) for promoting easy access from PAPs to GRS and/or immediate contact those who are in charge of grievances at DOR such as the Social Development Officer and Environmental Officer at GESU of the DOR (See Figure 1.4.16).



Source: GESU Business Plan (2069/2070 – 2071/2072), GESU/DOR, July 2013

Figure 1.4.16 GESU Administrative Structure