

Initial Environmental Examination

July 2016

NEP: SASEC Roads Improvement Project

Prepared by the Ministry of Physical Infrastructure and Transport, Department of Roads,
Government of Nepal for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 05 July 2016)

Currency unit - Nepalese rupee (NR)

NR1.00 - \$0.0092898815

\$1.00 – NR107.644000

ABBREVIATIONS

AADT	Average Annual Daily Traffic
ADB	Asian Development Bank
ADT	Average Daily Traffic
AP	Affected People
BOD	Biological Oxygen Demand
BLT	Bhairahawa - Lumbini - Taulihawa
CBOs	Community Based Organizations
CBS	Central Bureau of Statistics
CFUG	Community Forest User Group
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CO	Carbon monoxide
CO ₂	Carbon dioxide
COI	Corridor of Impact
CSC	Construction Supervision Consultant
DBST	Double Bituminous Surface Treatment
DDC	District Development Committee
DG	Diesel Generating
DHM	Department of Hydrology and Meteorology
DHO	District Health Office
DHs	District Hospitals
DNPWC	Department of National Parks and Wildlife Conservation
DoF	Department of Forest
DoR	Department of Roads
DC	Design Consultant
EA	Executing Agency
EAG	Environmental Assessment Guidelines
EFPP	Environmental Focal Person
ERPP	Emergency Response Preparedness Plan
EIA	Environmental Impact Assessment
EMG	Environmental Management Guidelines
EMP	Environmental Management Plan
EPR	Environment Protection Rules
ES	Environmental Specialist
FS	Feasibility Study
GBIA	Gautam Buddha International Airport
GESU	Geo-Environment and Social Unit
GHG	Green House Gas
GRM	Grievance Redress Mechanism
IA	Implementing Agency
IEE	Initial Environmental Examination

IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
LAC	Local Area Committee
LPG	Liquefied Petroleum Gas
MCT	Main Central Trust
MoPE	Ministry of Population and Environment
MoPIT	Ministry of Physical Infrastructure and Transport
MRM	Mahendra Raj Marg
NAAQS	National Ambient Air Quality Standard
NEP	Nepal
NGO	Non-governmental Organization
NOx	Nitrogen oxide
PD	Project Directorate
PIU	Project Implementation Unit
PPE	Personal Protective Equipment
PIP	Priority Investment Plan
PM	Particulate Matters
RCC	Reinforced Cement Concrete
REA	Rapid Environmental Assessment
RoW	Right of Way
SASEC	South Asia Subregional Economic Cooperation
SC	Supervision Consultant
SDC	Social Development Consultant
SEA	Strategic Environmental Assessment
SEMP	Site specific Environmental Management Plan
SO ₂	Sulphur dioxide
SRIP	SASEC Road Improvement Project
SRN	Strategic Road Network
TA	Technical Assistance
TMO	Transport Management Office
TPPF	Transport Project Preparation Facility
TSS	Total Suspended Solids
VDC	Village Development Committee
ZOI	Zone of Influence

WEIGHTS AND MEASURES

°C	-	degree Celcius
cm	-	centimeter
dBA	-	decibels A
km	-	kilometer
KWH	-	Kilowatt-hour
m	-	meter
msl	-	mean sea level
ppb	-	parts per billion
pph	-	persons per hectare
ppm	-	parts per million

GLOSSARY

Bikram Sambat (B. S.) – Nepalese calendar year that runs from mid-April to mid-April. Unless otherwise stated, year ranges written in the form 2015/016 denote a single calendar year.

NOTES

- (i) The fiscal year (FY) of the Government ends on 15 July. FY before a calendar year denotes the year in which the fiscal year ends, e.g., FY2012 ends on 15 July 2012.
- (ii) In this report, "\$" refers to US dollars.

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EXECUTIVE SUMMARY

A. Introduction

1. The proposed South Asia Subregional Economic Cooperation (SASEC) Road Improvement Program (SRIP) will finance improvements of two strategic high-priority highways in the central and western region of Nepal: i) Narayanghat – Butwal Highway, and ii) Bhairahawa - Lumbini-Taulihawa Feeder Road. The Bhairahawa-Lumbini-Taulihawa road section connects to Lumbini, the birth place of Gautama Buddha, the founder of Buddhism, and a world heritage site. Taulihawa, according to Buddhist tradition, is the birthplace of Queen Mayadevi, the mother of Gautama Buddha. These places are important part of the Buddhist pilgrimage. The road also connects to the Gautam Buddha International Airport in Bhairahawa.

2. The Project is consistent with the Government's transport strategy and development plans. Nepal's Three Year Interim Plan (TYIP) 2013/14-2015/16 emphasizes on continuous development of Strategic Road Network (SRN) and strengthening EWH, while the proceeding plan, the Three Year Plan Approach Paper (TYPAP) 2013/14-2015/16, aims to: (i) connect the regional centers and all 75 district headquarters (ii) complete the Mid-Hill East-West Corridor (MHC) and (iii) strengthen the system of regular maintenance and management of road structures by providing regular maintenance of 8,300 km. and periodic maintenance of 1,500 km. roads. The Sector Wide Road Program (SWRP), Priority Investment Plan (PIP) and Strategic Road Network (SRN), currently calls for the expansion of the country's road improvement program from 7,917 km of the country's total road length of 18,828 km, to 9,900 km by 2016.

3. The project roads are: i) Narayanghat-Butwal (115 km - 4 lane highway) Road, and ii) Bhairahawa-Lumbini -Taulihawa Road (45 km, one lane and 2 lanes currently). The Department of Roads (DoR) intends to improve Narayanghat-Butwal road to an all-weather asphalt concrete four-lane Asian Highway Standard. The 45 km Bhairahawa-Lumbini-Taulihawa road has 2 sections: Section 1: 24.1 km, km 0+00 to km 24+100 (Bhairahawa-Lumbini); and Section 2: 20.9 km, km 24+100 to 45+00 (Lumbini - Taulihawa). Section 1 will be improved from the current 2 lanes to an all-weather bituminous 4 lanes while section 2 will be improved from 1 lane to 2 lanes feeder road standards. The road starts from Buddha chowk with coordinates 27°37'35" N and 86°28'3" E located at an elevation of 130 m msl of Siddharthanagar Municipality of Rupandehi district and ends at Purano Hat Bazar chowk with coordinates 27°32'42" N and 83°3'21" E located at an elevation of 107m msl of Kapilvastu municipality of Kapilvastu district. There will be no land acquisition since the road right-of-way is property of the government.

4. The proposed Bhairahawa-Lumbini-Taulihawa Road will contribute to promote regional trade and tourism along the 'Buddhist Circuit' being supported by the SASEC initiative. Upgrading of this road section will directly complement the ongoing upgrade of Gautam Buddha International Airport in Bhairahawa. Also, the project improves connectivity to Bhairahawa as one of the major border crossing points with India and as a potential industrial hub. The Bhairahawa inland clearance depot is handling the largest trade volume, and the second largest value of imports and exports of Nepal. The Bhairahawa border crossing point is also designated to be one of the four locations of the integrated check points, a major project of India to construct both its own side and the Nepal side of the adjoining border-crossing facilities. Furthermore, in November 2014, Nepal inaugurated the country's first Special Economic Zone (SEZ) in Bhairahawa to promote export-oriented industries in a bid to attain higher and

sustainable growth by boosting exports. The proposed Bhairahawa-Lumbini-Taulihawa Road is the subject of this initial environmental examination.

5. All roads proposed to be upgraded under the SASEC Road Improvement Project (SRIP) were screened and categorized using Rapid Environmental Assessment (REA) Checklist (Appendix A). The REA Checklist consists of screening questions related to the sensitivity and vulnerability of environmental resources in the sub-project area and the potential for the sub-project to cause significant adverse environmental impacts. All project roads under the SRIP were classified as Category "B" except Narayanghat-Butwal Road which has been classified as Category "A".

B. Description of Environment

6. Physiographically, the proposed road project lies in Terai plain region. Climatologically, this project lies in low tropical (elevation less than 300 m from msl), upper tropical (elevation 300-1000 m from msl) and subtropical region (elevation 1000-2000 m from msl). Rupandehi district, which is under the Federal State-5 of Nepal, is mostly plain district, although some parts lie in the mountainous area. The elevation of the district is 100 meters to 1,219 meters from the mean sea level. The diverse geography of the district is attributed to the combination of Terai Plains and Chure range within an area of 1,360 sq km. The average temperature of the district varies from minimum 7.10°C to maximum 40.20°C in the month of May based on Department of Hydrology and Meteorology (DHM) temperature records of Rupandehi for the last 30 years. The average annual precipitation is 1808.33 mm. The lowest rainfall is 1081.6 mm in 2005-2006 and the maximum was 2797.4 mm in 1998. The major rivers of Rupandehi district are Tinau, Rohini, Daanav, Kothi, Mahav, Baghela, Danda, Ghagra, and Koilijhyang.

7. Kapilvastu district is composed mostly of plains in the south and forested hills known as Chure hills in the north. The total area of the district is 1738 sq. km. The elevation of the district is 90 meters to 824 meters from the mean sea level. The district lies in the Federal State-5 of Nepal with 41 % forest coverage. Among them 30% are in Chure hilly terrain and 11% of the forest are in the plains. Banganga, Surai, Bel and Chirai are the main rivers originating from the Chure hills and flowing to the plains in the south. These hills, steeply sloped with young and fragile rocks and soils, are susceptible to soil erosion and annually are the source for flooding. The road mainly passes through cultivated land, settlements and 2.16 km from the edge of the buffer zone of Lumbini UNESCO World Heritage Site.

8. The soil found in the sub-project area is mostly alluvial. The road alignment traverses Terai plains of the project site and its surrounding is made up of ill compacted sand silt and clay layers and represents the alluvial belt of greater Ganga basin. The lithological formations are termed as Gangetic Alluvium. Structurally, the region is stable and shows no major faults in the vicinity of the BLT road project.

9. The project corridor offers habitat for mammals, birds (local and migratory), butterflies and reptiles. Only the Lumbini Development Trust masterplan area is traversed by the road sub-project. An estimated 1,870 road side trees will be cleared all of which are located within the DoR right-of-way (RoW). The dominant forest and fodder species reported in the road alignment are *Mangifera indica* (Aanp), *Melia persica* (Bakaino), *Ficus benghalensis* (Baar), *Ficus religiosa* (Peepal), Jack fruit, Babuwa, Wood Apple, *Dalbergia Sissoo* (Sisau), *Tamarindus indica* (Imli), *Dalbergia Sissoo* (Sisau), *Melia azadirach* (Nim), *Bombax ceiba* (Simal).

10. Indian Sarus Crane *G. a. antigone* inhabits Nepal's Terai lowlands, and can be found in rice paddies and small seasonal marshes in the vicinity of the Bhairahawa – Lumbini – Taulihawa Road.

11. Agriculture, business, and domestic and foreign remittances are the main sources of income of the people in the project area. Agriculture is still in subsistence level, though gradually shifting from traditional cereal crops to high value horticultural crops. The major religions followed by the people in the project area include Hinduism, Islam and Buddhism.

C. Anticipated Environmental Impacts and Mitigation Measures

12. The significant impacts during construction stage are air quality deterioration due to increase in fugitive dust emissions from materials hauling and unloading, ground shaping, hot mix plant operation and unpaved road travel. Mitigation measures include water sprinkling in dust prone locations, prohibition of burning of solid wastes, use of dust control methods, provision of personal protective equipment, including masks for workers, and locating mixing plants and hot mix plants at least 1 km downwind from nearest settlements. Hot mix plant shall not be located 3 km away from the Lumbini World Heritage Site. During operation, the DoR will coordinate with relevant agencies to enforce Nepal Vehicle Mass Emission Standard, as well as development organizations to motivate local communities to maintain greenery along the road.

13. Nuisance to nearby residents due to increase in noise from heavy equipment operation, hindrance in accessibility to common property resources, and increase in traffic on road sections where construction will be on-going are other anticipated impacts. These can be mitigated through the construction of temporary facilities such as labour camps away from settlements and other sensitive areas, protection devices such as ear plugs shall be provided to workers, scheduling of construction activities during daytime only, construction of noise barriers, provision of pedestrian crossings to lessen interferences arising from the use of vehicle horns, and continuous education for drivers on ways to minimize noise levels.

14. Other impacts include land use conversion from agricultural or residential to built-up area (road) due to expansion of road. Right-of-way is adequate for an improved carriageway. Similarly, surface water quality deterioration of the rivers and rivulets, and siltation of waterways from silt-laden surface runoff coming from the construction sites will also take place. Health and safety risks, particularly to children, will increase due to increase in heavy equipment traffic near pedestrian crossings. To lessen the impacts on water quality, the contractor, among others will be prohibited to dispose excavated spoils and wastes into streams, implementing training program to all equipment operators and drivers, avoiding washing, parking or refueling near streams, and locating labour camps away from settlements. The contractor will follow Nepal's regulations on health and safety, as well as the WHO prescribed guidelines on health and safety.

15. Although the road passes through Lumbini¹, and only 2.16 km from the edge of the buffer of UNESCO's Lumbini World Heritage Site, the road will have minimal to almost no impact on both Lumbini and the heritage site, as the road will only be widened to 2 lanes, and will not affect the boundary fences separating the northern and southern sections of Lumbini.

¹ Lumbini, as distinguished from Lumbini World Heritage Site, is based on the Master Plan prepared by Kenzo Tange from 1972-1974. The former measures 5 miles by 5 miles whereas the UNESCO World Heritage Site is only 1.95 ha, with a buffer zone of 22.78 ha. Lumbini is traversed by the proposed road improvement to 2 lanes, and is 2.16 km from the edge of the buffer zone of Lumbini World Heritage Site.

16. Although Sarus cranes inhabit rice paddies and marshes in the vicinity of the proposed road, their habitat maybe affected with the effluent from labour camps from workers and siltation from construction activities that may affect the water quality in rice paddies. Prior to construction, the contractor shall coordinate with the Department of National Parks and Wildlife Conservation (DNPWC) and Bird Conservation Nepal on the necessary mitigating measures the latter need to undertake to ensure this bird species will not be affected.

17. During operation stage, the main impact may be on the surface water hydrology since the construction of a road across several river/rivulets in the flood-affected sections can act as impediment to natural flow of water.

18. Other than the permanent change in land use, all identified impacts are of short-duration and co-terminus with the construction stage and are easy to mitigate.

19. Other anticipated impacts for both roads involve dust, noise, exhaust, construction and domestic waste, water contamination, occupational health and safety, erosion, siltation, and traffic congestion. Measures to manage these have been included in the environmental management plan (EMP) which will be mandatory for implementation by the contractor.

D. Public Consultation, Information Disclosure, and Grievance Redress Mechanism

20. Public consultations were organized at two levels namely, (i) district level, and (ii) project level. During consultation, local beneficiaries, affected people and stakeholders expressed various ideas and opinions. All suggestions and recommendations were discussed and considered in the project design including the environmental management and monitoring plans. Consultation with UNESCO was also conducted on June 2, 2016 to solicit their opinion on the potential impact of the project on the Lumbini World Heritage Site. The improvement in front of Lumbini will only be 2 lanes. The boundary fence will not be affected at all. UNESCO representatives responded positively on the proposed road improvement as it will help improve access to Lumbini World Heritage Site. Consistent with the ADB Communication Policy and SPS 2009, this report will be disclosed in the ADB and DoR websites.

21. Grievance redress mechanism will be established to resolve grievances from public or stakeholders concerning the project. This mechanism will be made effective by establishing mandatory grievance register book at the office of Project Implementation Unit (PIU). The grievances in the register book will be assessed in the case of genuine grievance or acceptable suggestion. Accordingly, the response will be given by the concerned PIU in consultation with supervision consultant or by DoR / Geo-environment and Social Unit (GESU) if the supervision consultants and contractor are unable to resolve the issue. The outcome will also be included in the quarterly report of ADB.

E. Greenhouse Gas Emission

22. GHG emissions likely to be generated from the project roads have been computed using the IPCC methodology and the Transport Emissions Evaluation Model for Projects (TEEMP)² developed by Clean Air Asia³. Total CO_{2eq} emissions for the IPCC methodology was computed at **39,449.63** tonnes /year using the mid-year, 2027 as basis. For the TEEMP, the CO₂ emission

² TEEMP is an excel-based, free-of-charge spreadsheet models to evaluate emissions impacts of transport projects.

³ A network of 250 organizations in 31 countries established by the Asian Development Bank, World Bank, and USAID to promote better air quality and livable cities by translating knowledge to policies and actions that reduce air pollution and greenhouse gas emissions from transport, energy and other sectors.

for the business-as-usual, with-project (excluding construction emissions) and with project (including construction emissions) scenarios were estimated at 194,067 tons/year, 42,396 tons/year and 42,396 tons/year, respectively. The proposed project hence, does not produce significant quantities of greenhouse gases⁴, as far as the two methodologies are concerned.

F. Environmental Management Plan and Grievance Redress Mechanism

23. Environmental Management Plan (EMP) in the IEE report has identified key issues likely to arise from project implementation, and has proposed mitigation measures, including responsibility. A separate Social Analysis and Resettlement Studies Report have also been prepared by the Social Development Specialist and the Resettlement Specialist, respectively. However, the correlated issues such as safety of community and construction crews, safe passages for public, protection of common physical, cultural, religious, historical, archaeological and public utilities/facilities reinstatement are covered under the mitigation plan. Environmental monitoring is an essential component in the implementation of IEE recommendation. The environmental monitoring program (EMoP) has been prepared to monitor the implementation performance of the EMP.

24. The civil works contractor will be required to have a team of environmental, health and safety officers to ensure proper implementation of the EMP. Semi-annual stakeholder consultations workshops on the progress of environment safeguards implementation will be held with relevant stakeholders such as DNPWC, WWF, CNP and others. These workshops will serve as a forum for external review on environment safeguards implementation under the Project.

G. Conclusion and Recommendation

25. The initial environmental examination of the 45-km Bhairahawa-Lumbini-Taulihawa Road sub-project will not pose significant adverse environmental impacts. Most of the significant impacts are site specific and limited to the RoW and the camp site. Majority of the impacts are co-terminus to the project construction phase and easily mitigated through proven measures including good engineering practices, compliance to occupational health and safety guidelines, and maintenance of camp sites. The IEE is adequate for the approval of the proposed project, and further environmental impact assessment is not required. This project is recommended for the implementation with incorporation of mitigation measures and environmental monitoring plan in the bidding documents.

⁴ Appendix 1 of SPS 2009. Discussion on Greenhouse Gas Emissions.

I. INTRODUCTION

A. Project Background / Rationale

1. The proposed South Asia Subregional Economic Cooperation (SASEC) Road Improvement Program (SRIP) will finance improvements of two strategic high priority highways in the central and western region of Nepal: i) Narayanghat – Butwal Highway, and ii) Bhairahawa-Lumbini-Taulihawa Feeder Road. The Narayanghat-Butwal Highway is part of the Asian Highway 2 that passes through the eastern portion of Nepal and at Kakarvitta and traverses Itahari, Dhalkebar, Pathlaiya, Hetauda, Narayanghat, Butwal, Kohalpur, Attaria and Mahendranagar.

2. The Project is consistent with the Government's transport strategy and development plans. Nepal's Three Year Interim Plan (TYIP) 2013/14-2015/16 emphasizes on continuous development of Strategic Road Network (SRN) and strengthening East-West Highway (EWH), while the succeeding plan, the Three Year Plan Approach Paper (TYPAP) 2013/14-2015/16, aims to: (i) connect the regional centers and all 75 district headquarters; (ii) complete the Mid-Hill East-West Corridor (MHC); and (iii) strengthen the system of regular maintenance and management of road structures by providing regular maintenance of 8,300 km. and periodic maintenance of 1,500 km. roads. The Sector Wide Road Program (SWRP), Priority Investment Plan (PIP) and Strategic Road Network (SRN), currently calls for the expansion of the country's road improvement program from 7,917 km of the country's total road length of 18,828 km, to 9,900 km by 2016.

3. The project roads are: (i) Narayanghat-Butwal (115 km - 4 lane highway) Road, and (ii) Bhairahawa-Lumbini-Taulihawa Road (45 km). The Department of Roads (DoR) intends to improve Narayanghat-Butwal Road to an all-weather asphalt concrete four-lane Asian Highway Standard. The 45 km Bhairahawa-Lumbini-Taulihawa road has 2 sections: Section 1: 24.1 km, km 0+00 to km 24+100 (Bhairahawa-Lumbini); and Section 2: 20.9 km, km 24+100 to 45+00 (Lumbini - Taulihawa). Section 1 will be improved from the current 2 lanes to an all-weather bituminous 4 lanes while section 2 will be improved from 1 lane to 2 lanes feeder road standards.

4. The Narayanghat-Butwal road is part of NH1 and AH2, the main lifeline of the central, western and mid-western territories. It also links to the Sanauli Border, the second largest trading post of Nepal through the Bhairawa dry port. The Bhairahawa-Lumbini-Taulihawa road section connects to Lumbini, the birth place of Gautama Buddha, the founder of Buddhism, and a world heritage site. According to Buddhist tradition, Taulihawa is the birthplace of Queen Mayadevi, the mother of Gautama Buddha. These places are important part of the Buddhist pilgrimage. The road also connects to the Gautam Buddha International Airport in Bhairahawa.

5. About 160 km of strategic roads will be upgraded and improved under SASEC SRIP. Project roads and bridges will be upgraded to comply with applicable road standards and enhance road safety and climate resilience. The Department of Roads (DoR) intends to improve the Bhairahawa-Lumbini-Taulihawa sub-project road to an all-weather sealed four and double lanes feeder road standards. There will be no land acquisition since the road right-of-way is property of the government. The formation width of the roads varies from 43 m to 12 m and shoulders will have minimum width of 2.5 m for whole length of the road originating from Bhairahawa and ending at Taulihawa covering 45-km length.

B. Purpose of the IEE Study

6. The main objective of the initial environmental examination (IEE) study is to identify the impacts from the construction and operation of the proposed road upgrading on the physical, biological, socio-economic and cultural environment of the subproject area. The IEE study recommends practical and site specific environmental mitigation and enhancement measures, prepare and implement environmental management and monitoring plan and make sure that IEE is sufficient for the proposed upgrading of the road project.

7. An IEE study of a proposed project is a legal requirement according to the Environment Protection Act, 1997; and Environment Protection Rule, 1997 (Amendment 2007) of GoN; and according to the provisions of ADB's Environment Safeguards Sourcebook (2012) and Safeguard Policy Statement (2009).

C. Extent of IEE Study

8. This IEE covers the proposed upgrading of the project road including ancillary facilities like camp, quarry, material storage, and plant operations. This IEE Report is prepared based on the information and data available through the engineering design studies including socio-economic and resettlement studies, field visits, public consultations and discussions, collection of primary and secondary information and data. The study has established a core zone of impact for 200 meters on either side of the existing road.

D. IEE Report Content

9. The content covers the following eight chapters, including this introduction chapter:

- Chapter – 1: Introduction
- Chapter – 2: Policy, Legal and Administrative Framework
- Chapter – 3: Description of Project
- Chapter – 4: Description of Environment
- Chapter – 5: Specific Impact Issues and Mitigation Measures
- Chapter – 6: Climate Change Consideration
- Chapter – 7: Analysis of Alternatives
- Chapter – 8: Institutional Arrangements
- Chapter – 9: Environmental Management Plan
- Chapter – 10: Grievances Redress Mechanism
- Chapter – 11: Conclusion and Recommendation

E. Methods Adopted to Prepare the IEE Study Report

10. The zone of impact of project road consists of three municipalities and nine affected Village Development Committees (VDCs) within its alignment. The affected municipalities are Siddharthanagar Municipality, Lumbini Cultural Municipality and Kapilvastu Municipality. Affected VDCs are Gonaha, Hati Bangai and Kamahariya of Rupandehi district and Baskhor, Dharmapaniya, Dohani, Dumra, Labani and Pakadi of Kapilvastu district.

11. The conduct of this IEE was guided by ADB SPS 2009. Relevant documents were collected and reviewed. Relevant information and data pertaining to the physical, biological and socio-economic and cultural environment were gathered and consultations with following key stakeholders were made:

- Consultation with DoR, ADB Directorate, GESU/DoR, MoPIT officials
- Consultation with Transport Project Preparation Facility (TPPF) Consultants
- Consultation with UNESCO and Lumbini Development Trust
- Review of ADB and GoN policy including legal requirements
- Completion and submission to ADB of REA Checklists and Project Description
- Project visits and consultation with affected people and stakeholders including primary information collection
- Review of relevant documents for secondary information and data collection
- Preparation of Draft IEE Report and submission to ADB for comments and feedback
- Institutional review and finalization of EMP in consultation with the executing agency (EA)
- Preparation of Final IEE Report incorporating ADB comments and feedback

F. Sources of Information and Data

12. Key sources of information include:

Table 1: Primary and Secondary Sources of Information and Data

Environmental Component	Sources of Information and Data
Project technical details Objectives Present road condition Proposed improvement activities Other technical aspects	<ul style="list-style-type: none"> • Engineering Design Consultants • Inception Report, Dec 2015 • Feasibility Study Report, March 2016
Physical environment: Climate, geology, soil, topography, river hydrology and morphology, drainage and flooding patterns, land use, soil erosion, sedimentation, natural hazards	GoN, DHM; District profiles; environmental statistics of Nepal, NPC/CBS, 2013; ESMF, 2008; Topographic maps of the respective districts; project walkover survey/group discussions
Biological environment: Forestry and biodiversity: flora- tree species, shrub species, grasses species; fauna-mammals, birds, butterflies; amphibians and reptiles; aquatic fauna-fish	DoF, DFO, DNPWC, Profiles of respective districts, field visits and consultation including group discussions/2016; Environmental Statistics of Nepal, 2013
Socio-economic and cultural environment: Economic characteristics, industrial development, and social and cultural resources	NPC/CBS, 2011; field survey by environmental, social and resettlement studies, 2016; District profiles

G. Public Consultation

13. Consultation meetings were organized systematically by informing stakeholders and affected people 1-2 days earlier and requesting the presence of VDC representatives including key personnel interested in social work, school teachers, and other user groups for large and diverse participation. To make the consultation more meaningful, agendas for discussions were prepared and raised among the participants. Major subject matters for discussions included were the need for the proposed road improvements; likely benefits and adverse impacts from the improvement activities on environment; and people's concerns, opinions, ideas, suggestions

on mitigation measures needed to be pursued during different stages of the road improvement activities. Group discussions were also held for collecting primary information. For this purpose, checklists were developed in order to include necessary information particularly on the valued environmental components and the need for their preservation. The summary of the discussion at project influence area of Bhairahawa – Lumbini - Taulihawa is shown in Table 2.

Table 2: Summary of Discussion

S.N	Date	No. of Participants	Location	Type of People Attended	Issues Raised
1	08/02/2016	Male: 15 Female: 10	Lumbini gate	Farmers, service holders, and businessmen	<ul style="list-style-type: none"> • Land acquisition • Construction modality • Compensation package and community support
2	10/02/2016	Male: 10 Female: 7	Parsa Chowk	Local politicians, students, teachers, and businessmen	<ul style="list-style-type: none"> • Land acquisition • Project benefits and community trainings • Community support
3	12/02/2016	Male: 12 Female: 9	Pakadi	Students, businessman, farmers, teachers, and local politicians	<ul style="list-style-type: none"> • Land acquisition • Resettlement of displaced persons • Involvement of the community in the project activities
4	14/02/2016	Male: 11 Female: 5	Barohia	Farmers, businessmen, and local politicians	<ul style="list-style-type: none"> • Land acquisition • Resettlement of displaced persons • Community involvement in the project activities

H. Consultation with UNESCO

14. Consultation was held in Nepal Resident Mission (NRM) on 2 June 2016 to discuss the proposed Bhairahawa-Lumbini-Taulihawa road with UNESCO representatives. The Department of Roads and ADB NRM are also present in the consultation. The Lumbini World Heritage Site is about 2.16 km from the proposed road improvement. As conveyed by the Design Consultants, the proposed upgrading of the road to 2 lanes, without any land acquisition and without impact on the boundary fence of Lumbini⁵, will not negatively impact the Lumbini World Heritage Site. UNESCO representatives did not raise any concern after they were briefed on the project. The list of attendees to the June 2 consultation is listed in Appendix B.

⁵ Lumbini, as distinguished from Lumbini World Heritage Site, is based on the Master Plan prepared by Kenzo Tange from 1972-1974. The former measures 5 miles by 5 miles whereas the UNESCO World Heritage Site is only 1.95 ha, with a buffer zone of 22.78 ha. Lumbini is traversed by the proposed road improvement to 2 lanes, and is 2.16 km from the edge of the buffer zone of Lumbini World Heritage Site.

II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

15. This section presents the national policies, laws and regulations of Nepal, as well as international agreements and conventions that apply to the environmental assessment of the proposed Bhairahawa-Lumbini-Taulihawa Road. The policy emanates from the Constitution, where the state guarantees its citizens the right for clean environment, the right of the victim of environmental pollution and degradation for compensation, the right to strike a balance between environment and development, and conservation of natural resources through inter-generational and judicious use of resources. The environmental impact assessment of the proposed road is governed primarily, among other rules and regulations, by the Environmental Protection Act of 1996 and the Environmental Protection Rule of 1997. The ADB Safeguard Policy Statement (2009) requirements is also presented since the project is categorized as “B” for environment. Although the proposed road is 2.16 km away from the edge of the buffer zone of Lumbini, a UNESCO declared World Heritage site, it is noteworthy to include discussions on the said UN convention, among other treaties and convention, of which Nepal is a member.

A. Environment Policies and Regulations of Nepal

1. Constitution of Nepal (2015)

16. The 2015 Constitution provides the right of every citizen of Nepal to live in a healthy and clean environment. The Constitution also allows the victim of environmental pollution and degradation the right to be compensated by the polluter. The State for its part shall strike a balance between environment and development for the country’s development. The State also has the duty to protect, promote, and make environment friendly and sustainable use of natural resources available in the country and adopt the concept of inter-generational equity and equitable distribution of resources, and preferential right to local communities.

2. The Tenth Five-year Plan (2002-2007) and Thirteenth Three-year Plan (TYP) (2013/14 – 2015/16)

17. The Tenth Five-year Plan (2002–2007) identified EIA as a priority area and emphasized environmental monitoring, the need to set-up national environmental standards and promote local participation in environment conservation through the local bodies and making them responsible and capable to manage local natural resources.

18. The thirteenth three-year plan (2013/14 – 2015/16) has adopted the concept of green development. The approach of the plan is to frame strategic programs to promote national and local adaptation, initiate carbon trading and internalize and address environment sensitive issues.

19. The TYP gives high priority to road sector because of its considerable contribution to socio-economic development, social integration, service delivery and governance. The operating policies include the construction and upgrading of roads that enhance access to tourism, industrial projects, agriculture, education, and health services, among others. To ease the pressure of urbanization, road networks will also be expanded in a safe and environment friendly manner.

3. The Environmental Protection Act, 1996 (EPA) and the Environmental Protection Rule, 1997 (first amendment 1999) (EPR)

20. The Environmental Protection Act (1996) and the Environmental Protection Regulation (1997) both provide the institutionalization of environmental aspects in development projects including road sector. Both regulations allow the then Ministry of Population and Environment (MoPE) and currently the Ministry of Environment, Science and Technology (MoEST) to approve environmental impact assessment (EIA) report. For initial environmental examination (IEE) study, the then Ministry of Physical Planning and Works (MoPPW) and currently the Ministry of Physical Infrastructure and Transport (MoPIT) is authorized to approve the Final IEE Report.

21. The EPA recognizes the link between development and environment and emphasizes that impacts on people, animals, plants and their environment, should be minimized. The Act requires the proponent to conduct IEE and EIA of proposals, plans or projects which may alter the existing environmental conditions and authorizes the Ministry of Environment to approve EIA and line ministries for IEE study.

22. The Act likewise gives authority to the then MoPE (MoEST currently) to prohibit the use of any matter, fuel, equipment or plant, which has adverse effects on the environment. The Act likewise subscribes to polluter-pays-principle by requiring polluters to compensate affected persons from polluting activities and empowers government to provide additional incentives to any industry, occupation, technology or process, which has positive impacts on environmental conservation.

23. The Environmental Protection Rule (EPR) (1997), on the other hand outlines the preparation and approval process of projects that require IEE and EIA approval. These include scoping document, terms of reference, information dissemination, public consultation, and environmental monitoring and auditing. The concerned ministry, the MoPIT, is authorized to approve the Final IEE Report. The EPR also lists the environmental screening for different types of development activities that will require either an IEE or an EIA level study. The proposed Bhairahawa-Lumbini-Taulihawa Road, is classified under the EPR to prepare an IEE since it requires the rehabilitation and upgrading of a feeder road.

4. Relevant Road Sector Policies and Guidelines

a. Environmental Management Guidelines, GESU / DoR, July 1997

24. EIA sectoral guidelines were issued for proponents and preparers in conducting impact assessments. Two of these guidelines are the draft EIA Guidelines for Road Sector, 1996 and the DOR Environmental Management Guidelines (EMG), 1997. These guidelines provide detailed environmental mitigation measures on the management of quarries, borrow pits, stockpiling of materials and spoil disposal, earthworks and slope stabilization, and location of stone crushing plant. Other guidelines regarding environmental management and road development are: i) Reference Manual for Environmental and Social Aspects of Integrated Road Development; MPPWD/DOR.HMGN,2003; ii) Environmental Management Guidelines for Roads and Bridges, GEU/DoR,1997; iii) Public Work Directives, HMGN,2002; iv) Guide to Road Slope Protection Works, DoR; and v) Environmental Guidelines for Local Development – Ministry of Local Development.

b. Reference Manual for Environmental and Social Aspects of Integrated Road Development, MPPW / DoR, 2003

25. The manual is designed to help integrate social and environmental considerations, including public involvement strategies, with technical road construction practices. The manual prescribes step-by-step process of addressing environmental and social issues based on best practices experiences of Nepal.

c. Public Roads Act, 1974

26. The Department of Roads may temporarily acquire the land and other property adopting compensatory measures during the construction, rehabilitation and maintenance of the public roads according to the Act (Article 14 &15). The Act also empowers the DoR to operate quarries, borrow pits and other facilities during road construction (Article 17). In sum, the Act facilitates the acquisition of land and property for the extraction of construction materials and development of other facilities as well as to maintain greenery along the roadside with adoption of compensatory measures.

d. The National Transport Policy, 2001

27. The applicable policy to the proposed Bhairahawa – Lumbini - Taulihawa Road is that the entire process of land acquisition and transferring of land ownership to the project shall be established prior to the commencement of the road project implementation.

e. Forest Act, 1993 (with amendments)

28. The Forest Act (1993) recognizes the importance of forests in maintaining a healthy environment. The Act requires decision makers to take account of all forest values, including environment services and biodiversity, not just the production of timber and other commodities. The basis of the Act is resource oriented rather than use oriented.

29. The Forest Act, 1993, (with amendment) contains several provisions to ensure the development, conservation, management and sustainable use of forest resources, based on approved work plan. The work plan should contain a list of activities that should be implemented in the different forest categories - national forests, community forests, leasehold forests, private forests, and religious forests. Section 23 of the Act empowers the government to delineate any part of the national forest, which has 'special environmental, scientific or cultural importance', as a protected forest. Section 49 of the Act prohibits reclaiming lands, setting fires, grazing cattle, removing and damaging forest products, felling trees of plants, wildlife hunting and extracting boulders sand and soil from the national forest without prior approval. However, the government may enforce Section 68 of the Forest Act to provide parts of any type of forest for the implementation of a national priority plan with the assurance that it does not adversely affect the environment significantly. As provisioned under the Act, while clearing the forest on the RoW of road, the implementing authority will coordinate with the District Forest Office. If necessary, the compensatory replantation will also be carried out at the rate of 1:25 under the provision of the Act.

f. Forest Rule, 1995

30. The Forest Rules 1995 (with amendment) further elaborate legal measures for the conservation of forests and wildlife. Based on forest legislation, thirteen plant species are

included in the level protection list. Of them, GoN has banned the felling, transportation and export of Champ (*Michelia champacta*), Khayer (*Acacia catechu*), *Bombax ceiba* and Sal (*Shorea robusta*).⁶ The rule also stipulates that the entire expenses for cutting and transporting the forest products in a forest area to be used by the approved project shall be borne by the proponents of the project.

g. Land Acquisition Act, 1977

31. The Land Acquisition Act (1977, as amended 1993) guides the compulsory acquisition of land. GoN can acquire land at any place and in any quantity by giving compensation pursuant to the Act for the land acquired for any public purpose(s) or for operation of any development project initiated by GoN institutions.

h. Water Resources Act, 1992

32. Water Resources Act (1992) makes provision for the rational use of surface and underground water. The act seeks to prevent environment and hazardous effects from the use of water and prohibit water pollution from chemicals and wastes from industries. Water may only be used in manner that does not permit soil erosion, landslide or flood. Pollution of drinking water is prohibited under the Nepal Drinking Water Corporation Act (1989).

i. Local Self-governance Act, 1999

33. The Local Self-governance Act (1999) institutionalizes the process of development by allowing the participation of all people, including ethnic communities, indigenous people and down-trodden as well as socially and economically backward groups to enhance social equity and balancing and allocating fruits of the nation's development.

j. Soil and Watershed Conservation Act, 1982 and Watershed Conservation Rule, 1985

34. The Soil and Watershed Conservation Act promulgated in 1982 gives authority to the government to declare any watershed a Protected Watershed and to implement various conservation measures in these areas. The Watershed Conservation Rule, on the other hand was formulated to support the enforcement of the Act.

k. Motor Vehicle and Transportation Management Act, 1993

35. This act sets standard for vehicles emission and mechanical condition for vehicle registration by the Transport Management Office (TMO). The TMO can deny a permit based on environmental factors. Standards are set for petrol and diesel engines under the Nepal Vehicle Mass Emission Standard 1999.

l. Child Labor Prohibition and Regulation Act, 2001

36. Section 3 of the Act prohibits a child⁷ from engaging in work, sub clause 1 of clause 3 states "Nobody shall engage in work a child who has not completed fourteen years of age as a

⁶ <http://www.floraofnepal.org/page/StaticRoot/Conservation/PlantLists>

⁷ Defined in Chapter 1, section 2 of the Child Labor Prohibition and Regulation Act as a minor not having completed the age of sixteen years.

labour and sub clause 2 states “Nobody shall engage a child in a risk full occupation or work set forth in the Schedule”. Section 4 states “Child not to be engaged in work against his will by temptation or fear or pressure or by any other means”. The proposed project will prohibit child labor in all its forms.

m. Labour Act, 1992

37. Chapter 5 of the Act on Health and Safety includes the duty of the general manager in the implementation of health and safety for each establishment, protection of eyes, protection from chemical substances, dangerous machineries to be fenced, lifting and carrying of excessive loads, the power of the Labour Office to issue orders to make arrangements for safety, the duty of the establishment to inform the Labour Office in case any worker or employee dies or becomes unable to work for more than 48 hours after sustaining injury because of any accident, and the duty of the government to determine labour standards.

B. Safeguard Policy Statement 2009

38. ADB’s Safeguard Policy Statement 2009 consists of three operational policies on environment, involuntary resettlement and indigenous peoples. It requires that (i) impacts are identified and assessed early in the project cycle, (ii) plans are prepared and implemented to avoid, minimize, mitigate or compensate potential adverse impacts, and (iii) affected people are informed and consulted during project preparation and implementation.

39. All roads proposed to be upgraded under the Strategic Road Improvement Project were screened and categorized using Rapid Environmental Assessment (REA). The REA consists of questions relating to: (i) the sensitivity and vulnerability of environmental resources in the sub-project area, and (ii) the potential for the sub-project to cause significant adverse environmental impacts. These roads are then classified into one of the following categories:

- **Category A.** A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required.
- **Category B.** A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination is required.
- **Category C.** A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.

40. The Bhairahawa-Lumbini-Tauihawa Road project is classified as Category “B” for environment.

41. All ADB investments are subject to an environmental assessment to address environmental impacts and risks. The environmental assessment starts with screening and categorization; followed by baseline data collection, impact analysis, environmental

management planning, information disclosure, consultation and participation, grievance redresses mechanism development, EMP implementation, and reporting.

C. International Conventions and Treaties

1. Convention Concerning the Protection of the World Cultural and Natural Heritage, UNESCO, 1972

42. The proposed Bhairahawa-Lumbini-Taulihawa Feeder Road is about 2.16 km from the edge of buffer zone of Lumbini, the birthplace of the Lord Buddha and declared as a world heritage site by UNESCO. Article 4 of the Convention Concerning the Protection of the World Cultural and Natural Heritage (1972) directed each State Party, of which Nepal belongs, to ensure the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage of the country, such as the Lumbini World Heritage Site. The Convention further requires each Party to do all it can to the utmost of its own resources and, where appropriate, with any international assistance and cooperation. Article 6 of the Convention directed each Party not to undertake any deliberate measures which might damage directly or indirectly the cultural and natural heritage belonging to its territory.

2. Other Conventions and Agreements

43. Nepal is also a Party to the Convention on the Vienna Convention for the Protection of Ozone Layer (1985) and UN Framework Convention on Climate Change (1992). The proposed upgrading of the proposed road will generate greenhouse gases during construction and operation, specifically on increased emissions from vehicles as a result of increase in vehicle volume. The country likewise is a Party to the Convention on Biological Diversity (1992) and the Convention on the International Trade in Endangered Wild Fauna and Flora (CITES, 1973). There is no forest in the project influence area, but two types of forests dominate the landscape of Rupandehi and Kapilvastu districts: natural and artificial forests. Terrestrial wildlife can be found in and near the Lumbini Cultural Municipality, which includes a number of common as well as rare species.

44. Nepal is also a signatory of the Convention (No. 169) concerning indigenous and tribal peoples in independent countries. Article 7 of this convention provides right to the indigenous and tribal peoples to decide their own priorities for the process of development. However, for the national development plans and programs, it mandates consultation with them in the formulation of their own plans and programs.

D. Permissions and Clearances Required for the Project

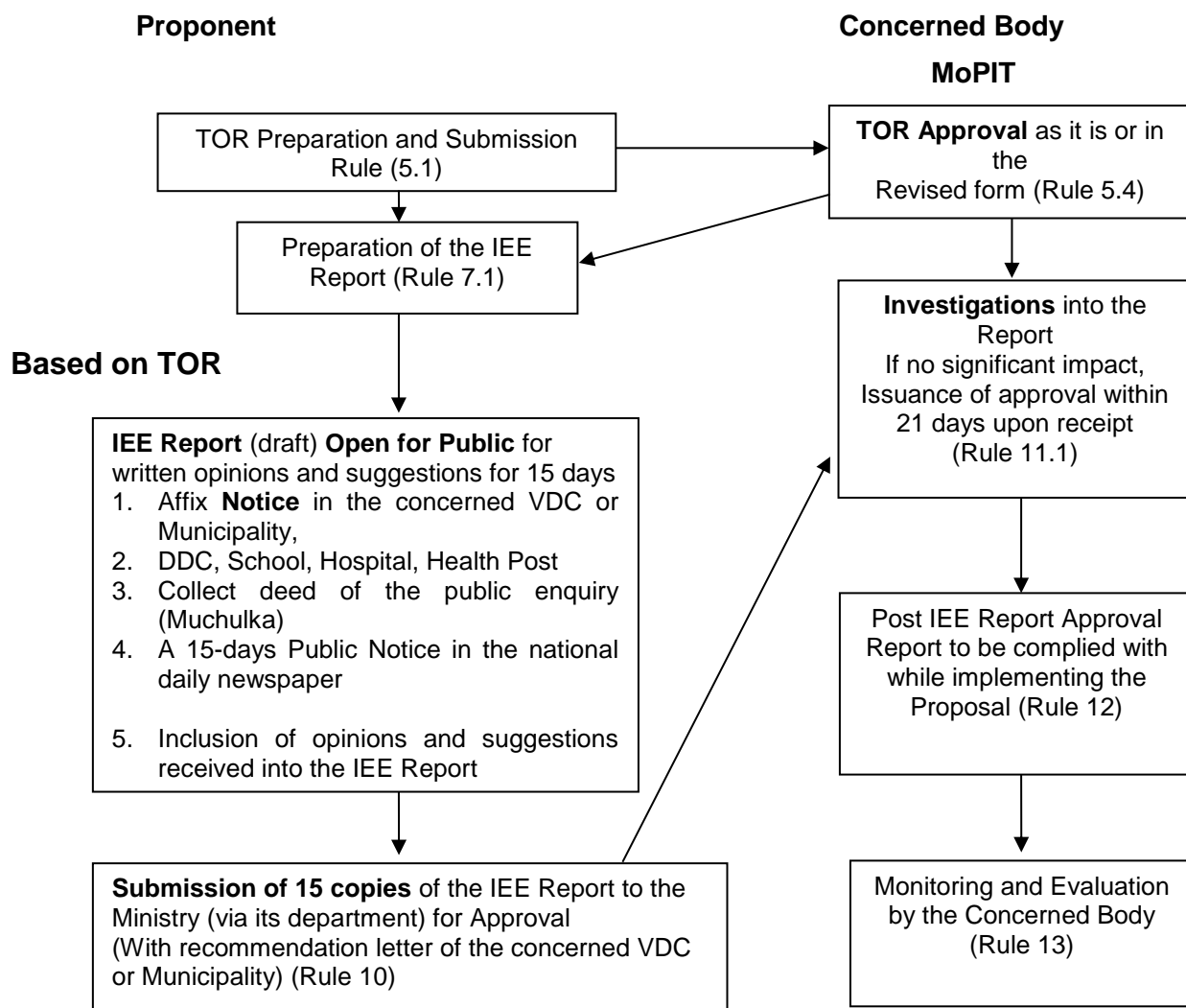
45. The legal framework of the country consists of several acts, notifications, rules, and regulations to protect the environment and wildlife. List of required clearances / permissions related to environment has been summarized in Table 3.

Table 3: Permissions and Clearances Required

S.N.	Clearance	Act/Rule/Notification/Guideline	Concerned Agency	Responsibility
A. Pre-construction Stage				
1	Environmental Clearance (categorized as “B” with IEE requirement)	Environment Protection Act 1996 and Environment Protection Rules, 1997 (with amendments)	Ministry of Physical Infrastructure and Transport	Department of Roads / PD, DoR (ADB)
2	Land Acquisition and Compensation	Land Acquisition Act , 1977 (with amendments)	Ministry of Physical Infrastructure and Transport	Department of Roads / PD, DoR (ADB)
3	Forestry clearance for felling of trees	Forest Act, 1993 (with amendment), Forest Rule, 1995, Forest Products Collection and Sales Distribution Guidelines, 2001 and Local Self-Governance Act, 1999	Ministry of Forest and Soil Conservation	Department of Roads / PD, DoR (ADB)
B. Implementation Stage				
4	Permission for construction material quarrying (stone, cobble, sand, gravel, soil, etc.)	Local Self-Governance Act, 1999 and Soil and Watershed Conservation Act, 1982 and Watershed Conservation Rule, 1985. PA,1996 and EPR, 1997 (with amendments)	Concerned Project and Concerned Village Development Committee (VDC), District Development Committee (DDC) and Municipality	Contractor
5	Consent to operate hot mix plant, crushers, and batching plant	Local Self-Governance Act, 1999	Concerned Project and Concerned VDC, DDC and Municipality	Contractor
6	Consent for disposal of sewage from labour camps	Water Resource Act, 1992	Concerned Project	Contractor
7	Pollution Under Control Certificate	Motor Vehicle and Transportation Management Act, 1993	Department of Transport Management	Contractor

46. The Environmental Clearance Processes in Nepal is described in Fig 1.

Figure 1: Environmental Clearance Procedure in Nepal



III. DESCRIPTION OF THE PROJECT

A. The Project

47. The proposed SASEC Road Improvement Project (SRIP) will finance improvements of two roads namely (i) Narayanghat-Butwal Highway (115 km); and (ii) Bhairahawa-Lumbini-Taulihawa Feeder Road 45 km, or a total of 160 km. These would be important as to provide an improved access to rural and hilly areas for people moving through the highways as well as to the Terai-based people to reach their desired destinations through these roads. The Project will contribute to development and expansion of the Strategic Road Network (SRN). It will include an institutional capacity assessment, specifically including road safety and road maintenance, which will form the basis for a capacity development program.

48. The project roads are: (i) Narayanghat-Butwal Highway (115 km, 2 lane), (ii) Bhairahawa-Lumbini-Taulihawa (45 km (single and 2-lane feeder road)). The Department of Roads (DoR) intends to improve Bhairahawa-Lumbini-Taulihawa road from two lanes to four lanes from Bhairahawa to Lumbini (24.1 km) and two lanes from Lumbini to Taulihawa (20.9 km) with Double Bituminous Surface Technique (DBST) Feeder Road Standard. The project roads were selected by the Department of Roads (DOR) for improvement based on their environmental, social and economic impacts.

B. Project Location

49. The existing Bhairahawa-Lumbini-Taulihawa has 24.1 km of double lane and 20.9 km of single lane road sections located between Rupandehi and Kapilvastu districts in the mid southern plains of Nepal. The road starts from Buddha Chowk, Siddharthanagar Municipality and ends at Purano Hat Bazar Chowk of Kapilvastu Municipality. The road provides connectivity to settlements/villages, tourism potential areas, market centres; agriculture production pockets and district headquarter. The salient features of the project improvement are presented below.

Table 4: Salient Features of the Project

Name of the Project	SASEC Road Improvement Project
Name of the Road Section	Bhairahawa-Lumbini-Taulihawa Road
LOCATION	
Districts	Rupandehi and Kapilvastu
Municipality/VDCs	Gonaha, Hati Bangai and Kamahariya VDCs and Siddharthanagar and Lumbini Sanskrit municipalities of Rupandehi district. Similarly, Baskhor, Dharmapaniya, Dohani, Dumara, Labani, Pakadi VDCs and Taulihawa municipality of Kapilvastu district.
Start Point	Buddha Chowk, Siddharthanagar Municipality
End Point	Purano Hat Bazar Chowk, Kapilvastu Municipality
GEOGRAPHICAL FEATURES	
Terrain	Terai Plains
Altitude	Start Point: 130 m at Buddha Chowk, Siddharthanagar municipality End Point: 107 m at Purano Hat Bazar Chowk, Kapilvastu Municipality
Climate	Lower-tropical

Road Type			
Classification of road		Four-lane (24.1 km) and two-lane road, Class II (20.9 km)	
Length of Road		26.9 km four lane and 24.1 km double lane	
Type of Pavement		ASPHALT CONCRETE (km 0+000 - 3+620), DBST (km 3+620 to – 45+000)	
Standard of Pavement		Pavement design Guidelines (flexible Pavement) DoR – 2014, Overseas Road Note 31 (RN 31) and/or AASHTO design method	
Design Parameters			
SN	Design Parameters	Design Standard	
		Four Lane	Double Lane
		Class II	Class II
1	Terrain	Plain	Plain
2	Design Speed, km/h	80.00	80.00
3	No of Lanes	4.00	2.00
4	Carriageway width, m/lane	3.50	3.50
5	Shoulder width(minimum), m	2.50	2.50
6	Right of Way, m (Total)	50.00	30.00
7	Sight Distance		
7.a	Stopping Distance, m	130.00	130.00
7.b	Overtaking Distance, m	470.00	470.00
8	Horizontal Alignment		
8.a	Minimum Radius of Horizontal Curves	240.00	240.00
8.b	Length of Transition curve, m	80.00	80.00
9	Vertical Alignment		
9.a	Maximum Gradients, %%	4	4
9.b	Maximum(critical) Length, m	600	600
9.c	Minimum Gradient, %	0.5	0.5
10	Median(Minimum), m	3.00	0.00
11	Camber, %	3	3
12	Shoulder Slope %	3	3
13	Maximum super elevation , %	7.00	7.00
14	Total Road Width without Drain	23.00	12.00

Source: Feasibility Study Report, 2016

1. Characteristics of the Existing Road

50. **Bhairahawa-Lumbini Road (km 0+00 to 24+100 km).** The road is of two lanes DBST with gravel packed shoulder in this zone. The section has five bridges, one irrigation crossing and four slab culverts. The upgrading of the bridges is ongoing.

51. **Lumbini-Taulihawa Road (km 24+100 to 45+000).** The road is of single lane DBST with gravel packed shoulder in this zone. The section has five bridges and twenty-five slab culverts. The upgrading of the bridges is ongoing.

52. Special attention has been given for the four lanes road with service road, especially the terrain is flat and evacuation of storm water could pose a problem for drainage outlet due to presence of settlements along both sides of the road. For a granular road base with DBST, camber of 3% is provided in the carriageway and shoulder for a quick evacuation of runoff down

the embankment. The following provisions are proposed: i) road side drains with suitable outlets at small market areas to prevent pavement damage, and ii) suitable outlets in areas of high embankment or at curves to prevent reel formation on the embankment or pavement edge.

53. **Cross Drains:** There are 29 cross drainages along the BLT section. Almost all of them are in good condition. During the construction phase all of them have to be reinstated for the sustainability of the project. These cross drains are sufficient to drain out the storm runoff for their respective catchments.

54. **Bridges:** This road section has 10 bridges. During the dry season, almost all of the rivers do hold very less flow of water and it attains its flow capacity to maximum during monsoon. The bridges are designed for 100 years expected flood.

55. **Land Slide and Erosion:** The entire road passes through the Terai plains and no erosion or landslides are expected. The side slope erosion will be protected by bioengineering works. Bioengineering uses vegetation, either alone or in conjunction with some engineering materials, to reduce instability and erosion on cut slopes. It is important to start planting of vegetation as early as possible in the construction process, or immediately after soil disturbance takes place. The right variety should be considered, according to soil type, climate, ease of maintenance, and desired engineering function.

56. The road starts from Buddha Chowk at an elevation of 130 m msl of Siddharthanagar Municipality of Rupandehi district, traverses across Lumbini Cultural Municipality of Rupandehi district and ends at Purano Hat Bazar Chowk at an elevation of 107m msl of Kapilvastu municipality of Kapilvastu district. The project road is the gateway to Lord Gautam Buddha's birthplace. Initially, the road has been constructed from Bhairahawa to Taulihawa as an access road. The road runs along the gently plain land, mostly cultivated land and settlements.

57. The road passes through the VDCs of Gonaha, Hati Bangai and Kamahariya and Lumbini Cultural Municipality of Rupandehi district. The road then passes through six VDCs namely Baskhor, Dharmapaniya, Dohani, Dumra, Labani, Pakadi and Kapilvastu Municipality of Kapilvastu district.

58. The major settlements along the road are Buddha Chowk at start point at Bhairahawa, Airport Chowk at km 3+360, Bangai at 5+150, Motipur at 10+150, Rampur at 16+100, Parsa at 17+650, Parsa Chowk at 18+050, Tenuhawa at 19+650, Hathiawa at 21+500, Jatwapur at 23+100, Bazar at 30+050, Tilaurakot at 30+250, Pakadi at 31+800, Dumara at 34+100, Dharmapaniya at 35+700, Dohani at 37+100, Mainihawa at 39+750, Taulihawa at 40+750, and Purano Hat Bazar Chowk at 41+850. From Gautam Buddha Chowk to Gautam Buddha Airport, the RoW is 50 m. For this portion of the road, the formation width is 43 m including foot path. The RoW beyond Gautam Buddha Airport is 30 m and hence it has been agreed to make four lane roads up to Parsa Chowk with formation width 23 m without foot path. From Parsa Chowk to Purano Hat Bazar Chowk, Taulihawa, the formation width is 12 m with double lanes without foot path. The road will be upgraded as per the DoR standards for carriage width, shoulders, service roads, median, drains, foot paths and other necessary additional structures including bridges, culverts, etc.

59. The location map of the road alignment, quarry and borrow pits are presented in **Figures 2 and 3.**

Figure 2: Project Location Map

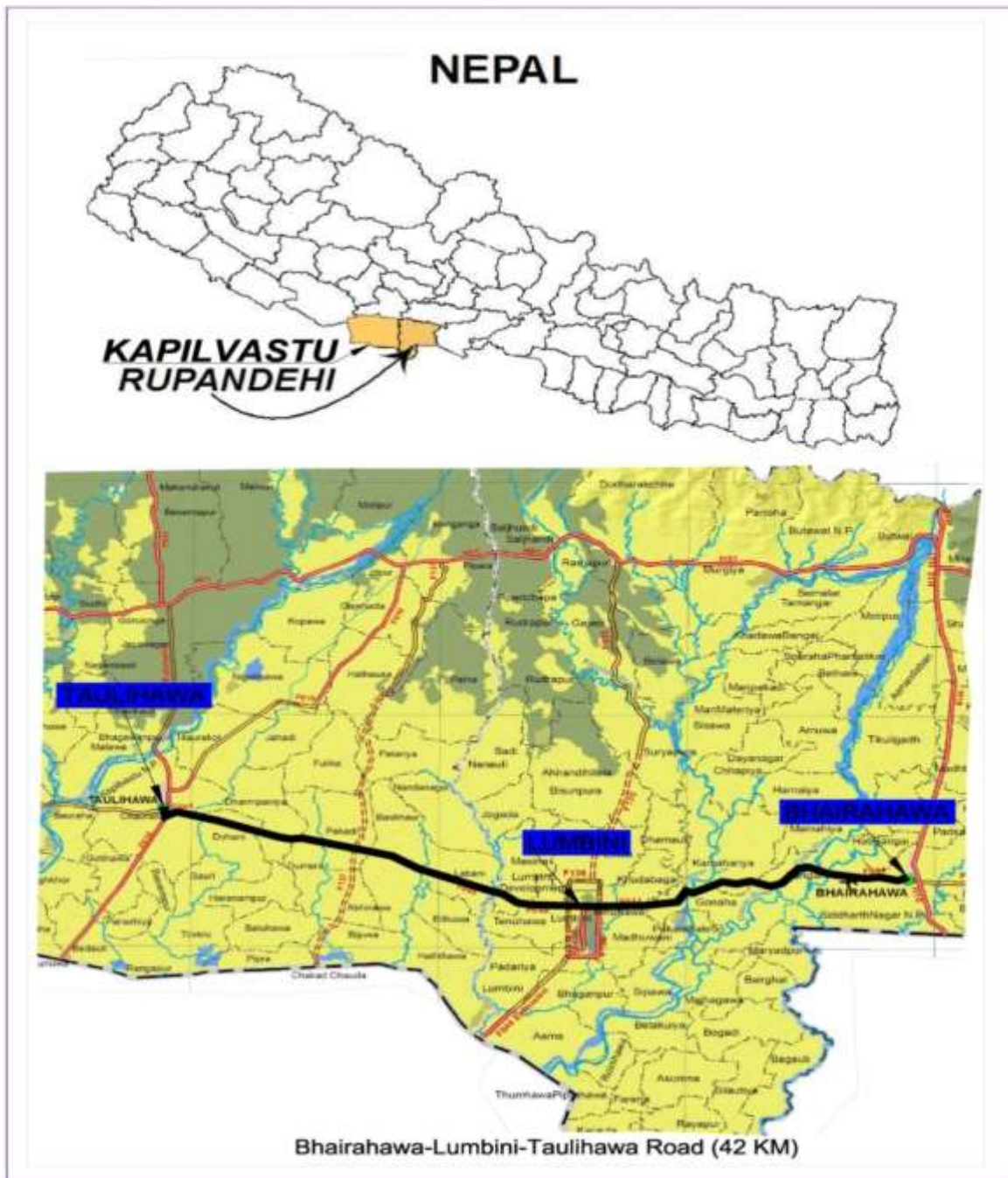
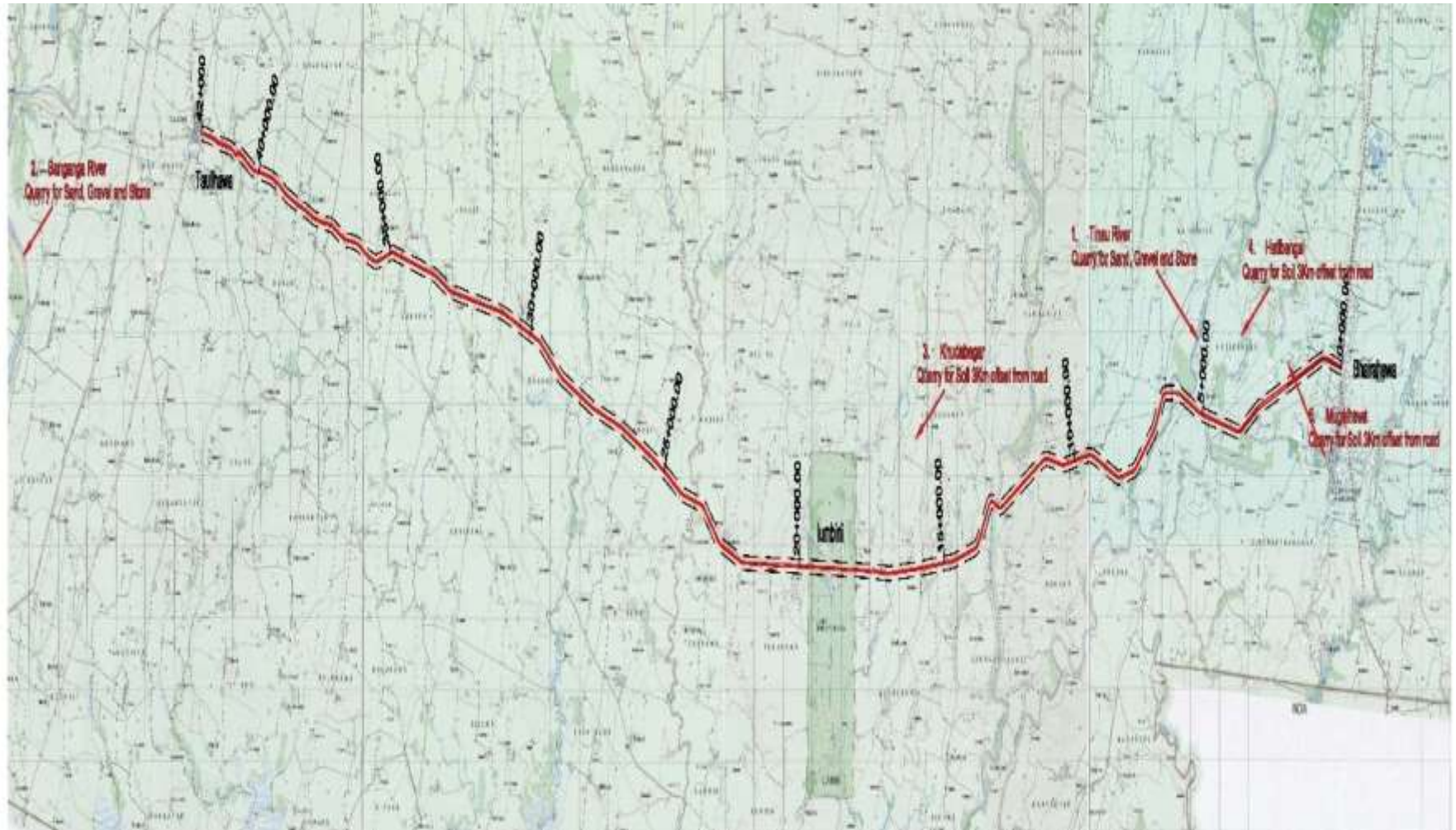


Figure 3: Road alignment with the Material Quarry and Borrow Pits Locations



2. Category of the Project

60. The Asian Development Bank's Roads and Highways Rapid Environmental Assessment (REA) Checklist (Appendix A) along with the Project / Site Description were prepared. The project road alignment passes through the Terai plains, cultivated paddy land, and settlements/villages. The project area passes through Lumbini Development Area. The Lumbini World Heritage Site, a UNESCO declared World Cultural Heritage site is about 2 km from the road. There is no wetland area, national park, wildlife reserve and conservation area, and hunting reserve. The anticipated impacts from the improvement of the proposed road are minor, local, short term and reversible. The project road has been classified as Category B in accordance with ADB's Safeguard Policy Statement, 2009.

3. Need for the Project Road

61. Bhairahawa – Lumbini - Taulihawa Road is one of the two priority roads considered for upgrading by ADB under SASEC Road Improvement Project (SRIP) in Nepal. This road is the gateway to Lumbini, the birth place of Lord Buddha, a UNESCO World Heritage Site. The project road will connect Bhairahawa, Gautam Buddha International Airport with Lumbini and Taulihawa. The road is expected to play a vital role in improving the socioeconomic conditions of the people of Rupandehi and Kapilvastu districts through enhanced accessibilities of various services. It is also expected that there will be increased economic activities arising from the road improvement.

4. Existing and Projected Traffic

62. For the purpose of Annual Average Daily Traffic (AADT) study, the 45-km road was divided into three sections: (i) Section 1: Bhairahawa section (3.62 km); (ii) Section 2: Bhairahawa – Lumbini section (20.48 km); and Section 3: Lumbini – Taulihawa section (20.9 km). For 2016, the following are the AADT per section: Section 1 - 12,927 vehicles; Section 2 – 6,215 vehicles; and Section 3 – 3,846 vehicles. AADT forecasts up to year 2038 are indicated in Tables 5 to 7. It is predicted that the volume will grow almost 5 times in 23 years for the 3 sections.

Table 5: Annual Average Daily Traffic with Projection(BLT 1 – Bhairarawa, 3.62 km)

Year	Multi-Axle Truck	Heavy Truck	Light Truck	Bus	Mini-Bus	Micro-Bus	Car	Four-Wheel Drive	Tractor	Utility Vehicle	Motor Cycle	3-Wheeler	Power Tiller	Total
2016	882	520	157	161	460	134	1,269	595	588	688	7,462	10	1	12,927
2017	946	557	168	174	498	145	1,384	649	594	738	8,283	10	1	14,148
2018	1,014	598	180	189	540	157	1,510	708	600	791	9,194	11	1	15,492
2019	1,087	641	193	205	584	170	1,648	773	606	848	10,205	11	1	16,971
2020	1,155	681	206	218	622	181	1,763	827	612	901	11,205	12	1	18,384
2021	1,228	724	219	232	663	193	1,887	885	618	958	12,304	12	1	19,922
2022	1,305	769	232	247	706	206	2,019	947	624	1,018	13,509	13	1	21,596
2023	1,387	818	247	263	752	219	2,160	1,013	630	1,082	14,833	13	1	23,419
2024	1,475	869	263	280	801	233	2,311	1,084	637	1,150	16,287	14	1	25,405
2025	1,547	912	275	295	842	245	2,448	1,148	637	1,207	17,720	15	1	27,291
2026	1,623	957	289	310	886	258	2,592	1,215	637	1,266	19,279	15	1	29,328
2027	1,702	1,004	303	326	932	272	2,745	1,287	637	1,328	20,976	16	1	31,528
2028	1,786	1,053	318	343	981	286	2,907	1,363	637	1,393	22,822	16	1	33,905
2029	1,873	1,104	333	361	1,032	300	3,078	1,443	637	1,461	24,830	17	1	36,472
2030	1,958	1,154	348	378	1,081	315	3,245	1,521	637	1,527	26,668	18	1	38,851
2031	2,046	1,206	364	397	1,133	330	3,420	1,604	637	1,596	28,641	18	1	41,392
2032	2,138	1,260	381	416	1,187	346	3,605	1,690	637	1,668	30,760	19	1	44,107
2033	2,234	1,317	398	436	1,244	362	3,799	1,781	637	1,743	33,037	20	1	47,008
2034	2,334	1,376	416	456	1,304	380	4,004	1,878	637	1,821	35,481	21	1	50,109
2035	2,430	1,433	433	476	1,361	397	4,193	1,966	637	1,896	37,894	21	1	53,137
2036	2,530	1,491	450	497	1,421	414	4,390	2,058	637	1,973	40,471	22	1	56,356
2037	2,633	1,553	469	519	1,484	432	4,596	2,155	637	2,054	43,223	23	1	59,779
2038	2,741	1,616	488	542	1,549	451	4,812	2,256	637	2,138	46,162	23	1	63,418
Total	40,053	23,614	7,130	7,722	22,062	6,427	65,785	30,845	14,423	31,243	531,248	370	24	780,946

Table 6: Annual Average Daily Traffic with Projection (BLT 2 – Lumbini, 20.48 km)

Year	Multi-Axle Truck	Heavy Truck	Light Truck	Bus	Mini-Bus	Micro-Bus	Car	Four-Wheel Drive	Tractor	Utility Vehicle	Motor Cycle	Three Wheeler	Power Tiller	Total
2016	574	280	48	93	273	98	777	261	213	243	3,348	5	2	6,215
2017	615	300	51	101	296	106	848	285	215	261	3,716	5	2	6,801
2018	660	322	55	109	320	115	925	311	217	279	4,125	5	2	7,445
2019	707	345	59	118	347	124	1,009	339	219	299	4,579	6	2	8,154
2020	752	367	63	126	369	133	1,080	363	222	318	5,028	6	2	8,827
2021	799	390	67	134	393	141	1,155	388	224	338	5,520	6	2	9,558
2022	849	414	71	143	419	150	1,236	415	226	360	6,061	6	2	10,353
2023	903	440	76	152	446	160	1,323	444	228	382	6,655	7	2	11,219
2024	960	468	80	162	475	171	1,415	475	231	406	7,307	7	2	12,160
2025	1,007	491	84	170	500	179	1,499	503	231	426	7,951	7	2	13,051
2026	1,056	515	88	179	526	189	1,587	533	231	447	8,650	8	2	14,011
2027	1,108	540	93	188	553	199	1,681	565	231	469	9,411	8	2	15,047
2028	1,162	567	97	198	582	209	1,780	598	231	492	10,240	8	2	16,166
2029	1,219	595	102	209	612	220	1,885	633	231	516	11,141	9	2	17,372
2030	1,274	621	107	219	642	230	1,987	667	231	539	11,965	9	2	18,492
2031	1,331	649	111	229	672	241	2,094	703	231	564	12,850	9	2	19,688
2032	1,391	679	116	240	705	253	2,207	741	231	589	13,801	10	2	20,965
2033	1,454	709	122	252	738	265	2,326	781	231	615	14,823	10	2	22,328
2034	1,519	741	127	264	774	278	2,452	824	231	643	15,920	10	2	23,784
2035	1,582	771	132	275	808	290	2,567	862	231	670	17,002	11	2	25,203
2036	1,646	803	138	287	843	303	2,688	903	231	697	18,158	11	2	26,710
2037	1,714	836	143	300	881	316	2,814	945	231	726	19,393	11	2	28,312
2038	1,784	870	149	313	919	330	2,946	990	231	755	20,712	12	2	30,014
Total	26,066	12,715	2,180	4,460	13,094	4,700	40,280	13,530	5,225	11,035	238,357	185	49	371,876

Table 7: Annual Average Daily Traffic with Projection (BLT 3 – Bhairahawa, 20.9 km)

Year	Multi-Axle Truck	Heavy Truck	Light Truck	Bus	Mini-Bus	Micro-Bus	Car	Four-Wheel Drive	Tractor	Utility Vehicle	Motor Cycle	Three Wheeler	Power Tiller	Total
2016	60	76	34	109	182	139	428	117	124	177	2,397	3	0	3,846
2017	64	81	36	118	197	151	467	128	125	190	2,661	3	0	4,221
2018	69	87	39	128	213	163	509	139	126	203	2,953	3	0	4,635
2019	74	94	42	138	231	177	556	152	128	218	3,278	3	0	5,091
2020	79	100	45	147	246	188	595	163	129	232	3,599	4	0	5,525
2021	84	106	47	157	262	200	636	174	130	246	3,952	4	0	5,999
2022	89	112	50	167	279	213	681	186	132	262	4,340	4	0	6,515
2023	94	120	53	178	297	227	729	199	133	278	4,765	4	0	7,078
2024	100	127	57	190	317	242	780	213	134	296	5,232	4	0	7,691
2025	105	133	60	200	333	254	826	226	134	310	5,692	4	0	8,278
2026	110	140	63	210	351	268	874	239	134	326	6,193	5	0	8,912
2027	116	147	66	221	369	282	926	253	134	342	6,738	5	0	9,597
2028	121	154	69	232	388	296	980	268	134	358	7,331	5	0	10,338
2029	127	161	72	244	408	312	1,038	284	134	376	7,976	5	0	11,139
2030	133	169	75	256	428	327	1,094	299	134	393	8,566	5	0	11,880
2031	139	176	79	268	448	342	1,153	315	134	411	9,200	6	0	12,673
2032	145	184	82	281	470	359	1,216	332	134	429	9,881	6	0	13,520
2033	152	192	86	295	492	376	1,281	350	134	448	10,612	6	0	14,426
2034	159	201	90	309	516	394	1,351	369	134	468	11,398	6	0	15,395
2035	165	209	94	323	539	411	1,414	387	134	488	12,173	6	0	16,343
2036	172	218	98	337	562	429	1,481	405	134	508	13,000	7	0	17,350
2037	179	227	102	352	587	448	1,550	424	134	528	13,884	7	0	18,422
2038	186	236	106	367	613	468	1,623	444	134	550	14,829	7	0	19,563
Total	2,725	3,451	1,544	5,228	8,729	6,667	22,188	6,065	3,041	8,038	170,651	111	0	238,438

5. Key Upgrading Activities

63. The proposed project involves key upgrading activities including geometry improvement, pavement upgrading, drainage improvement, retaining structures; slope protection/stabilization, other off-road works, and works on traffic management and road safety and described in the succeeding section. Proposed cross-sections of the roads are given in Figures 4 and 5.

Figure 4: Proposed Cross-section of the Road (Bhairahawa – Lumbini)

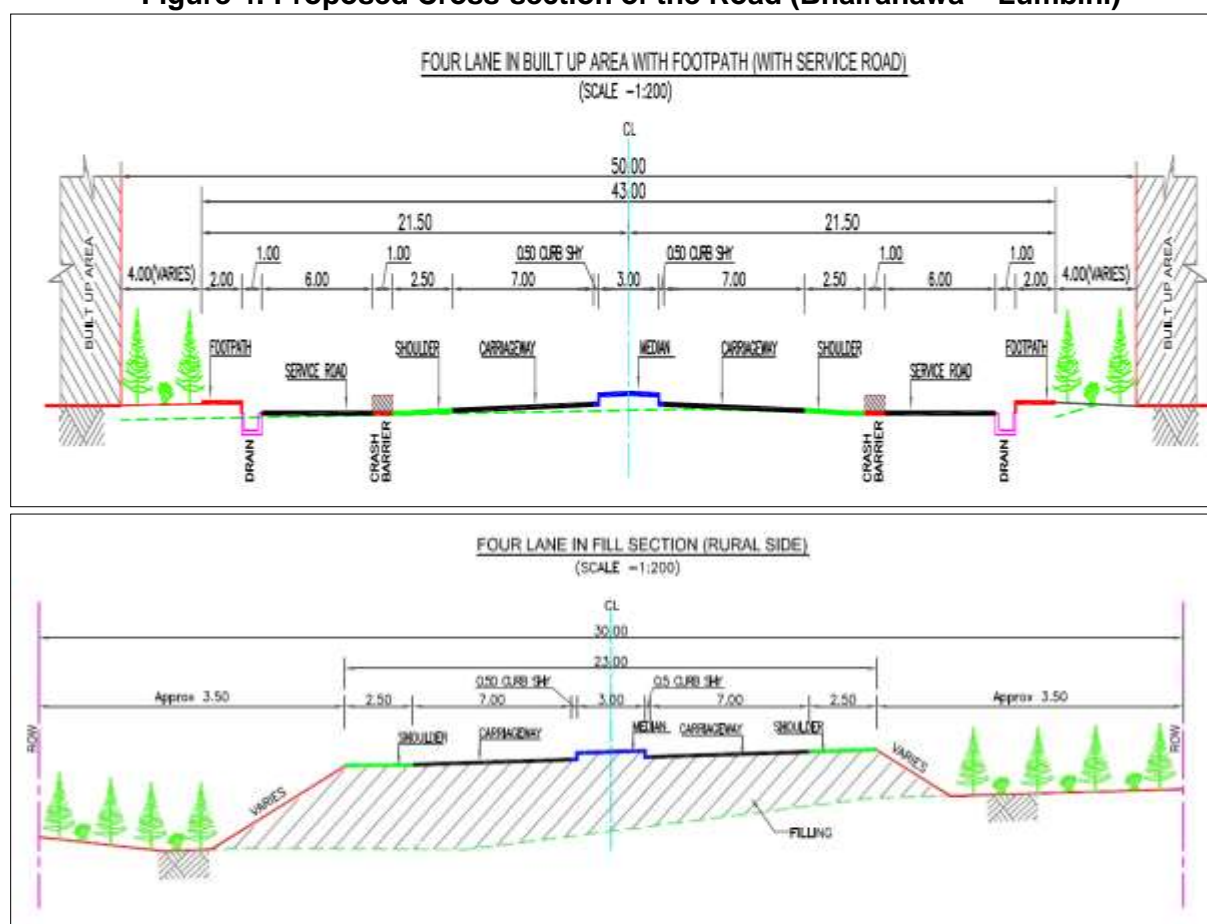


Figure 5: Proposed Cross-section of the Road (Lumbini - Taulihawa)

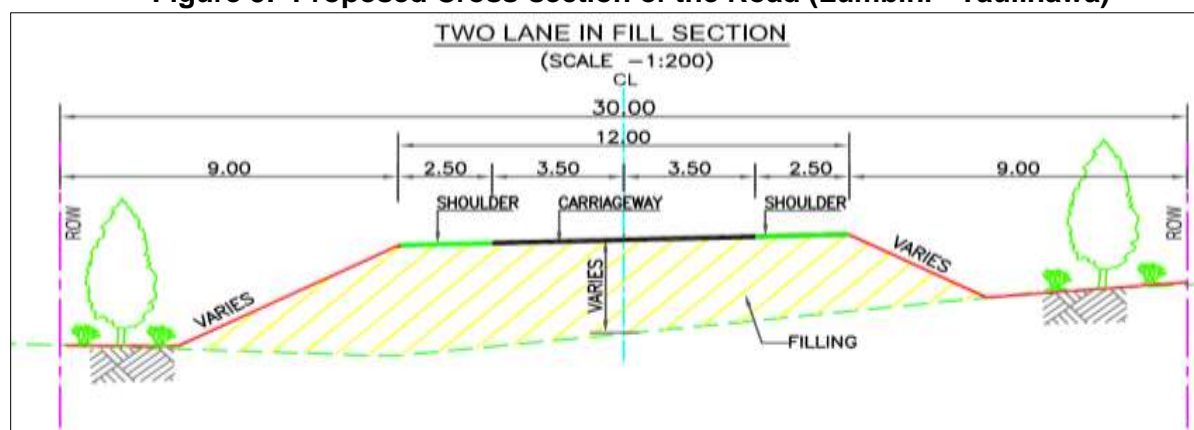


Figure 6: Proposed Road Development in Lumbini Development Area



- Geometry Improvement:** This involves widening of road width to 43 m up to Gautama Buddha International Airport (GBIA), 23 m from GBIA to Parsa Chowk and 12 m from Parsa Chowk to Purano Hat Bazar Chowk of Kapilvastu Municipality to meet the design standards including sections along religious and cultural sites, markets, and built-up areas. Along selected major built-up areas and market fronts, consideration has been made in preliminary design to widen the road to full width. The geometry improvement will enhance serviceability of road, provide hard stand to parking/stopping vehicles and better drainage management.
- Pavement upgrading:** The road pavement activities involve strengthening, resurfacing and full reconstruction on existing sections including new construction on upgrading sections. It also covers shoulder improvement and sealing of shoulder in some specified section of the road. The existing road surface is made of Double Bituminous Surface Technique (DBST). As part of its upgrading, full pavement with DBST is designed for whole section of the road. The minimum gradient of the road is designed 0.5 %.
- Drainage Improvement:** This involves lining of side drains in some specified designed section, improvement of existing natural drainage systems, culverts and side drains along main market fronts. The road has cross-drainage works comprising bridges, RCC culverts and pipe culverts.
- Retaining Structures:** No retaining structure is proposed except bridge abutment side protection.

- **Slope protection / stabilization:** This involves road side slope protection activities. Both civil engineering and bioengineering⁸ activities will be under consideration.
- **Road Safety Measures:** This includes provision of signs, delineators, barriers and pavement markings, minor realignment at identified black spots including pedestrian foot paths in market areas. Pedestrian crossings at grade sections are proposed at Bhairahawa Chowk, Airport Chowk and Parasa Rani Chowk.
- **Bridges:** There are 10 small and large streams across the road alignment in the perennial rivers. There is 1 irrigation canal crossing along the road alignment at Ch 9+620 km. No wetlands are found within the vicinity of the road.

a. **Materials Required and Sourcing**

64. As per engineering study, Tinau and Banganga rivers are the main alluvial sources of gravel, sand and stone situated in the vicinity of the project road. Other sources for soil quarry include Khudabagar, Hati Bangai and Mugalhawa.

b. **Project Implementation Schedule and Cost**

65. The detailed design and preparation of bid documents for SASEC Road Improvement Project (SRIP) roads has been carried out under TPPF/PPC-2. The construction work is expected to begin at the beginning of 2017. A 24-month construction period is estimated followed by a 12-month defects liability period enabling the completed project road to be opened by 2019. The total cost of the project including VAT is Rs 3,096,423,620.00. This estimate includes the Environmental Mitigation cost of Rs 15,866,894.00 which is split into: i) Bioengineering (Rs 12,886,894.00); ii) Environmental mitigation (Rs 1,500,000.00); and iii) Social safeguard (Rs 1,500,000.00).

⁸ Bioengineering is an effective, simple and economical method of reducing instability and erosion on cut slopes by providing protection using vegetation, either alone or in conjunction with some civil engineering materials.

IV. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

1. Meteorology and Climate

66. **Rupandehi:** The elevation of the district lies between 100 m to 1,229 m from msl. The total area of the district is 1,360 km² with 16.1% in Churia Range and the rest in the Terai region. The climate zone of the project area lies in lower tropical climate zone. The temperature during summer reaches 40.2°C and winter remains below 7.10°C.

Table 6: Climate Zone Distribution of Rupandehi

Climate Zone	Elevation Range	% of Area
Lower Tropical	below 300 m	89.3%
Upper Tropical	300 to 1,000 m	10.5%
Subtropical	1,000 to 2,000 m	0.2%

Source: Central Bureau of Statistics, 2011.

67. **Kapilvastu:** The district is situated at a height of 93 to 1,491 meters above sea level. Geographically, the district can be divided into the low land plains of Terai and the low Chure hills. The summer is hot with absolute extreme temperature reaching 43.6°C in April, 2010 and 5.5°C minimum in January, 2010. The annual precipitation data of Rupandehi district (2001-2012) is presented in Table 8.

Table 7: Climate Zone Distribution of Kapilvastu

Climate Zone	Elevation Range	% of Area
Lower Tropical	below 300 m	86.8%
Upper Tropical	300 to 1,000 m	12.0%
Subtropical	1,000 to 2,000 m	1.2%

Source: Central Bureau of Statistics, 2011.

Table 8: Annual Precipitation of Bhairahawa, Rupandehi District

Year (2001 – 2006)	2001	2002	2003	2004	2005	2006
Annual Precipitation (mm)	2016	1269	1953	1524	1768	1214
Year (2007 – 2012)	2007	2008	2009	2010	2011	2012
Annual Precipitation (mm)	2066	1669	1504	1904	1284	1387

Source: Department of Hydrology and Meteorology, Nepal.

2. Topography and Soils

68. The project area is generally flat, and the mean altitude is 110 m from mean sea level. The topography of the project area is characterized by Chure hills in the north and the plain land in the south up to international border of India and Nepal. The road alignment follows on the plains of alluvium deposits of Rupandehi and Kapilvastu districts and passes through cultivated land, local markets, settlements and villages such as Bhairahawa, Bangai, Motipur, Rampur, Parsa, Hathihawa, Jatwapur, Jaruwa Bazar, Labani, Dharamapaniya, Dohani, Dimiya Bazar, Tilaurakot, Manojpur, Pakadi, Dumara, Mainihawa, and Taulihawa. The project site comprises loose soil represented by clay loam (70%), sandy loam (10%) and loam soil (20%). Table 9 presents the soil properties in the project area. The soil in the project area has a water holding capacity (WHC) of 59%.

Table 9: Soil Property in the Project Area

S. No.	Parameters	Values
1	pH	6.8
2	Alkalinity(mg/100gm)	0.48
3	Chloride(mg/100gm)	5.68
4	Organic matter (mg/gm)	8.3
5	Carbon (%)	1.1
6	Total Nitrogen (%)	1.2
7	Total Phosphorus (%)	2.31
8	Water holding Capacity (%)	59.54
9	Water Soluble Salts (ppm)	0.0025

Source: IEE Report, Lumbini Airport, 2006

3. Land Use Pattern

69. Land use pattern of the direct corridor of impact (COI) of 100 meters either side from the centre line of the road was observed and noted during field survey. It was found that the land use pattern is dictated by topography (elevation and slopes), climate, soils and availability of irrigation facility. Accordingly, lands in the project corridor are used for agriculture, settlements, grazing and market areas. Agriculture is another important land use practice along the road corridor. The major crops grown are paddy, wheat, maize, barley, pulses, oilseed, potato, sugarcane and vegetables. Besides cultivation of crops, farm grown trees such as fodder, fruit species are grown around homestead areas. There are few patches of grazing lands where livestock open grazing is practiced. The detailed existing land use patterns along the road corridor are indicated in Table 10.

Table 10: Land Use Pattern Along the Road Alignment

S. No.	Ch. (From)	Ch. (To)	Length (m)	Land use Pattern	Remarks
1	0+000	0+850	850	Settlement / Market	Start point : Buddha Chowk
2	0+850	3+600	2750	Cultivated land	
3	3+600	4+200	600	Settlement / Market	
4	4+200	4+800	600	Cultivated land	Ghagar Khola
5	4+800	5+650	850	Settlement and small bazaar	Bangai, 5+150 Chhotki Bangal, 5+500
6	5+650	6+300	650	Cultivated land	Tinau River 6+150
7	6+300	6+850	550	Settlement and small bazaar	Bethahari, 6+500
8	6+850	8+300	1450	Cultivated land	
9	8+300	8+750	450	Settlement and bazaar	Gurwaniya, 8+640
10	8+750	9+850	1100	Settlement area	
11	9+850	12+150	2300	Settlement area	Motipur, 10+050
12	12+150	13+400	1250	Cultivated land	
13	13+400	13+800	400	Settlement area	
14	13+800	14+150	350	Cultivated land	
15	14+150	15+500	1350	Settlement area	
16	15+500	15+700	200	Cultivated land	Kohelihawa Bridge, 15+700
17	15+700	16+100	400	Settlement area	
18	16+100	17+650	1550	Cultivated land	Tilhar River, 17+050 Rampur, 17+550, Parsa, 17+650

S. No.	Ch. (From)	Ch. (To)	Length (m)	Land use Pattern	Remarks
19	17+650	18+100	450	Market and settlement	Parsa Chowk, Way to Lumbini, 18+050
20	18+100	19+650	1550	Cultivated land	Harewa Bridge, 19+220
21	19+650	20+000	350	Settlement and small bazaar	Tenuhawa
22	20+000	20+850	850	Cultivated land	
23	20+850	21+500	650	Settlement area and small bazaar	Hathihawa Majidiya, 20+950 Masina, 21+450
24	21+500	21+950	450	Cultivated land	
25	21+950	22+400	450	Settlement area	Mahagala chaurara, 22+150
26	22+550	22+800	250	Settlement area	Mugalhawa, 22+500
27	22+800	23+100	300		Jitawapur
28	23+100	26+100	3000	Cultivated land	Police Area, 23+550, Kothi Bazar, 23+700, Kothi Bridge, 23+800, Jaruwa Bazar, 24+350, Tawoni, 25+350
29	26+100	26+750	650	Settlement and small bazaar	Hardewa, 26+200, Labani Chauraha, 26+600
30	26+750	30+100	3350	Cultivated land	Tithtriya, 27+500, Bridge, 28+000, Dimiya Bazar, 30+050
31	30+100	30+600	500	Settlement	Tilaurakot, 30+250
32	30+600	31+700	1100	Cultivated land	Bimiya, 31+000 Manojpur 31+150
33	31+700	33+150	1450	Settlement and small bazaar	Pakadi, 31+800 Chauraha, 32+250, Barauhiya, 32+850
34	33+150	34+500	1350	Cultivated land	Sisai Nala Bridge, 33+500 Dumara, 34+100
35	34+500	34+900	400	Settlement and small bazaar	
36	34+900	37+550	2650	Cultivated land	Dharmapahniya, 35+700 Dohani, 37+100
37	37+550	38+450	900	Settlement area	
38	38+450	39+250	800	Cultivated land	
39	39+250	40+450	1200	Settlement area	Mainihawa, 39+750
40	40+550				Jamuwar Khola Bridge
41	40+650	41+856	1206	Market and settlement	Taulihawa, 40+750
42	41+856				Purano Hat Bazar Chowk (End Point)

Source: TPPF/PPC-2 Field Study 2016, Legend: MA- Market Area, SA- Settlement Area, CL- Cultivated Land

4. Hydrology and Drainage

70. Hydrologic study includes the rainfall – runoff study of the locality and also includes the identification of flood affected area within that road. The intensity duration frequency (IDF) curve gives the idea of rainfall intensity of different return period which is presented in graph. The

maximum rainfall intensity of 2, 5, 10, 50 and 100 years return period are 90.4, 114.4, 126.6, 145.6 and 181.0 mm/hr, respectively in this road.

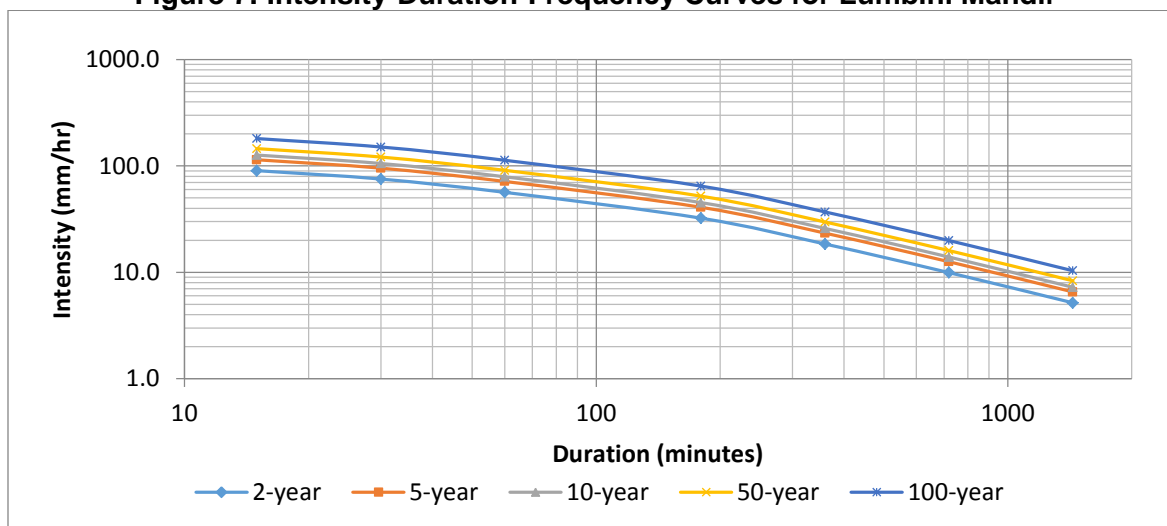
71. Drainage were designed only for 10-year return period flood and rainfall intensity considered in the design is 126.6 mm/hr. The terrain of that locality shows the gentle slope and coefficient of runoff is also low due to salty-clay nature of the soil. The IDF curve for the Bhairahawa –Lumbini-Tauliwaha Road is provided in Table 11 and Figure 7.

Table 11: Rainfall Intensity (mm/hr) at Lumbini Mandir

Duration (hr)	24-hr Depth	24	12	6	3	1	0.5	0.25
Return Period	(mm)	I_{24}	I_{12}	I_6	I_3	I_1	$I_{0.5}$	$I_{0.25}$
2	124	5.16	9.93	18.44	32.3	56.5	75.3	90.4
5	157	6.54	12.57	23.34	40.9	71.5	95.3	114.4
10	174	7.23	13.91	25.83	45.2	79.1	105.5	126.6
20	200	8.32	16.00	29.71	52.0	91.0	121.3	145.6
50	227	9.44	18.15	33.71	59.0	103.2	137.6	165.2
100	248	10.34	19.89	36.93	64.6	113.1	150.8	181.0

Duration (minutes)	2-year	5-year	10-year	50-year	100-year
15	90.4	114.4	126.6	145.6	181.0
30	75.3	95.3	105.5	121.3	150.8
60	56.5	71.5	79.1	91.0	113.1
180	32.3	40.9	45.2	52.0	64.6
360	18.4	23.3	25.8	29.7	36.9
720	9.9	12.6	13.9	16.0	19.9
1440	5.2	6.5	7.2	8.3	10.3

Figure 7: Intensity-Duration-Frequency Curves for Lumbini Mandir



72. There are 10 small and large streams across the road alignment including perennial rivers. There is an irrigation canal crossing the road alignment at Ch 9+620 km. No wetlands are found within the vicinity of the road. Table 12 shows the list of rivers crossings by the BLT Road.

Table 12: Rivers/Streams Crossed by the Road Section

S.No.	Chainage	Name of River/Stream/Canal
1	4+800	Ghaghar
2	6+150	Tinau
3	9+620	Irrigation canal
4	12+860	Dano
5	15+720	Koilihawa
6	17+060	Telar
7	19+230	Harewa
8	23+800	Kothi
9	28+010	Bethi
10	33+530	Sisai
11	40+570	Jamuwar

Source: TPPF/PPC-2 Base Line Survey-2016

73. This road section has 10 bridges. The details of the bridge including chainages, widths, and lengths are given in Table 13. There are more than 29 drainage crossings in the entire road length. The bridges are designed for its 100 years expected flood. During the dry season, almost the rivers do hold very less flow of water and it attains its flow capacity to maximum during monsoon. The bridges are designed for its 100 years expected flood.

Table 13: Existing Bridge Details along BLT Road

S.N.	Chainage	Type	Length (L) (m)	Existing / Proposed	Condition
1	4+825	Bridge (Ghaghar)	15.80	E	Bad
2	6+158	Bridge (Tinau)	22.60	E	Bad
3	12+879	Bridge (Dano)	22.60	E	Bad
4	15+728	Bridge(Koilihawa)	10.20	E	Bad
5	17+083	Bridge(Telar)	10.20	E	Bad
6	19+229	Bridge (Harewa)	16.5	E	Good
7	23+792	Bridge (Kothi)	22	E	Good
8	28+032	Bridge (Bethi)	19.6	E	Good
9	33+529	Bridge (Sisai)	4+22.50+4	E	Good
10	40+573	Bridge (Jamuwar)	6.80	E	Good

Source: TPPF/PPC-2 Base Line Survey-2016

74. Since the BLT road lies in the virtually flat area, there is no land slide and erosion problem along and across the whole road section.

5. Geology / Seismology

75. The project site and its surrounding are made up of ill compacted sand silt and clay layers and represent the alluvial belt of greater Ganga basin. The road is entirely located in the plain terrain of Terai zone. This zone is characterized by pebbly and brown to grey colour unconsolidated sandy sediments with few clay partings. No rock formation is observed nor expected on shallow depth. The lithological formations are Gangetic Alluvium. Structurally, the region is stable and shows no major faults in the vicinity of the BLT road project area. In general, there is no instability problem along the road alignment. There are some minor problems of river undercutting and deepening of soft clayey deposit. The geological formation of the area is given in Figure 8.

Figure 8: Geological Formations of the Area

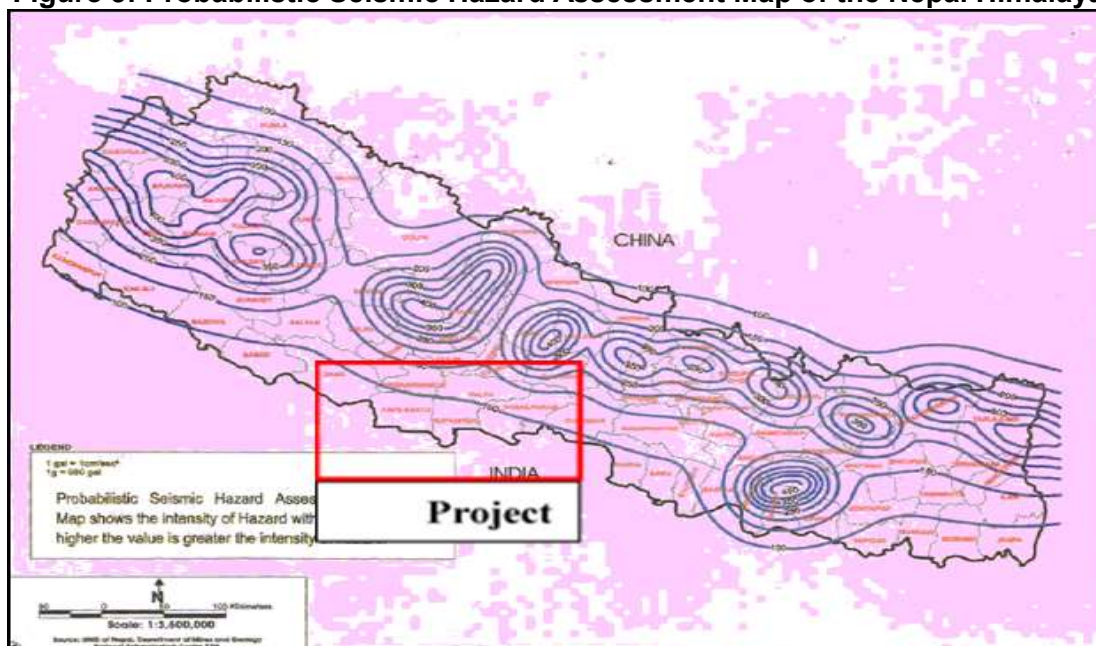
76. The Himalayan seismicity, in general, owes its origin to the continued northward movement of Indian plate after the continental collision between Indian plate and Eurasian plate. The magnitude, recurrence and the mechanism of continental collision depend upon the geometry and plate velocity of Indian plate in relation to southern Tibet (Eurasian Plate). Recent results suggest that the convergence rate is about 20 mm / year and the Indian plate is sub-horizontal below the Sub- Himalaya and the Lesser Himalaya.

77. The result of micro seismic investigation, geodetic monitoring and morphotectonic study of Central Nepal has depicted that the more frequent medium size earthquakes of 6 to 7 magnitude are confined either to flat decollement beneath the Lesser Himalaya or the upper part of the middle crustal ramp. The ramp is occurring at about 15 km depth below the foothills of the Higher Himalaya in the south of Mid Central Thrust (MCT) surface exposures. Big events of magnitude greater than eight are nucleated near the ramp flat transition and rupture the whole ramp-flat system up to the Mid Boundary Thrust (MBT) of the Sub-Himalaya (Pandey et. al. 1995).

78. This general model worked out for the Western Nepal can be applied to other parts of the Himalaya with the evaluation of further subsequent ramping towards more to the south in the Lesser Himalaya and the associated seismicity. This structural variation along Himalayan arc is responsible for the segmentation of potential ruptures along the arc i.e. along the longitudinal direction. For deterministic assessment of seismogenic sources, the local structural environment modifying the general model near the project site is considered.

79. As compared to northern to eastern part of Nepal, proposed project area is less susceptible to seismic hazard. Based on probabilistic Seismic Hazard Assessment Map (Figure 9) prepared by the Department of Mine and Geology of Nepal in 2002, peak horizontal acceleration at or around project area is about 100 gal. Considering soil strata at or around project sites, top soil layer may be susceptible towards liquefaction around loose river flood plain.

80. The proposed project road falls under the Seismic Zone IV, which is susceptible to major earthquakes as per the seismic zone map of Nepal.

Figure 9: Probabilistic Seismic Hazard Assessment Map of the Nepal Himalaya

6. Air quality

81. No primary data was gathered for the BLT road. However, Clean Air Initiative for Asian Cities (CAI – Asia) prepared a country synthesis report (CSR) for Nepal in 2006.⁹ The report includes primary air quality data for nine urban areas outside Kathmandu, Bhairahawa included. The primary data gathered are indicated in Table 14.

Table 14: Air Quality Data for Bhairahawa ($\mu\text{g}/\text{m}^3$), 2006

Parameters	TSP	PM ₁₀	SO ₂ (8-hour average time) ¹⁰	NO ₂ (8-hour average time) ¹¹
Bhairahawa	840.76	776.59	106.8	22.68
Nepal Air Quality Standards	230 (24 hr ave)	120 (24-hr ave.)	70 (24-hr ave.)	80 (24-hr ave.)
World Bank Guidelines	none	Interim target: 75-120 (24-hr ave.); Guideline: 50 (24-hr ave.)	Interim target: 50-125 (24-hr ave.); Guideline: 20 (24-hr ave.)	Guideline: 200 (1-hr ave.)

82. The ambient air quality parameters data for Bhairahawa exceed the National Ambient Air Quality Standards (NAAQS) of Nepal for TSP, PM₁₀ and SO₂. Only NO₂ passed Nepal air quality standards. Although most air quality parameters were exceeded, this cannot be generalized for the rest of the road sections. Outside the built up areas, the land use is dominantly agricultural with associated residential land use. Because of lack of capacity in Nepal and difficulty in getting

⁹ Country Synthesis Report on Urban Air Quality Management (Nepal). Asian Development Bank and the Clean Air Initiative for Asian Cities (CAI-Asia) Center. 2006.

¹⁰ Sampling taken on 22 December 2000.

¹¹ Ibid.

technical experts in the country, no primary data were generated. Prior to construction, primary data will be established from ADB funds.¹²

83. The major noise generating sources at the project area are from vehicle movements. The noise level during monitoring was maximum 92 dBA and the minimum was 35 dBA. Five different locations were chosen and the one-hour average noise levels were monitored and recorded, as indicated in Table 15. Given that the surrounding land use is predominantly agricultural, no major impacts of noise are envisaged to the nearby settlements except the vehicular noise. Result indicates the sound levels in the market and areas with high volume of traffic, have higher noise levels than the noise level standards.

84. The noise zones of the WB EHS guidelines and the National Ambient standards for Government of Nepal is quite different as can be seen in table 16. It is difficult to assign locations within the project road into different noise zones of WB-EHS and GON and make comparisons between them. Within these constraints it was seen that noise levels (arithmetic average) exceeded the GON standards at 2 locations (1 and 5) and the WB-EHS standards at 1 of 4 locations with suitable WB-EHS noise zones.

Table 15: Noise Level Monitoring Along the Road Alignment

S. No.	Location	Land Use	One hour average sound level (dBA)		
			Maximum dBA	Arithmetic average dBA	Minimum dBA
1	Pasi Chowk, Taulihawa	Market and traffic area	91	73.5	56.4
2	Barohiya, Pakadi	Market and traffic area	82.1	67.9	57.3
3	Parsa Chowk, Lumbini	Market and traffic area	85.2	62.9	52.9
4	Bethari, Gonaha	Market and traffic area	81	57.7	44.8
5	Lumbini Gate, Bhairahawa	Market and traffic area	91.5	69.3	57.2

Source: Field Survey, 2016

Table 16: World Bank Noise Guideline Standards

Receptor	World Bank		Government of Nepal (GON)	Receptor
	Daytime	Nighttime	Daytime (average) Ldn, dBA	
	7:00-22:00	22:00-7:00		
Residential	55	45	66.28	Old Residential Area
Institutional; educational			62	New Residential Area
Industrial	70	70	72.75	Commercial Cum Residential Area
Commercial			69.25	Commercial Cum Tourist Area
			74.36	High Traffic Area
Silence Zone	None	None	None	None

¹² For Nepal SASEC projects, ADB has allocated about US\$100,000 for the purchase of environmental and air quality monitoring equipment. Further, under CSC, one environmental / bio-engineering expert, one wildlife expert, six mobilizer, and three surveyors will be engaged during project implementation. Afforestation has been included in civil works.

B. Ecological Resources

1. Forest/Vegetation

85. The forest landscape in general consisted of two types of forests in the districts of Rupandehi and Kapilvastu: natural forests and artificial forests (plantation). Common trees in the project area are: *Acacia catechu* (Khayer), *Adina cordifolia* (Haldu), *Albizia lebbbeck* (Seto Siris), *Albizia procera* (Pink Siris), *Bombax ceiba* (Simal), *Dalbergia sissoo* (Sisau), *Delonix regia* (Gulmohar), *Ficus bengalensis* (Baar), *Ficus religiosa* (Peepal), *Grevillea robusta* (Kangio), *Jacranda momosifolia* (Jacreanda), *Mangifera indica* (Aanp), *Melia azadirach* (Neem), *Melia persica* (Bakaino), *Pithocelbium dulce* (Jalebi), *Shorea robusta* (Sal), *Tamarindus indica* (Imli), *Tectona grandis* (Teak), *Terminalia belerica* (Barro) and *Terminalia chebula* (harro). The available forest area occurs on newly deposited alluvium, often in moist localities along the streams and rivers of the study area. The dominant forest and fodder species reported in the road alignment are *Mangifera indica* (Aanp), *Melia persica* (Bakaino), *Ficus bengalensis* (Baar), *Ficus religiosa* (Peepal), *Artocarpus heterophyllus* (Jack fruit), Babuwa, *Limonia acidissima* (Bel fruit or wood apple), *Dalbergia Sissoo* (Sisau), *Epilippi*, *Tamarindus indica* (Imli), *Dalbergia Sissoo* (Sisau), *Melia azadirach* (Nim), *Bombax ceiba* (Simal). About 1,870 trees are along the road side and all of them will be cut for the upgrading the road. There is no forest in the project influence area. Horticultural plants such as *Mangifera indica* (Aanp), *Prunus persica* (Aaru), Banana (*Musa paradisiaca*), Lemon (*Citrus aurantifolia*), and Arubhakhada (*Prunus domestica*) are also reported.

2. Protected Vegetation

86. The protected vegetation found in the road project area contains one tree species and one herb species. However, *Bombax ceiba*, a protected species banned for felling, transport and export, will be protected with the upgrading of the road. Five Simal (*Bombax ceiba*) trees have been found within the RoW from Buddha Chowk to GBA Chowk (0-3.620 km) of the road. Sal (*Shorea robusta*) was not found within RoW of road.

87. The protected vegetation is listed below in Table 17.

Table 17: Protected Vegetation in the Subproject Area

SN	Local Name	Scientific Name	Remarks			Estimated Number and Location
			IUCN Category	CITES Code	Forest Act and Rules	
1.	Sal	<i>Shorea robusta</i>	-	-	Banned for collection, use, sale and transport	None
2.	Simal	<i>Bombax ceiba</i>	-	-	Banned for collection, use, sale and transport	5 (0-3.620km)

Source: Field Survey, 2016, E= Endangered V= Vulnerable T= Threatened

88. There is no community forest or private forest in the Zone of Influence (ZOI) of the road. No religious, leasehold and government forest are found along the road alignment.

89. Terrestrial wildlife found in and near by the Lumbini Cultural Municipality includes a number of common as well as rare species as provided in Table 18.

Table 18: Terrestrial Wildlife in the Subproject Area

S. No.	Common Name	Scientific name	Conservation Status		
			CITES Appendix	IUCN Red List	GoN
1	Giant Flying Fox	<i>Pteropus giganteus</i>	II	LR/nt	-
2	Rhesus Macaque	<i>Macaca mulata</i>	II	LR/nt	-
3	Hanuman Langoor	<i>Semnopithecus entellus</i>	I	LR/nt	-
4	Red Fox	<i>Vulpes vulpes</i>	III	-	-
5	Golden Jackal	<i>Canis aureus</i>			-
6	Bengal Fox	<i>Vulpes bengalensis</i>	III	-	-
7	Common mongoose	<i>Herpestes edwardsii</i>	III	-	-
8	Jungle Cat	<i>Felis chaus</i>	II	LR/nt	-
9	Common Leopard	<i>Panthera pardus</i>	I	LR/nt	-
10	Spotted Deer	<i>Axis axis</i>	-	-	-
11	Blue Bull	<i>Boselaphus tragocamelus</i>	-	-	-
12	Three-Stripped Squirrel	<i>Funambulus palmarum</i>	-	-	-
13	Roof Rat	<i>Rattus rattus</i>	-	-	-
14	Rufous Tailed hare	<i>Lepus nigricollis ruficaudata</i>	-	-	-

Source: EIA of Lumbini Development Area, 2006

IUCN: LR/lc=Lower Risk/least concern, LR/nt=Lower Risk/near threatened, CITES=I-Listed in CITES, Appendix I, II-Listed in CITES Appendix II, GON=P-Protected

90. A total of six globally threatened birds are listed in the study area. Birdlife International has declared Lumbini as an “Internationally important bird area” with a considerable diversity of bird life. Information related to birds is collected from secondary literature. Table 18 provides a list of bird species found in the project area and conservation status. There are three vulnerable species listed on IUCN Red List that can be found in the vicinity of the project. Sarus crane, the tallest crane species at six feet tall and with a wingspan of eight feet, inhabits the plains of northern India and the western half of Nepal’s Terai lowlands. Their optimal habitat includes a combination of small seasonal marshes, floodplains, high altitude wetlands, human-altered ponds, fallow and cultivated lands, and rice paddies. Lesser adjutant, with an estimated breeding population in Nepal of between 300-1000 birds¹³, has declined dramatically across its range due to persistent and unregulated harvesting of eggs and chicks at nesting colonies, loss of nesting trees and loss and degradation of wetland habitats.¹⁴ Recent threat recorded in Nepal is the practice of poisoning pools to catch fish, which leads to incidental mortality of this species. The Indian Spotted Eagle (*Aquila hastata*), on the other hand, is a widespread species that has always been recorded at very low densities in lowlands of the Indian subcontinent, Nepal included. The species is a powerful predator that seizes mostly mammalian prey from the ground. It is a tree-nesting species, favouring open habitats such as low intensity agriculture, wetlands and open forest and forest clearings year-round. Threats include the conversion and disturbance of forested habitats within its range.

91. The road has already acquired 18-meter wide 1.600 km length land from Lumbini Development Trust Area (LDTA). BLT road project will widen the existing road to 12-m wide. Still there is 3-meter gap of land on both sides of the road. Both sides of the road boundary are

¹³ C. Inskipp and H. S. Baral *in litt.* 2013

¹⁴ <http://www.birdlife.org/datazone/species/factsheet/22697713>

walled and fenced and no disturbance is envisaged from the work activities. The upgrading work will not harm any bird species. Detailed mitigation measures are indicated in Chapter V.

Table 19: List of Birds in the Project Area under the Conservation Category

S.No.	Common Name	Scientific Name	IUCN Red List	GoN
1	Lesser Adjutant	<i>Leptoptilos javanicus</i>	VU	
2	Pallas's Fish-eagle	<i>Haliaeetus leucoryphus</i>	-	P
3	Indian Spotted Eagle	<i>Aquila hastata</i>	VU	
4	Sarus Crane	<i>Grus antigone</i>	VU	
5	Bristled Grassbird	<i>Chaetornis striata</i>	-	P
6	White-throated Bushchat	<i>Saxicola insignis</i>	-	

Source: EIA Lumbini Development Trust, 2013

Note IUCN: VU=Vulnerable, P=Protected

92. The information described in this section is based on the field observation, local people perception and secondary literature. Habitat conditions on the riverine areas of Kapilvastu district are suitable for reptiles as the terrain has abundant shady stretches of land with leaves, litter and rotten logs. It also has farmland and grasslands which forms an ideal habitat for reptiles. Presently, the mobility range of all reptiles and amphibians is very small. These are sluggish animals that are easily hunted and killed by animal predators and humans. A total of 18 reptile and amphibian species were reported in the study area. Among the 18 reported species, two species *Varanus flavescens* and *Python maurus maurus* are legally protected by the Government of Nepal. Likewise, six species are listed in the CITES Appendix (One-Appendix II and Four- Appendix II). Two species (*Varanus flavescens* and *Python maurus maurus*) are listed under IUCN red list of which one species (*Python maurus maurus*) is at lower risk and near threatened. Another species, *Varanus flavescens* is categorized as lower risk and of least concern. Most of the reported species habitat is wetland followed by grassland, farmland and forest.

93. Reptiles and amphibians reported in the project area include Indian Bull frog (*Rana Tigerina tigerina*), Marbled Toad (*Haplobatrachus tigerinus*), Asiatic Rat Snake (*Ptyas mucosa mucosa*), Russell's Viper (*Vipera russelli*), Banded Krait (*Bungarus fasciatus*), Binocellate Cobra (*Naja naja*), Common Indian Krait (*Bungarus caeruleus*), Bengal Monitor Lizard (*Varanus bengalensis*), Brahminy Skink (*Mabuya carinata*), Brone Grass Skink (*Mabuya macularia*), Wall Gecko (*Hemidactylus flaviviridis*), Golden Monitor Lizard (*Varanus flavescens*), Common Garden Lizard (*Calotes versicolor*), Indian Roofed Turtle (*Kachuga tecta*), Indian Burrowing Frog (*Tomopterna breviceps*), Skittering Frog (*Rana cyanophlyctis*), Indo Gangetic Flapshell Turtle (*Lissemys punctata anderson*), Asiatic Rock Python (*Python maurus maurus*). Among them Bull frog (*Rana Tigerina tigerina*), Marbled Toad (*Haplobatrachus tigerinus*), Asiatic Rat Snake (*Ptyas mucosa mucosa*), Binocellate Cobra (*Naja naja*) are listed in CITES category II, Golden Monitor Lizard (*Varanus flavescens*) and Asiatic Rock Python (*Python maurus maurus*) are listed in CITES category I.

94. Study area is dependent on wetland resources for their livelihoods. Wetlands found within the 15-km periphery area include lakes, village ponds, reservoirs, rain water ponds and paddy fields. During the monsoon, all the cultivated lands become wetlands with adequate water. A large mass of soil is usually excavated by the surrounding industries, mainly by brick factories, which has transformed the area into lowland which gets flooded with little rain. During the field survey, the local people highlighted the presence of some species in the region such as Suia (*Gudusia chapra*), Patara (*Notopterus notopterus*), Naini (*Cirrhinus mrigula*), Bam (*Amphipnaus cuchia*), Kauwa (*Xenatodon Cancila*), Garahi (*C.punctatus*), and Mangoor

(*Clarius batrachus*). Paddy fields can be found on both sides for majority of sections of the road. Sarus cranes are present in Lumbini Garden. Besides cranes, gray hornbill, eurasian eagle owl (the biggest owl species of the world), and the globally endangered Lesser Adjutant Stork can be found in the area.

C. Economic Development

1. Industries

95. Nearly 57 industries including brick factories (30), cement and clinker production factories (11), steel production factories (11), noodles production (1), paper production factory (1), flour production factories (2), pharmaceuticals (5) and others (10) are registered in the study area.

2. Infrastructure Facilities

96. **Market Centers.** Rupandehi and Kapilvastu district have well organized facilities for procuring agricultural and marketing inputs. Road networks including agricultural roads are developed in the districts to facilitate the marketing operations. There are about 9 market centers, open markets (Hat Bazar) and tea stalls in the project area of the proposed feeder road. Main bazaars of Zone of Impacts (ZOI) are Bhairahawa and Taulihawa. The main dealing commodity of the markets is agriculture products. There are few small markets and vendor, shops along the project area and few of them are located in Lumbini gate area, Bangai, Muglaha, Parsa, Pakadi, Barohia, Labani, Dohani, and Dumara.

97. **Communication.** Regarding communication, most of the settlements have telephone facilities mostly with CDMA connection, cellular phones and there are post offices/additional post offices in all VDCs and municipalities of the project area. The communication facilities utilized by the project area people are given in Table 20. As per CBS Nepal, 2011, out of 37,768 households (HHs), 2,035 HHs have no communication facility, 34,961 HHs use at least one facility and the maximum users HHs of mobiles are 25,968 in numbers.

Table 20: Households by Types of Household Facilities

Area	Total	Without any facility	At least one facility	Household having facility of							Not stated
				Radio	Television	Cable Television	Computer	Internet	Telephone	Mobile Phone	
Gonaha	1,944	112	1,803	290	468	160	25	8	49	1,277	29
Hati Bangai	1,247	40	1,183	294	554	220	59	10	91	1,066	24
Kamahariya	2,779	146	2,605	285	883	24	24	2	17	1,753	28
Siddharthanagar Municipality	12,497	363	11,980	4,333	6,280	7,768	2,158	997	3,352	10,356	154
Lumbini Cultural Municipality	8,331	481	7,652	1,252	2,241	265	73	12	90	5,263	198
Baskhor	1,362	108	1,212	234	206	9	4	2	4	829	42
Dharmpaniya	667	90	574	106	177	3	2	1	1	319	3
Dohani	938	60	863	206	259	4	4	1	7	443	15
Dumara	716	28	661	168	232	2	6	0	12	501	27
Kapilvastu Municipality	5,130	406	4,557	1,806	1,835	1,305	336	126	585	2,992	167
Labani	1,055	87	917	75	179	1	3	0	0	354	51

Area	Total	Without any facility	At least one facility	Household having facility of							Not stated
				Radio	Television	Cable Television	Computer	Internet	Telephone	Mobile Phone	
Pakadi	1,102	114	954	218	361	17	8	4	24	815	34
Total	37,768	2,035	34,961	9,267	13,675	9,778	2,702	1,163	4,232	25,968	772

Source: CBS Nepal, 2011

98. **Transportation.** Rupandehi district has well-developed transportation facilities. A regional Bhairahawa airport is located in the district. The East-West Highway runs through 8 VDCs and a municipality and Sidhartha Highway connects two municipalities of the district. Altogether 1,092 km of road including highways, gravelled roads, municipal roads, and temporary roads run in the district. District headquarter Bhairahawa is connected to major market centres through roads. Kapilvastu district has well developed transportation facilities. Transportation road network system consists of 442 rural roads comprising a total of nearly 1,790 km.

Table 21: Roads to Major Market Centres

S.No	Bhairahawa to	Road length, km
1	Butwal	22
2	Lumbini	22
3	Devdaha	37
4	Parroha	34
5	Manigram	11
6	Saljhandi	44
7	Suryapura	23
8	Majhgawa	15
9	Semara Marchwar	27

Source: Rupandehi District Profile

99. **Electricity and Energy.** All VDCs and municipalities have access to electricity in Rupandehi and Kapilvastu districts. Rupandehi produces 25-megawatt (MW) electricity from mini-hydro plants. All the domestic and industrial consumers are getting electricity from national grid for both districts.

100. **Agriculture Development.** The economy of the area is predominantly agriculture based with paddy, maize, wheat, pulses, oilseeds, and potato as the main cereal crops and sugarcane, vegetables, mango, lychee, guava, pineapple, jack fruit and banana are the cash crops in both districts. The major vegetables produced are potatoes, cabbage, cauliflower, tomatoes, and radish. These districts have well developed facilities for procuring agricultural inputs and marketing produce. Farmers sell their agricultural products in nine market centres (Taulihawa, Labani, Pakadi, Dohani, Dumara, Parsa, Bangai, Bhairahawa and Barohiya) and many open markets (Hat Bazar).

101. **Social and Cultural Resources.** Lumbini, considered to be one of the most important UNESCO World Heritage sites in Asia, is the birthplace of the Buddha. It was in Lumbini that Prince Siddhartha Gautama was recorded to take his first seven steps towards the East, signaling the beginning of his path to enlightenment. In 249 BC, Emperor Asoka erected a stone pillar with an inscription distinguishing Lumbini as the site of the birthplace of the Lord Buddha.

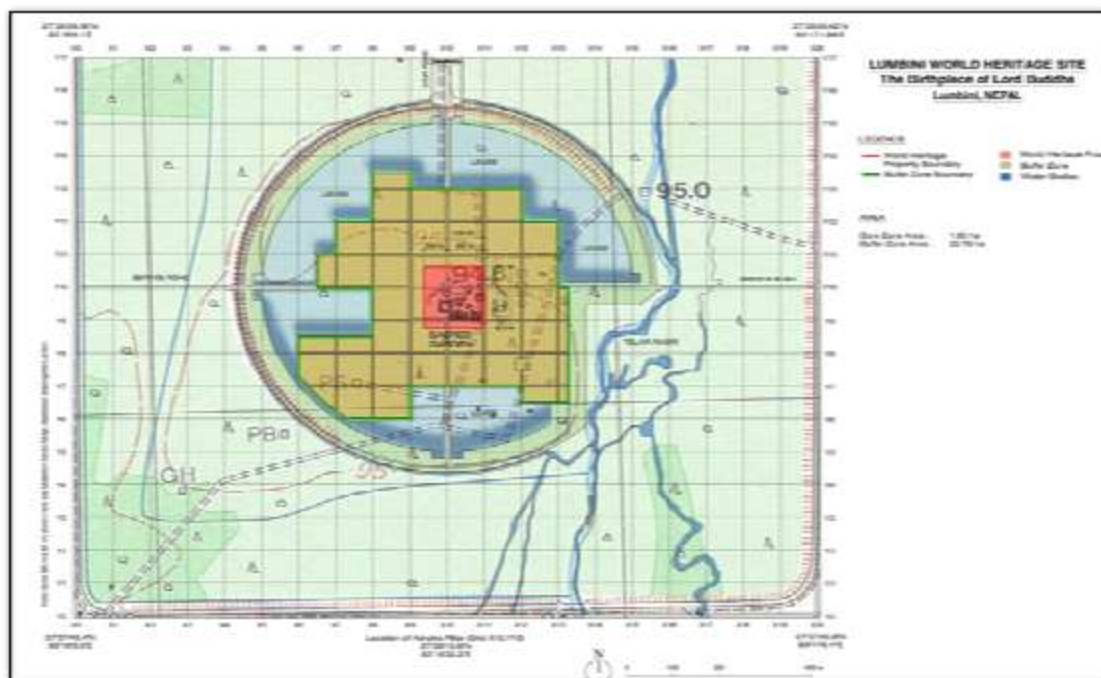
102. The property site is protected by the Ancient Monument Preservation Act of 1956. The complex of structures within the archaeological conservation area includes the Shakya Tank; the remains within the Maya Devi Temple consisting of brick structures in a cross-wall system dating from the 3rd century BC to the present century and the sandstone Ashoka pillar with its Pali inscription in Brahmi script. There are also the excavated remains of Buddhist viharas (monasteries) of the 3rd century BC to the 5th century AD and the remains of Buddhist stupas (memorial shrines) from the 3rd century BC to the 15th century AD. The site is now being developed as a Buddhist pilgrimage center, where the archaeological remains associated with the birth of the Lord Buddha form a central feature.

103. The road traverses 1,600 meters on both sides of Lumbini Development Trust Area (LDTA). The Department of Road has already acquired 18-meter wide land from Lumbini Development Trust Area (LDTA). BLT road project will widen the existing road to 12-m wide. There is still a 3-meter gap of land on both sides of the road. Both sides of LDTA's boundary fences will not be affected at all by the proposed construction activities.

104. The edge of the buffer zone of Lumbini World Heritage Site, which is composed of 1.95 ha core zone area and 22.78 buffer zone area, is 2.16 km away from the centerline of Bhairahawa – Lumbini – Taulihawa Road (Figure 10).

Figure 10: Proposed Road Alignment and the Lumbini World Heritage Site





105. **Population and Communities.** According to the Census 2011 (CBS), total population of Rupandehi is 880,196 with 432,193 male and 448,003, and average family size of 5.37. The projected population of 2015 is 960,411 having 464,574 male and 495,836 female with a slight decrease in average family size of 5.13. The population density per square kilometer is 647.20 in 2011 and projected to increase in 2015 to 705.92. In Kapilvastu the population was 571,936 with 285,599 male and 286,337 female with an average family size of 6.26. The projected population by 2015 is 622,955 with 312,594 male and 310,361 female and average family size of 6.23. The population density per square kilometer is 277 in 2011 and 329 by 2015.

Table 22: Population Distribution by Project Affected Municipality/VDCs

S. No	VDCs and Municipalities	2011 census						2015 Projection				
		Ave HHs size	Total no of HHs	TP	Male	Female	Literacy %	Ave HHs size	Total no of HHs	TP	Male	Female
1	Siddharthanagar Municipality	5.08	12497	63483	31673	31810	80.26	4.89	13993	68473	33794	34679
2	Hati Bangai	6.38	1247	7954	4011	3943	64.92	6.21	1370	8509	4248	4261
3	Gonaha	7.08	1944	13760	6980	6780	55.71	7.01	2159	15141	7605	7536
4	Kamhariya	6.89	2779	19157	9623	9534	53.99	6.97	2981	20766	10364	10402
5	Lumbini Culatural Municipality	7.34	8333	61157	30356	30801	54.3	7.29	8971	65431	31933	33498
6	Labani	6.72	1055	7092	3538	3554	45.89	6.71	1099	7376	3623	3753
7	Baskhor	7.21	1362	9818	4921	4897	45.28	7.29	1426	10394	5119	5275
8	Pakadi	6.62	1102	7293	3546	3747	49.73	6.33	1227	7772	3674	4098
9	Dumara	7.77	716	5561	2831	2730	52.69	7.65	751	5745	2882	2863
11	Dohani	7.17	938	6721	3420	3301	51.8	7.24	984	7124	3607	3517
12	Kapilvasu Municipality	5.93	5130	30428	15204	15224	62.48	5.81	5486	31852	15664	16188
Total		6.28	37770	237303	118568	118735	55.74	6.17	41145	253780	125130	128650

Source: District profile and VDC profile of Nepal 2014/15 based on CBS 2011, Intensive Study and Research Center

106. **Religion and Ethnicity.** Rupandehi district has a multi-ethnic composition of different casts with Brahmin hills, Muslims and Yadavs as the dominant groups in Rupandehi district. Muslims and Yadavs and Kurmis in Kapilvastu district. Distribution of this ethnic composition is led by Muslims with 19.46 % followed by Yadavs 10.30 %, Brahmin hills 8.81%, Chamar/Harijan/Ram 4.82 %, Magar 4.46 %, Chhetri (4.27%), Kahar 4.14 %, Lodh 3.65 %, Tharu 3.44%, Malaha 2.93 %, Gurung (1.90%), Kewat 1.90 %, Newar (1.60%), Kami (1.54%), and remaining 24.05 % in other groups. In Kapilvastu, it's the Muslims 20.60 % followed by Yadavs 12.30 %, Kurmis 8.84%, Brahmin hills 5.51 %, Magar 1.48 %, Chhetri 1.46 %, Kahar 5.39 %, Dhobi 2.96 %, Tharu 1.43 %, Teli 3.30 %, Dusad/Pasawan/Pasi 5.11 %, Kewat 1.07 %, Chamar /Harijan /Ram 5.84 %, Kami 0.60 %), and remaining 20.56 % in other groups.

Table 23: Ethnic Composition of Affected Municipality/VDCs of Rupandehi

Cast/Ethnicity wise population in Rupandehi district			
S. No	Casts	Total	%
1	Brahmin hills	14,565	8.81
2	Magar	7,379	4.46
3	Tharu	5,689	3.44
4	Muslim	32,180	19.46
5	Yadav	17,041	10.30
6	Chhetri	7,069	4.27
7	Chamar /Harijan /Ram	7,967	4.82
8	Kami	2,545	1.54
9	Lodh	6,042	3.65
10	Kewat	3,141	1.90
11	Kahar	6,848	4.14
12	Newar	2,642	1.60
13	Gurung	3,135	1.90
14	Malaha	4,850	2.93
15	Kurmi	4,522	2.73
16	Others	39,786	24.05

Source: District profile and VDC profile of Nepal 2014/15 based on CBS 2011, Intensive Study and Research Centre

Table 24: Ethnic Composition of Affected Municipality/VDCs of Kapilvastu

Cast/Ethnicity wise population in Kapilvastu district			
S. No	Casts	Total	%
1	Muslims	14,786	20.60
2	Tuhar	1,029	1.43
3	Yadav	8,831	12.30
4	Brahmin hills	3,954	5.51
5	Kurmi	6,345	8.84
6	Chhetri	1,049	1.46
7	Dusad /Paswan /Pasi	3,671	5.11
8	Chamar /Harijan /Ram	4,196	5.84
9	Magar	1,059	1.48
10	Kahar	3,869	5.39
11	Kewat	769	1.07
12	Dhobi	2,128	2.96
13	Teli	2,367	3.30
14	Kami	477	0.66

Cast/Ethnicity wise population in Kapilvastu district			
S. No	Casts	Total	%
15	Kathabani	2,503	3.49
16	Others	14,759	20.56

Source: District profile and VDC profile of Nepal 2014/15 based on CBS 2011, Intensive Study and Research Centre

107. In the project area, language wise, 34.05% of total population speaks Avadhi, 30.29% people speak Bhojpuri, 14.60% people speak Nepali, 12.90 % speak Urdu, 3.71 % speak Maithili and 3.87 % speak other languages.

108. **Literacy Rate and Education Level.** As per Census report 2011, about 69.78 % population aged five and above are literate and can read and write if which 38.66 % are male and 31.12 % are female in Rupandehi. In Kapilvastu the same distribution pattern and dominated by males with 32.34 % and females with 22.57 %. About 9.13 % populations from Rupandehi and 7.17 % from Kapilvastu districts have passed School Leaving Certificate. Following Table shows the literacy and education level in Rupandehi and Kapilvastu districts.

Table 25: Literacy status of Rupandehi District

Census	Total Population aged 5 Yrs and above	Able to read and write		Read only		Unable to read and write		Not stated	
		Male	Female	Male	Female	Male	Female	Male	Female
2011	800,430	30,9480	24,9086	8,722	9,611	72,134	150,502	315	580
%		38.66	31.12	1.09	1.20	9.01	18.80	0.04	0.07

Source: District profile and VDC profile of Nepal 2014/15 based on CBS 2011, Intensive Study and Research Centre

Table 26 : Literacy status of Kapilvastu District

Census	Total Population aged 5 Yrs and above	Able to read and write		Read only		Unable to read and write		Not stated	
		Male	Female	Male	Female	Male	Female	Male	Female
2011	508,498	164,431	114,788	9,120	9,325	79,443	130,856	222	313
%	-	32.34	22.57	1.79	1.83	15.62	25.73	0.04	0.06

Source: District profile and VDC profile of Nepal 2014/15 based on CBS 2011, Intensive Study and Research Centre

Table 27: Completed Level of Education

District	Rupandehi		Kapilvastu	
	2011	%	2011	%
No of Schooling	23069	4.10	13429	4.63
Primary	219707	38.61	142797	49.24
Lower secondary	122040	21.45	59270	20.44
Secondary	73551	12.93	27965	9.64
SLC	51931	9.13	21372	7.37
Intermediate	39299	6.91	12369	4.27
Graduate	16410	2.88	4654	1.60
Post graduate	4777	0.84	1338	0.46
Non formal	572	0.10	733	0.25

District	Rupandehi		Kapilvastu	
Other	14843	2.61	4818	1.66
Not stated	2830	0.50	1243	0.43

Source: District profile and VDC profile of Nepal 2014/15 based on CBS 2011, Intensive Study and Research Centre

109. **Health facilities.** About 68% of the sampled household reported that at least one family member has fallen sick last year. The prominent diseases are diarrhea, asthma, and skin disease. No HIV/AIDs positive person has been reported during community consultation. More than 96 % of the households are aware of HIV/AIDs and human trafficking.

110. There are different health institutions such as government hospital, private clinics which are providing health services to the people of the project influence area and provided below.

Table 28: Health Institutions Visited for the Treatment

S.N.	Health Institutions	No of House holds	%
1	Government Hospital	67	19.09
2	Primary Health Centre	35	9.97
3	Health/Sub-health Post	130	37.04
4	Private Clinics	90	25.64
5	Nursing Home	20	5.70
6	Traditional Healers	9	2.56

Source: Baseline Survey, February 2016

111. In health sector, there are 5 health posts along the project road alignment. Major health problems associated with local people are gastric, water borne diseases, gyneco-related diseases, bath, respiratory diseases, skin, malnutrition, typhoid, worm etc. Sanitation awareness among local people is on the rise and many of them have toilets in their home.

112. **Sanitation.** In the project influence area 41.92 % of the households have toilet facilities, 57.01 % households are without toilet facility and 1.04 % has not stated anything about toilet facility. Those who have toilets, mostly possess either pan or pit type toilet with flush system and is shown in succeeding table.

Table 29: Type of Toilets Available in the Project Influence Area

	Total HHs	HHs without toilet facility	HHs with toilet facility		Not stated
			Flush toilet	Ordinary toilet	
Total	37,768	21,532	13,086	2,749	394
%	100	57.01	34.65	7.28	1.04

Source: CBS Nepal, 2011

113. **Drinking Water** A majority of 71.11 % of the population source their domestic water from tube wells and 24.76 % s from piped water supplied through community made water tanks. About 0.48 % of the household also use spring water as a source of drinking water while others from rivers and streams.

Table 30: Households by Main Source of Drinking Water

Tap / piped water	Tube well	Covered well / kuwa	Uncovered well / kuwa	Spout water	River / stream	Others	Not stated	Total
9,350	26,855	67	102	183	1	810	387	37,768

Source: CBS Nepal, 2011

114. **Occupational Status.** Households along the project alignment area were found to depend on more than one occupation in each settlement. The major occupation of the households is business trade accounting for 20.51% of the total household's members. About 15% depends on agriculture, 4.5% are foreign employed, and 4% are service oriented. About 3% of the population are unemployed.

Table 31: Main Occupations of Households

S.N.	Occupation	Sex			%
		Male	Female	Total	
1	Agriculture	153	158	311	15.68
2	Service	68	12	80	4.03
3	Trade & Business	265	142	407	20.51
4	Agriculture Labour	24	10	18	0.91
5	Non-agriculture Labour	61	7	68	3.43
6	Students	359	303	707	35.64
7	Foreign Employment	108	14	88	4.44
8	House wife	0	237	242	12.20
9	No job	33	30	63	3.18
10	Total	402	358	760	100.00

Source: Baseline Survey, February 2016

115. **Physical Cultural Heritage.** The project districts host to several religious and cultural structures. People in the project area have different cultural values amongst the different ethnic groups. Major religious places of the districts are Siddha Baba Mandir situated at the border of Palpa and Rupendehi, Lumbini - the birth place of Gautam Buddha, Mani Mukunda Sen park, Parroha Bol Bam Dham situated in Saina Maina Municipality, Sankar Nagar Ban Bihar and Research Centre and Maya Devi Temple which are situated in Rupandehi district. Tauleswar Nath Temple located at Taulihawa, Paltimai temple, Semara Siva Mandir, Pipara Stupa are the main religious places in Kapilvastu district. The major festivals of project area are Dashain, Tihar, Buddha Jayanti, Krishna Ashtami, Maha Shiva Ratri, Basant Panchami, Holi, Lhoshar, Chaite Dashain, Eid, Muharam and Christmas. Most of the ethnic groups celebrate the major festivals such as Dashain and Tihar, although these are Hindu festivals. Muslims of the area celebrate the Eid and Muharam.

V. IMPACT ASSESSMENT AND MITIGATION MEASURES

116. Environmental impacts of the proposed road improvement activities or actions during pre-construction, construction and operation stages have been identified and assessed. Appropriate qualitative and quantitative methods were applied for determining the likely direct and indirect impacts. The impacts have been predicted in terms of their magnitude (i.e. minor, moderate and major); extent (i.e. local, regional, national and trans-boundary) and duration (i.e. short-term, medium-term and long-term) along with their nature, (i.e., direct and indirect; reversible and irreversible).

117. Mitigation measures and appropriate actions are taken by DoR mainly through its contractors that avoid, reduce or compensate the potential adverse environmental consequences of the project activities. The mitigation measures are of preventive, curative and compensatory types. Mitigation measures that have been proposed for the augmentation of beneficial impacts and minimization of the adverse impacts of the proposed road improvement activities also incorporate the outcomes arrived through consultations and discussions with affected people and stakeholders.

A. Impacts on Physical Environment

118. Project road improvement activities will have no impact on physical environment during pre-construction stage.

1. Micro climate

119. **Construction Stage.** There is a risk of impact on the micro-climate due to change in land use from the removal of approximately 1,870 trees from road corridor and increase in paved surface which will increase the change in micro climate.

120. **Mitigation Measures.** Compensatory plantation will be carried out at the rate of 25 saplings with provision for 10 % mortality rate for each felled tree. Altogether plantation of 51,425 saplings will be carried out as the compensatory plantation in order to ameliorate the micro - climate of the project area. Attempts will be made from every aspect to protect trees during construction and minimize impacts on the micro-climate.

121. **Operation Stage.** The compensatory afforestation will help to reduce the effects of greenhouse gas emission from vehicle to a certain extent. Further, additional plantation of tree will maintain the micro climate of the whole corridor.

122. **Mitigation Measures.** Condition of vehicles will be constantly monitored and rules will be enforced by the transport department. Compensatory plantation will also reduce the level of GHGs in atmosphere.

2. Air Quality

123. **Construction Stage.** Potential sources of air pollution during the construction stage include: dust emission from earth works; emissions from the operation of construction equipment and machines; fugitive emissions from vehicles plying on the road; fugitive emissions during transport of construction materials; air pollution from combustion of hydrocarbons particularly from the hot mix plants, and localized increased traffic congestion in construction areas.

124. Most of the emissions will be in the form of coarse particulate matter and will settle down in close vicinity of construction site. Installation of crusher unit will also lead to air pollution. Hot mix plant will generate carbon monoxide (CO), un-burnt hydrocarbon, sulphur dioxide (SO₂), particulate matters, and nitrogen oxides (NO_x) emissions. This may affect the air quality of nearby areas especially due to emission discharge from low height stack. The impact will be minor, local, short-term, direct and reversible.

125. Construction materials will be transported from Tinau River, Ban Ganga River and other outside sources and this area are away from settlements. The vehicles that transport construction materials will be covered with tarpaulin. Hence, minimal impact is envisaged.

126. **Mitigation Measures.** Following mitigation measures shall be applied to avoid or minimize the impacts during construction. They include:

- Water sprinkling, water fogging, broom sweeping shall be carried out in dust prone locations, unpaved haulage roads, earthworks, stockpiles including asphalt mixing plant areas.
- Open burning of solid wastes (plastic, paper, organic matters) shall be prohibited.
- Use of dust control methods (such as covers, water suppression on unpaved road surfaces, or increase moisture content for open materials storage piles) shall be practiced.
- Very old vehicles emitting gases beyond prescribed standard shall be checked and avoided.
- Masks and personal protective equipment (PPE) shall be provided to the construction workers to minimize inhalation of suspended particulate matters.
- Mixing plants and asphalt (hot mix) plants including crushers and the batching plants shall be located at least 1 km downwind from the nearest residential property only after receiving permission from the Supervision Consultant. Hot mix plant shall be fitted with stack/chimney of adequate height¹⁵ as prescribed by Supervision Consultant to ensure enough dispersion of exit gases.
- Heaters shall be used for heating purpose to the extent feasible.
- Only crushers licensed by GoN shall be used.
- LPG or kerosene shall be used as fuel source in construction camps instead of wood. Tree cutting for fuel wood shall be prohibited.
- Diesel with low sulphur content shall be used in DG sets as well as other machineries.
- Air quality shall be monitored using National Ambient Air Quality Standards of Nepal during construction stage and if monitored parameters are above the prescribed limit, suitable control measures shall be applied.

127. **Operation Stage.** Vehicular emission will be the main source of air pollution during operation stage. The project road runs mostly through settlements, patches of trees including agriculture lands and grazing patches. Forests and planted trees along the sides of the road will serve as a sink for pollutants and reduce the flow of dust/gaseous pollutants.

¹⁵ In the absence of stack height regulation for Nepal, the General EHS Guidelines on Environmental Air Emissions and Ambient Air Quality of the World Bank will be followed. This follows the Good International Industry Practice (GIIP) formula $HG = H + 1.5L$; where HG = GEP stack height measured from the ground level elevation at the base of the stack; H = Height of nearby structure(s) above the base of the stack; L = Lesser dimension, height (h) or width (w), of nearby structures; "Nearby structures" = Structures within/touching a radius of $5L$ but less than 800 m

128. Mitigation Measures

- Roadside plantation of pollution resistant tree species like *Eucalyptus species*, *Azadirachta indica*, *Melia azediarch*, and *Grevelia robusta* along nearby settlements and other public places will help to reduce ambient dust. Only native species will be planted.
- DoR will coordinate with relevant agencies on the implementation and enforce Nepal Vehicle Mass Emission Standard, 1999 and will stipulate vehicle owners to engage in proper and regular vehicle maintenance.
- Air pollution by dust will be controlled with provision of paved shoulders, especially in the sensitive/built up areas.
- DoR will partner with Development organizations (NGO, INGO and CBOs) to motivate the local communities to maintain greenery along the road apart from their houses by planting fodder, fuel wood and fruit trees including flowering plants.
- Air quality shall be monitored specifically in LDT master plan area, using National Ambient Air Quality Standards of Nepal to assess the impact of increase in road traffic.
- Improvement in emission through speed regulation and strict implementation of regulations pertaining to emission and overloading.

3. Noise Level

129. **Construction stage.** Level of ambient noise may increase temporarily in the vicinity of various construction activities including maintenance of workshops and vehicles, and earthmoving equipment. These activities are expected to produce noise levels in the range of 80 - 95 dB (A) (at a distance of about 5 m from the noise source). Although this level of noise is higher than the permissible limit for ambient noise level for residential/commercial areas, this range will occur only intermittently and temporarily. This noise level will attenuate with increase in distance from noise source. Impact due to noise during construction activities will be minor to sensitive receptors since most of the settlements are located at a distance from the road.

130. **Mitigation measures.** The following mitigation measures shall be applied to avoid and/or reduce impact of noise arising through various activities during construction. These include:

- Temporary construction facilities such as labour camps, vehicle maintenance workshop and earth moving equipment shall be located away from settlements and other sensitive areas as far as possible. Facilities will not be located in LDT master plan area.
- Contractor shall announce construction works so that residents can plan ahead their schedule.
- Noise sources such as stone crushers, vehicle movement and work at stone quarry and borrow pits shall be relocated to less sensitive areas to take advantage of distance and shielding.
- Silencers shall be installed to construction equipment and machinery and maintained properly.
- Equipment and machinery with lower sound power levels shall be selected for the use.

- Protection devices such as ear plugs/or ear muffs shall be provided to the workers during period of operating high noise generating machines.
- Noise levels shall be measured to ensure the effectiveness of mitigation measures.
- Construction activities shall be carried out only between 6AM to 8PM to avoid disturbance to nearby communities at night.
- Construction works near schools, temples, hospitals construction work need to be carefully timed to avoid disturbance.
- Multi-layered plantation shall be initiated during construction near the built up areas close to the project. This shall serve as mitigation for operation stage.
- Noise barriers such as earth mounts or walls of wood, metal that form a solid obstacle between the road and roadside community shall be used, especially in the schools and hospitals.
- Provision of pedestrian crossing facilities so that pedestrian interferences will not increase the use of horn.
- Use of horn shall be prohibited in built-up areas.
- The Contractor shall subscribe to occupational noise standards per WHO guidelines.
- A Grievance Redress Mechanism shall be developed to record and respond to complaints on noise by the local communities.

131. **Operation Stage.** Noise generated by traffic movement will be the main source of noise during operation stage. Traffic congestion and pedestrian interferences may increase the use of horns. This may disturb nearby sensitive locations such as hospitals, schools, religious and cultural sites.

132. **Mitigation Measures**

- Effective traffic management and good riding conditions shall be maintained to reduce the noise level throughout the stretch and speed limitation and restrictions on the use of horns shall be enforced near sensitive locations such as hospitals, schools etc.,
- Effectiveness of the multi-layered plantation shall be monitored.
- Awareness shall be created amongst the residents about likely noise levels from road operation at different distances.

4. Vibration

133. **Construction Stage.** There is likelihood of damage of infrastructure (crack formation) due to the vibration caused by operation of heavy machines and equipment including blasting.

134. **Mitigation Measures**

- Structural survey shall be conducted to determine impact of vibration on property prior to construction stage.
- Precaution shall be taken while using the machines and equipment, especially nearby public and private infrastructures.
- Contractor shall aware the operator for careful handling of machines and equipment.

- Blasting shall be avoided as far as possible. Blasting will be prohibited within the LDT master plan.
- Where required controlled blasting techniques shall be adopted.
- The Contractor shall inform the VDC and community in due time about operations that bear the risk of nuisance and accidents, especially when blasting operations are underway.

135. **Operation Stage.** There is high possibility of vibration due to plying of overloaded buses and trucks that may damage the infrastructure. This can be compounded by the increase in the volume of vehicles plying the road.

136. **Mitigation Measures**

- The loaded vehicles plying on the road shall be monitored by MoPIT as per Nepal Road Standard, 2027 B.S. (First revision 2045 BS).
- Drivers shall be made aware about the capacity of the road and bridges, and their consequences.

5. **Impact on Land and Soil**

137. **Construction Stage.** Land and soil will be contaminated through inappropriate construction methods and management of spoils. Pollution risks may originate from transportation of hazardous materials during road construction and subsequent traffic operation. There will be temporary change in the land use patterns by access road and labour camp. This will also result in loss of soil productivity.

138. **Mitigation Measures**

- The top soil (0-25 cm) from the productive land (borrow areas, road widening areas, etc.,) shall be preserved and reused for plantation and restoration purposes.
- It shall be ensured that any private land taken on lease, used community or/ government land for access road and construction/labour camp shall be restored back to its original land use before handing it over back to land owner.

139. **Operation Stage.** Better access can lead to conversion of agriculture land close to roads, especially in bazaar area for residential and commercial purposes. This will result in loss of productive land and agricultural production.

140. **Mitigation Measures**

- DoR has policy of 30 m to 50 m RoW protection in the feeder roads and highways. However, GoN policies and guidelines suggest most economical and practical way possible and make best uses of appropriate technology. Accordingly, the technical design of project road is based on the design standard by (i) utilizing the existing alignment and (ii) considering 50 metres corridor of impact (COI) for 43m of formation width, 30 metres corridor of impact (COI) for 23 m and 12 m of formation width.
- The local governments traversing the road shall implement the land use zoning in their respective jurisdictions to regulate the incremental commercial/industrial development associated with improved road access.

6. Landslide and Soil Erosion

141. **Construction Stage.** The project area passes entirely through the Terai plains. Land slide case is insignificant. But soil erosion from the road embankment is significant.

142. Mitigation Measures

- Soil erosion shall be stabilised by applying engineering as well as bioengineering techniques in approximately 200,000 sq. m. area along the road section.
- During road improvement only required vegetation shall be cleared and eroded bare slopes shall be re-vegetated.

143. **Operation Stage.** Soil erosion occurs due to both natural and induced phenomena thus continuous monitoring of the road condition is imperative; especially during and after rainy season.

144. **Mitigation Measures.** DoR has established a system of employing Length-Persons (road maintenance staff) and their supervisor. They are responsible for routine and recurrent maintenance of roads like cleaning up drains.

7. Borrow Pits and Quarry Sites

145. **Construction Stage.** Collection of construction materials may have long-term and sometimes irreversible effects. Detail investigation has been carried out during detailed design for borrow pits and quarry sites.

146. Apart from the availability of suitable quality of the construction materials, selection of locations for borrows pits and quarry sites depend on a large number of other factors. Such factors include fragility of landscape, legal aspects, aesthetic value of the landscape, and ownership of lands, protected and sensitive areas including approval from the prescribed authority.

147. Mitigation Measures

- Borrow pits and quarry sites shall be selected avoiding protected and sensitive areas, nearby settlements, water sources, and in forest areas and fertile agriculture lands. The potential sites will be the waste and low quality of barren lands.
- Approval from authorities of government and land owners shall be taken.
- Suitable size of borrow pits and quarry sites shall be operated as per required volume of materials.
- Top soil shall be stockpiled and preserved to spread during reinstatement of sites. In turn, preserved top soil shall be spread and grasses seeding with long mulch and tree planting shall be carried out as a part of bioengineering. Leguminous plant species shall be planted in order to restore nitrogen in the soil.
- Monitoring of borrow pits and quarry sites restoration plan in tune with the proposed restoration plan is indicated in Appendix G.
- No borrow pit, quarry or other related facilities shall be located inside LDT masterplan area.

148. **Operation Stage.** Since the road passes along gently flat area, the borrow pits and quarry sites are developed far from the road alignment and if left without restoring such sites, it does not have any significant impact. Conditionally for the borrow pits near the road alignment shall have the significant impact on the road. Such sites eventually have become causes of soil erosion along the embankment of the road.

149. **Mitigation Measures.** DoR will orient the Supervisor in order to check and maintain drains and erosion and also to protect vegetative covers on the restored sites of borrows and quarries.

8. Soil Contamination and Compaction

150. **Construction Stage.** Nearby the road length, soil of the cultivated may be contaminated from mixing of construction materials such as stones, sands, gravels including bitumen, lubricants, paints and other. Soil will be compacted and contaminated in the labour camps, workshop areas and haulage roads due to movement of construction vehicles, machineries, and equipment if haulage roads are unpaved. Such activities will reduce the fertility of land. Soil will be contaminated due to inappropriate disposal of liquid wastes (lubricating oil and fuel spills, and vehicle/equipment washing effluent) and solid wastes such as fuel filters, oily rags, and replaced vehicle parts likely to be generated from repair and maintenance of transport vehicles, construction equipment and machinery. Further, soil will also be contaminated due to mixing with domestic solid waste, sewage from labour camps, if not disposed of safely and carefully.

151. Mitigation Measures

- Detailed plan of action including locations shall be prepared by the Contractor for labour camps, haulage roads, workshop and storage of area for different materials and approval shall be taken through the Construction Supervision Consultant.
- Fuel and lubricants shall be stored as per the plan. Storage area shall be paved with gentle slope to a corner and connected with a chamber to collect and recover any oil spill.
- All efforts shall be made to avoid and/ minimise the solid and liquid wastes generation. Unavoidable solid and liquid wastes shall be stored at designated places prior to disposal. To avoid soil contamination at the wash-down and re-fuelling areas, "oil interceptors" shall be provided. Oil and grease spill and oil soaked materials shall be collected and stored in labelled containers (Labelled: WASTE OIL; and hazardous sign be displayed).
- Attempt shall be made to minimise soil compaction in the adjoining farm lands through movement of construction vehicles, machinery and equipment. Their movement shall be restricted to designated haulage route.
- Farm land shall be restored after the completion of road improvement activity.
- Temporary toilet pits shall be provided in labour camps and shall be restored after completion of the activity.
- Solid wastes generated from labour camp shall be segregated into biodegradable and non-biodegradable wastes. Recyclable wastes shall be sold off. Efforts shall be made to compost biodegradable wastes in small size compost pits by the Contractor. Non-biodegradable and non-saleable wastes shall be disposed in a secured and safe location. They shall not be burnt in any case.

- The Contractor shall apply preventive and protective measures consistent with the World Bank Group's Environment, Health and Safety Guidelines on waste management and hazardous materials management.

152. **Operation Stage.** No impact on soil is anticipated during operation stage of the project except near low lying areas where unexpected rainfall may erode soil and deterioration of borrow areas if not rehabilitated properly.

153. **Mitigation Measures.** Rehabilitated labour camp sites including side drains and cross drainage structures shall be monitored regularly to check for blockage.

154. Locations of quarry sites and borrow pits shall be monitored and if found not restored properly then the Contractor shall be asked for correction of these works until defect liability period.

9. Siltation and Surface Water Quality of Streams

155. **Construction Stage.** The project area belongs to gently plain ecological region where the ground water table is shallow. People around the project area use the water as drinking from their private hand pumps generally from the shallow wells. The contractor can use water from the shallow wells for the construction and camp utilities. Siltation problem is minimal because of the geography and ecological condition of the land. But the stream water and ground water may be contaminated by the spillages of chemicals, vehicles lubricants and fuels.

156. Mitigation Measures

- The Contractor is prohibited to dispose excavated spoils and wastes into streams water.
- All chemicals and oil shall be stored away from water and shall be stored at concreted platform with catchments pits for spills collection.
- The Contractor shall arrange training program to all equipment operators, drivers, and warehouse personnel on immediate response for spill contamination and eventual clean-up. Further, emergency procedures and reports preferably written in easy to understand local dialects shall be distributed to the workers as well as local people.
- All wastes arising from the construction sites shall be disposed in an environmentally acceptable manner. The wastes shall be collected, stored and transported at approved disposal sites.
- No vehicles or equipment shall be washed, parked or refuelled near streams water, so as to avoid contamination of streams water from fuel and lubricants.
- Large labour camps shall be avoided along the alignment and shall be located away from settlements and river sides. Construction labourers shall be preferably recruited from the local community. Sewage from labour camps shall be managed in such a way that it shall not pollute streams water and other public and private areas. No untreated sanitary wastewater shall be discharged into the streams water.
- Detailed mitigation measures to protect from solid wastes, chemicals including other hazardous materials have been dealt with under soil contamination and compaction in the study.

- The Contractor shall apply preventive and protective measures consistent with the World Bank Group's Environment, Health and Safety Guidelines on waste management and hazardous materials management.

157. **Operation Stage.** With the increase in traffic volume, there is a potential for negative long-term impact on streams due to risk increase due to spillages of chemicals, vehicle lubricants and fuels.

158. **Mitigation Measures.** As in the other roads, DoR will engage road maintenance personnel. They will check road condition including cleaning up chemicals and soils deposited on roads by drain blockage/ chocking. The maintenance-person's supervisor will inform to Divisional Engineer in case of unmanageable cases and roads blockage.

10. Hydrology and Drainage

159. **Construction Stage.** Obstruction of natural drainage pattern by road may modify the natural flow of surface runoff by concentrating flow at certain points. As a result, velocity of flow may increase. In turn, diversion or disruption of natural surface water and drainage patterns is inevitable.

160. Information about rainfall intensities and their temporal and spatial distributions are vital information for hydrological characteristics of the project area. Flows of the streams are high during the monsoon season (June-September). In general, the peak flood flow in the streams occurs in July and August but sometimes it may occur in June or September depending on rainfall amount and duration in the drainage basin.

161. Mitigation Measures

- Existing natural drainage system shall not be disturbed. Culvert / bridges shall be provided in each perennial and seasonal streams as well as rivulets. In addition, adequate cross drainage structures shall also be provided to avoid natural flow of water especially for unusual rainfall events.
- The size of the drainage structures shall be designed to accommodate increasing volumes of water.

162. **Operation Stage.** The road side slopes erosion is minimal due to the soil and ecological condition. But in the long run the erosion occurs slowly and continuously. Consequently, drain blockage/chocking will be perpetual problem. However, these problems will be more severe during rainy season.

163. **Mitigation Measures.** Bio-engineering will be done on the side slope of the road by turfing to stabilize the side slopes. As in the other roads under it, DoR will engage Length-Persons for regular check-up of the road condition including refilling of soils in road side slopes, drain blockage/ chocking etc. Length- Person's supervisor will inform Divisional Engineer in case of large damage and major road blockage.

11. Management of Construction Spoils/Wastes

164. **Construction Stage.** Careful management of construction spoils/wastes is essential. Spoils generated through excavation of existing roads constitute bitumen and other pavement materials with various chemicals, oils, grease, etc. pose hazards to human health. Safe and

careful management of such wastes generated through road construction is vital. Probable location of spoil disposal with available area is presented in Table 32. ADB is currently assisting four municipalities in Nepal, Siddhartanagar included, under the Integrated Urban Development Project (IUDP). For Siddhartanagar, there is a proposal for integrated solid waste management including the construction of sanitary landfill. The proposed landfill has been bidden out just last December 2015.

Table 32: Probable Locations for Spoil Disposal

SN	Location /Chainage	VDC	Quarry site	Approximate available area
1	16+000	Khudabagar	3 km off-side the road	>3000 m ²
2	17+500	Hati Bangain	3 km off-side the road	>3000 m ²
3	24+100	Mugalhawa	3 km off-side the road	>5000 m ²
4	36+700	Dharampaniya	3 km north of the road	>4000 m ²

Source: Baseline Survey, Construction Material Report, 2016

165. Mitigation Measures

- The Contractor shall apply preventive and protective measures consistent with the World Bank Group's Environment, Health and Safety Guidelines on waste management and hazardous materials management.
- The Contractor shall prepare a detailed Site Environmental Management Plan (SEMP) including suitable disposal locations for spoils/wastes and that shall be approved by the Construction Supervision Consultant.
- Locations for disposal shall be selected with the consent of local community, VDC representatives, and the sites shall be located at least 1 km away from the settlements, schools, hospitals, religious and cultural sites, water sources including other sensitive areas from environmental point of view.
- The Contractor shall use such spoils/wastes for construction purposes as far as possible.
- No spoils or waste is allowed to be disposing other place than the prescribed place.
- The Contractor shall ensure that all quarry sites have all the required permits prior to its use.
- Once the landfill construction is finished, coordinate with Siddhartanagar municipality for possible reception of construction spoil / wastes from the proposed road improvement.

12. Natural Hazard

a. Flood and Siltation

166. Construction Stage. The road alignment traverses mainly through southern Terai plains. It crosses ten small streams, rivers and rivulets. Among them Tinau is the major perennial one (km 6+150). Other nine streams and rivulets also exist along the road alignment. The road pavement is designed in such a way that the storm water does not over top the pavement of the road. The number of bridges, slab culverts is sufficient to carry the storm water from the rivers and the cultivated lands. There will be no siltation on the lands because of the river capacity to carry it downstream with the high flood.

167. Mitigation Measures

- Road embankment level has been designed at least 0.90 m higher than the highest flow level and/or flood level of the streams and rivulets.
- The project structures have been designed with the consideration of seismicity.

168. **Operation Stage.** The road improvement design and construction assure that it will be better able to cope with natural hazards.

b. Earthquake

169. **Construction Stage.** The proposed road improvement from Bhairahawa to Taulihawa traverses the southern Terai plains, which falls under the Seismic Zone IV, which is susceptible to major earthquakes. Roads and bridges failures due to inadequate designs may cause injuries to community and other road users.

170. **Mitigation Measures.** Project structures are designed with the consideration of probability of earthquakes. This risk is mitigated through the compliance with appropriate engineering design standards. All new bridge constructions were designed to cope with a 100 year return period and withstand earthquakes usually experience for Seismic Zone 5.

171. **Operation Stage.** The road improvement design and construction assure that it will be better able to cope with earthquakes.

B. Ecological Resources

1. Forestry and Biodiversity

172. The project corridor is rich in ecological resources such as forestry and biodiversity. It contains various types of trees, shrubs and bushes, and grasses. They comprise diverse values and offer habitat for different types of mammals, birds and butterflies. The road alignment does not pass through forest. Around 1,870 trees need to be cleared while widening the road. These all trees are located on DoR land.

173. **Construction Stage.** Around 1,870 trees will be required to be felled during the construction period including the clearing of bushes and shrubs.

174. Mitigation measures

- Only native tree species will be used for revegetation.
- The DoR will fix number and types of trees to be felled through the detailed design/or its site verification and will coordinate with DFOs for clearance.
- Trees shall be felled only after receiving permissions from the concerned authorities.
- The Contractor shall coordinate with DoR and manage felled trees as per their suggestions.
- The Contractor shall support/involve DoR to carry out compensatory plantation at the rate of 25 saplings for each felled tree in available locations and their management till the age of 5 yrs. To cope with the mortality of the trees additional 10 % trees will be planted.
- Plantation and protection of trees will increase aesthetic value of the area. Thus it is recommended that the project shall arrange for planting suitable species of

saplings at available spaces and protection and beautification of entire road sides.

- No spoils including bitumen containers and other waste/spoil generated from road construction works shall be thrown in and around vegetation and forest areas.
- If slopes with the vegetative covers are cleared they shall be re-vegetated by the suitable species.

175. **Operation Stage.** Positive impacts on greenery are expected during the project operation due to increasing vegetative covers and aesthetic value of landscapes along the road alignment. No adverse impacts are anticipated during operation stage

176. **Mitigation Measures.** The project shall involve DFO in plantation of the trees. The amount required for the plantation and management for 5 years will be managed from the project.

2. Aquatic Biodiversity

177. **Construction Stage.** Through the project improvement activities accidental spill of materials, chemicals, and oils will deteriorate quality of stream water.

178. **Mitigation Measures.** There are few streams for fishing, destructive fishing activities by the construction workers will be discouraged. The Contractor shall apply preventive and protective measures consistent with the World Bank Group's Environment, Health and Safety Guidelines on waste management and hazardous materials management.

179. **Operation Stage.** No impact is anticipated during operation stage, hence no mitigation measures proposed. However, periodic observation will be carried out by DoR to check siltation, bank erosion and others.

3. Fauna

180. **Construction Stage.** Movement of wildlife like monkey, langur, fox and jackal will be disturbed. There is also the possibility that wetlands and nests will be affected because of construction activities.

181. **Mitigation Measures**

- Efforts shall be made to avoid disturbance to these animals to the extent possible.
- Every precaution shall be taken to minimise noise and other human activities during construction within the road corridor.
- Construction activities shall be carried out during day time to prevent disturbance to wildlife.
- The contractor shall ensure that hunting and poaching activities will not be carried out.
- Enforcing and orientation among construction workers related to laws prohibiting hunting, trapping and poisoning of birds.
- Prohibit the removal of any tree outside bird breeding season. If they have to be taken down in breeding season, it needs to be done after consultation with qualified ornithologist.

- Prohibit the direct discharge of sewage inflow to streams that may affect paddy fields and wetlands

182. **Operation Stage.** The operation of the road will disturb the movement of wild animals.

183. **Mitigation Measures**

- Efforts shall be made to avoid disturbance to these animals to the extent possible.
- The upgrading activities shall be appropriately managed so that there will be minimum disturbance to the wildlife and birds.
- No construction work during night time. (6:00 AM to 8: 00 PM only)
- Prohibit wildlife harassment from the construction worker
- Coordination with DFO to control the activities like illegal hunting and poaching of wild fauna, especially listed in CITES and IUCN red data book by enforcing acts and regulations strictly.

C. Socio Economic Impacts

1. Impacts on the Lumbini UNESCO World Heritage Site

a. Air Quality

184. **Construction Stage.** Potential sources of air pollution during the construction stage include dust emission from earth works, emissions from the operation of construction equipment and machines, fugitive emissions from vehicles plying on the road, fugitive emissions during transport of construction materials; air pollution from combustion of hydrocarbons particularly from the hot mix plants, and localised increased traffic congestion in construction areas.

185. Most of the emissions will be in the form of coarse particulate matter and will settle down in close vicinity of construction site. Installation of crusher unit will also lead to air pollution. Hot mix plant will generate carbon monoxide (CO), unburnt hydrocarbon, sulphur dioxide (SO₂), particulate matters, and nitrogen oxides (NO_x) emissions. This may affect the air quality of nearby areas especially due to emission discharge from low height stack. The impact will be minor, local, short-term, direct and reversible.

186. Construction materials will be transported from Tinau River, Ban Ganga River and other outside sources and this area are away from settlements. The vehicles that transport construction materials will be covered with tarpaulin. Hence, minimal impact is envisaged.

187. As the Lumbini World Heritage Site is 2.16 km from the Bhairahawa – Lumbini – Taulihawa Road, impacts from air pollution is minimal and can be readily mitigated.

188. **Mitigation Measures.** The following mitigation measures shall be applied to avoid or minimize the impacts during construction. They include:

- Water sprinkling, water fogging, broom sweeping shall be carried out in dust prone locations, unpaved haulage roads, earthworks, stockpiles including asphalt mixing plant areas.
- Open burning of solid wastes (plastic, paper, organic matters) shall be prohibited.

- Use of dust control methods (such as covers, water suppression on unpaved road surfaces, or increase moisture content for open materials storage piles) shall be practiced.
- Very old vehicles emitting gases beyond prescribed standard shall be checked and avoided.
- Masks and personal protective equipment (PPE) shall be provided to the construction workers to minimize inhalation of suspended particulate matters.
- Mixing plants and asphalt (hot mix) plants including crushers and the batching plants shall be located at least 1 km downwind from the nearest settlement only after receiving permission from the Supervision Consultant. Hot mix plant shall be fitted with stack/chimney of adequate height as prescribed by Supervision Consultant to ensure enough dispersion of exit gases. Hot mix plant shall not be located 3 km away from the Lumbini World Heritage Site.
- Heaters shall be used for heating purpose to the extent feasible.
- Only crushers licensed by GoN shall be used.
- LPG or kerosene shall be used as fuel source in construction camps instead of wood. Tree cutting for fuel wood shall be restricted.
- Diesel Generating (DG) sets shall be fitted with adequate height.
- Diesel with low sulphur content shall be used in DG sets as well as other machineries.
- Air quality shall be monitored during construction stage and if monitored parameters are above the prescribed limit, suitable control measures shall be applied.

2. Socio-Economic Benefits

189. Improvement of proposed road will have many socio-economic beneficial impacts compared to adverse ones. In the consultation meetings with communities and stakeholders, they had expressed that improvement of road is vital for the enhancement of quality of life of the people of project area. The benefits during construction phase include: generation of employment, new opportunities for income-generating activities, enhancement of technical skills. During operation phase the expected benefits area: harnessing of potential local resources, increase in opportunities of cash crops cultivation, improve access to services and reduced total transportation cost, increase crop productivity and sale of farm products, appreciation in land value, and development of tourism in the Lumbini area, enhancement of community development services.

3. Anticipated adverse impacts

190. Project road improvement activities will have no impact on socio-economic environment during pre-construction stage.

4. Impacts due to Construction / Labour Camp

191. **Construction Stage.** Impacts anticipated from construction camp establishment and operation include disposal of solid waste (organic waste, plastic and metal scrap, and domestic effluent) competition on public facilities (drinking water sources, health facilities, schoolings and others), impairment of aesthetic value of the landscape (loss of vegetation, compaction and contamination of soil and land), poor sanitation (unhygienic toilets, poor drainage facility),

transmission of communicable diseases (sexually transmitted diseases, insect borne diseases, etc), poor water supply, use of alcohols, gambling and conflict with local communities.

192. However, in contractor package, contractor will establish camp if he brings workers from outside of the area. Siting of camp may cause encroachment of agriculture land, and alteration of drainage, solid waste and waste water problems. Petrol, diesel and grease required for vehicles to operate and kerosene for workers to cook meals. Spillage of these chemicals will damage the soil.

193. **Mitigation Measures**

- Efforts shall be made to establish construction camp at such sites so as to utilise the existing houses / infrastructure as far as possible.
- The Contractor will be required to prepare detailed plan for construction camp including location (distance from settlements, drainage facility, outdoor facilities, and surrounding areas), housing facilities (site roads, drainage, waste management and other facilities) and need to get approval from the Construction Supervision Consultant.
- Basic facilities such as fire precaution, lavatories and showers, potable water supply, clean eating area, lighting, safe access, air supply, LPG /kerosene, and others shall be provided.
- Appropriate facilities for women and children shall be provided in the construction campsites.
- First aid facilities shall be made available at camp sites. In addition to this, collaboration with VDC level health/sub-health posts for major injury cases including a contingency plan for emergency cases shall be prepared.
- The Contractor shall ensure that all workers, drivers, delivery crew, as well as the communities are aware of the risk of communicable diseases such as HIV virus, STD and AIDS. In order to prevent the risk of transmission of such diseases, awareness raising programs such as information education, posters, and consultation and communication campaigns about primary health care shall be organized regularly.
- The Contractor shall be responsible to control open space defecation and pollution of stream sites and public places by workers.
- The Contractor shall ensure that sufficient and good quality of food stuff at reasonable price including adequate and safe drinking water has been supplied to the workers.

5. **Safety of Construction Workers and Accident Risk to Local Community**

194. **Construction Stage.** This aspect includes: (i) safety of general public, (ii) safety of construction workers, (iii) safety of road users, (iii) safety to cattle, (iv) unsafe/ hazardous traffic conditions due to construction vehicle movement during design and construction stage, and, (v) conduct of safety audit.

195. Children are one of the most vulnerable to injury from collisions with moving vehicles due to their lack of understanding of traffic hazards, behaviour while at play, and their small size makes it difficult for the motorist to see.

196. **Mitigation Measures**

- The Contractor shall ensure that internationally accepted and practiced safety measures are adopted during (i) road works, (ii) handling of large construction equipment and machineries, (iii) handling of chemicals including hazardous materials and inflammable substances, (iii) welding/hot work, and (iv) electrical works. The Contractor shall apply preventive and protective measures consistent with international good practice such as the World Bank Group's Environment, Health and Safety Guidelines.¹⁶ A set of mitigation measures for construction workers have been provided in EMP matrix in Appendix C.
- The occupational health and safety (OHS) Clauses established by the DoR shall be included in the work contracts. This refers basically the International Federation of Consulting Engineers (FIDIC) rules for road construction works encompassing all accident prevention measures which can happen at work sites and in the camps.
- The Contractor shall keep at site a full time Safety and Environment Monitoring Officer and a Medical Officer. Safety Officer shall ensure proper safety measures undertaken at camps and work sites. Regular safety drill shall be conducted and safety signs shall be kept at work areas.
- The Contractor shall arrange all Personal Protective Equipment (PPEs) for workers, including first aid facilities at construction sites. An Emergency Response Preparedness Plan (ERPP) shall be prepared duly approved by the Construction Supervision Consultant to respond to any instance of safety hazard.
- Entry of unauthorised persons to the construction sites and equipment storage sites shall be restricted.
- Workers shall not be allowed to enter work areas without wearing proper safety gear (hard hat, work boot, gloves, ear muffs, face mask, reflective jacket, goggles, safety belt etc. as appropriate).
- General medical centre with a bed shall be established at the campsite to treat simple/minor injuries or illness. Arrangement shall be made with the District Hospital to keep a dedicated bed for emergency treatment of project staff and workers, and a doctor of the hospital shall periodically make a visit to the site office for health check-up of workers.
- The Contractor shall arrange to prepare a comprehensive traffic management plan to avoid disruption of the existing traffic due to construction activities.
- Installation of speed calming/controlling structures like bumps near designated pedestrian crossing areas shall be arranged.
- The Contractor shall be responsible for erecting signs and signals on sensitive and risky areas, which should be visible from long distance.
- After construction is completed in a particular section, it shall be opened for normal traffic operation.
- Use of delineators, traffic cones, empty bitumen drums, barricades, and flag men shall be used to ensure traffic management and safety.
- Regular safety audit on safety measures shall be conducted during construction. The audit shall cover manpower and their safety, machinery, temporary works, equipment and vehicles, materials storage and handling, construction procedures and environment, site safety guidelines, and miscellaneous services.
- No one under the age of 18 will be employed by the project.

¹⁶ World Bank Group, 2007. Environmental, Health and Safety Guideline. Washington, DC.

197. **Operation Stage.** The provision of service roads and crossings has been made in the road design for safe movement of people and animals across the roads. Other issues related during operational stage are monitoring of emergencies and establishing procedures to carry out rescues during sudden disasters such as floods and accidents.

198. **Mitigation Measures.**

- Monitoring and supervision by DoR is required to ensure safe travelling.
- Pedestrian crossings at grade sections are proposed at Bhairahawa Chowk, Airport Chowk and Parasa Rani Chowk.
- Covered side drains, service lane for slow moving vehicle in urban area are proposed in market areas to be forgiving to the pedestrians and facilitate them to access adjacent properties. Similarly, cover slabs of the side drains will be installed at higher level than carriageway to separate them from the carriageway to protect the pedestrians. Footpaths have to be made on the sides of service lane.

6. Impact due to Transportation and Storage of Materials

199. **Construction Stage.** In general, the sources of construction materials include (i) locally available resources, and (ii) materials that need to be transported from large markets of the country. Locally available resources consist of cement, iron, pipes, soil, water, stone, sand, gravel, aggregates and other similar items. Materials that will be transported from large markets/outside the project area include cement standard not available in the local production companies, bitumen, small equipment, machineries, fuels and lubricating oils. The locally available materials will be transported from nearby locations along the road alignment.

200. **Mitigation Measures**

- These materials shall be stored nearby the construction sites without damaging farm lands. While oils, fuels, bitumen and other chemicals shall be stored on concreted platform with spill collection pits and cement shall be covered by water proof tarpaulin. They shall be located at least 500 m away from the habitat.
- Use of haulage trucks heavier than the carrying capacity of the haulage roads and existing roads shall be avoided. The contractor shall be responsible for repair and maintenance of damaged existing road by the haulage trucks.

7. Impact on Land and Private Properties

201. **Construction Stage.** There will be impact on land and private properties of the people falling along road alignment. This aspect has been dealt in the resettlement plan. The land and private properties that will be affected by the upgrading of the road is summarised in Table 33.

Table 33: Impact on Land and Properties

S.N	Type of impact	Unit	Affected Properties	Remarks
1	Private house demolition	No	2	Fall under RoW
2	Petrol Pump nozzle stand shift	No	2	,,
3	Temple demolition	No	1	,,
4	Lumbini Gate at Bhairahawa	No	1	,,
5	Waiting Shed demolition	No	2	”

S.N	Type of impact	Unit	Affected Properties	Remarks
6	Police Check Post	No	2	"
7	Temporary Sheds	No	28	"
8	Electric poles shifting	Throughout entire road length		"

Source: Resettlement Plan, 2016

202. **Mitigation Measures.** The project shall provide compensation for all land and private properties before commencing road construction. The resettlement study will deal all these aspects in detail. The Contractor will coordinate with the Department of Roads, the Department of Archaeology and other relevant agencies for temple relocation.

8. Impact on Public and Private Utilities

203. **Construction Stage.** There is likelihood of impact on the public and private utilities/facilities. Table 34 lists the public and private utilities and facilities within the ROW.

Table 34: List of Public and Private Utilities/Facilities within RoW of the Road

Chainage	Details	No	Direction	Remarks
0+250	Lumbini Gate	1	Crosses the road	Lies within the RoW
1+200,1+350	Pump Nozzles	2	Left	"
At various chainages	Temporary Sheds of Public	28	Right/Left	"
9+620	Irrigation Canal	1	Crosses the road alignment	
4+400	Siva Temple	1	Right	"
1+380,1+600	Private Building	2	Left/ Right	"
23+550	Check Post	2	Left/Right	"
26+600	Public Waiting Place	2	Left	"

Source: Resettlement Plan, 2016

204. Mitigation Measures

- The Contractor shall avoid any actions that bear the risk to destroy the sites or alter their scientific or aesthetic or social values.
- In the case of accidental damage of important infrastructure, the Contractor shall be obliged to inform the DoR immediately through Construction Supervision Consultant. Further, the Contractor shall also be obliged to carry out immediate corrective and repair measures, as suggested by the concerned authority.
- The Contractor shall reinstate the public and private utilities/facilities that will be affected by the project improvement activities.

205. **Operation Stage.** Due to the movement or plying of vehicles nearby the important sites, there is possibility of nuisance such as air pollution, vibration and noise.

206. **Mitigation Measures.** The DoR will install traffic signals such as "NO HORN" and "SPEED LIMIT" nearby important sites.

9. Impact on Physical Cultural Resources

207. **Construction Stage.** Negative impacts on physical cultural resources¹⁷ can happen during construction phase and may be in the form of damage, destruction, removal, wear, burial, modification, change of use, neglect, denial of access and desecration.¹⁸ Impacts can happen in work camps, during excavation, construction and soil compaction, during use of heavy equipment, expansion of corridor of impact from 2-lane to 4-lane road, utilization of quarry sites, and disposal and landfilling of construction wastes.

208. Workers staying in work camps may resort to theft and vandalism of movable PCR, and these migrant workers may have access to pieces of monumental structure, causing its destruction. During excavation, construction and soil compaction, PCRs may be inadvertently damaged by construction equipment or workers. Compaction of soil may result to permanent damaged to buried PCR on site. It is also possible that drains and water supply pipelines serving PCR will be damaged. Extracting construction aggregates from quarry sites may also damage or destruction of buried PCR. The activity can also damage the landscape adjacent to or the quarry site itself. The disposal and landfilling of spoils and other construction materials can also create permanent damage to PCR.

209. **Mitigation Measures.** If previously unknown physical cultural resources, specifically archaeological finds, are discovered by chance as a result of road construction activities, the following steps should be considered by the borrower: (i) notify the Department of Archaeology of the find; (ii) temporarily stop the work in the immediate area where the archaeological item was found; (iii) request the Department of Archaeology to do site inspection; and (iv) set up agreement with the Department of Archaeology for schedule to resume work.

210. Chance find procedures will be included in road construction and maintenance contracts. The conditions of contract should indicate that the Contractor must immediately notify the Engineer and take precautions to protect the archaeological items discovered during construction.

211. **Operation Stage.** Impacts on physical cultural resources during operation will be in the form of increased air pollution and noise pollution and vibration from passing vehicles that may damage PCR. The ease of access of buried or monumental PCR may result to sacrilege of nearby sacred sites, and theft or vandalism of movable PCR.

212. **Mitigation Measures.** In coordination with the Department of Archaeology, the DoR will install warning signs such as those that will limit the speed of vehicles in areas adjacent to important physical cultural sites.

D. Cumulative and Induced Impacts

213. According to the ADB Environment Safeguards Sourcebook, cumulative impact is described as: "The combination of multiple impacts from existing projects, the proposed project, and anticipated future projects that may result in significant adverse and/or beneficial impacts that cannot be expected in the case of a stand-alone project." The sourcebook also describes induced impacts as: "Adverse and/or beneficial impacts on areas and communities from unintended but predictable developments caused by a project, which may occur at later or at a different location."

¹⁷ SPS 2009 defined physical cultural resources as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic or other cultural significance.

¹⁸ Physical Cultural Resources Safeguard Policy - Guidebook

214. When the upgrading of the road is completed, induced impacts during the operation of the road include deterioration of air quality due to increased emissions from vehicles and risk of structural damage of important properties adjacent to the road from increase in vibration.

215. The upgrading of \$97.2 million Bhairahawa International Airport, which is partly funded by ADB under the South Asia Tourism Infrastructure Development Project, is expected to serve 760,000 passengers per year by 2030, including 280,000 visitors to Lumbini, which is only 20 km from the airport. The road improvement will improve accessibility that will further entice visitors coming from the airport to visit Lumbini. This will create demands for more accommodation and related services that will increase the footprint of built-up area along the road. Other induced impacts include possible deterioration of water quality in nearby streams and rivers as a result of oil leak from vehicles, and increase in road accidents.

216. During the project operation phase, the DoR has limited control over the road users and can only implement activities that will influence vehicle owners in controlling emissions. These activities include coordination with relevant agencies on the implementation of the Nepal Vehicle Mass Emission Standard, 2056 (2000)¹⁹, provision of road signs reminding the motorists to properly maintain their vehicles to economize on fuel consumption and protect the environment.

217. Increase in vibration due to the plying of heavy vehicles (buses, trucks, containers etc.) may damage the infrastructure. The DoR will coordinate with the MoPIT to monitor truck loads as per Nepal Road Standard, 2027 B.S. (First Revision 2045 B.S.) and drivers will be made aware about the capacity of the road and bridges, and their consequences through appropriate signage.

218. ADB's administration of a grant to be provided by Asia Clean Energy Fund (ACEF) for the additional financing will support the introduction of clean public transport services using electric vehicles for tourists and local residents in Lumbini area. This will help reduce noise and pollution from poorly maintained diesel and gasoline engine buses and add value to tourism experience. The Lumbini Development Trust is the implementing agency for tourist destination improvement component.

¹⁹ This standard is similar to the European Standard, popularly known as the EURO-1 standard.

VI. CLIMATE CHANGE IMPACTS AND RISKS AND ADAPTATION NEEDS CONSIDERATION

219. Climate change refers to any significant change in the measures of climate lasting for an extended period of time. Climate change may cause more flooding of roads, bridges and airport runways, especially in low land areas as a result of erratic rains. A range of adaptation responses can be employed to reduce risks through redesign or relocation of infrastructure, increased redundancy of critical services, and operational improvements. Roads, bridges, tunnels and railway lines will be vulnerable to increased precipitation, groundwater levels, temperatures and winds.

A. Greenhouse Gas Emission Estimation

1. Intergovernmental Panel on Climate Change

220. ADB requires the borrower to quantify greenhouse gas emissions in accordance with internationally recognized methodologies such as the Intergovernmental Panel on Climate Change (IPCC). ADB has set a significance threshold level of 100,000 tonnes of carbon dioxide equivalent (CO₂e) per year. Projects with direct and indirect emissions exceeding the threshold are required to include in the EIA an evaluation of alternative to minimize or offset emissions. The average annual vehicular GHG emissions from Bhairahawa – Lumbini – Taulihawa Road were estimated using general equation at the project life mid-point, or at year 2027.

Emission = $A \times EF \times (1-ER)/100$ Where:

A= activity, taken as kilometer travelled by each type of vehicle in 2027²⁰, km

EF= CO₂, CH₄, and N₂O emission factors, in g/km

ER = emission reduction efficiency, is set at 0 as GHG vehicular emission is uncontrolled

Table 35: AADT for BLT by Section, 2027

Sections	Length (km)	AADT, 2027						
		2-wheeler	3-wheeler	Car	Multi-axle	Bus	2-axle	Total
Bhairahawa	3.62	20,976	16	2,745	2,706	1,530	3,555	31,528
Bhairahawa – Lumbini	20.48	9,411	8	1,681	1,648	940	1,357	15,045
Lumbini – Taulihawa	20.9	6,738	5	926	263	871	1,720	10,523

221. The average annual daily traffic (AADT) for 2027 were interpolated from the traffic data provided in the Detailed Design Report. Table 32 revealed that two-wheelers dominate the road users for the three road sections, accounting for 65% of the total vehicles, respectively.

222. Emission factors were taken from various literatures as there are no published emission data yet for Nepal. Average emission factors were taken from <http://www.nepjol.info/index.php/HN/article/viewFile/14641/11868>.

223. The CO₂ emission factors developed by the Government of India Central Pollution Control Board/Ministry of Environment and Forest (CBCP/MOEF)²¹ (2007) for vehicles widely

²⁰ The median year of assessment (2016 – 2038)

used in Nepal were used. However, no published data for CH₄ and N₂O factors are available for Nepal in-use vehicles and instead USEPA²² (2014) derived factors were used as surrogate. The CH₄ and N₂O emission factors for 3-wheelers are not available. The following emission factors were used for this project.

Table 36: GHG Emission Factors

GHG	Emission Factor, g/km						Remarks
	2-wheeler	3-wheeler	Car	2-axle	Bus	Multi-axle	
CO ₂	24.82	73.80	126.37	255.98	817.52	837.5	CO ₂ emission of Zen, Alto, Matiz, WagonR for cars, Eicher 20/diesel for bus, Pulsar, BAL Wind/ Avenger, Bajaj Discover, Eliminator, Yamaha Enticer Unicorn, HHML Ambition/ CBZ for 4-stroke, 2-wheeler with 100-200 cc (motorcycle), All Bajaj 4S petrol 3-W for 4-stroke three-wheeler (<200cc). 2-axle – MUV diesel (<300 cc) Scorpio CRDI (2.6 ltr), Safari (2.95ltr) Innova (2.5 ltr), Tata 207 (2.95ltr), Spacio (2.95ltr), Endeavor (2.5) Tavera (2.5 ltr) Tourister (2.6 ltr) , etc. TECO LPT 2518(5.9lt) , TELCO LPT2515(5.9lt) , Volvo FM9, B7R (9.4lt) , Volvo FM12 (12.3lt) , TECO LPT 2518(5.9lt) , TELCO LPT2515(5.9lt) for multi-axle - HCV diesel truck (>600 cc).
CH ₄	0.042	Not available	0.01075	0.0163	0.000625	0.0031875	CH ₄ and N ₂ O from passenger cars in-use in 2009, diesel light duty trucks for in-use vehicle from 1996-2009, and diesel heavy duty trucks for vehicles in use from 1960-2009. USEPA / Gasoline motorcycles, 1996-present. 2-axle – gasoline light duty truck (van, pick-up, truck, SUV), 2009-present
N ₂ O	0.0043	Not available	0.002375	0.0066	0.000938	0.003	

224. Given the projected AADT for year 2027, the activity rate of kilometer travelled was estimated for each road section as provided in Table 37.

Table 37: Projected Travel by Vehicle Type and Road Section, 2027

Road Section	Length, km	Projected km travelled, 2027					
		2-wheeler	3-wheeler	Car	Multi-axle	Bus	2-axle
Bhairahawa	3.62	62,928	47	9,937	9,796	5,539	12,869
Bhairahawa – Lumbini	20.48	47,057	39	34,422	33,751	19,251	27,791
Lumbini – Taulihawa	20.9	33,690	24	19,350	5,497	18,204	35,948

²¹ Draft (2007) Report on Emission Factor Development for Indian Vehicles; The Automotive Research Association of India.

²² Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2009, EPA 430-R-11-005

225. The CO₂, CH₄, and N₂O emissions for each type and vehicle and road stretch are given in the succeeding Table 38. The weighted total CO₂e emission is calculated at **39,449.63** tonnes using the global warming potentials of 23 and 298 for CH₄ and N₂O, respectively.

Table 38: GHG Emission Estimate for Bhairahawa-Lumbini-Taulihawa Road

Road Sections	CO ₂ t/yr						
	2-wheeler	3-wheeler	Car	Multi-axle	Bus	2-axle	Total
Bhairahawa	570.08	1.27	458.34	2,994.51	1,652.81	1,202.39	6,879.40
Bhairahawa – Lumbini	426.30	1.05	1,587.72	10,317.26	5,744.40	2,596.59	20,673.32
Lumbini – Taulihawa	305.21	0.65	892.52	1,680.36	5,431.98	3,358.72	11,669.44
CH ₄ t/yr							
Bhairahawa	22.19		0.90	0.26	0.03	1.76	25.14
Bhairahawa – Lumbini	16.59		3.11	0.90	0.10	3.80	24.51
Lumbini – Taulihawa	11.88		1.75	0.15	0.10	4.92	18.79
N ₂ Ot/yr							
Bhairahawa	29.43		2.57	3.20	0.57	9.24	45.00
Bhairahawa – Lumbini	22.01		8.89	11.01	1.96	19.95	63.83
Lumbini – Taulihawa	15.76		5.00	1.79	1.86	25.81	50.21
Grand Total							39,449.63

2. Transport Emissions Evaluation Model for Projects (TEEMP)

226. One of the main triggering factors for climate change is increase in greenhouse gas emission. Nepal's contribution to global greenhouse gas emissions is negligible at only 32 Mt CO₂e in 2010, which is less than 0.1% of global emissions. Over the period 1990–2010 Nepal's greenhouse gas emissions excluding LULUCF have increased by 1.3% per year on average. With current policies, this emissions growth is projected to accelerate to 2.4% per year, on average, in the period 2010–2030, reaching 52 Mt CO₂e in 2030. Even with this accelerated growth, per capita emissions will still be very low at around 1.3 t CO₂e per capita by 2030²³. Nepal's transport sector is dominated by road transport. Transportation sector in Nepal contributes to around 12% of the total GHG emission, which is equivalent to the GHG emissions from the industrial sector²⁴.

227. GHG emission likely to be generated from the project roads have been computed using the Transport Emissions Evaluation Model for Projects (TEEMP)²⁵ developed by Clean Air Asia²⁶ was utilized to assess the CO₂ gross emissions with and without the project improvements. The main improvement from the project that was considered for the model are better surface roughness with less than 2.5m/km, improvement and strengthening of shoulders including service road in the urban section (in Bhairahawa Urban West) and widening of project

²³<http://climateactiontracker.org/countries/nepal.html#>

²⁴<http://unfccc.int/resource/docs/natc/nplnc2.pdf>

²⁵ TEEMP is an excel-based, free-of-charge spreadsheet models to evaluate emissions impacts of transport projects.

²⁶A network of 250 organizations in 31 countries established by the Asian Development Bank, World Bank, and USAID to promote better air quality and livable cities by translating knowledge to policies and actions that reduce air pollution and greenhouse gas emissions from transport, energy and other sectors.

road section in rural segment from 1.0 lane to 2.0 lanes. These were translated into increase in traffic speed and hence fuel consumption. The model has also been used for CO₂ emission assessment during construction stage. The model also allows for the inclusion of impacts related to traffic congestion with and without project through provisions for inserting data on the traffic numbers, lane width, number of lanes and volume/capacity saturation limit.

228. Few assumptions made in this software are:

- (i) Fuel efficiency as reckoned in business as usual (BAU) and with project scenario (WPS) is given in Table 39.
- (ii) It is assumed that there would be no or minimum number of vehicles with vintage year before 2000 using Euro –I fuel type after 22 years (Table 40). Pre-Euro vehicles are assumed to be completely discarded for vehicle categories except 3 wheelers.

Table 39: Fuel efficiency in km/l

Scenario	BAU		WPS	
	Petrol	Diesel	Petrol	Diesel
2 Wheeler	50.00		50.00	
3 Wheeler	30.00	20.00	30.00	20.00
Car	15.00	18.00	11.00	18.00
Multi-axle		8.00		8.00
Bus		6.00		6.00
Two-axle		8.00		8.00

Source: DPR Consultant

Table 40: Emission Standards of Fleet (%)

Vehicle Type	Current Scenario				Post 22 Years		
	Pre-Euro	Euro I	Euro II	Euro III	Euro I	Euro II	Euro III
2 Wheeler		20%	80%		20%	60%	20%
3 Wheeler			100%			100%	
Car			20%	80%		20%	80%
Multi-axle		10%	20%	70%	10%	20%	70%
Bus		10%	20%	70%	10%	20%	70%
Two-axle		10%	20%	70%	10%	20%	70%

229. The model demands information on length of road or section, lane configuration, mode wise count of average annual daily traffic (AADT) in vehicles, average trip length, share or local traffic, trip length of local traffic, fleet characteristics i.e. breakdown of fleet based on fuel type, percentage breakdown of vehicle- fuel type based on Euro standard. Traffic forecasts indicates variable increase depending upon the vehicle type and is presented using HDM-4 forecast:

230. Input parameters as considered for all the project roads are as given in Table 41. Design period is considered to be 24 years and volume capacity saturation limit is considered based on the current traffic velocity and is considered as 1.5.

Table 41: Input Parameters for TEEMP

S. No.	Particular	Project Road (Bhairahawa – Lumbini - Taulihawa Road)					
		Bhairahawa to Lumbini				Lumbini to Taulihawa	
1	Length of Road (km)	24.1				20.9	
2	BAU - No. of Lanes	4 (including service land in first 3.8 km)				1	
3	WPS - No. of Lanes	4				2	
4	BAU - Land Width (m)	3.5				3.5	
5	WPS - Lane Width (m)	4.33 and 4.75				4.75	
6	BAU - Roughness (m/km)	6.0				6.0	
7	WPS - Roughness (m/km)	2.5				2.5	
8	Induced Traffic	No				No	
9	Start of Assessment Year	2016				2016	
10	AADT in Vehicles per day	Section 1		Section 2		Section 3	
		2016	2038	2016	2038	2016	2038
	2-wheelers	7462	46,162	3,348	20,712	2,397	14,829
	3-wheelers	10	23	5	12	3	7
	Car	1,269	4,812	777	2,946	428	1,623
	Multi-axle	1,402	4,358	854	2,654	136	423
	Bus	755	2,543	464	1,563	430	1448
	Two-axle	2028	5519	765	2125	880	2857
	Total	12,926	63,418	6,213	30,012	4,274	21,187

231. Maximum PCU in urban section for 4-lanes was considered as 80,000; whereas for rural section for 1.5 and 2 lanes were considered as 12,000 and 36,000 respectively (Source: TEEMP database). In the absence of emission factors data for vehicles in Nepal, emission factors were mostly taken from the CPCB/ MEF&CC (2007) Draft Report on Emission Factor Development for Indian Vehicles, The Automotive Research Association of India, and C. Reynolds *et. al* (2011) Climate and Health Relevant Emissions from in-use Indian three-wheelers rickshaw as presented in Table 5. Furthermore, it has been assumed that after 24 years, there will be reduction of 15% in the emissions, due to advancement of technology and improved efficiency:

Table 42: CO₂ Emission Factors for different vehicle types²⁷

Vehicle Type	CO ₂ Emission Factor (kg/L)	
	Gasoline	Diesel
2-Wheel	2.28	
3-Wheel		2.63
Cars	2.59	2.68
Multi-axle		3.21
Bus		3.61
Two-axle		3.50

232. It was assumed that the 2-wheelers and 3-wheelers have average trip distance of about 5 km in each section, whereas all other vehicles do use the entire length as average trip distance. Furthermore, 2-wheelers and 3-wheelers constitute 90% each of the total local traffic, whereas car, LCV, Bus and HCV constitute 100% respectively of the total local traffic. It has also been assumed that over the time, the fleet composition will change and the assumption taken for the same are as follows:

²⁷It has been assumed that the emission factors will be reduced by 15% in 24 years.

233. Emissions from road construction were estimated by using the emission factor for urban and rural/urban roads, by using:

- a. Monitoring Report Transmilenio Phase - II (<http://cdm.unfccc.int/UserManagement/FileStorage/E6LUMUUAQA83IUZAP09XWBMS6BTSAB>); and
- b. ADB - Carbon footprint 1(<http://www.adb.org/documents/reports/estimating-carbon-footprints-road-projects/default.asp>), which are equivalent to 1,390,000 kg CO₂/km and 48,400 kg CO₂/km of road construction, respectively.

234. **Estimated carbon emissions.** The proposed road widening and upgrading resulting to surface roughness and road capacity improvements have implications in CO₂ emissions. Improved roughness results to higher speed and lesser emissions while increase road users increase emissions. These factors are further affected by traffic congestion once the volume/capacity saturation limit.

235. Total CO₂ emissions at business-as-usual, and with project (including construction) scenarios were estimated at 194,067 tons/year and 42,396 tons/year, respectively. These values are also lesser than the 100,000 tons per year threshold²⁸ set in the ADB SPS 2009.

236. With a gross vehicular GHG emission not exceeding the 100,000 tonnes CO₂e/yr, for both IPCC and TEEMP methodologies (39,450 tons/year vs. 42,396 tons/year), it is not necessary to implement options to reduce or offset CO₂ emissions under the project. However, the Project will continue to evaluate technically and financially feasible and cost-effective options to further reduce greenhouse gas emissions during the lifetime of the project.

B. Climate Adaptation Measures

237. Key engineering measures that will be taken to address flood risks in the design are: i) increase in embankment height, ii) construction of new side and lead away drains, iii) construction of new culverts, widening of existing ones and extension of existing ones. As shown in Table 44, costs for taking these measures add up to a total of NRs. 721.21 million. This is 33.87 % of the total project cost for the project road. It must be pointed out that these measures would have been considered anyway in the conventional design as the issue of flooding is a threat to the sustainability of the road. However, these measures also contribute to adaptation of the roads for future increases in precipitation. This risk screening and risk identification exercise has helped to ensure that all roads with climate risks have adequate risk mitigation or adaptation measures. The detailed list of road with climate risks, specific engineering measures taken and the costs of those measures are provided in Table 43. Provisions have also been made in the bidding documents for the contractor to prepare contract package specific EMPs based on the final detailed design to address a range of issues including climate related risks and vulnerabilities such as flooding, erosion and accordingly incorporate required costs in the BOQ.

Table 43: Cost of Climate Adaptation Measures (in million Rs)

Section	Increase Embankment Height	New side and lead away drains and Retaining walls	New/ Widening Culverts	Major & Minor Bridges	Total
Bhairahawa-Lumbini-Taulihawa Road	167	206.23	348.58	NA	721.21

²⁸Page 38, Appendix I, footnote 10 of SPS 2009

Table 44: Climate Adaptation Measures and associated costs for Bhairahawa-Lumbini-Taulihawa Road project

Road Section	Climate risk	Cause of risk	Adaptation measures taken in design	Costs for adaptation measures (Million Rs)
Bhairahawa - Lumbini-Taulihawa Road	Damage of road due to flooding	Located in low lying areas	<ul style="list-style-type: none"> Raising embankment height by 0.30 m (average) in road section (low lying area) 	167
		Crossing of project road	<ul style="list-style-type: none"> Construction of culverts (new culverts, widening, extending and rehabilitation) along the Road Section 	348.58
		Crossing of project roads	<ul style="list-style-type: none"> Construction of Major and Minor bridges along the Road Section 	Not Applicable
		Crossing of project roads	<ul style="list-style-type: none"> Construction of drainage and protection work (bio-engineering, side drains (lines and unlined) etc.) along Bhairahawa-Lumbini-Taulihawa Road Section 	190.92
			<ul style="list-style-type: none"> Construction of retaining walls to protect slopes on earth fill embankment along Bhairahawa-Lumbini-Taulihawa Road Section 	15.31

238. To improve the impact on micro-climate due to cutting of trees, compensatory plantation (51,425 saplings) at the ratio of 1:25 with additional 10% mortality rate has been proposed in this road project, which will also help to reduce the level of GHG in the atmosphere. The road improvement design assures that it will be better able to cope with the effects of climate change impacts.

VII. INSTITUTIONAL ARRANGEMENTS

A. Institutional Setting

1. Project Organization

239. MoPIT will be the Executing Agency (EA) and DoR will be the Implementing Agency (IA) for SRIP. In the road infrastructure component, the detailed design has been completed by an international consulting firm as part of TPPF (PPC-2) while the construction supervision will be done by an international Construction Supervision Consultant as part of SRIP. The civil works will be awarded to International Contractors. DoR's Geo-Environmental and Social Unit (GESU) will be responsible for environmental and social impact monitoring.

240. In the capacity development component, the formal training will be managed by DoR. The Sector Skills Development Unit and the technical assistance support for environmental and social impact monitoring will be given to DoR's GESU. The Contract Supervision Consultant will provide support to GESU for environmental monitoring through their Environmental Specialist and to RSSDU for selection of training courses through their Project Management Specialists. The overall organization structure of CRIP is shown in Figure 6.1.

2. Project Management

241. Both the EA and the IE have extensive experience in implementing ADB-financed road projects. The Project Directorate (ADB), established in 1987, will be maintained within DoR and serve as the Project Implementation Unit (PIU). The Project Director will have overall responsibility for all aspects of project implementation and management including procurement, contract administration, progress monitoring, financial management, reporting, land acquisition and resettlement.

3. Consulting Services

242. It is envisaged that consulting services in four areas will be required. Under SRIP a Contract Supervision Consultant firm (CSC) will be recruited for construction supervision and to assist DoR in procurement. The CSC will be an international consulting engineering company working in association with one or more national consulting engineering companies with relevant experience.

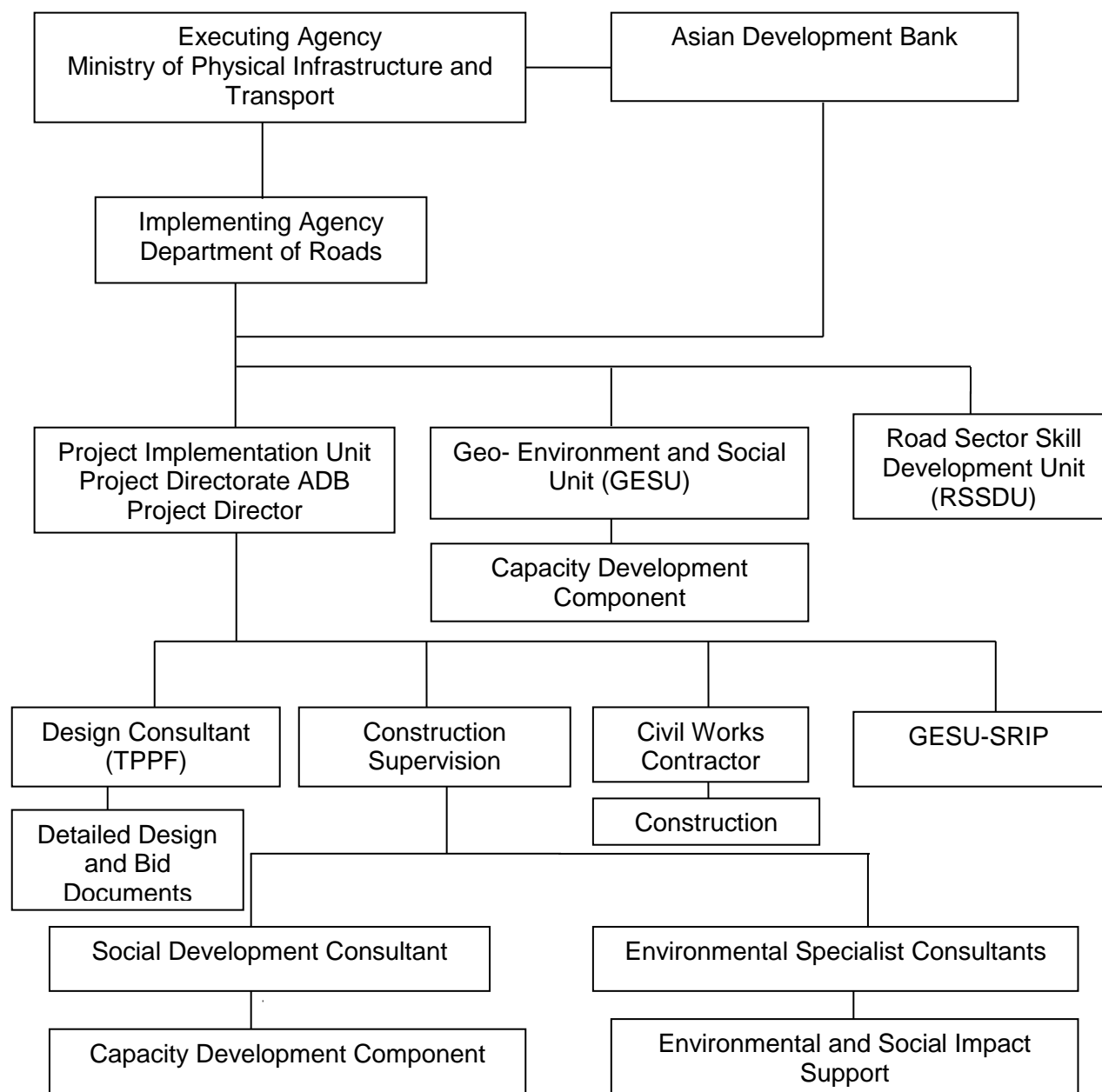
243. In order to reduce the number of consultant contracts, for the capacity development component, it is recommended that the CSC will provide environmental specialist technical support to the GESU in environmental monitoring and contract and project management technical support in the selection of formal training to the RSSDU. These services can be included in the CSC's terms of reference.

4. Environmental and Social Safeguards Monitoring

244. It is proposed that DoR's GESU with the support of the supervision consultants is given responsibility for monitoring implementation of the Environmental Management Plan (EMP) in the construction contract, the Resettlement Plan and the poverty reduction program. GESU has developed technical capacity to carry out these functions on behalf of DoR and has completed environmental monitoring in several DoR projects. SRIP should support the sustainability of this capacity in DoR by involving GESU in SRIP. It is proposed that SRIP provide support for

transport, field visits and acquiring national environmental and social consultant support. The project shall have six (6) months intermittent annual input of Environmental Monitoring Consultant. The Consultant shall coordinate and report PID and GESU. GESU shall submit Semi-annual environmental compliance monitoring report.

Figure 11: Project Organisation Structure for EMP Implementation



5. Capacity Building

245. Capacity building encompasses a range of activities in addition to training including enactment of enabling legislation, provision of budget support, and organization of appropriate government agencies. One vital prerequisite for building capacity is public awareness of environmental problems and support for measures necessary to address those problems. The

capacity building will need to address adequate public concern for the environment, which is often the underlying cause of depletion of natural resources and deterioration of the environment. In this regards, to enhance the capacity of staff for effective implementation of proposed mitigation measures and monitoring the resultant effect, as well as create awareness amongst workers and public the trainings and awareness programs will be prepared by the Construction Supervision Consultant-Environmental Specialist in consultation with the GESU/DoR.

VIII. ENVIRONMENTAL MANAGEMENT PLAN

A. Formulation of the Environmental Management and Monitoring Plans

246. The Environmental Management Plan (EMP) for the project road, consisting of impact mitigation and monitoring plan, are prepared as part of this IEE. The EMP is designed in accordance with the requirements stated in ADB-SPS 2009, moreover adapted to the specific requirements of the project road. Based on preliminary designs and construction scope and methodologies the impacts to the physical and social environment were developed along with the corresponding mitigation measures.

247. To be more effective during implementation the EMP will be attached to the tender documents (Particular Conditions of Contract of the FIDIC format). As part of the environmental management, the procedures for workers' health and safety; public safety and reducing inconvenience and disposal of construction wastes, etc., are also included.

248. A Site Specific Environmental Management Execution Plan (EMEP) is to be prepared by the contractor based on the generic EMP provided in the IEE. The EMEP will perform a risk assessment of all mitigation options and will propose site specific mitigation options that would be appropriate and commensurate with the actual impact. The contractor shall submit EMEP for Engineer's endorsement. The Contractor will not be able to start the construction works before the approval of EMEP from the Engineer.

249. A detailed EMP is prepared and presented in Appendix C.

250. The total budget for implementing the EMP (compensatory plantation and bioengineering) is NRs. 13,049,545.00. The cost involves bio-engineering, environmental mitigation and social safeguards components of the project.

B. Social Analysis Study

251. A separate Social Analysis Study Report has been prepared by Social Development Specialist under the TPPF (PPC-2). The study covers all social issues related with the project area. However, the correlated issues such as safety of community and workers, protection of common physical cultural resources, safe passages for public are covered under the IEE mitigation plan.

C. Resettlement Study

252. Under the TPPF (PPC-2), a separate Resettlement Study is being carried out by the Resettlement Specialist for the project. The study will cover detailed information about the resettlement plan for the project including entitlement matrix for the affected peoples (APs).

D. Environmental Monitoring Program (EMoP)

253. A program of monitoring, the Environmental Monitoring Plan (EMoP), is also developed to ensure that all concerned agencies take the specified action to provide the required mitigation, to assess whether the action has adequately protected the environment, and to determine whether any additional measures may be necessary. Regular inspection of implemented measures by the Contractors will be conducted by the Construction Supervision

Consultant (CSC), and overseen by the Department of Roads (DoR), as the Implementing Agency (IA). Monitoring during operation stage will be the responsibility of DoR.

254. Environmental monitoring plan is prepared focusing on the following objectives:

- To ensure that impacts do not exceed the established legal standards
- To check the implementation of mitigation measures in the manner described in the IEE report
- To monitor implementation of the EMP
- To provide an early warning of potential environmental damage
- To check whether the proposed mitigation measures have achieved the intended results, and / or other environmental impacts occurred

255. The monitoring plan will be used for performance monitoring of the project. A monitoring plan defining all parameters to be monitored, with tentative location, project stages for measurements, implementation and institutional responsibility for different environmental components is prepared for all stages of project and presented in Appendix D.

E. Reporting

256. Following reports shall be prepared and submitted for ADB approval and disclosure:

- Environmental Safeguards Matrix for Quarterly Country Program Review
- Environmental Safeguards Monitoring Chapter in the Quarterly Project Progress Report
- Semi-annual Environmental Compliance Monitoring Report (Jan-June in July, and July-Dec in January next year)
- Analytical Project Completion Report on Environmental Performance of the Project.

IX. GRIEVANCE REDRESS MECHANISM

257. Public dissent, especially amongst local stakeholders may be expressed due to: material extraction, locating cross outfall drainage over private land, hazardous spills if any over the private land, and inconveniences to the locals due to littering, dust, noise etc.

258. The concern/grievances from local/affected people may come up related to inappropriate implementation of various components of EMP or the overall road upgrading itself. These issues will be addressed through acknowledgement, evaluation and corrective action and response approach. A grievance redress mechanism (GRM) will be established to receive, evaluate, and facilitate the resolution of affected people's concerns, complaints, and grievances about the social and environmental performance of the project. The GRM aims to provide a trusted way to voice and resolve concerns linked to the project, and to be an effective way to address affected people's concerns. The GRM for the project is outlined below, and consists of three levels with time-bound schedules and specific persons to address grievances.

259. **First Level GRM.** The first level and most accessible and immediate contact for the fastest resolve of grievances are the contractors, and design and supervision consultants on site. Prior to construction of any works, the PIU and DIU will ensure local community meetings are held to notify local residents and businesses of any temporary disturbances, and to inform them of the Project. If a local area committee (LAC) exists in the area, they should also be informed. If any complaints arise, the contractors, consultants, and DIU can immediately resolve the complaint on site. The PIU can also be involved in grievance redress at this stage. The PIU and DIU office phone number will be posted in public areas within the project area and construction sites. Any person with a grievance related to the project works can contact the project to file a complaint. The DIU offices will have a safeguards focal person to field and resolve complaints. The safeguards (environment and resettlement) focal person will document the complaint, and immediately address and resolve the issue with the contractor within 1-2 days, if the complaint remains unresolved at the field level. The DIU may seek the assistance of the consultant safeguards specialists (the environmental specialist or social safeguards specialist) to resolve the issue. The DIU safeguards focal person will notify the PIU safeguards focal person that a complaint was received, and whether it was resolved. The DIU safeguards focal person will fully document the following information: (i) name of the person; (ii) date complaint was received; (iii) nature of complaint; (iv) location, and (v) how the complaint was resolved.

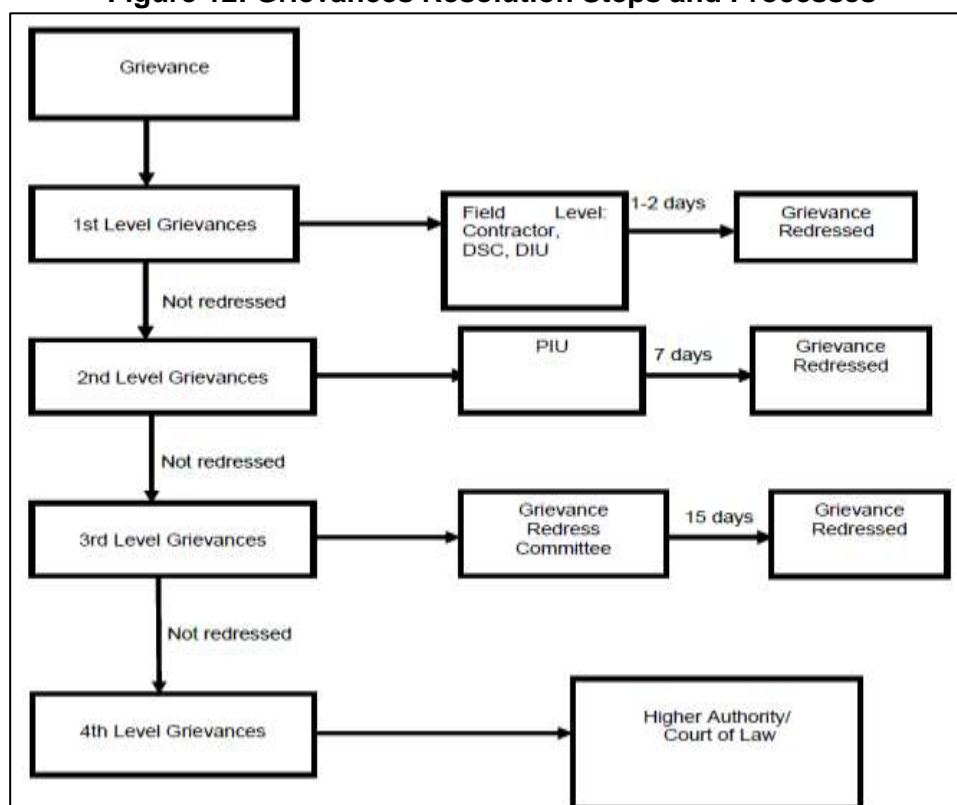
260. **Second Level GRM.** Should the grievance remain unresolved; the DIU will forward the complaint to the PIU safeguards focal person. The person filing the grievance will be notified by DIU safeguards focal person that the grievance was forwarded to the PIU safeguards focal person. The PIU will address the grievance. Grievances will be resolved through continuous interactions with affected persons, and the PIU will answer queries and resolve grievances regarding various issues including environmental or social impacts. Corrective measures will be undertaken at the field level by the PIU safeguards focal person within 7 days. He/she will fully document the following information: (i) name of the person; (ii) date complaint was received; (iii) nature of complaint; (iv) location and (v) how the complaint was resolved.

261. **Third Level GRM.** Should the grievance remain unresolved, the PIU's project director will activate the third level of the GRM by referring the issue (with written documentation) to a Grievance Redress Committee (GRC) constituted by the EA, which will, based on review of the grievances, address them in consultation with the PMU, PIU, DIU, and affected persons. The GRC will consist of PMU leadership, affected persons, and local area committee, among

others—determined to provide impartial, balanced views on any issues. The GRC should consist of at least five persons. A hearing will be called with the GRC, if necessary, where the affected person can present his/her concern and issues. The process will promote conflict resolution through mediation. The GRC will meet as necessary when there are grievances to be addressed. The GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within 15 days. The functions of the GRC are as follows: (i) to provide support to affected persons on problems arising from environmental or social disruption, asset acquisition (where required), and eligibility for entitlements, compensation, and assistance; (ii) to record grievances of affected persons, categorize and prioritize them, and provide solutions within 15 days; and (iii) to report to the aggrieved parties developments regarding their grievances and decisions of the GRC. The PMU safeguards focal person will be responsible for processing and placing all papers before the GRC, recording decisions, issuing minutes of the meetings, and taking follow-up action to see that formal orders are issued and the decisions carried out.

262. **Fourth Level GRM.** In the event that a grievance is not addressed by the contractor, DSC, DIU, PIU or GRC, the affected person can seek legal redress of the grievance in the appropriate courts, the fourth level of the GRM, which is the formal legal court system. The GRM however does not prevent affected persons from seeking legal redress at any time. The grievance redress mechanism and procedure is depicted in Figure 12.

Figure 12: Grievances Resolution Steps and Processes



Note: DIU= district implementation unit, DSC= design and supervision consultant, PIU= project implementation unit

Source: Draft Environmental Assessment and Review Framework, Nepal: Earthquake Emergency Assistance Project, June 2015

X. CONCLUSION AND RECOMMENDATION

263. The proposed project has been categorized as Category 'B' based on environmental screening and assessment of likely impacts while the initial environmental examination ascertains that it is unlikely to cause any significant environmental impacts. Few impacts were identified attributable to the proposed project, all of which are localized and temporary in nature and could be mitigated easily.

264. The project's corridor of impact area does not contain any national park, wildlife reserve, and conservation area, hunting area, buffer zone and paleontological significance. The subproject road does is about 2.16 km away from the edge of the buffer zone of Lumbini World Heritage Site. The land use patterns of the corridor of impact are mainly, agriculture lands, grazing lands, settlements and stream beds. Along the project road are *Bombax ceiba* (Simal) and *Shorea robusta* (Sal) which are legally protected by the Government of Nepal but all are outside the RoW and none will be affected as efforts have been made to protect these species during detailed design. No wildlife species listed in the IUCN Red List will be affected by the proposed road upgrading. Around 1,870 trees will be felled and ameliorated by compensatory plantation.

265. The significant impacts envisaged during construction stage are air quality deterioration due to increase in fugitive dust emissions from materials hauling and unloading, ground shaping, hot mix plant operation, quarry operation, and unpaved road travel. Nuisance to nearby residents due to increase in noise level from heavy equipment operation, hindrance in accessibility to common property resources and increase in traffic on road sections will cause where construction is on-going. Land use conversion from agricultural or residential to built-up area. Surface water quality will be deteriorated of the rivers and rivulets, and siltation of waterways from silt-laden surface runoff coming from the construction site. Health and safety risk due to increase in heavy equipment traffic particularly to children and near pedestrian crossing points. During operation stage, the main impacts are related to emissions and road safety.

266. Other than the permanent change in land use, all identified impacts are short-duration and co-terminus with the construction stage, and are easy to mitigate. All private lands and structures that disturbed will be compensated in compliance to existing laws.

267. The initial environmental examination of the project ascertains that the project is unlikely to cause any significant environmental impacts. No additional studies or need of undertaking detailed EIA is envisaged at this stage. The Executing Agency shall ensure that EMP and EMoP is included in Bill of Quantity (BOQ) and forms part of bid document and civil works contract. The same shall be revised if necessary during project implementation or if there is any change in the project design and with approval of ADB.

APPENDIX A: RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

Country/Project Title: Nepal SASEC Roads Improvement Project (SRIP)
 Bhairahawa – Lumbini - Taulihawa Road Upgrading

Sector Division : Department of Roads (DoR/ADB)

Category of Road : Feeder Road

Project Districts : Rupandehi and Kapilvastu

SCREENING QUESTIONS	YES	NO	REMARKS
<ul style="list-style-type: none"> Cultural heritage site 		√	Lumbini, the birthplace of Lord Buddha, and a UNESCO World Heritage site is about 2.0 km away from the project road.
<ul style="list-style-type: none"> Protected area 		√	
<ul style="list-style-type: none"> Wetland 		√	
<ul style="list-style-type: none"> Mangrove 		√	
<ul style="list-style-type: none"> Estuarine 		√	
<ul style="list-style-type: none"> Buffer zone of protected area 		√	
<ul style="list-style-type: none"> Special area for protecting biodiversity 		√	
Potential Environment Impacts Will the Project cause:			
<ul style="list-style-type: none"> Encroachment on historical/cultural areas? 		√	The road passes through Lumbini Development Trust Masterplan Area. There will be no impacts as the road will be improved on the existing alignment (2-lane), there will be no land acquisition, and that the boundary fences of LDT on both sides of the road will not be affected.
<ul style="list-style-type: none"> Encroachment on precious ecology (e.g. sensitive or protected areas)? 		√	
<ul style="list-style-type: none"> Alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site? 		√	Impacts will be minor, short- term and site specific. Mitigation measures include: <ul style="list-style-type: none"> - Provision of sufficient drains for easy drainage flow - Prevention of dumping of construction spoil and debris in streams and rivers
<ul style="list-style-type: none"> Deterioration of surface water quality due to silt runoff and sanitary wastes from work-based camps and chemicals used in construction? 		√	Impacts will be minor, short- term and site specific. Mitigation measures include: <ul style="list-style-type: none"> - Proper waste management facilities to be provided in labour camps - Disallow storage of chemicals within 100 m periphery of permanent water course or spring

SCREENING QUESTIONS	YES	NO	REMARKS
			<ul style="list-style-type: none"> - Contaminated run off from storage areas need to be captured in ditches or ponds - Apply sealing or binding materials in the case of major spills of hazardous materials (liquids)
<ul style="list-style-type: none"> ▪ Increased local air pollution due to rock crushing, cutting, and filling works, and chemicals from asphalt processing? 	√		<p>Impacts will be minor, site specific, and short-term. Mitigation measures include:</p> <ul style="list-style-type: none"> - Locate static plants at least 500 m from occupied buildings and sites deemed by the Engineer - Locate asphalt plants 1 km away from residential areas, schools, hospitals. - Stone crushing plants will be fitted with approved dust control devices and operate in accordance with manufactures specifications and should be operated in day time only - Sprinkle water on sites with ongoing construction activities in order to control dust nuisance as per necessity.
<ul style="list-style-type: none"> ▪ Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation? 	√		<ul style="list-style-type: none"> - Facilities for occupational health and safety will be provided and detailed in the EMP. - Training will be provided on materials and, equipment handling and use of protective gear and clothing.
<ul style="list-style-type: none"> ▪ Noise and vibration due to blasting and other civil works? 		√	<ul style="list-style-type: none"> - Provision of certificates of noise standard for the equipment
<ul style="list-style-type: none"> ▪ Dislocation or involuntary resettlement of people 		√	<p>Some people likely to shift their houses. Mitigation measures include:</p> <ul style="list-style-type: none"> - A resettlement plan for affected families will be prepared
<ul style="list-style-type: none"> ▪ Dislocation and compulsory resettlement of people living in right -of -way? 	√		<ul style="list-style-type: none"> - Resettlement plan to be prepared
<ul style="list-style-type: none"> ▪ Disproportionate impacts on the poor, women and children, indigenous people or other vulnerable groups 		√	<ul style="list-style-type: none"> - Improvement of the road is likely to increase several beneficial impacts such as girls' enrolment in schools, regular health check-up facility for pregnant women including delivery in the health facilities. Similarly, the project is expected to increase employment and income

SCREENING QUESTIONS	YES	NO	REMARKS
			opportunities.
<ul style="list-style-type: none"> Other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress? 		√	<p>Impacts will be minor, site specific, and short-term. Mitigation measures include:</p> <ul style="list-style-type: none"> Locate hot mix and batching plants 1 km away from residential areas, schools, hospitals, and other sensitive areas. Control dust nuisance by periodic sprinkling of water
<ul style="list-style-type: none"> Hazardous driving conditions where construction interference 		√	<p>Impacts will be minor, site specific, and short-term. Mitigation measures include:</p> <ul style="list-style-type: none"> Provide proper alternative traffic management plan during construction Construct interchanges in such a way that traffic flow is not disturbed Define alternative routes Ensure proper traffic management on the road crossings near proposed interchanges
<ul style="list-style-type: none"> Poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable (such as STI's, HIV/AIDS) diseases from workers to local population? 	√		<p>Impacts will be minor, site specific and short-term since most labour will be locally recruited. Mitigation measures include:</p> <ul style="list-style-type: none"> Avoid construction camps near settlement areas, near water sources, religious and cultural sites Ensure cleanliness and appropriate management of construction camp sites Provision of waste disposal at designated sites Educate workers on transmission of communicable diseases
<ul style="list-style-type: none"> Creation of temporary breeding habitats for mosquito vectors of diseases? 		√	<p>Road doesn't passes through the areas that are prone to mosquito diseases vectors.</p>
<ul style="list-style-type: none"> Accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials and loss of life? 		√	<p>Impacts will be minor. Mitigation measures include:</p> <ul style="list-style-type: none"> Enforcing of speed limits, and imposing penalties on the traffic rules violators Provide provision of rest places Provide traffic signs for speed limits and rest areas. Displayed "Warning Messages" such as "better late than never"

SCREENING QUESTIONS	YES	NO	REMARKS
<ul style="list-style-type: none"> Increased noise and air pollution resulting from traffic, leading from traffic volume? 		√	Impact will be minor. Mitigation measures include: <ul style="list-style-type: none"> - Enforcing and monitoring of GoN Rules for gaseous emissions generated by traffics - Encourage road side plantation to control noise pollution and air pollution.
<ul style="list-style-type: none"> Increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road? 		√	Impacts will be minor. Mitigation measures include: <ul style="list-style-type: none"> - Restrict washing of vehicles in streams - Awareness raising of vehicle drivers on negative impacts of washing vehicles in streams and river
<ul style="list-style-type: none"> Social conflicts if workers from other regions or countries are hired? 	√		Impacts will be limited as it is likely majority of the workers will be from the locality.
<ul style="list-style-type: none"> Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)? 		√	<ul style="list-style-type: none"> - Impacts will be minor as majority of workers will be from the locality. - The workers camp sites should be located outside residential and market areas. - Water and other social services and infrastructure will be sourced/used through ways that do not interfere with the local community
<ul style="list-style-type: none"> Risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation? 	√		Impacts will be minor and temporary in nature. Mitigation measures include: <ul style="list-style-type: none"> - Raise awareness among drivers and store keepers for safe handling and disposal of the hazardous materials and their containers. - Educate communities on risk to health due to explosives, fuel and other chemicals during construction and thereby precautions should be taken during construction and operation of the road.
<ul style="list-style-type: none"> Community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the 	√		<ul style="list-style-type: none"> - Restriction of the local people to the construction areas, - Use of traffic and warning signs at and near the construction site - Educate the contractors and the

SCREENING QUESTIONS	YES	NO	REMARKS
affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning.			local people on safety issues - Enforcement of speed limits, traffic rules and regulations; - Installation of warning signs, speed breakers, pedestrian crossings and specific areas for bus stops due to increased number of vehicles and increased speeds.

The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.

Climate Change and Disaster Risk Questions	Yes	No	Remarks
Is the project area subject to hazards such as earthquake, flood, landslide, tropical cyclone, wind, storm surges, tsunami or volcanic eruptions and climate changes?	√		The project road passes through the plain terrain. Therefore, there are chances of flood, but no tsunami or volcanic eruptions. and is less susceptible to seismic hazards compared to northern part of Nepal
Could changes in temperature, precipitation, or extreme events patterns over the project lifespan affect technical or financial sustainability (e.g. increased erosion or landslide could increase maintenance costs, permafrost melting or soil moisture content could affect sub-grade)?		√	No. The proposed road takes advantage of the existing route which is not prone to flooding, land slide, erosion.
Are there any demographic or socio-economic aspects of the project area that are already vulnerable (e.g. high incidence of marginalized populations, rural-urban migrants, illegal settlements ethnic minorities, women or children)?		√	None
Could the project potentially increase the climate or disaster vulnerability of the surrounding area (e.g. by encouraging settlement in areas that will be more affected by floods in the future or encouraging settlement in earthquake zone)?		√	No

APPENDIX B: CONSULTATION WITH UNESCO (JUNE 2, 2016)

Department of Roads

Shyam Bikram Khana – Deputy Project Director

Design Consultants

Lalit Sharma – Team Leader

Utshb Subedi – Design Engineer

Chintamani Sharma – Resettlement Expert

UNESCO

Nava Basnyat Thapa – UNESCO Representative for Lumbini World Heritage Site
Consultant Archaeologist, UNESCO consultant and former Director General of Nepal's
Department of Archaeology

**APPENDIX C: AUTHORIZATION FROM LUMBINI DEVELOPMENT TRUST AND
DEPARTMENT OF ARCHEOLOGY**

नेपाल सरकार
संस्कृति, पर्यटन तथा नागरिक उड्डयन मन्त्रालय
पुरातत्त्व विभाग
(विश्व सम्पदा-भरक्षण शाखा)

E-mail: info@doa.gov.np
website: www.doa.gov.np

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४२५०६८४
४२५०६८५
४२५०६८६
४२५०६८७
४२५१४४०

फ्याक्स: ९७७-९-४२६२८४६

अभिलेखालय भवन
रामझाहपथ, काठमाडौं

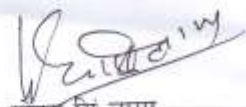
मिति:-२०७३।३।२६

पत्र संख्या:- वि.सं.२/०७२।७३/
चलानी नं.- ३१०४

विषय:-सहमती दिईएको सम्बन्धमा ।

श्री सडक विभाग,
आयोजना निर्देशनालय
विशालनगर,काठमाण्डौ ।

प्रस्तुत विषयमा तर्हाको प.सं. पि.डी TPF-2. ०७२।७३ च.नं. ८९९ मिति २०७३।३।९ को पत्रसाथ सडक विभाग अन्तर्गत भैरहवा- लुम्बिनी- तौलिहवा सडक खण्डको आगामी आ.व.मा स्तरोन्नति गर्ने कार्यक्रम रहे अनुसार संलग्न ड्रइङ डिजाईन र फोटोको आधारमा पुरातात्विक स्थलहरुमा प्रभाव पर्ने नपर्ने सम्बन्धमा राय प्रतिक्रिया उपलब्ध गराई दिनु हुन लेखी आए अनुसार प्राप्त कागजातहरुको प्रतिलिपी सहित लुम्बिनी विकास कोषमा पत्राचार गरिएकोमा उक्त कोषको प.सं.०७२।७३ च.नं. ४९२ मिति २०७३।३।१३को पत्रबाट प्रस्तावित सडक लुम्बिनी गुरुयोजनाको पूर्वपश्चिम १६०० मिटर भएर जाने गुरुयोजनाको सांस्कृतिक केन्द्र नयाँ लुम्बिनी ग्राममा पर्ने एवं विश्व सम्पदा स्थलबाट २ किमी उत्तरतर्फ पर्ने उक्त स्थलमा HIA गर्दा कुनै पनि पुरातात्विक स्थल फेला नपरेको हुनाले प्रस्तावित ड्रइङ अनुसार सडक स्तरोन्नतका लागि स्वीकृत प्रदान गरिएको व्यहोरा अनुरोध छ भनि राय प्रतिक्रिया प्राप्त हुन आए अनुसार कारवाही हुँदा सो क्षेत्रको सडक स्तरोन्नत गर्ने कार्य गर्दा कुनै पनि पुरातात्विक महत्वका संरचनाहरु फेला पर्ने आएको खण्डमा सम्बन्धित निकायलाई जानकारी गराई सो निकायको उपस्थितिमा आवश्यक प्रतिक्रिया प्राप्त गरेपछि मात्र कार्य सुचारु गर्ने गरी सहमती उपलब्ध गराउने मिति २०७३।३।२२ मा विभागीय निर्णय भएको व्यहोरा अनुरोध गर्दछु ।


माहेश सिंह लामा
अनुसन्धान अधिकृत

बोधार्थ
श्री लुम्बिनी विकास कोष
लुम्बिनी ।

Government of Nepal
Ministry of Culture, Tourism and Civil Aviation
Department of Archaeology
(World Heritage Protection Section)

Archive building
Ramshah Path, Kathmandu
Date: July 10, 2016

Letter no. B.S. 2/072/73
Invoice no. 3104

Re: Consent provided

The Department of Roads
Project Directorate
Bishal Nagar, Kathmandu.

Apropos to the subject, as requested in writing for providing comments through the letter dated June 23, 2016 with letter no. P.D. TPPF-2 072/73 and invoice no. 899 on whether the program to upgrade Bhairahawa-Lumbini-Taulihawa section of the road under the Department of Roads in the upcoming fiscal year, would impact archaeological sites, correspondence was duly made to the Lumbini Development Trust along with copies of the drawing design and photos available. Given the response received thereafter from the Trust through the letter dated June 27, 2016 with the letter no. 072/73 and invoice no. 412, that stipulates that the permission has been granted to upgrade the road that runs 1600 meters along east-west side of the Lumbini Master Plan, two kilometers north of the world heritage site and which falls within the cultural center of the new Lumbini village area under the master plan upon finding that there were no archaeological sites discovered through Heritage Impact Assessment (HIA) in the site for the proposed upgrading of the road, it is hereby notified that the Department grants permission to upgrade the road provided that the relevant agencies should be informed if any structures of archaeological importance are found in the course of upgrading the road and only should the upgrading of the road continue after taking their response.

Mohan Singh Lama
Investigation Officer

CC:
The Lumbini Development Trust
Lumbini



पत्र संख्या: ०६२/०६३
चलानी नं: ४९२

मिति: २०७३/०३/१३

श्री पुरातत्व विभाग
विश्व सम्पदा संरक्षण शाखा
रामशाह पथ, काठमाण्डौ।

विषय :- राय प्रतिक्रिया उपलब्ध गराइएको बारे।

प्रस्तुत विषयमा जस विभागको मिति २०७३/०३/०९ को च.नं. २७९५ को राय प्रतिक्रिया उपलब्ध गराइने सम्बन्धि पत्र प्राप्त नै व्यहोरा अवगत भयो। सो सम्बन्धमा प्रस्तावित सडक लुम्बिनी गुरुयोजनाको पूर्व पश्चिम १६०० मिटर भएर जाने गुरुयोजनाको सांस्कृतिक केन्द्र, नयाँ लुम्बिनी ग्राममा पर्ने एवं विश्व सम्पदा स्थलबाट १ कि.मि. उत्तर तर्फ पर्ने उक्त स्थलमा H.I.A. गर्दा कुनै पनि पुरातात्विक स्थल फोसा नपरेको हुनाले प्रस्तावित बृद्ध अनुसार स्तरोन्मूलन तथा स्विक्की प्रदान गरिएको व्यहोरा अनुरोध छ।

बोधार्थ:

श्री सडक विभाग, आयोजना निर्देशनालय, विशालनगर, काठमाण्डौ।

०/८

अजितमान तामाङ
सदस्य-सचिव

केन्द्रीय कार्यालय: पवित्रउद्यान, रुपनेही, लुम्बिनी, नेपाल, फोन: +९७७-७१-४०४०४०, फ्याक्स: +९७७-७१-४०४०४२
E-mail: headoffice@lumbinidevtrust.gov.np, Website: www.lumbinidevtrust.gov.np, www.lumbinitrust.org
लुम्बिनी कार्यालय: बबरमठ, काठमाण्डौ, नेपाल, फोन: ४०४२, लुम्बिनी, काठमाण्डौ, फोन: ४२६८२८४, फ्याक्स: ४२६८२८६

Government of Nepal
Ministry of Culture, Tourism and Civil Aviation
Lumbini Development Trust
Pabitra Udhyan, Rupandehi, Lumbini, Nepal
(Lumbini: Birthplace of Lord Buddha, World Heritage Site)

Letter no. 072/73
Invoice no. 412

Date: June 27, 2016

The Department of Archaeology
World Heritage Protection Section
Ramshah Path, Kathmandu.

Re: About presentation of comments.

Apropos of the subject, it is hereby notified that a letter dated June 23, 2016 with the invoice no. 2795, calling for the submission of comments was received. In that regard, while conducting Heritage Impact Assessment (HIA) in the site for the proposed upgrading of the road that runs 1600 meters along east-west side of the Lumbini Master Plan, two kilometers north of the world heritage site and which falls within the cultural center of the new Lumbini village area under the master plan, no archaeological site was discovered. Thus it is hereby notified that, permission has been granted for upgrading the road as per the proposed drawing.

CC:
The Department of Roads, Project Directorate, Bishal Nagar, Kathmandu.

(Ajitman Tamang)
Member Secretary

APPENDIX D: ENVIRONMENTAL MANAGEMENT PLAN

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
[0] Pre-Construction Stage (Upon issuance of Notice to Proceed)						
The Contractor shall complete the following activities no later than 30 days upon issuance of Notice to Proceed:						
1) Submit appointment letter and resume of the Contractor's Environmental Focal Person (EFP) to DOR Project Directorate						
2) EFP will engage CSC-Environment Specialist and DOR/PD to a meeting to discuss in detail the EMP, seek clarification and recommend corresponding revisions if necessary						
3) EFC will request CSC-ES copy of monthly monitoring formats and establish deadlines for submission.						
4) EFC will submit for CSC-ES approval an action plan to secure all permits and approvals needed to be secured during construction stage which include but not limited to: i) operation of crushers and hot mix plants, ii) transport and storage of hazardous materials (e.g. fuel, lubricants, explosives), iii) waste disposal sites, iv) temporary storage location, iv) water use, and v) emission compliance of all vehicles. Arrangements to link with government health programs on hygiene, sanitation, and prevention of communicable diseases will also be included in the action plan.						
5) EFC will submit for approval of CSC-ES the construction camp layout before its establishment.						
[A] Construction Stage						
Physical Environment						
Micro-Climate 1,870 trees will be removed along the right of way (ROW)	- 1:25 compensatory plantation	Throughout the road alignment especially at forest areas	Before tree felling	1870 trees x 25 x 1.1 (mortality) x NRs. 99= NRs 5,091,075.00	Compensatory plantation to be implemented by Forest Department. Funds will come from DOR	CSC, DOR/PD
	- Avoid or minimize clearing of trees, shrubs and bushes as far as possible.		During implementation period			
Air Quality Emissions from plants, vehicles, unpaved road travel, and hauling of materials.	- Aware and support community with regard to plantation of trees in the available spaces	Throughout the road corridor mainly nearby settlements, bazaar, religious, cultural and archeologica l sites	During Construction Stage	Dust and noise control NRs. 150,000.00	CSC and Contractor	CSC, DOR/PD
	- Carryout water sprinkling and fogging, broom sweeping in dust prone locations, unpaved haulage roads, earthworks, stockpiles and asphalt mixing plant areas. - Prohibit open burning of solid wastes (plastic, paper, organic matters). - Control dust nuisance using covers, spraying water on unpaved road surfaces, or increase moisture content for open materials storage piles. - Include in bid document to avoid use of very old vehicles, emitting gases beyond standards. - Provide masks and personal protective equipment (PEP) to workers to minimize inhalation of respiration of suspended particulate matters. - Locate mixing and asphalt (hot mix) plants, and crushers and batching plants at least 1 km downwind from the nearest settlements only after receiving approval from the CSC. - Operate Hot Mix plant with stack of adequate height as prescribed by CSC to ensure enough dispersion of exit gases. - Use heaters for heating purpose, if possible					

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
	<ul style="list-style-type: none"> - Use crushers only licensed by GoN. - As far as possible, use LPG or kerosene as fuel source for cooking purpose. - Restrict tree cutting for use of fuel- wood. - Operate Diesel Generating (DG) sets with adequate height. - Use diesel with low sulphur content in DG sets as well as other machineries. 					
Noise Level Temporary increase in ambient noise level in the close vicinity of various construction activities	<ul style="list-style-type: none"> - Locate temporary construction facilities such as labour camps, vehicle maintenance workshops and earth moving equipment away from settlements and other sensitive areas as far as possible. - Relocate noise sources such as stone crushers, vehicles movements, and operation of quarry and borrow pits to less sensitive areas to take advantages of distance and shielding. - Take advantages of natural topography as a noise buffer - Install silencers in construction equipment and machinery, and repair and maintain in time. - Select equipment and machinery with lower sound power levels for the use. - Provide protection devices such as ear plugs/ or earmuffs to workers during operation of high noise generating machines. - Perform construction activities only between 5 A.M. and 8 P.M. to avoid disturbance to nearby communities at night. - Initiate multilayered plantation during construction near built up areas close to the road alignment. - Use noise barriers such as earth mounds or walls of wood, metal that form a solid obstacle between the road and roadside community, especially in schools and hospitals sites. - Refer to occupational noise standards per WHO Guidelines 	Throughout the road corridor mainly nearby settlements, bazaar, religious, cultural and archeological sites	During Construction	Included in Engineers' Estimate	CSC and Contractor	CSC, DOR/PD

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
Vibration and Blasting Damage to infrastructures due to vibration caused by operation of heavy machines and equipment including blasting	<ul style="list-style-type: none"> - Observe precaution while operating machines and equipment, especially nearby public and private infrastructures. - Avoid/minimize the use of blasting as far as possible. - Give prior information to VDC and community on blasting operations. 	Throughout the road length	During Construction stage	Included in Engineers' Estimate	Contractor	CSC, DOR/PD
Impact on Land and Soil Contamination from inappropriate construction and management practices	<ul style="list-style-type: none"> - Preserved top soil for reuse for plantation and restoration purposes. - Restore back to any land taken on lease or used - The local governments traversing the road shall implement the land use zoning in their respective jurisdictions to regulate the incremental commercial/industrial development associated with improved road access. 	Throughout the road alignment	During Construction	Included in Engineers' Estimate	Contractor	CSC, DOR/PD
Landslide and Soil Erosion Occurrence of landslide and soil erosion due to construction	<ul style="list-style-type: none"> - Clear only required vegetation and re-vegetate eroded bare slopes by the cleared vegetation. - Apply civil and bioengineering techniques to stabilize landslide and soil erosion. 	Throughout the road COI at landslide and erosion prone area	During Construction stage	NRs 12,866,894.00 (This cost of bio engineering works is based on Engineers' Estimate)	Contractor	SC, DOR/PD
Borrow Pits and Quarry Sites Slope failure, sedimentation, water logging, change in the aesthetic values of the landscape, damage to sensitive areas due to improper selection and management of borrow pit and quarry sites for the construction materials	<ul style="list-style-type: none"> - Avoid protected and sensitive areas, nearby settlements, water sources, forest areas and fertile agriculture lands in siting borrow pit. - Select borrow and quarry sites at waste and low quality of lands. - Obtain approval from authorities of government and private land owners. - Operate borrow pits and quarry sites as per required volume of materials. - Stockpile and preserve top soil to spread for restoration of sites. - No borrow pit, quarry or other related facilities shall be located inside LDT masterplan area. 	Throughout the project road corridor wherever additional soil and stones required	During Construction Stage	Included in Engineers' Estimate	Contractor	CSC, DOR/PD
Soil Contamination and Compaction Contamination of land due to mixing of construction materials and wastes/spoils; and	<ul style="list-style-type: none"> - Before operation obtain approval for labour camps, haulage roads, workshop and storage area for different materials through the SC. - Store fuel and lubricants as per the approved plan. The storage area should be paved covered, paved, with interceptor drains, and oil/water separator. Collected 	Throughout the road alignment mainly at haulage roads and	During Construction Stage	Included in Engineers' Estimate	Contractor	CSC, DOR/PD

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
compaction due to movement of heavy construction equipment along haulage roads and workshop areas, and construction camps	fuels and contaminated materials should be re-use, stored and disposed outside. All hazardous materials should be properly labeled. - Restrict movement to the designated haulage route. - Design approach roads through waste/barren land and rocky area to reduce compaction induced impact on soil. - Restore affected farm land after completion of road improvement activity. - Provide temporary latrine pits in labour camps and restore after completion of activity. - Segregate solid wastes generated into biodegradable and non-biodegradable wastes. Recycle, re-use, and compost waste accordingly.	labour camp locations				
Siltation and Surface Water Quality of Streams Likelihood of increased siltation through soil erosion due to borrow pits and quarry sites operation, and contamination of water due to solid and liquid wastes from the labour camps and construction equipment	- Prohibit to recharge the ground water with solid and liquid wastes which ultimately contaminate the ground water - Orient workers not to throw excavate spoils and wastes into stream water. - Store all chemicals and oil away from water and provide concrete platform with catchments pits for spills collection. - Arrange training program to all equipment operators, drivers, and warehouse personnel on immediate response for spill contamination and eventual cleanup. Distribute emergency procedures and reports preferably written in easy to understand local dialects to the local people. - Install silt fencing and/or brush barrier for collecting sediments before letting them into the water body. Collect silt/sediment and stockpile for possible reuse as surfacing of slopes for re-vegetation. - Dispose of all wastes generating from construction sites in an environmentally acceptable manner so as not to block the flow of water in the channels. Collect, store and transport wastes to dispose at approved sites. - No vehicles or equipment washing, parking or refueling near streams water, so as to avoid contamination of streams water from fuel and lubricants. - Provide chute drains to drain surface runoff and prevent erosion from slopes. - Avoid large labour camps along the alignment and	Nearby rivers, and water bodies streams, rivulets throughout the road alignment	During Construction Stage	Included in Engineers' Estimates	Contractor	CSC, DOR/PD

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
	locate away from settlements and river sides. - Recruit construction labours preferably from the local community. - Manage sewage of labour camps without creating pollution in streams water and other public and private areas. - No untreated sanitary wastewater shall be discharged into streams water.					
Hydrology and Drainage Modification of the surface water due to intersection of the drainage basin by the road	- Retain existing natural drainage system without disturbing them. - Provide bridges in each perennial and seasonal streams as well as rivulets. - Consider adequate cross drainage structures to avoid natural flow of water especially for unusual rainfall. - Maintain channels used by the farmers for irrigation purpose as they are.	Throughout the road COI especially rivers, streams, rivulets and bridge site areas	During Construction	Included in Engineers' Estimate	Contractor	CSC, DOR/PD
Management of Construction Spoils/Wastes Generation of spoils due to the excavation of existing road that constitute subgrade and pavement materials	- The Contractor shall apply preventive and protective measures consistent with the World Bank Group's Environment, Health and Safety Guidelines on waste management and hazardous materials management. - All disposal sites shall have consent of local community, VDC representatives. - Use spoils/wastes for construction purposes as far as possible.	Throughout the road COI wherever spoils need to be managed	During Construction Stage	Included in Engineers' Estimate	Contractor	CSC, DOR/PD
Natural Hazard Possibility of damage to road due to natural hazard such as flooding and siltation, and earthquake	- Road embankment level has been designed to be higher than the highest flow level and/or flood level of the streams and rivulets. - Project structures are designed with the consideration of probability of earthquakes.	As required at the road alignment	During Construction	Included in Engineers' Estimate	Contractor	CSC, DOR /PD
Biological Environment						
Forestry and Biodiversity Likely impact from clearance of trees, shrubs and bushes along the roadside	- The Contractor shall determine number and types of trees to be felled through the detailed design/or its verification and shall coordinate with CFUGs then apply to DFO for clearance process - The Contractor shall seek necessary help with CSC to obtain approval for clearing trees, if needed - Trees shall be felled only after receiving permissions from the concerned authorities. - The Contractor shall coordinate with CSC /Project In-charge/CFUGs and manage felled trees. - Clear only necessary vegetative covers in connection	Throughout the road alignment especially at forest areas	At the beginning of construction	25*1870*1.1*95= NRs 5,091,075.00 (Cost is calculated assuming 10% mortality and per sapling & caring cost for 5 years Rs 95)	Contractor	CSC, DOR/PD

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
	with road improvement. - Prohibit throwing spoils including bitumen containers and other wastes/spoils generated from roads excavation in and around the forest areas.					
Aquatic Biodiversity Possibility of destructive fishing activities by the construction workers	- Discourage destructive fishing by the construction workers.	All areas of water bodies throughout the alignment	During Construction Stage	-	Contractor	CSC, DOR/PD
Fauna Possibility of destroying the habitat of bird species	<ul style="list-style-type: none"> Prohibit the killing or capture of birds by construction worker. Prohibit the removal of any tree outside bird breeding season. If they have to be taken down in breeding season then, it needs to be done after having been checked and signed off by a qualified ornithologist. Prohibit the direct discharge of sewage inflow to streams that may affect paddy fields and wetlands The contractor shall coordinate with the Department of National Parks and Wildlife Conservation (DNPWC) and Bird Conservation Nepal on the necessary mitigating measures 					
Socio-economic Environment						
Impacts due to Construction / Labour Camp Likely haphazard disposal of solid waste, competition on public facilities, impairment of aesthetic value of the landscape, poor sanitation, transmission of communicable diseases and other social conflicts	<ul style="list-style-type: none"> The Contractor shall apply preventive and protective measures consistent with international good practice such as the World Bank Group's Environment, Health and Safety Guidelines. To the extent possible, utilize existing houses for workers/staff lodging. Provide basic facilities such as fire precaution, lavatories and showers, potable water supply, clean eating area, lighting, safe access, air supply, LPG gas/kerosene, and others. Make available first aid facilities at camp sites. Prepare contingency plan for emergency and large injury cases in collaboration with VDC level health/sub-health posts. All workers, staff, and communities undergo STD, HIV awareness by linking with existing government programs. Restrict open space defecation and pollution of stream sites and public places by workers. Ensure that sufficient and good quality of food stuff at reasonable price including adequate and safe drinking 	All labour camp locations throughout the road alignment	During Construction	Included in Engineers' Estimate	Contractor	CSC, DOR /PD

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
	water has been supplied to the workers.					
Safety of Construction Workers and Accident Risks to Local Community Increased risk of accidents to construction workers and local community	<ul style="list-style-type: none"> - Ensure that internationally accepted and practiced safety measures are adopted during (i) road works (ii) handling of large construction equipment and machineries (iii) handling of chemicals including hazardous materials and inflammable substances (iii) welding/hot work (iv) electrical works etc. - Include the occupational health and safety (OHS) Clauses established by the DOR in the work contracts encompassing all accident prevention measures which can happen at work sites and in the camps. - Arrange all personal protective equipment (PPEs) for workers, including first aid facilities at construction sites. - Prepare an emergency plan duly approved by the CSC to respond to any instance of safety hazard. - Restrict entry of unauthorized persons to the construction sites and equipment storage sites. - Prepare and implement comprehensive traffic management plan to avoid disruption of the existing traffic due to construction activities. - Conduct regular safety audit on safety measures during construction. The audit shall cover manpower and their safety, machinery, temporary works, equipment and vehicles, materials storage and handling, construction procedures and environment, site safety guidelines, and miscellaneous services. - No one under the age of 18 will be employed by the project. 	All construction camps and throughout the road alignment	During Construction Stage	Personal protective equipment NRs 784,176.00	Contractor	CSC, DOR /PD
Transportation and Storage of Materials Likely impact due to transportation and storage of materials such as oils, fuel, bitumen, blasting materials, construction materials, etc.	<ul style="list-style-type: none"> - Proper storage (paved, covered, with interceptor drains and oil/water separator) and labeled for storage. - Equip with fire extinguishers and first aid kit all storage and transporter of hazardous materials. - Avoid the use of haulage trucks higher than the carrying capacity of the haulage roads and existing roads. The contractor will be responsible for repair and maintenance of damaged existing road by the haulage trucks. 	Construction camp and approved temporary storage areas	During Construction Stage	Included in Engineers' Estimate	Contractor	CSC, DOR/ PD

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
Impact on common Property Resources Likely damage of common properties such as public utilities and facilities, religious, historical and cultural sites etc.	<ul style="list-style-type: none"> - Implement mitigation measures to control dust, noise, and traffic - Chance find of archeological artifacts importance, the Contractor shall immediately inform CSC and DOR to seek further guidance. - Avoid any actions that bear the risk to destroy the sites or alter their scientific or aesthetic or social values. - In the case of accidental damage of infrastructure of archaeological importance, the contractor will be obliged to inform DOR immediately through CSC. Further, he (the Contractor) shall also be obliged to carry out immediate corrective and repair measures, as suggested by concerned authority. - Coordinate with the Lumbini Development Trust and the Department of Archaeology prior to road improvement that traverses the Masterplan Area 	Throughout the road COI	During Construction	Included in Engineers' Estimate	Contractor	CSC, DOR /PD
[B] Operation Stage						
Physical Environment						
Micro-Climate Change in the micro-climate due to emission of GHG from operation of vehicles	<ul style="list-style-type: none"> - As part of transport rules, condition of vehicles will be monitored regularly and rules will be enforced effectively. In addition, reduction in emission of GHG is also anticipated due to the reduced travel time and improved road condition. 	Throughout the road corridor	During Operation Stage	To be determined by DoR	DoR	DoR
Air Quality Emission of GHG from the operation of vehicles	<ul style="list-style-type: none"> - Shifting cropping /land use patterns from traditional cereals to high value horticultural crops along the RoW in the cultivated area could be one of the preferred solutions to maintain environmental and economic sustainability. - DOR will maintain roadside planted trees especially nearby settlements and other public places. - GoN will control and enforce Nepal vehicle mass emission standard, 1999 and will stipulate vehicle owners to engage in proper and regular vehicle maintenance. - Local petrol pump stations will make aware to ensure proper use and sale of clean fuel. - Air pollution by dust will be controlled with provision of paved shoulders, especially in the sensitive/built-up areas. - Road signs will be provided reminding the motorist to properly maintain their vehicles to economize on fuel consumption and protect the environment. 	Throughout the road corridor	During Operation Stage	To be determined by DoR	DoR	DoR

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
	- Development organizations (NGO, INGO and CBOs) can motivate the local communities to maintain greenery along the road apart from their houses by planting fodder, fuel wood and fruit trees including flowering plants.					
Noise Level Likelihood of increase in ambient noise level due to operation of vehicles and use of horns	<ul style="list-style-type: none"> - Effective traffic management and good riding conditions shall be maintained to reduce the noise level throughout the stretch. - Speed limitation and honking restrictions shall be enforced near sensitive locations, like hospitals, schools etc. - Effectiveness of the multilayered plantation shall be monitored. - Awareness will be created amongst the residents about likely noise levels from road operation at different distances. - Labor camps will not be located within or near Lumbini Development Trust's master plan area 	Throughout the road corridor especially nearby, wildlife habitat, settlements, bazaar areas, religious, cultural and archeological sites	During Operation Stage	To be determined by DoR	DoR	DoR
Vibration Possibility of vibration due to plying of heavy and over loaded vehicles	<ul style="list-style-type: none"> - Loaded vehicles plying on the road shall be monitored by MoPIT as per Nepal Road Standard, 2027 B.S. (First revision-2045 B.S.). - Drivers shall be made aware about capacity of the road and bridges, and their consequences. 	Throughout the road COI	During Operation	To be determined by DoR	DoR	DoR
Impact on Land and Soil Conversion of agricultural land to built up areas for commercial purpose, especially in market centres	In general, the policy of DoR is of 15 and 25 m either sides from the centreline for feeder road and highway, respectively. But in case of this road, construction of infrastructures is strictly prohibited within the specified RoW.	Throughout the road COI mainly nearby built-up areas and farm lands	During Operation Stage	To be determined by DoR	DoR	DoR
Soil Erosion Occurrence of landslide and soil erosion due to both natural and induced phenomena.	- DOR has established a system to check roads employing Length-Persons and their supervisor. They are responsible for routine and recurrent maintenance of roads like cleaning up drains, soil deposited on the roads due to minor slope failure and erosion.	Along the road corridor, especially near bridges where embankment level is high	During Operation Stage	To be determined by DoR	DoR	DoR
Borrow Pits and Quarry Sites Likelihood of landslide	- DOR shall orient supervisor in order to check and maintain drains and erosion and also to protect vegetative covers on the restored sites of borrows and	Especially at borrow pits and quarry	During Operation Stage	To be determined by DoR	DoR	DoR

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
and soil erosion due to incomplete restoration of borrow pits and quarry sites along the road alignment	quarries. - The contractor will ensure that borrow pits and quarry sites have proper licenses prior to construction.	sites used areas throughout the alignment				
Soil Contamination and Compaction Possibility of soil erosion and deterioration of borrow areas if not rehabilitated properly	- Locations of quarry sites and borrow pits shall be monitored and if found not restored properly then the Contractor will be asked for correction of these works under defect liability period	All borrow, quarry and construction camp sites throughout the alignment	During Operation	To be determined by DoR	DoR	DoR
Siltation and Surface Quality of Rivers Possibility of contamination of surface water by oil and lubricants during monsoon season	- As provisioned, DOR will engage road Length-Persons. They will check road condition including cleaning up soils deposited on roads by erosion and slides drain blockade/ chocking. The Length- Persons supervisor will inform to Senior Divisional Engineer in case of large landslide and major road blockade.	All areas nearby streams and rivulets throughout the road alignment	During Operation	To be determined by DoR	DoR	DoR
Hydrology and Drainage Blockage/Chocking of natural drainage pattern due to landslide and soil erosion	- As provisioned, DOR will engage Length-persons for regular checkup of the road condition including cleaning up the erosion, slides, drain blockade/ chocking etc. Length-Persons supervisor will inform to regional engineer in case of large landslides and major road blockade.	All areas nearby streams and rivulets throughout the road alignment	During Operation Stage	To be determined by DoR	DoR	DoR
Natural Hazard Likely impact of natural hazard such as flooding, siltation and earthquake	- Development organizations will play role in awareness raising about the risk of natural hazards including preventive cure and preparedness on safety measures to local communities.	All sites nearby streams and rivulets throughout the road alignment	During Operation Stage	To be determined by DoR	DoR	DoR
Ecological Resources						
Forestry and Biodiversity Increased possibility of poaching and logging due to improved access	- The project shall involve local people in maintaining of planted trees and their management activities. -	All forest areas along the road Corridor	During Operation Stage	To be determined by DoR	DoR	DoR
Socio-economic Environment						
Accident Risks to	- Monitoring and supervision by DOR is required, to	Throughout	During Operation	To be determined	DoR	DoR

Environmental Issues / Component	Mitigation Measures	Location	Time Frame	Mitigation Cost	Institutional Responsibility	
					Implementation	Supervision
Local Community Increased risk of road accident	ensure the safe travelling with the provision of Road Furnitures..	the road alignment		by DoR		
Impact on Common Property Resources Increased noise, vibration and air pollution	<ul style="list-style-type: none"> - The DOR will install traffic signals such as “NO HORN” and “SPEED LIMIT” nearby the archaeological sites. - Labour camps will not be located inside Lumbini Development Trust managed master plan area 	Throughout the road COI especially at sensitive locations	During Operation Stage	To be determined by DoR	DoR	DoR

APPENDIX E: ENVIRONMENTAL MONITORING PLAN

Environmental Indicators	Project Stage	Parameters	Methods/Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implementation	Supervision
Air Quality	Construction Stage	TSPM, PM ₁₀ , NO _x , SO _x , CO _x	Stack emission testing	Crusher, hot mix plants, diesel generator	Annual in line with permit renewal	National Ambient Air Quality Standards (NAAQS)	Part of permit renewal	Contractor	CSC, /DOR
			Emission testing for all vehicles	Construction camp	Annual as part of permit renewal			Contractor	CSC, /DOR
			Ambient air quality sampling and analysis at selected sites/sensitive spots using through High Volume Sampler 24-hour	Madhawaliya, Be tahari, Parsa Chowk, Pakadi chauraha, Dharampaniya, Tauliwa	Baseline: 1 sampling each before construction		6 sites x 20,000/ sampling = NRs 120,000	CSC	DOR
	Operation			Major settlements				DOR	
Water Quality	Construction	BOD, Turbidity, pH, <i>E.Coli</i> , TSS, Oil and Grease	<ul style="list-style-type: none"> Collect and analyze sample from source Observation of blockage of waterways - extent and secondary impacts Water pollution incidents due to unsafe disposal of waste and spoil, analyzing effects on local fisheries Observations on vehicle and equipment washing practices in rivers 	Streams and rivers (Ankhu Khola)	Quarterly	Nepal Water Quality Guidelines for the Protection of Aquatic Ecosystems	Part of construction cost	CSC	PD/ DOR
				Construction camp final discharge effluent				CSC	PD/ DOR
				Construction camp				Contractor	PD/ DOR
	Operation	Drinking water quality parameters Clogging of drains from silt with oil	Water sampling Visual	All drains	Annually before the onset of rainy season	National Drinking Water Quality Standards (NDWQS)	Agency budget	DOR	

Environmental Indicators	Project Stage	Parameters	Methods/Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implementation	Supervision
Soil Quality	Construction Stage	Check for contamination from material spills and compaction due to heavy equipment	Visual	Agricultural Land, oil spillage locations and other probable hazardous materials contamination location or as suggested by CSC	Continuing during construction	Should be the same as baseline before start of construction	Part of construction cost and Grievance redress mechanism	Contractor	CSC, DOR
	Operation Stage			Agricultural Land, oil spillage locations and other probable hazardous materials contamination location or as suggested by CSC (3 Locations)	Continuing		Clean up of spills is responsibility of polluter	DOR	
Noise Levels	Construction Stage	(1 hr Leq dB(A)) WHO Standards	<ul style="list-style-type: none"> Point source measurements in dB (A) at settlement sites/sensitive spots for noise level at 5, 25 and 50 m from road shoulder Traffic volume measurements 	Camp site and major settlement sites	Four times a year during the construction	Nepal Ambient Noise Level as per NHRC	Part of construction cost	Contractor	CSC, PD/DOR
	Operation			Major road intersections, residential, commercial and sensitive receivers along the road alignment or suggested by CSC (2 Locations)	Once during the first year of operation		Part of agency budget	DOR	
Landslide and Soil Erosion	Construction	Magnitude, extent and location	Visual	Along the entire stretch	Regular	None	Part of construction cost	Contractor	CSC, PD/DOR
	Operation	Magnitude, extent and location		Throughout the road alignment	Regular		Part of agency budget	DOR	

Environmental Indicators	Project Stage	Parameters	Methods/Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implementation	Supervision
Siltation by rivers and drainage congestion	Construction	<ul style="list-style-type: none"> Siltation and presence of construction spoils and wastes Blockage of waterways - extent and secondary impacts 	Direct Observation	Throughout the road alignment, especially at the drainage congestion areas as mentioned in the IEE report or as suggested by CSC	Continuing during construction phase	Visual Observation / Nepal Water Quality Guidelines for the Protection of Aquatic Ecosystems	Construction contract	Contractor	CSC, PD/DOR
	Operation	<ul style="list-style-type: none"> Siltation Blockage of water ways - extent and secondary impacts 			Annual		DOR Length Person System	DOR	
Borrow Areas and Quarry Sites	Construction	Location, drainage condition, siltation, erosion, spoil management, etc	Site observation, discussion with workers and local people	Borrow areas, quarry sites location	Quarterly during construction period	Visual Observation / No evidence of water ponding or no observed turbidity of water ²⁹	Construction Contract	Contractor	CSC, PD/DOR
	Operation	Restoration as recommended in the EMP	Site observation, discussion with workers and local people		Once immediately after the completion of construction		DOR	DOR	
Labour Camps	Construction	Proper siting of food stalls, camp sanitation facilities	Site observation, discussion with workers and local people	Construction and camp sites	Quarterly during construction period	Visual Observation / Environmental Management Guidelines for Labour Camps, 1997	Construction Contract	Contractor	CSC, PD/DOR
	Operation	Restoration of construction camp as recommended in the EMP	Site observation and discussion with local people	Construction sites and camps	Once immediately after the completion of construction		DOR	DOR	

²⁹ Environmental Management Guidelines (1997), Nepal. Borrow Pits, under Monitoring Indicators.

Environmental Indicators	Project Stage	Parameters	Methods/Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implementation	Supervision
Tree Plantation	Construction	Maintenance of saplings planted as compensation for trees felled	Direct Observation, discussion with workers and local people	Throughout the road alignment	Once a month for one year immediately after plantation	Visual Observation / Forest Policy (1993), Forest Rule (1995)	Included in environmental mitigation cost	CFUGs	DFO, DOR
	Operation	<ul style="list-style-type: none"> • Maintenance of saplings planted during construction • Survival rate of trees • Growth and development of saplings 	Direct Observation and discussion with local people		<ul style="list-style-type: none"> • Once a month for one year for saplings that are less than a year old • Once in a year for 5 years 			CFUGs	DFO, DOR
Road Safety and Accidents	Construction	<ul style="list-style-type: none"> • Accidents (Major and minor) • Safety 	<ul style="list-style-type: none"> • Record numbers and types of road accidents recorded by the traffic police and the local health service centres • Suitability of signs at construction sites • Direct observation and discussion with workers and local people 	Throughout the road alignment	Once after the construction begins	Visual Observation, Verification and discussion with workers and local people	Construction contract	Contractor	CSC, PD/DOR
	Operation		<ul style="list-style-type: none"> • Record numbers and types of road accidents recorded by the traffic police and the local health service centres • Suitability of local road signs • Records on public road safety awareness campaigns • Direct observation and discussion with local people • Speed measurements at selected spots 	Throughout the road alignment	Once a year		DOR	DOR	

APPENDIX F: NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) FOR NEPAL

Parameters	Units	Averaging Time	WHO Guideline	Concentration in Ambient Air, maximum	Test Method
TSP (Total Suspended Particulates)	$\mu\text{g}/\text{m}^3$	Annual	120-230	-	HVS 24 hour sampling(one weak sample on 2 road side station
		24-hours*		230	
PM ₁₀	$\mu\text{g}/\text{m}^3$	Annual	70	-	Light Volume Sampling
		24-hours*		120	
Sulphur Dioxide	$\mu\text{g}/\text{m}^3$	Annual	125	50	Diffusive sampling based on weekly average
		24-hours**		70	
Nitrogen Dioxide	$\mu\text{g}/\text{m}^3$	Annual	150	40	Diffusive sampling based on weekly average
		24-hours**		80	
Carbon Monoxide	$\mu\text{g}/\text{m}^3$	8 hours**	100000	10,000	To be determined before 2005
		15 minute		100,000	Indicative sampler
Lead	$\mu\text{g}/\text{m}^3$	Annual	0.5-1.0*	0.5	Atomic absorption spectrometry analysis of PM ₁₀ samples
		24-hours		-	
Benzene	$\mu\text{g}/\text{m}^3$	Annual	-	20****	Diffusive sampling based on weekly average
		24-hours		-	

Notes:

*24 hourly values shall be met 95% of the time in a year. 18 days per calendar year the standard may be exceeded but not on two consecutive days,

**24 hourly standards for NO₂ and SO₂ and 8 hours standard for CO are not to be controlled before MOPE has recommended appropriate test methodologies. This will be done before 2005,

***If representativeness can be proven, yearly averages can be calculated from PM₁₀ samples from selected weekdays from each month of the Year,

****To be re-evaluated by 2005.

Source: Nepal Gazette B.S. 2060/4/19 (4 August, 2003)

APPENDIX G: NOISE QUALITY STANDARD

Ambient Noise Level Limits (in Leq dB (A), Nepal)

Environmental Setting	Typical Range of Ldn, dBA	Average Ldn, dBA
High Traffic Area	64-86	74.36
Old Residential Area	59-73	66.28
New Residential Area	48-69	62.00
Commercial Cum Residential Area	69-75	72.75
Commercial Cum Tourist Area	59-76	69.25

Source: Nepal Health Research Council, 2003

Guideline values for community noise in specific environments

Specific environment	Critical health effect(s)	LAeq [dB]	Time base [hours]	LAmx fast [dB]
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	
Inside bedrooms	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60
School class rooms and pre-schools, indoors	Speech intelligibility, disturbance of information extraction, message communication	35	during class	-
Pre-school	Sleep disturbance	30	sleeping	45
Bedrooms, indoors			-time	
School, playground outdoor	Annoyance (external source)	55	during play	-
Hospital, ward rooms, indoors	Sleep disturbance, night-time	30	8	40
	Sleep disturbance, daytime and evenings	30	16	-
Hospitals, treatment rooms, indoors	Interference with rest and recovery	#1		
Industrial, commercial, shopping and traffic areas, indoors and Outdoors	Hearing impairment	70	24	110
Ceremonies, festivals and entertainment events	Hearing impairment (patrons:<5 times/year)	100	4	110
Public addresses, indoors and outdoors	Hearing impairment	85	1	110
Music through headphones/ Earphones	Hearing impairment (free-field value)	85 #4	1	110

Specific environment	Critical health effect(s)	LAeq [dB]	Time base [hours]	LAmx fast [dB]
Impulse sounds from toys, fireworks and firearms	Hearing impairment (adults)	-	-	140 #2
	Hearing impairment (children)	-	-	120 #2
Outdoors in parkland and conservation areas	Disruption of tranquility	#3		

Source: WHO, 1999

APPENDIX H: DRINKING WATER AND IRRIGATION WATER QUALITY STANDARDS

Nepal's Drinking Water Quality Standards & Water Quality for Irrigation

Group	Parameter	Unit	Maximum Concentration Limits
	Turbidity	NTU	5 (10)**
	pH		6.5-8.5*
	Color	TCU	5 (15)**
	Taste & Odor		Would not be objectionable
	Total Dissolved Solids	mg/l	1000
	Electrical Conductivity	µc/cm	1500
	Iron	mg/l	0.3 (3)**
Physical	Manganese	mg/l	0.2
	Arsenic	mg/l	0.05
	Cadmium	mg/l	0.003
	Chromium	mg/l	0.05
	Cyanide	mg/l	0.07
	Fluoride	mg/l	0.5-1.5*
	Lead	mg/l	0.01
	Ammonia	mg/l	1.5
	Chloride	mg/l	250
	Sulphate	mg/l	250
	Nitrate	mg/l	50
	Copper	mg/l	1
Chemical	Total Hardness	mg/l	500
	Calcium	mg/l	200
	Zinc	mg/l	3
	Mercury	mg/l	0.001
	Aluminum	mg/l	0.2
	Residual Chlorine	mg/l	0.1-0.2*
Micro Germs	E-Coli	MPN/100ml	0
	Total Coli form	MPN/100ml	95 % in sample

Source: Ministry of Physical Planning and Works (Nepal Gazette (B.S. 2063/03/12))

Notes:

* These standards indicate the maximum and minimum limits.

** Figures in parenthesis are upper range of the standards recommended.

Nepal Water Quality Guidelines for the Protection of Aquatic Ecosystem

S.N.	Parameter name		Target Water Quality Range	Chronic Effect Value	Acute Effect Value
1.	Aluminium (mg/l)		At pH <6.5: 5 At pH >6.5:10	10 20	100 150
2.	Ammonia (µg/L)		< 7	< 15	< 100
3.	Arsenic (µg/L)		< 10	< 20	< 130
4.	Atrazine (µg/L)		< 10	< 19	< 100
5.	Cadmium				
	Soft water	(60 mg/l CaCO ₃)	< 0.15	0.3	3
	Medium water	(60 – 119 mg/l)	< 0.25	0.5	6
	Hard water	120 – 180 mg/l	< 0.35	0.7	10
	Very Hard	> 180 mg/l	< 0.40	0.8	13
6.	Chlorine (Residual) µg/L		< 0.2	0.35	5
7.	Chromium (VI) µg/L		7	10	200
8.	Chromium (III) µg/L		< 12	24	340
9.	Copper µg/L				
	Soft water	(60 mg/l CaCO ₃)	< 0.3	0.53	1.6
	Medium water	(60 – 119 mg/l)	< 0.8	1.5	4.6
	Hard water	120 – 180 mg/l	< 1.2	2.4	7.5
	Very Hard	> 180 mg/l	< 1.40	2.8	12
10.	Cyanide µg/L		1	4	110
11.	Dissolved Oxygen (% saturation)		80 – 120	> 60	> 40
12.	Endosulphan (µg/L)		< 0.01	0.02	0.2
13.	Fluoride (µg/L)		< 750	1500	2540
14.	Iron		The iron concentration should not be allowed to vary by more than 10 % of the background dissolved iron concentration for a particular site or case, at a specific time.		
15.	Lead µg/L				
	Soft water	(60 mg/l CaCO ₃)	< 0.2	0.5	4
	Medium water	(60 – 119 mg/l)	< 0.5	1.0	7
	Hard water	120 – 180 mg/l	< 1.0	2.0	13
	Very Hard	> 180 mg/l	< 1.2	2.4	16
16.	Manganese (µg/L)		< 180	370	1300
17.	Mercury (µg/L)		< 0.04	0.08	1.7

S.N.	Parameter name	Target Water Quality Range	Chronic Effect Value	Acute Effect Value
18.	Nitrogen (inorganic)	Inorganic nitrogen concentrations should not be changed by more than 15 % from that of the water body under local unimpacted conditions at any time of the year; The trophic status of the water body should not increase above its present level, though a decrease in trophic status is permissible (see Effects); The amplitude and frequency of natural cycles in inorganic nitrogen concentrations should not be changed.		
19.	pH			
	All aquatic ecosystems	pH values should not be allowed to vary from the range of the background pH values for a specific site and time of day, by > 0.5 of a pH unit, or by > 5 %, and should be assessed by whichever estimate is more conservative.		
20.	Phenols (µg/l)	<30	60	500
21.	Phosphorus (inorganic) All surface waters	Inorganic phosphorus concentrations should not be changed by > 15 % from that of the water body under local, unimpacted conditions at any time of the year The trophic status of the water body should not increase above its present level, though a decrease in trophic status is permissible (see Effects); The amplitude and frequency of natural cycles in inorganic phosphorus concentrations should not be changed.		
22.	Selenium (µg/l)	< 2	5	30
23.	Temperature (All aquatic ecosystems)	Water temperature should not be allowed to vary from the background average daily water temperature considered to be normal for that specific site and time of day, by > 2 °C, or by > 10 %, whichever estimate is the more conservative.		
24.	Total Dissolved Solids (All inland waters)	<ul style="list-style-type: none"> TDS concentrations should not be changed by > 15 % from the normal cycles of the water body under unimpacted conditions at any time of the year; The amplitude and frequency of natural cycles in TDS concentrations should not be changed. 		
25.	Total Suspended Solids (All inland waters)	Any increase in TSS concentrations must be limited to < 10 % of the background TSS concentrations at a specific site and time.		
26.	Zinc (µg/l)	< 2	3.6	36

Source: Department of Irrigation, Ground Water Project (Nepal Gazette (Number 10, B.S., 2065-03-02))

APPENDIX I: BORROW PITS AND QUARRY SITES MANAGEMENT GUIDELINES

A. Guidelines for Borrow and Quarry Areas Management

Datasheet for Quarry Management and Restoration Plan

(i) Datasheet

- **Name of Subproject:**
- **Contract No:**
- **Locations of Civil Works:**
- **Type of Structure:** Slab culvert / Pipe culvert / RRM wall / Gabion wall (Chainage wise).
- **Required Type of Material from Local Sources:** Stone / Gravel / Sand / Soil
- **Required quantity of material from local quarry (in cum):**
- (Write qty. from different sources in serial order)
- **Parameter for quarry site selection:** (e.g. unsuitable land for cultivation, stable slope, minimum environmental hazard etc.).
- **Sources of Material:** Within RoW / Private land / Public land / Forest (community/ private/government/religious/leasehold)/Surplus material extracted by workers / River / Stream / Borrow pit / Roadway
- **Available quantity in Selected Source (in cum):**
- **Approval for Quarry site:** GON Organizations/ Private Party/ Community / Land Owner (Attach agreement herewith).
- **Method of extraction and transportation:** Depth of cut / Height of cut / and Tractor / Tipper / manually or any means.
- **Precaution measures during excavation:**
- **Likely negative environmental impacts:**

(ii) Restoration Plan

Restoration Plan: Trimming of slope/Filling of quarry/Need of check wall/Toe wall/ Plantation/Benching etc.

- Any special safety arrangement required:
- Mitigation measures for negative environmental impacts:
- Verification of Restoration Work as Planned by the Supervision Consultant Engineer/ES:
- Certification of the Restoration Plan at the end of work at each location
- Annex:

Quarry plan:

- X-section @ of 5-10m intervals (where appropriate)
- Quantity estimation sheets
- Restoration design on X-section and plan

Submitted by:

Checked by:

Approved by:

Note: The payment of each structure will be made only after filling of the data by the contractor for Quarry Management and Restoration Plan. Final payment will be dependent on verification and approval by SC at the end construction of each respective structure.

B. Guideline for Quarries and Borrows Management and Restoration Plan Preparation

Introduction

1. The guideline makes effort to highlight points to be considered in preparing quarry management and restoration plan. The purpose of this document is to provide reference to select quarry and borrow sits and check the quarry management and restoration plan submitted by the Contractor. The guideline has been prepared taking into consideration to the works mentioned in contract and EIA/EMP.

Quarry Site

2. Quarry is a place from which construction materials (soil, stone, sand, gravel, etc.,) are extracted. Quarry site potential depends upon availability of sources (quantity) and suitability of materials.

Parameter to be considered for Quarry Site Selection

3. Quarry site should be located 1 km away from the villages/settlement area, drinking water supply sources, community infrastructure such as school, health post, bridge, etc., religious sites, cultivated land, protected forests, natural drainage systems. Quarry will not be located at wildlife conservation area. River gravel will not be extracted from flowing water due the disturbance of raising sediment and danger of resulting oil/fuel leaks.
4. Quarry sites should be selected in stable area, in agriculturally unsuitable land and away from the above mentioned sites. In addition to this, local communities will be consulted and take approval from respective owner before selecting the place for quarry operation.

Likely Negative Environmental Impacts

5. The potential negative impacts are disruption of natural landscape and vegetation, accelerated erosion and landslides, slope stability, disturbance in natural drainage patterns, siltation due to surface water, water pollution and dust pollution. In case of riverbeds, scouring of riverbeds resulting endangerment of bridges and continuous degradation of river regime and detrimental effects on aquatic lives and their habitats.

Quarry Operation

6. Prohibition to work during the night time
7. Barricade to site to control free movement of local people

Points to be considered in Restoration Plan

8. In order to prepare quarry management and restoration plan the following points should be taken into consideration:
9. The plan must contain site restoration measures such as spoil management, slope stabilization, drainage pattern, etc.
10. Suitability of proposed mitigation measures for negative environmental impacts is needed to be conformed and verified.
11. Provision of drainage system during operation and no risk of likelihood of depositions of debris from quarry to lower catchments are important.

12. The plan must contain provision of spoil collection and appropriate management during operation, if necessary.
13. The plan should mention use of safety gears during working hours in the quarry site, and appropriate means of safeguarding for passer-by and nearby households.
14. The plan should include suitable bioengineering techniques where appropriate.
15. **Acceptance of Restoration Work:** The Supervision Consultant should satisfy himself and accept the restoration works carried out by the Contractor. The mentioned teams' engineer/ES will make sure that quarries are operated and closed according to the submitted plan.
16. The payment of each works structure should only be made after filling of the data by the Contractor for quarry management and restoration plan and acceptance by the Supervision Consultant. Final payment will be dependent on verification and approval by SC at the end construction of each respective structure.
17. **Site Supervision:** The Supervision Consultant Engineer/ES shall supervise the following parameters and indicators:
 - Implementation of mitigation measures as per design plan;
 - No evidence of water pounding or presence of fresh gullies;
 - Proper site closure;
 - Natural contours and vegetation restoration;
 - Engineers report testifying to completion of restoration work.
18. Other details will be submitted in Appendices.

APPENDIX J: PHOTOGRAPHS



1. Buddha Chowk, Bhairahawa, starting point of BLT



2: Existing Road at Parsa Chowk



3: Existing BLT road near Pakadi



4: Monitoring the noise and gas level at Barohiya



5: Lumbini Gate at Ch 0+255 of BLT



6: Waiting shade on BLT road



7: Public Consultation work on BLT road



8: Mayadevi Chowk



9: Public Consultation, BLT Road



10: Existing Pipe Culvert along BLT Road



11: Checking the house boundary



12: BLT Road end point at Taulihawa Ch