Ministry of Physical Infrastructure and Transport
Department of Roads

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR THE IMPROVEMENT OF SURYABINAYAK-DHULIKHEL ROAD IN NEPAL

DECEMBER 2016

JAPAN INTERNATIONAL COOPERATION AGENCY

CTI ENGINEERING INTERNATIONAL CO., LTD.
TONICHI ENGINEERING CONSULTANTS INC

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PREFACE

In response to the request from the Government of Nepal, the Government of Japan decided to conduct the "The Preparatory Survey on the Project for the Improvement of Suryabinayak – Dhulikhel Road in Nepal" and entrusted the Study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched the Survey Team headed by Mr. Shingo GOSE of CTI Engineering International Co., Ltd. in association with Tonichi Engineering Consultants Inc. from June 2014 to November 2016.

The Survey Team held discussions with the officials of the Ministry of Physical Infrastructure and Transport, Department of Road, and other authorities concerned. The Survey Team also conducted field surveys to collect necessary data for analysis and outline design of the objective road. The Study team also conducted stakeholders' meetings to solicit opinions from various stakeholders concerning the Study.

The team has prepared this Final Report to summarize the results of the Survey. I hope that this report will be a valuable reference for the implementing agency of the project and other authorities concerned and believe it will contribute to the promotion of this project and to the enhancement of friendly relationship between our countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Nepal for their close cooperation and help extended to this Survey.

December 2016

Akira Nakamura
Director General
Infrastructure and Peacebuilding Department
Japan International Cooperation Agency

SUMMARY

1. Country Profile

Nepal is located in South Asia and is an inland country with a total land area of 147,000 square kilometers that shares its border with China and India. Its topography is characterized as flat plains, the Terai region in the south, hills in the center and mountains (Himalayas) in the north. More than 70% of the country is occupied by the Himalayas that stand high in the north from east to west of the country. The capital city, Kathmandu is located in the center of the country. The 2011 census recorded the population of the country totaling to 26.49 million people. The population growth rate was projected as 1.35%.

GDP of Nepal according to the Central Statistics Bureau of Nepal in 2013/14 is about US $ 19.8 billion, the GDP per capita is about 703 US dollars, the real economic growth rate is 5.4%, stable since democratization in1990. The ratio of GDP by industry classification (2014, WB) is 33.7% for primary industry, 15.6% for secondary industry, 50.7% for tertiary industry, and the tertiary industry such as tourism industry, information communication industry etc. which is playing vital roles in the economic growth of the country.

Nepal is facing regional disparity problem as Nepal's poverty rate (population proportion living on less than 1.25 dollars per day) is on a downward trend and according to the UN, it was 23.7% in 2010, but climbs to 43% in mountainous areas and hilly areas. There are over 100 ethnic groups in Nepal and 10 religions, and there are disparities against the background of caste and ethnic groups.

2. Background and Outline of the Project

Two of the country's District Headquarters are yet to be connected by trunk roads despite connecting all District Headquarters was one of the main targets set in the National Development Plan. Only 50 percent of the other trunk roads are paved. Practically, there is only one arterial that connects the Kathmandu Valley with the Terrain regions in the southeast area or the borders with the neighboring country India. It takes significantly long time to travel between Kathmandu and the Terrain plains in the eastern parts of the country as the route requires a detour to the western area. The geology alongside the road is steep and fragile making it vulnerable to damages triggered by heavy rains. Almost every year the road is temporarily closed to traffics due to slope failures or landslides. These issues have been raising urgency to secure stable and reliable roads to enhance logistics efficiency and lower the transport costs.

In the 13th Planning Approach Paper, the Government of Nepal aims to develop a stable and reliable transportation network with a view to socio-economic development throughout the country. In addition, the Master Plan for Strategic Road Network, 2005 and the Sector Wide Road Programme, 2007 both have prioritized construction/improvement of the Mid-hill Highway. As part of it, the government of Nepal has put forward the improvement of the Suryabinayak – Dhulikhel Road and has sought for the Grant Aid Assistance of Japan.

3. Project Scope

Table 1 shows the scope of the project. This includes widening of the existing road widening for a stretch of about 14.91 km (Suruyabinayak – Dhulikhel), construction of 1 bridge (Sanga bypass), replacement of 4 existing bridges, 20m long culvert at Sanga Pass for an underpass) , 6 pedestrian bridges, and improvements of 6 major intersections.

Table-1　Project Scope

Items	Dimensions/sizes	Remarks
Widening	To 4 lanes、L=14,910m	About 2km bypass at Sanga
New Bridge	PC（4lanes, L=198m）	Sanga area (5+520 ～ 5+718)
Replacement of existing bridges	N=4 locations	Jagati(1+700)、Bhikteshor(10+540)、Banepa(7+850, 12+100)
Underpass culvert	L=10m	Underpass at Sanga Pass (6+375)
Pedestrian bridges	4 spam RC bridge、N=6 locations	Suryabinayak (0+100), Jagati (1+50), Banepa (11+0 , 11+340, 11+820), Infront of Kathmandu University (13+270)
Intersection improvement	N=6 locations	Suryabinayak (0+000), Jagati (1+200), Sanga (4+900), Banepa (11+480), Infront of Kathmandu University (13+330), Dhulikhel (14+900)

Major geometric criteria applied are shown in Table-2.

Table-2 Major Geometric Criteria

Design Criteria		Class Ⅰ		Remarks
Design speed		80km/h	60km/h	80km/h Sections：0+000～4+830, 6+580～12+200 60km/h Sections：4+830～6+580, 12+200～14+920
Width (m)	Lanes	3.5	3.5	Standard for design speed of 80km/h applied
	Shoulder	3.0	2.5	
	Median	3.0	2.5	
Minimum horizontal radius (m)		210	115	
Crossfall (%)		2	2	
Maximum relative gradient (%)		10	10	
Maximum vertical gradient (%)		5	7	
Clearances (m)		5.0	5.0	Vertical

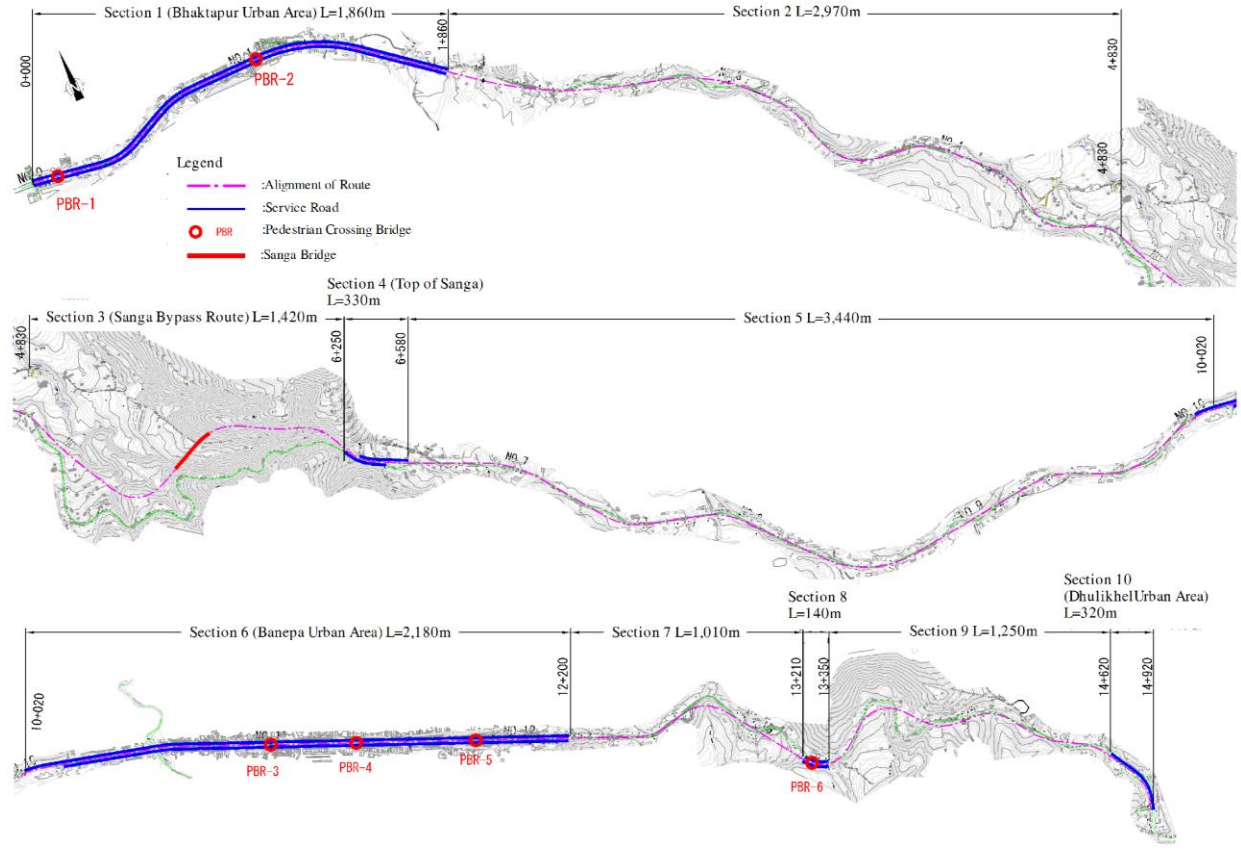


Figure-1 Route Summary Map

4. Project Schedule and Project Cost

1) Period

The project is planned to be constructed in two phases. Phase 1 will undertake detailed design of the entire section and construction of sections 1 to 4 (Suryabinayak to Sanga Pass). Phase 2 will undertake review of detailed design and construction of sections 5 to 10 (Sanga Pass to Dhulikhel).

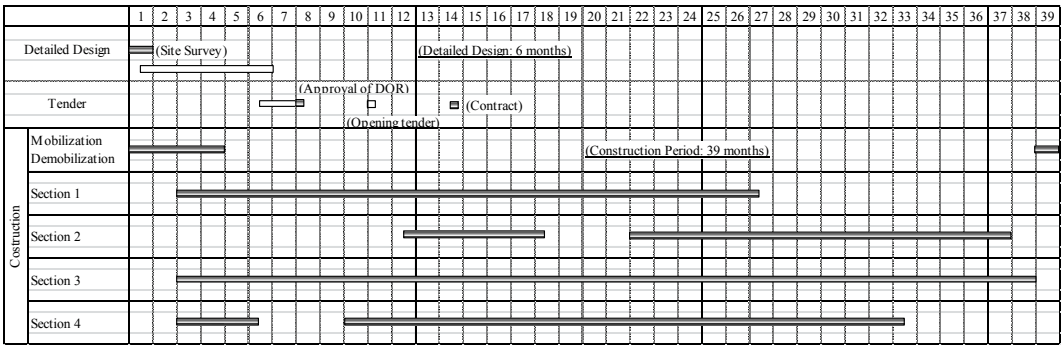
a) Phase 1 Implementation Schedule

After Exchange of Notes (E/N) is signed for detailed design, the consultant will carry out the detailed design and tender document preparation for construction works under Japan's Grand Aid Scheme. The consulting services of the detailed design would be completed in 6 months.

The construction will continue for 39 months till the completion of phase 1of the Project.

The overall time mentioned above is shown in Table -3.

Table-3 Implementation Schedule of Phase 1

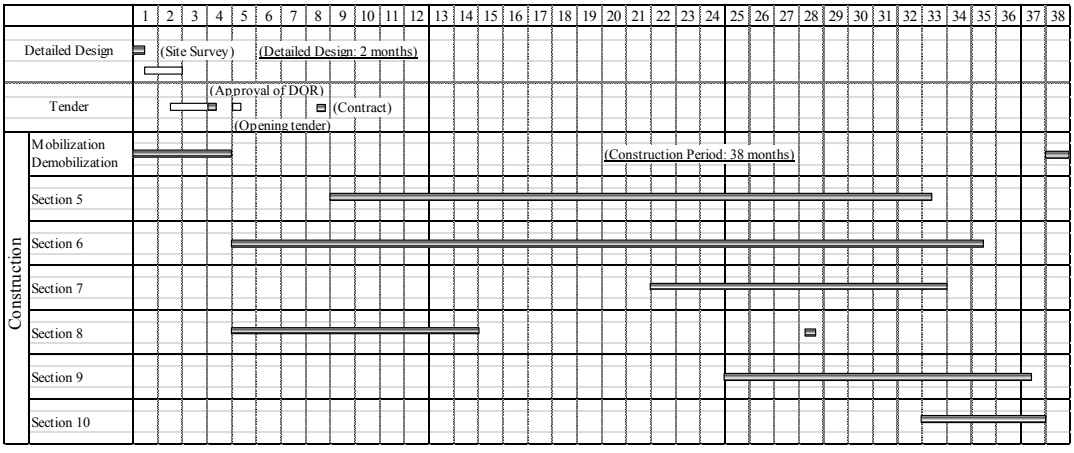


b) Phase 2 Implementation Schedule

After signing E/N for the detailed design and the construction work, the consultant will carry out the review of the detailed design and preparation of the tender documents for construction works. The consulting services of the detailed design would be completed in 2 months. The construction will continue for 38 months till the completion of phase 2 of the Project.

The overall period is as shown in in Table-4.

Table-4 Implementation Schedule of Phase 2



5. Project Cost Estimation

a) Cost to be borne by Japanese Side

JPY16. 039 billion (Phase I: JPY 9. 173 billion, Phase II JPY 6. 865billion)

b) Cost to be borne by Nepalese Side

The project cost to be borne by the Nepalese side is as shown in Table-5.

Table-5 Project Cost to be borne by Nepalese Side

Cost Item	Details	Approx. Cost (NRs)
Acquisition expense of road site	for existing road widening and new road	3,750,200
Acquisition & compensation expense	Site clearance within ROW (compensation for houses)	411,250
Relocation of religious facilities	Temples, shrines and monuments from ROW	450
Relocation of public utilities	Electric poles/cables, telephone cables and water fountains	42,256
Relocation of underground utilities	Relocation of drinking pipes and communication cables	86,495
Felling of trees	Felling of tree in ROW, grubbing up roots and disposal	1,330
Acquisition of disposal area	Disposal of unsuitable soil, asphalt and common concrete	14,538
Land for preparatory works	Leased land for construction yard and temporary place	24,358
Vegetation plantation along median strip	Planting and sodding after construction completion	4,050
Bus stop customs shed	Building bus shelters after completion of construction	300
Bank charge (in connection with (AP)		29,640
Total	4,364,867 thousands NRs	

c) Cost Estimate Conditions

i) Time of estimate : November 2015

ii) Exchange rate (Nepal Rupee) : NRs 1.00 = 1.16 Japanese Yen

iii) Exchange rate (US Dollar) : US$ 1.00 = 122.20 Japanese Yen

iv) Construction period : 39 months (Phase 1), 38 months (Phase 2)

v) Others :

This plan will be implemented in accordance with Japanese Government's grant aid guidelines. The above estimated project cost will be reviewed by the Japanese government before E / N.

6. Operation and Maintenance Cost

The operation and maintenance cost to keep the infrastructure provided under this project sustainable are as tabulated in Table-6.

Table-6 Cost to be borne by Nepalese Side for O&M

Item	Frequency	Component	Details	Approx. Cost	
				Phase1	Phase2
Cleaning road surface (by manpower)	Once a week	ROW	Clean road surface, shoulder, slope, side ditch	3,125	3,792
Cleaning intersection & bus-stop	Every 2 days	Road surface	Clean sidewalk etc.	927	1,140
Cleaning cross drainage	Once a year	Cross drainage	Clean box culvert & pipe culvert	15	28
Planting in median strip	4 times per year	Median	Planting & trimming	117	149
Maintenance of AC pavement	Ad hoc	Carriageway	Pathing 0.5% pavement area per year	1,410	1,815
Annual Operation & Maintenance Cost				**5,594**	**6,924**
Periodic maintenance of AC pavement	Every 10 years	Carriageway	Overlay of main lane & service road	243,773	316,284

Item	Frequency	Component	Details	Approx. Cost	
				Phase1	Phase2
Maintenance of sidewalk	Every 5 years	Sidewalk pavement	Replace damaged interlocking tiles	8,500	10,556
Maintenance of box culvert for river	Every 10 years	Revetment	Repair of gabions	1,139	3,447
Maintenance of lane marking	Every 3 years	Road surface	Painting of lane marking	59,783	71,932
Maintenance of traffic safety facilities	Every 5 years	Fence in median	Painting of Crossing prevention fence	13,506	18,067
	Every 5 years	Traffic sign board	Cleaning & Replace of traffic sign board	843	1,390
Periodic inspection of Sanga bridge (Subcontract)	Every 5 years	Whole bridge	Check & diagnose condition of bridge member	307	
Periodic inspection of pedestrian crossing bridge (Subcontract)	Every 5 years	Whole bridge	Check & diagnose condition of bridge member	614	1,229
Total Operation & Maintenance Cost for 20 years (Annual average of 20 years)				**440,339 (22,017)**	**561,394 (28,070)**

7. Project Evaluation

1) Relevance

The following reasons justify the relevance of this project to be implemented under the grant assistance of Japan.

- The project road (SD Road) of this project connects on both the start and the end points with roads that were constructed/improved under the grant aid assistance of Japan. The project begins from the end point of KB Road and ends at the beginning point of Sindhuli Road.
- The construction of the Mid-hill Highway, the highway where the project objective road (Suryabinayak – Dhulikehl Road) is a part of this road is given high priority in the development plans, “Strategic Road Network Development Plan”, in "Road Program and Priority Investment Plan (2007)" , and in “An Approach Paper to the Thirteenth Plan (APTP)”.
- The project road is a part of Asian Highway (AH42) that connects with another Asian Highway (AH2) and further proceeds to India. AH2 lies in the south of the country and runs from the east end to the west end. It is an important road that burdens the logistics of the country.
- Benefits of the project are not limited to residents including the poor along the objective road and extend to the people of Kathmandu and further to the citizens in the southeast Terai region.
- Nepal is capable to manage necessary resources for sustaining operation and maintenance of the infrastructures (Road, bridge and structures) constructed under this project.

2) Effectiveness

a) Quantitative Outcome

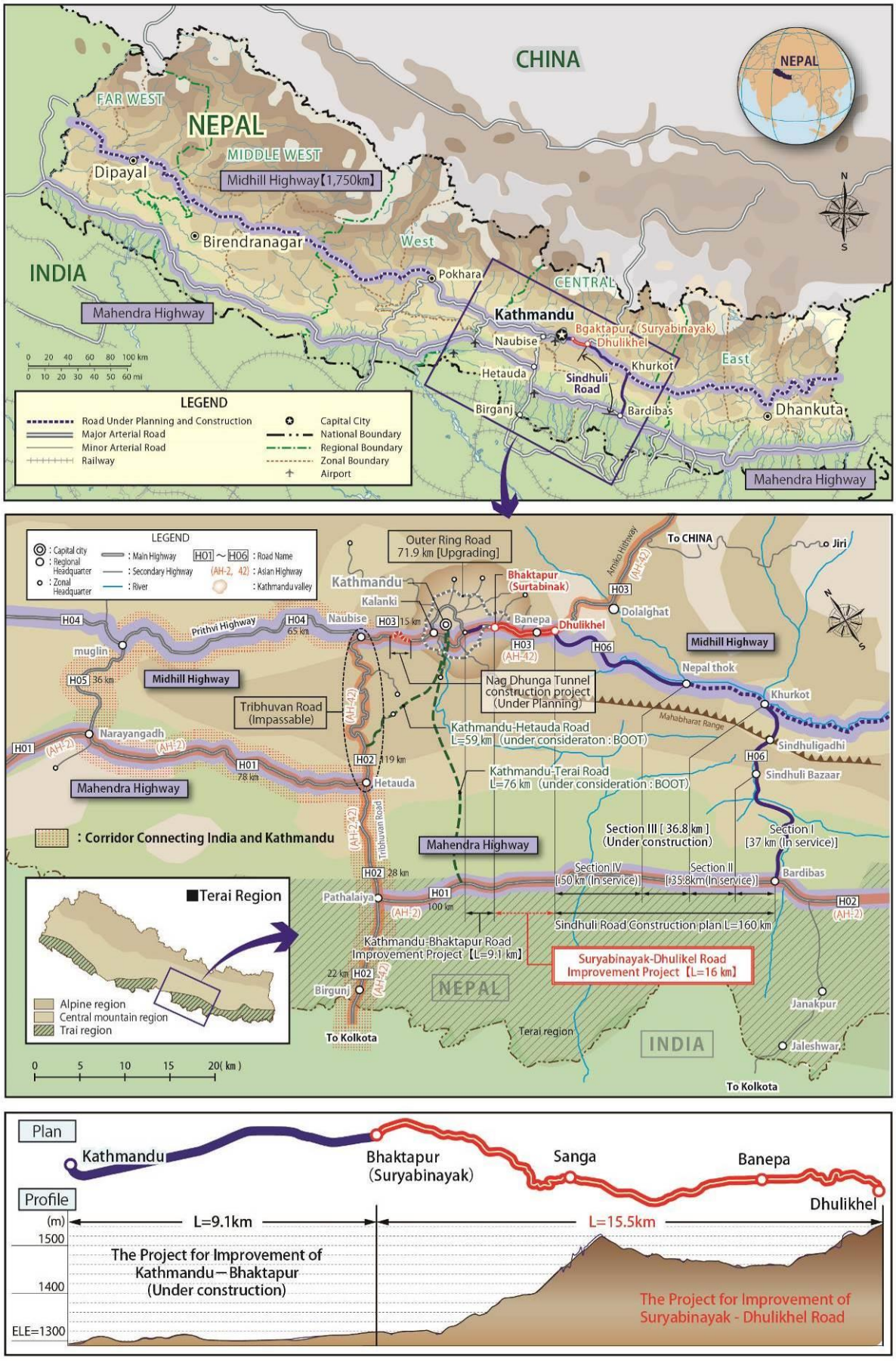
Expected quantitative outcome from implementation of this project is as shown in Table-7.

Table-7 Quantitative Outcome of this Project

Indicator	Vehicle Type	Travel Time (min)		Reduced Time (min.)
		Present (in 2015)	Target Period (3 years after Operation)	
Travel time reduction (approx.. 15km)	Large	38	24	14
(Suryabinayak to Dhulikhel)	Ordinary	31	14	17

b) Qualitative Outcome

- Enhancement of driving comfort
- Improvement of socioeconomic activities of residents along the road including improvement of emergency services due to enhancement of traveling performance and reduction in travel time.
- Contribution to reduction of CO2 emissions from vehicles due to improvement of drivability and alleviation of traffic congestion. Especially, provision of bypass at Sanga contributes in significant reduction of CO2 emissions and reduction of noise on the existing road and its vicinity.
- Provision of bypass at Sanga helps enhance reliability as severance due to slope failure can be avoided.



Project Location Map

Perspective (Sanga Bypass)

Perspective (Banepa Bazar)

Photo（1/3）：Site Condition

	
Start Point of the Project	Remaining Houses in Right of Way (ROW)
	
Embankment Section	Mountainous Section (Re-arraignment, Sanga)
	
Urban Section (Banepa)	End point of the Project

Photo（2/3）Major facilities and structures

	
Sacred Tree	Swimming Pool
	
Well	Underground Utility
	
Reservoir near Sanga	Bus Stop

Photo（3/3）：Major Meeting with Counterpart and etc.

	
Meeting on Minutes of Discussion (M/D)	Meeting on Technical Note (T/N)
	
Meeting with JICA Nepal Office	Expranation of Interim Report
	
Meeting on Minutes of Discussion 2	Explanation of Draft Final Report (DF/R)

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Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
ADB	Asian Development Bank
CDC	Compensation Determination Committee
DDC	District Development Committee
DOR	Department of Roads
EIA	Environmental Impact Assessment
E/N	Exchange of Notes
ESMF	Environmental and Social Management Framework
FGM	Focus Group Meeting
G/A	Grant Agreement
GESU	Geo-Environment and Social Unit
GOJ	Government of Japan
GON	Government of Nepal
IEE	Initial Environmental Examination
IRC	Indian Road Congress
JICA	Japan International Cooperation Agency
JPY	Japanese Yen
MOPIT	Ministry of Physical Infrastructure and Transport
MOPPW	Ministry of Physical Planning and Works
MOSTE	Ministry of Science Technology and Environment
NRs	Nepal Rupees
PAPs	Project Affected Persons
RAP	Resettlement Action Plan
ROW	Right of Way
SHM	Stakeholder Meeting
TOR	Terms of Reference
VDC	Village Development Committee
WB	World Bank

1. Background of the Project

1.1 Introduction

Being a landlocked mountainous country, the transportation system of the country is highly dependent on road transport. However, the existing road network in Nepal lacks reliability and safety. It lacks reliability due to the fact that the network does not have sufficient arterials as the road density accounts to only about 14km per 100 square kilometers, which stands lowest among the South Asian nations. It lacks in safety as only about 50% of the entire road network is paved and even the pavement on the arterials is in relatively poor condition. Two out of a total seventy five District Capitals in Nepal is yet to have direct access from an arterial road. It is not improper to say that the development of road network in Nepal is at an underdeveloped stage and has a long way to go ahead. Practically, there is no more than one arterial that currently connects Kathmandu Valley with the Terrain regions in the southeast area or the borders with the neighboring country India. It takes significantly long time to travel between Kathmandu and the Terrain plains in the eastern parts of the country as the route requires a detour to the western area. To make the situation worse, this only route is not only long and winding lacking safety but also lacks in reliability as it is frequently severed by landslides triggered by monsoon rainfall. It is therefore utterly important to ensure safety and reliability of the roads to secure smooth and safety traffic and improve logistics efficiency and lower the transport costs.

The traffic volume between Suryabinayak – Dhulikhel section as indicated by the traffic volume count survey conducted in 2012 already exceeded ten thousand vehicles per day. This sudden increase is considered to be the result of population influx and traffic increase in Kathmandu Valley, which is further expected to increase constantly. The opening of Sindhuli-Bardibas Road (July 2015) is expected to further contribute to the increase of the traffic volume.

To remedy the situations, the government of Nepal (GoN) on the country's thirteenth plan approaching paper emphasizes development/expansion of safe and reliable transport network for socio-economic development of the country.

The Master Plan for Strategic Road Network Development (2005) and Sector Wide Road Programme and the Priority Investment Plan/Ten Year Investment Plan (2007) recognize the importance of the Mid-hill Highway for the overall development of the country and sets high priority on its development. The objective section from Suryabinayak to Dhulikhel on the Arniko Highway is an integral part of the Mid-hill Highway as well as the Asian Highway 42. Development of this section is considered to be in line with the above mentioned national plans.

This survey was carried out upon request from the GON to the Government of Japan (GOJ) for a grant aid. It undertook the improvement of the existing Suryabinayak - Dhulikhel to establish an efficient road network such that it will contribute in the economic development of the country.

1.2 Request from Recipient Country

Request made by the GON in the grant aid assistance application is to improve a length of about 16 km (Suryabinayak to Dhulikhel) on the Arniko Highway including the following components; **i)** Upgrading to 4-lane road, ii) Installation of traffic signals and street lights, and iii) Provision of road safety facilities.

In this context, the major items to be undertaken by the GON were, but not limited to; i) Relocation of utilities, ii) Land and house acquisition, iii) Construction of footbridges, iv) Construction of service road (tracks), fly-over (overhead road) and underpass, and v) Installation of traffic surveillance system.

During the 1st and 2nd site survey carried out in July and August 2014 respectively, the DOR made strong request for undertaking changes in the project components in order to ensure early and easy achievement of project outcome right from after the completion of the project by possibly avoiding repetition of the bitter experiences learnt from relevant and similar projects implemented previously.

The components were prioritized and possibility of its inclusion were studied during analysis in Japan and during the third field survey (December 2014) taking into consideration the estimated project cost, expected project outcome, technical viability, and environmental and social consideration. The viability of the project as a Japan's grant aid including items to be undertaken by each government for the new components, listed hereunder in its priority order, were explained to and discussed with the DOR and its agreement attained.

(1) Objective Section

The objective section of this survey starts at Suryabinayak (end point of KB Road) and terminates at an intersection with the entrance point of Sindhuli Road. The total length is approximately 15 km.

(2) Improvement at Sanga Mountainous Area

The existing road at Sanga Pass consists of consecutive sharp curves and steep slopes. Widening and realignment of the existing road will require massive earthwork (cut and fill), provision of multiple bridges and retaining walls and is anticipated to have huge impact on construction cost and social and natural environment. Moreover, as a portion of the existing road needs to secure the existing traffic during construction, it will have significant influence on the construction efficiency. To avoid such impact, a bypass running adjacent (north side of the existing road) to the existing road was requested to be studied.

(3) Number of Lanes

Based on the results of traffic demand forecast, the number of lanes to be provided for the entire objective length will be 4 lanes (2 lanes on each direction). This indicates that the present 2-lane single carriageway needs to be improved to 2-lane dual carriageway (4-lane road with a median).

(4) Bus Laybys

Stretches where construction of service tracks will be undertaken by the Japanese side, bus laybys will be provided between the service track and the sidewalk with the purpose to secure safe and smooth traffic on the main road. Bus laybys where service tracks are to be constructed by the GON will be planned beside the main road. Bus shelters and

ancillaries will not be provided in both cases and will be undertaken by the GON necessarily.

(5) Service Tracks

Service tracks will be provided at built-up areas. Target areas are between Suryabinayak and Jagati, whithin Banepa Bazar, in front of Kathmandu University and Dhulikhel.

(6) Footbridge

Footbridges will be provided for enhancing safe and easy road crossing for pedestrians and bicycle riders at appropriate locations on sections where service tracks will be provided by Japan.

(7) Traffic Signals

Considering the current load shedding in the Kathmandu Valley, uninterrupted power supply and sustainable maintenance of traffic signal is deemed difficult. Therefore, provision of traffic signals is excluded from the project.

(8) Street Lights

For the same reason as that of traffic signals, provision of street lights will also not be included in this project.

(9) Traffic Surveillance System

Provision of traffic surveillance system will also not be included in this project for the same reasons as that for not including traffic signals and street lights. Traffic surveillance system means provision of CCTV cameras and construction of control rooms.

(10) Overpass and underpass

The objective road at Sanga Pass will have to be lowered from the elevation of the existing roads. An underpass will be planned for the main road and at-grade intersection for existing roads. Provision of a flyover at Banepa was excluded from the viewpoint that upgrading of the existing road suffices to achieve the project outcome.

1.3 Natural Conditions

1.3.1 Topography and Geology

Kathmandu Valley occupies an area of 26km on the east-west direction and 20 km in the north-south direction and is basically surrounded by high hills. It lies in an average altitude of 2,122 m. The altitude at the highest point is 2,762 and the lowest is 1,300m. Kathmandu, Madhyapur Thimi and Bhaktapur Districts lie in relatively flat region which gradually becomes steeper in the east upto Dhulikhel, although the terrain is low in Banepa.

The geological features of the Kathmandu Valley is comprised of two distinct deposits; i) lacustrine sediments and river bed sediments of the Quaternary Formation that are deposited atop the foundation in the central part of the valley, and ii) Precambrian epicenter of the Devonian (Paleozoic)" surrounding the basin. The lowland in the basin is clay in the west, sandy and gravel layer in the east. Earthquake here occurs due to the influence of the orogenic movement of the Himalaya Rift Belt.

The target road is part of the trunk road constructed in the sixties that extends from Kathmandu to the east. All the development is prominent along this road. Land use around the target road section is mostly

cultivated land and urban area, and only the 1.3 km section passing through the mountain area passes through forest. This forest area is designated as Suryamode Perungo Community Forest (21.87 ha), and the use of forest resources is permitted by the surrounding residents to a sustainable extent. The main tree species in the forest are Alnus nepalensis, Schima wallichii and Shorea robusta. (Refer to **Figure 1.3-1**)

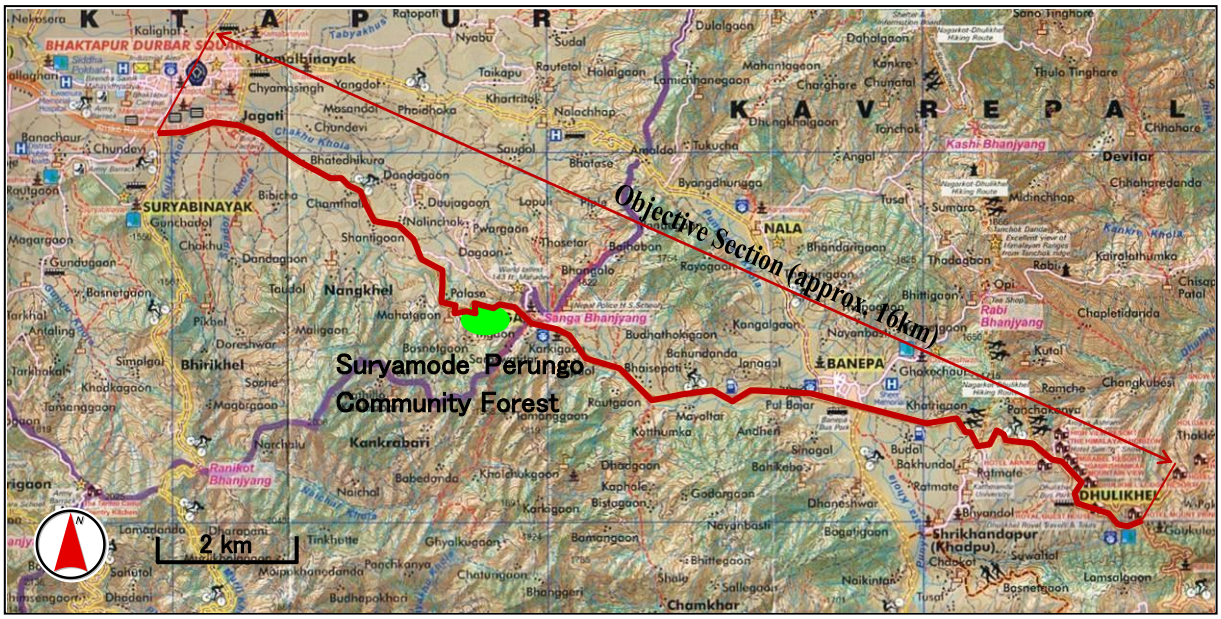
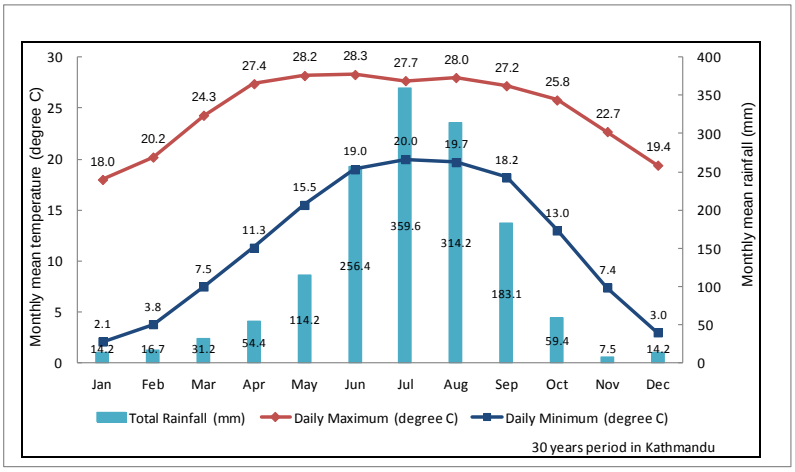


Figure 1.3-1 Forests and Tree Species

1.3.2 Climate and temperature

The Kathmandu Valley has a humid subtropical climate. **Figure 1.3-2** illustrates the climatic condition of the Kathmandu Valley. Light blue columns represent rainfall, dark blue line and red line indicates monthly mean temperatures. The numbers represent the average lows and highs for each month. During summer, average high temperature is about 28.3 ° C and average low temperatures are 19 ° C. Come Autumn/Winter, temperatures plummet with average highs of 26° C in the day time and 12.3° C generally after sunrise. The difference in the day and night temperatures are high which is attributed to the bowl shape of the Valley. The Valley is humid all through the year. Total annual precipitation is about 1350mm and up to 90% of its annual precipitation is received during the three summer months (June to September). The wind direction dominates the southeast in the rainy season and the northwest in the dry season.



Source：World Weather Information Service

Figure 1.3-2 Climate of the Kathmandu Valley

1.3.3 Earthquake

Nepal sits on the boundary of two massive tectonic plates - the Indo-Australia Plate and Asian Eurasian Plate and is prone to earthquakes. The Indo-Australia plate is moving northward and causing subduction under the Eurasian plate. An earthquake occurs due to the energy released at the time of the crustal deformation that occurs at this time. Earthquakes are frequently occurring in Nepal and its surrounding areas from long ago. List of earthquakes occurred after 1900 is tabulated in **Table 1.3-1**.

Table 1.3-1 List of Earthquakes Occurred in the 20th & 21st Century

Date	Region	Epicenter (km)	Magnitude	Estimated Acceleration (gal)
January 15, 1934	Nepal, North India, Tibet	177	8.4	88
May 27, 1936	Bihar region/India, Central Nepal	199	7.0	38
Sept. 4, 1954	Bihar region/India, Southeast parts/Nepal	163	6.5	34
July 29, 1980	Western part of Nepal	18	6.5	-
August 20, 1988	Kathmandu, Bihar region of India	197	6.5	36
April 25, 015(*1)	Northwest parts of Kathmandu	15	7.8	-

Source: The Study on Earthquake Disaster Mitigation in the Kathmandu Valley, March 2002 JICA *1 : wikipedia

The April 25, 2015 earthquake caused heavy damage to infrastructures. Many houses/buildings and walls collapsed or were severely damaged. Cultural heritages (temples, historical buildings) and conventional low-rise houses (typical Nepalese houses built with sun-dried bricks) were mostly affected. Buildings/houses in the Kathmandu Valley were relatively less damaged compared to those around the epicenter and the rubbles on the streets from the damaged houses have been cleared. However, the following restrictions on buildings are being imposed by the government.

- Cancellation of permission and approval of applications for new construction in order to revise the evaluation criteria for safety of buildings of three stories or more,
- Repair works and 2 story houses are excluded

From the hearings conducted with DOR and according to newspaper reports, damage to road infrastructure was small compared to buildings/houses. The five existing bridges between Kathmandu and Dhulikel were also intact causing no hindrance to traffics. **Figure 1.3-3** and **Table 1.3-2** show the damage situation of the Arniko Highway including the objective section of this project. Response (restoration works) to the damaged sections within Kathmandu and Dolalghat (east of Dulikhel, confluence point between the Sunkoshi River and the Indrawati River) have been completed and there are now no conspicuous damages obstructing the traffics.

Besides, there is little damage from the earthquake to both the existing road and the proposed bypass at the Sanga Pass. There are destresses on the pavement (cracks and corrugations) in the entire section of the Sanga Pass, but these are irrelevant to earthquake and are caused due to secular change.

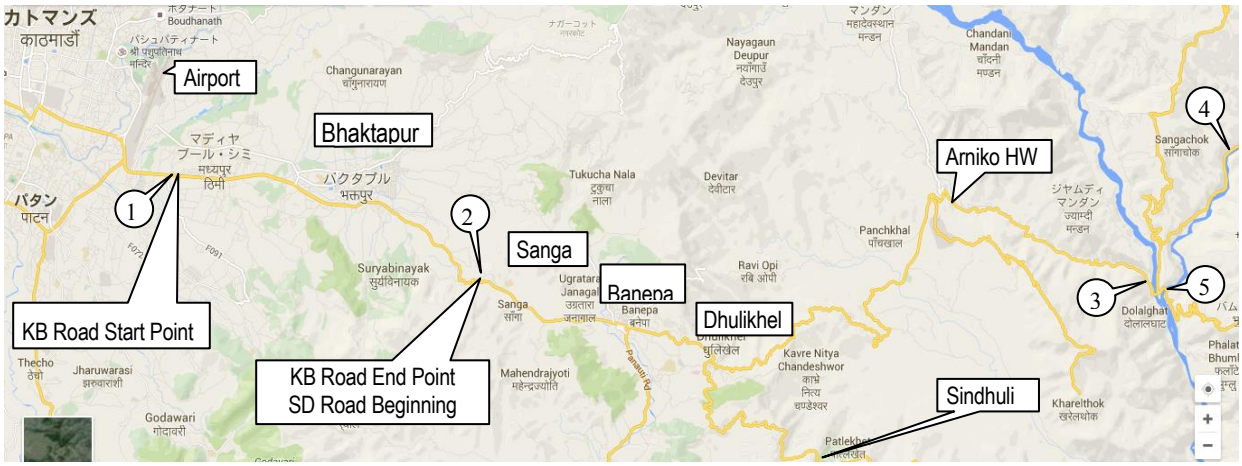


Figure 1.3-3 Damage Locations (KB and Objective Road)

Table 1.3-2 Location and Stretches of Damages on Arniko HW (Kathmandu – Dhulikhel)

No.	Road	Locality	Damages/Scale	Recovery/Restoration Works
1	Arniko Highway (KB Road)	Lokanthali to Kaushaltar	Damage: Cracks, collapse（L=500m） Scale: Severe	JICA project ” Urban Transport Improvement for Kathmandu” Cost:60 million NRs (Japanese Assistance), Period:2 months (July – September 2015), Method: Road surface sealing & repairing, Contractor: Local
		Kaushaltar	Damage: Displacement of Pedestrian Bridge Scale: Severe	Removal of superstructure on the Bhaktapur bound direction by DOR (Bhaktapur) in July 2015. Future restoration work to be determined
2	Arniko Highway (SD Road)	Sanga	Damage: Slope failure Scale: Minor	Removal of debris underway
3	Arniko Highway	Dolalghat (Sindhupalchok)	Damage: Partial collapse (river side), slope failure（L=30m） Scale: Large	Debris removal and provision of gabions at the toe of the slopes. Future restoration works include provision of gabions & drain treatment
4	Arniko Highway	Sindhupalchok District	Damage: Slope failure and landslide Scale: Large	Removal of debris (soil, rocks) underway.
5	Feeder Road (Sunkoshi Bridge)	Dolalghat (Sindhupalchok)	Damage: Expansion joint & Shoe protection wall Scale: Minor	Double span Truss bridge (out of DOR jurisdiction)

Note: Construction cost for response work for No 1. is based on the hearing from Bhaktapur Office of the DOR. Nikkan Kogyou Newspaper (Japanese) reports as about 80 Million Japanese Yen.

1.3.4 Hydrology

There are four major rivers in the Kathmandu Valley, the Bagmati River, the Manahara River, the Bishnumati River and the Dhobi River. The objective road passes through the Chakhu River Basin of the Manahara River flowing on the east side of the basin. Both flow down the basin with a gentle slope and run out from the southwestern part of the basin.

1.4 Environmental and Social Consideration

1.4.1 Environmental Impact Assessment

1.4.1.1 Outline of Project Component that have Impact on the Environment

The Project outline is as mentioned hereunder;

- Project Section : Suryabinayak – Dhulikhel (entry point of Sindhuli Road)
- Length of objective section : Approx. 16km (Widening: 13.6km, New provision: 2.4km)
- Type of project classification : Renovation (partially new construction)
- Number of Lanes : 4-lanes (Existing 2 lanes)
- Bridge : 5 locations (Reconstruction: 4, New construction 1)

Environmental Impact Assessment System in Nepal

According to " Environmental Protection Act 1996", development projects having potential environmental impacts require to conduct an Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) prior to the implementation. "Environment Protection (First Amendment) Rules 1999" regulates processes and procedures of the IEE and EIA. The Schedule 1 and 2 of the Environment Protection Rules mentions lists of projects required the IEE or EIA by sector. The projects required for each one is as below;

- Projects that Require Initial Environmental Examination

1. Construction of the following roads:
   (a) District roads, (b) Urban roads, (c) Rural roads, (d) Small feeder roads
2. Construction of major bridges
3. Constructions of tunnels
4. Improvement, up grading and reconstruction of national highways and feeder roads.

- Project that Require Environmental Impact Assessment

1. Construction of the following roads:
   (a) National highways, (b) Main feeder roads

Because the Project includes construction of new national highways, an EIA is required for the implementation.

1.4.1.2 Baseline of the Environmental and Social Condition

(1) Natural Environment

There are no protected areas in and around the target section of SD road. The distance between Shivapuri National Park that is the nearest protected area is more than 10 km. SD road runs through well-development areas. The land use along the target section (16 km) is mainly build-up areas or agricultural areas. The mountainous section (1.3 km) in the target section only runs through a forest zone. A part of this forest zone has been reignited as Suryamode Perungo Community Forest (21.87ha). The dominant tree species in this forest are Uttis (*Alnus nepalensis*), Chilaune (*Schima wallichii*) and Sal (*Shorea robusta*).

(2) Social Environment

The population and household of Bhaktapur and Kavrepalanchowk District as the survey area are shown in the **Table 1.4-1**. Bhaktapur District, adjoining Kathmandu city at the east has high population density

and low household size. The population density and sex ratio in Kavrepalanchowk District that is located in a transition zone in mountainous area are different from that of Bhaktapur.

Table 1.4-1 Population and Household in Survey Area

	Nepal	Bhaktapur	Kavrepalanchowk
Population (1,000)	26,494	304	381
Area in Sq. Km.	147,181	119	1,396
Population Density (Person/km^2)	180	2,560	274
Sex Ratio	94.1	103.42	91.93
Household (1,000)	5,427	68	80
Average Household Size	4.9	4.4	4.7

Source: National Population and Housing Census 2011, Central Bureau of Statistics

1.4.1.3 Pollution

Air quality and water quality analysis, and noise level measurement along the target section of SD road were carried out by a local consultant at three different locations shown in **Figure 1.4-1**. The result of air quality is compiled in **Table 1.4-2,** water quality in **Table 1.4-3**, and noise level in **Table 1.4-4.** The levels of Particulate Matter exceeds National Ambient Air Quality Standard. The BOD and Coliform in all surveyed rivers are high values. The noise levels of daytime and nighttime along the road exceed Noise Standard in Nepal.

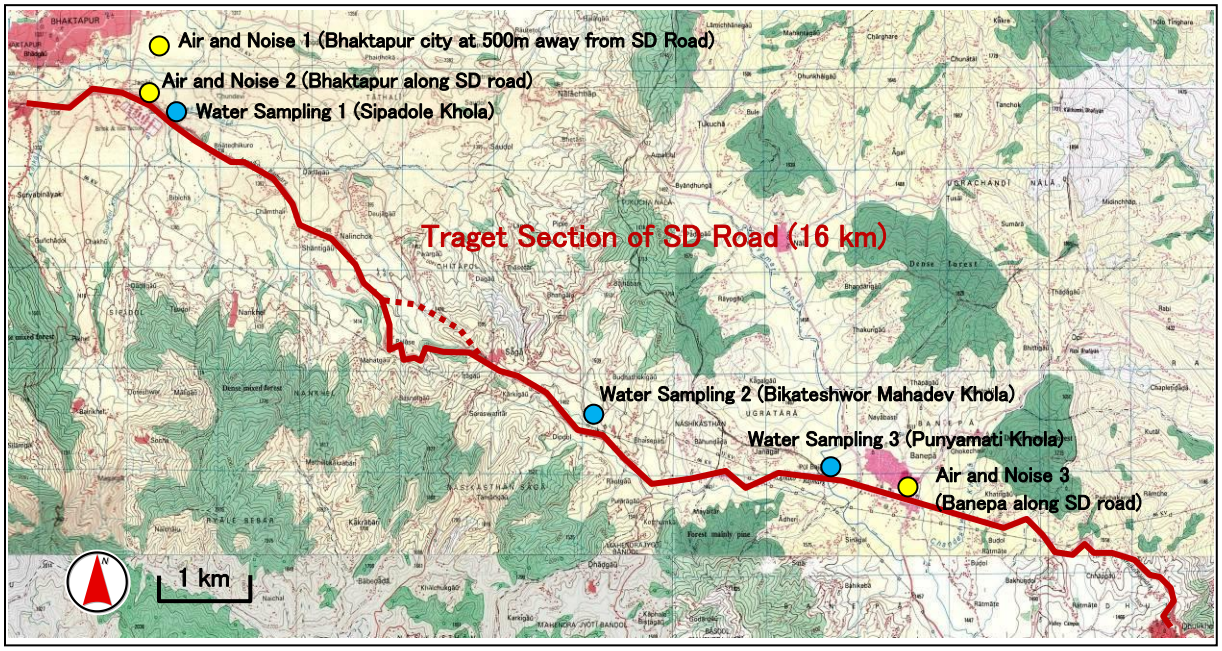


Figure 1.4-1 Survey and Sampling Points

Table 1.4-2 Result of Air Quality Analysis

Survey date: November 25 (Tuesday), 2014 (24 hours)

Survey Point	Bhaktapur (City)	Bhaktapur (Road side)	Banepa (Road side)	National Ambient Air Quality Standard
Total Particulate Matter (μg/m^3)	622	765	770	230
PM_{10} (μg/m^3)	604	728	531	120
NOx ($NO+NO_2$) (μg/m^3)	18.8	16.0	21.6	80
SO_2 (μg/m^3)	4.37	6.6	4.16	70

Table 1.4-3 Result of Water Quality Analysis

Sampling date : November 17 (Monday), 2014

Sampling Point	Sipadole Khola	Bikateshwor Mahadev Khola	Punyamati Khola
pH	7.2	7.2	7.3
Total Suspended Solids (mg/l)	8	15	22
Biological Oxygen Demand (mg/l)	6.8	7.8	30
Coliform (MPN/100ml)	>1100	>1100	>1100

Table 1.4-4 Result of Noise Level Measurement

Survey date: November 25 (Tuesday), 2014 (24 hours)

Survey Point	Bhaktapur (City)	Bhaktapur (Road side)	Banepa (Road side)	Noise Standard (Commercial Area)
Daytime (6:00~22:00)				
6:00 ~ 8:00 (dB)	64	77	79	
8:00 ~ 10:00 (dB)	73	80	81	
10:00 ~ 12:00 (dB)	69	79	80	
12: 00 ~ 14:00 (dB)	66	76	80	
14:00 ~ 16:00 (dB)	71	81	79	
16:00 ~ 18:00 (dB)	66	78	81	
18:00 ~ 20:00 (dB)	58	78	80	
20:00 ~ 22:00 (dB)	65	75	77	
LAeq (dB)	68	78	80	65
Nighttime (22:00~6:00)				
22:00 ~ 0:00 (dB)	57	69	72	
0:00 ~ 2:00 (dB)	51	67	68	
2:00 ~ 4:00 (dB)	49	57	63	
4:00 ~ 6:00 (dB)	54	76	70	
LAeq (dB)	54	71	69	55

1.4.1.4 Scoping Results

The potential environmental and social impacts of the project is shown in **Table 1.4-5**.

Table 1.4-5 Scoping Results

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction Phase Construction Phase	Operation Phase	
Pollution				
1	Air pollution	B-	B±	**Construction Phase::** ・ Operation of construction equipment will generate dust and emission gas. ・ Traffic congestion in construction site will cause increase in exhaust gas from vehicles. ・ Dust will occur in borrow pit and quarry site. **Operation Phase:** ・ In the future, total amount of air pollutant caused by vehicle exhaust gas will increase. ・ However, because of improved traffic efficiency, the amount may be reduced compared to without project.
2	Water pollution	B-	C-	**Construction Phase:** ・ Turbid water caused by construction works, especially bridge constructions, is likely to affect existing surface water resources. ・ In case of accidental massive leaking of fuel or oil, water pollution including ground water may occur. ・ In case of inadequate management in borrow pit and quarry site, turbid water from borrow pit and quarry site by rainfall may cause surface water contamination. **Operation Phase:** ・ Soil runoff due to heavy rain may occur in filling or steep slope sections and turbid water may cause surface water contamination. ・ In case of inadequate management or recovery in borrow pit and quarry site, turbid water from borrow pit and quarry site by rainfall may cause surface water contamination.
3	Waste	B-	C-	**Construction Phase:** ・ Construction waste caused by construction works and general waste from construction office will be generated. **Operation Phase:** ・ Illegal dumping of solid waste may increase along newly set parking spaces on road shoulder.
4	Soil pollution	D	D	**Construction Phase:** ・ Soil pollution is unlikely as materials that could cause pollution will not be used during construction. **Operation Phase:** ・ Soil pollution is unlikely as materials that could cause pollution will not be used during maintenance .

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction Phase Construction Phase	Operation Phase	
5	Noise and vibration	B-	B-	**Construction Phase:** ・ Construction works is likely to increase noise and vibration level. ・ Noise and vibration will occur in borrow pit and quarry site. **Operation Phase:** ・ In the future, noise and vibration level caused by vehicle driving will increase. However, because the distance between roadside and carriage way will be widened due to newly installed service road and footpath the level on road side may be reduced compared to without project.
6	Ground subsidence	C-	D	**Construction Phase:** ・ Subsidence due to fill loading may occur. **Operation Phase:** ・ Because pressure of loading on road will be low, subsidence is unlikely to occur.
7	Offensive odors	D	D	**Construction Phase:** ・ Impact of offensive odors from asphalt mixing plant will be limited. ・ Because materials and equipment to cause offensive odors will not be used in the construction works, offensive odors are unlikely to occur. **Operation Phase:** ・ Because vehicles with incomplete combustion as offensive odor sources are few, exhaust gas from vehicles is unlikely to cause offensive odor.
8	Bottom sediment	D	D	**Construction Phase/Operation Phase:** Because the construction works will not include dredging works and drainage of wastewater containing heavy metal or high-level organic substances, impacts on bottom sediment are unlikely to occur.
Natural Environment				
9	Protected areas	D	D	**Construction Phase/Operation Phase:** ・ There are no protected areas in and around the project site.

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction Phase Construction Phase	Operation Phase	
10	Ecosystem	B-	D	**Construction Phase:** ・ According to the EIA report, 320 silky oak (*Grevillea robusta*) trees in roadside will be lost by widening works. ・ Roadside vegetation will be lost by widening works. In a mountainous section, tree cutting in a community forest may be required depending on the alignment. ・ Agricultural ecosystem will be lost or disturbed by construction works. ・ Turbid water caused by bridge construction is likely to affect aquatic life. **Operation Phase:** ・ Because the target road section mostly passes through well-developed area such as agricultural land and urban area, considerable impacts on ecosystem are unlikely to occur. However, roadkill of animals is likely to increase due to increase in traffic lanes, more traffic volume and faster vehicle speed.
11	Hydrology	B	D	**Construction Phase:** ・ Water flow in the river or stream may be altered during construction works. **Operation Phase:** ・ Impacts caused by newly constructed road and bridge on surface water flow of rivers and streams are unlikely to occur.
12	Geographical features	B-	D	**Construction Phase:** ・ Topography will be changed in the new road section and mountainous areas. **Operation Phase:** ・ Impact on geographical features is unlikely to occur.
Social Environment				
13	Resettlement/ Land Acquisition	A-	D	**Pre-Construction Phase:** ・ According to the IEE report, 200 houses are located in Right of Way. Resettlement of these houses will be required. ・ In case of new road construction, additional land acquisition will be required. **Construction Phase:** ・ Temporal lease of land and additional small scale resettlement will be required. **Operation Phase:** ・ Additional resettlement and land acquisition will not be required.
14	Poor people	B-	D	**Pre-Construction Phase/Construction Phase:** ・ In case of inadequate compensation for resettlement, livelihood recovery of poor people will be difficult. **Operation Phase:** ・ Impact only on poor people is unlikely to occur.
15	Ethnic minorities and indigenous peoples	D	D	**Construction Phase/Operation Phase:** ・ Because of improvement project of existing main road, impact on culture and lifestyle of ethnic minorities is unlikely to occur.

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction Phase Construction Phase	Operation Phase	
16	Local economies, such as employment, livelihood, etc.	B±	B±	**Pre-Construction Phase:** ・ Land acquisition and resettlement may cause livelihood degradation of Project Affected Persons (PAPs). **Construction Phase:** ・ Construction will create job opportunities to local people. **Operation Phase:** ・ Reduction of travel time will contribute to local economies and promote tourism. ・ Road widening and faster vehicle speed will make it more difficult to access to social services and infrastructure.
17	Land use and utilization of local resources	B-	B+	**Construction Phase:** ・ In case of new road construction, land use, mostly agricultural land and residential area, will be shifted to Right of Way. **Operation Phase:** ・ Land use along the target road section will change and achieve economic and social development. ・ Improved transportation will contribute to effective utilization of local resources.
18	Water usage	B-	D	**Construction Phase:** ・ Existing agricultural canals located in roadside will be affected by widening works. **Operation Phase:** ・ Impacts caused by newly constructed road and bridge on water usage are unlikely to occur.
19	Existing social infrastructures and services	B-	B±	**Pre-Construction Phase:** ・ Relocation or protection of existing utilities, such as electric poll, water pipe and optical fiber cable will be required. **Construction Phase:** ・ Temporary traffic congestion in and around construction site will occur. **Operation Phase:** ・ Access to social services will be improved. ・ On the other hand, road widening and faster vehicle speed will make it more difficult to access to social infrastructure and may cause split of local communities or widening disparity.
20	Social institutions such as social infrastructure and local decision-making institutions	B-	B-	**Construction Phase/Operation Phase:** ・ Because of improvement project of existing road, considerable impact on social institutions is unlikely to occur. ・ Road widening including service road and faster vehicle speed will make it more difficult to access to social services and infrastructure, and may cause split of local communities or widening disparity.
21	Misdistribution of benefits and damages	C-	D	**Pre-Construction Phase/Construction Phase:** ・ Misdistribution of benefit among PAPs may occur. **Operation Phase:** ・ Because of improvement project of existing main road, considerable impact on misdistribution of benefit is unlikely to occur.

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction Phase Construction Phase	Operation Phase	
22	Local conflicts of interest	D	D	**Construction Phase/Operation Phase:** ・ Because of improvement project of existing main road, considerable impact on local conflict is unlikely to occur.
23	Cultural heritage	B-	D	**Construction Phase:** ・ According to the IEE report, there are a temple, four shrines and two sacred trees along the target road section. Depending on widening works, impacts on these cultural properties will occur. **Operation Phase:** ・ Because of improvement project of existing main road, considerable impact on religious value is unlikely to occur.  Pipal tree along road
24	Landscape	B-	D	**Construction Phase:** ・ 320 silky oak trees in roadside, which create beautiful scenery, will be lost by widening works.. **Operation Phase:** ・ Because there are no protected scenic view areas, considerable impact on landscape is unlikely  Silky oak trees in roadside
25	Gender	B-	D	**Construction Phase/Operation Phase:** ・ Women workers may be discriminated or sexually harassed by male workers and have different wage scale from male workers.
26	Children's rights	D	D	**Construction Phase/Operation Phase:** ・ Considerable impact only on children rights is unlikely

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction Phase Construction Phase	Operation Phase	
27	Infectious diseases such as HIV/AIDS	B-	D	**Construction Phase:** ・ Infection risks of HIV/AIDS may be increased among construction workers and local business offering food and entertainment. **Operation Phase:** ・ Being an improvement project of existing road in developed areas, considerable impact on infectious diseases is unlikely.
28	Working conditions (including occupational safety)	B-	D	**Construction Phase:** ・ Dust and emission gas may affect workers health. ・ Sanitary conditions around construction site may get worse due to waste from workers and toilet. **Operation Phase:** ・ Considerable impact on working conditions unlikely
Other				
29	Accidents	B-	B±	**Construction Phase:** ・ Labor accidents may occur in construction site, especially in tree cutting, slope protection and bridge construction works. ・ Traffic accident may occur at construction site **Operation Phase:** ・ Traffic safety including pedestrians will be improved by road widening and vehicle separation ・ Traffic accident due to more traffic volume and faster vehicle speed may increase ratio of traffic accident.
30	Trans-boundary impacts or climate change	B-	B±	**Construction Phase:** ・ Trans-boundary impacts including climate change will not occur. ・ Operation of equipment will generate CO_2. **Operation Phase:** ・ CO2 emission from vehicles will increase in future. ・ However, improved traffic efficiency may reduce.

A+/-: Significant positive/negative impact is expected., B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses), D: No impact is expected

* Impact Items referred from "JICA Guidelines for Environmental and Social Considerations April 2010"

1.4.1.5 Main Mitigation Measures

(1) Resettlement

Authorities concerned shall prepare and strictly implement a proper Resettlement Action Plan (RAP).

(2) Environmental pollution during construction phase

The contractor shall prepare and strictly implement mitigation measures against environmental pollution. The supervising consultant shall monitor the environmental conditions and complaints from the local people. If troubles occur, the supervising consultant shall direct the contractors to reconsider the construction technique and method.

For purchase from quarry firms, the firms shall have an official license and if needed the contract should include a task on environmental management to prevent potential issues at quarry sites.

(3) Impact on Religious Properties and Sacred Trees

The detail design consultant should consider the alignment to escape these properties at first. If the removals are required, the removal works should respect and follow Nepalese tradition and culture.

(4) Impacts on Traffic Condition

To ensure traffic safety of crossing SD road including pedestrians, improvement works of existing intersections and installation of crossover bridges should be implemented.

(5) Air Pollution in Operation Phase

Because of improved traffic efficiency, the amount may be reduced compared to without project. On the other hand, total amount of air pollutant caused by vehicle exhaust gas will increase in the future. The air quality monitoring system in Kathmandu valley should be strengthened. MOSTE should tighten the regulations on vehicle emission gas standards and fuel quality as needed.

1.4.1.6 Environmental Monitoring Plan

The environmental monitoring plan and draft form are shown in **Table 1.4-6**.

Table 1.4-6 Draft Environmental Monitoring Form

Environmental Item	Responsible Person and Organization	Monitoring Item/ Parameter	Location	Method	Frequency	Result
Construction Phase						
Air Quality	Supervising Consultant Contractor	Dust	Construction site	Visual observation Interview to pedestrians	Visual observation: Daily interview: Monthly or as needed	
Water Quality	Supervising Consultant Contractor	pH BOD Suspended Solid (SS) or Turbidity Coliform	River in and around construction site	Analysis using potable turbidity mete Instrumental analysis	Turbidity: Weekly or as needed Instrumental analysis: 4 rivers X 2 times	
Waste	Supervising Consultant Contractor	Disposal methods of construction and general waste	Construction site and disposal site	Visual observation Meeting with contractor	Visual observation: Daily Meeting: Monthly or as needed	
Noise and Vibration	Supervising Consultant Contractor	Noise level Vibration level	Construction site	Interview to local residents and pedestrians Instrumental measurement	Interview: Monthly or as needed Instrumental measurement: 5 points X 2 times	
Operation Phase						
Air Quality	Department of Roads	PM 10 PM 2.5 Sulfur Dioxide (SO2) Nitrogen Dioxide (NO2)	Along SD Road	Instrumental analysis	1 time X 2 points per year for 5 years after completion	
Waste	Local Government	Illegal dumping along SD road	Along SD Road	Visual observation	Monthly or as needed	

Environmental Item	Responsible Person and Organization	Monitoring Item/ Parameter	Location	Method	Frequency	Result
Noise and Vibration	Department of Roads	Noise level Vibration level	Along SD Road	Instrumental measurement	1 time X 2 points per year for 5 years after completion	
Vegetation	Department of Roads	Recovery condition of Vegetation	Road slop and borrow pits	Visual observation	Monthly or as needed	
Animal	Department of Roads Local Government	Condition of roadkill	Target section of SD Road	Visual observation	Monthly or as needed	
Traffic Condition	Department of Roads	Crossing pedestrians Intersection condition Number of traffic accident	Target section of SD Road	Interview to road users Traffic accident data	2 years after completion	
Project Affected Persons (PAPs)	Department of Roads Local Government	Living situations of PAPs	Target section of SD Road	Interview to PAPs	2 years after completion	

1.4.2 Land Acquisition and Resettlement

Land Acquisition (LA) and Involuntary Resettlement (IR) caused by the Project shall be planned, implemented, and monitored properly based on JICA's Guidelines with World Bank's Operational Policies. It will be secured by Nepalese domestic laws and regulations represented by Environmental and Social Management Framework (ESMF) of DOR in general. However, any policy gaps between above mentioned international policies/standards and Nepalese country system would be coordinated and solved by project specific measures in Resettlement Action Plan (RAP) and other relevant documents. RAP is attached as Appendix-6.

1.4.2.1 Components Causing Resettlement

(1) Estimated Impacts and Impact Areas

1) Positive Impacts

Suryabinayak - Dhulikhel Road is the only trunk road connecting Kathmandu and major municipalities and villages, such as Sanga, Banepa, and Dhulikhel. Increasing traffic capacity of the SD Road will contribute to regional connection and development, especially enhancement of mobility (transportation), logistics, farming products, socio-economic investment, commuting, and access to social facilities including hospitals. According to the development of Kathmandu City area, the east end point of the SD Road, Dhulikhel would be considered as one of the satellite town. Thus, improvement of the SD road will bring much positive impact in the project area and surrounding regions.

2) Negative Impacts

Land acquisition and resettlement will be required by the project components of road widening, curve improvement, construction of road-related facilities, etc. Displaced households will have negative impacts on their livelihood, production level, and living standards, especially vulnerable groups who occupy the land within right of way (ROW). Negative impacts are elaborated in the following sections.

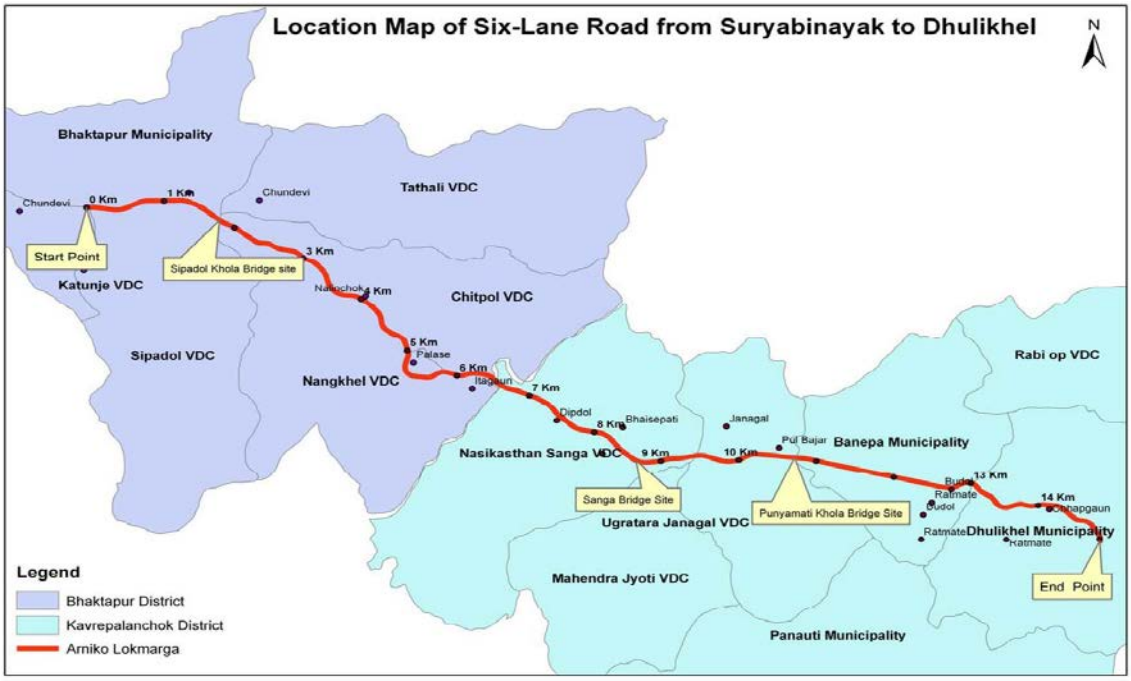
3) Impact Areas

The Project is located in Bhaktapur and Kavrepalanchok Districts. Most of the SD Road sections have ROW with land clearance such as in Banepa Town, however, some scattered local houses in Jagati, Nalinchowk, Sanga, and Dhulikel are observed. Major impact by land acquisition may be caused at such areas with private properties within ROW. The project affected area, including some Village Development Committees (VDCs) and Municipalities are presented in **Table 1.4-7** and **Figure 1.4-2**.

Table 1.4-7 The VDCs included in the Project Affected Area

District	VDC/Municipality	Ward No	Affected Households
Bhaktapur	Bhaktapur Municipality	12,11,7,6,2	30
	Sipadol VDC	1,2,8,9	70
	Nakhel VDC	9,8,7,1	33
	Chitapol VDC	1,2	48
Kavrepalanchok	Nasikasthan Sanga VDC	4,3,1,6	76
	Ugratara Janagal VDC	4,3,1,7,6	38
	Banepa Municipality	5,8,6,10,11	29
	Dhulikhel Municipality	6,7,4	37
Total			361*

Source: JICA Survey Team January 2015
* In addition to this number, 18 institutes are estimated to be affected



Source: IEE Report of Upgrading/Widening of Arniko Highway to Six Lane Standard - Suryabinayak-Dhulikhel Section, 2011

Figure 1.4-2 The VDCs included in the Project Affected Area

(2) Avoidance and Minimization of Impacts

Negative impacts caused by land acquisition and resettlement should be avoided as much as possible. If the situations cannot avoid such kinds of impact with possible measures, the impact should be minimized with technical and socio-economical means. Especially during the designing phase, the following points were considered in discussions of road alignment.

- Secure the traffic and pedestrian safety on the SD road and vicinity.
- Minimize the volume of soil disposal
- Minimize the number of persons required involuntary resettlement
- Avoid or minimize negative impacts on resource use, such as farmland, water and forest
- Avoid negative impacts on local cultural and religious places and activities.

During the discussions of road alignment, avoidance and minimization of affected households were taken into considerations in different level of route alternatives.

In addition, the following Nepali-specific conditions shall be taken into consideration formulate the most feasible and realistic schedule to minimize impacts on any properties and/or people's daily life.

- Nepali calendar and holidays.
- Agriculture season and off-season in the surrounding area of the ROW
- Dry season and Rainy season.
- Acceptability of night shift working

(3) Outline of the Possible Impact

Based on the results of the Census / Socio-economic survey conducted in the period of January to February 2015 along the road alignment (Suryabinayak to Dhulikhel) under the JICA preparatory Survey, estimated number of 2,202 persons of 361 households and 18 institutions are likely to be affected on their structure and land by the Project. Within the ROW of the SD road, there are observed some local temples, stone spout, communal wells, and other public/semi-public facilities related to people's life. Land acquisition and resettlement process should deal with such cases appropriately as same as the case of private properties within the affected areas. The RAP will be updated during the following detail design (D/D) phase according to final alignment and design.

Based on the relevant field surveys, total number of 379 households/institutions is likely to be affected by the Project. The 301 owners of structures are still staying in existing ROW illegally. The affected 18 institutions also need to be compensated. The summary of PAPs is shown in **Table 1.4-8**.

Table 1.4-8 Summary of the PAPs

Type of Loss	Number of Project Affected Household			Number of Project Affected Persons		
	Legal	Illegal	Total	Legal	Illegal	Total
Required for displacement						
1. House Holds (Structure owners within the ROW)	-	301	301	-	1,836	1,836

Type of Loss	Number of Project Affected Household			Number of Project Affected Persons		
	Legal	Illegal	Total	Legal	Illegal	Total
2. House Holds (Structure owners on private land)	35	-	35		214	214
3. Institutions (government offices, temple, etc.)	-	18	18		-	0
Sub-Total	35	319	354		2,050	2,050
Not required for displacement						
4. Land owner	25	-	25	152	-	152
Grand Total (1-4)	**60**	**319**	**379**	**152**	**2,050**	**1522,202**

Source: Census/Socio-economic Survey, Jan-Feb 2015

1.4.2.2 Elements of Impact

(1) Land

The Project alignment and impact zones were mapped out on the cadastral maps collected from the Survey Office in Bhaktapur and Kavrepalanchok during December 2014 to January 2015. These activities are divided into field verification, cadastral map scanning, cadastral survey in the field, and cadastral map digitization to find out affected land.

Land is one of the major private properties affected by the Project. Project affected land is classified into two major types: (1) land within the existing ROW, and (2) land beyond the existing ROW (private owned land). The cadastral survey shows that approximately 14 hector private lands will be required for the Project including new the alignment bypass area of Nalinchowk to Sanga and other curve improvements along the road. The necessary land areas in each VDC are shown in **Table 1.4-9**.

Table 1.4-9 Required Land Acquisition

S.N.	VDCs/Municipalities	Private Land (Sqm)
1	Bhaktapur	670
2	Chitpol	79,114
3	Nangkhel	15,583
4	Sipadol	2,000
5	Banepa	4,222
6	Dhulikhel	24,300
7	Nasikasthan Sanga	13,615
8	Ugratara Janagal	1,191
Total		**140,695**

Source: Cadastral Survey, Jan-Feb 2015

(2) Structures

Residential, business, and institutional structures are three major types of project affected structures across the project areas. There are few residential structures with small business along the road. However, other structures were set back after the Road Act 2031. There still are a lot of structures within ROW for the

business purpose to rent in or rented out. The Project will cause resettlement of 451 houses/structures (336 house owners) as shown in **Table 1.4-10**. Out of them, 18 houses/structures are belonging to institutions.

Table 1.4-10 Resettlement Needed for Houses/Structures

No.	Type	Number of House structures
1	Simple Hut/Shed	12
2	Thatched roof, walls constructed with bamboo and mud/stone	32
3	Tile/iron roof, walls constructed with brick/ mud/stone	151
4	Iron sheet/roofing with stone/ brick wall/cemented plaster	156
5	RCC Building	81
6	Movable kiosk /wall/fence etc.	19
Total		**451**

Source: Census/Socio-economic Survey, Jan-Feb 2015

(3) Trees and Crops

The field surveys identified altogether 320 trees along the SD Road (belonging to the government) and 293 trees belonging to the Community Forest that need to be fell/relocated under the Project. None of the private trees were counted with the affected land within the planned road alignment.

There are some farming areas in both within and beyond ROW and different kinds of crops including rice are grown. It is not necessary to pay compensation for the crops, if a project provides sufficient time (at least 6 months) for harvesting the crops. However, some compensation for the crops will need compensation, in the case of short notification (less than 6 months) by the Project to the crop owners.

(4) Loss of Public Resources and Utilities

There are some natural resources such as spring water including wells, perennial rivers and forest areas around Sanga pass section. Among that, the water-related utilities are used by community for their daily life. These facilities have been made and maintained by specific individual and/or community people since long. The followings are the major public utilities falls under the ROW of the SD Road:

1) Traditional use of water spouts

Some water spouts are located along the road and some of them are within ROW. These are the substantial water resource for the communities nearby, such as the point in Bhaktapur and the point near Sanga in Kavrepalanchowk district. Generally the local people want to relocate all such water related utilities while the Project implementation.

2) Seasonal Irrigation Canals

Being in the monsoon climatic zone, Nepal receives excessive rainfall in the rainy season / the summer with the duration between May to September in general. The monsoon rain does not come in regular basis, therefore, the farmers have to depend on perennial rivers for irrigation to their paddy field and the other farming activities. Therefore, different communities have built canals in different locations for their agriculture use. They have made some drainage canals along the both sides of road that may be disturbed by the Project. Therefore, the Project should rehabilitate such utilities in appropriate way.

3) Electric/telecommunication poles

Electric and telecommunication pole is one of the major obstacles for the Project that is extended along the whole road section. Electric and telecommunication poles located in the edges of the existing road have to be relocated to outside of ROW or project required width at each section before construction started by responsible authorities. These all electric and telecommunication poles are made of cement, metal and wooden materials. As per the existing engineering design, total of 588 electric poles and 490 telecommunication poles are required to be relocated.

(5) Temporary Loss of Land

The project requires some temporary land for the construction activities, construction yards/camp site, project office and stock piling area, etc. These required temporary lands should be managed by the contractor as per the agreement made with the project owner. The temporary land use (lease) should be properly and adequately compensated, if the land is a private property. It is preferable to use state land for the temporary purpose to reduce adverse impact on private land and to save cost of the Project.

1.4.2.3 Objectives and Scopes of the RAP

(1) Aim of the RAP

The aim of the RAP is to provide the policy and procedures of land acquisition, compensation and resettlement of affected persons. It has been prepared based on the findings of resettlement impact surveys conducted during the project designing period under the JICA's Preparatory Survey. The surveys identified the impact on property and income sources of PAPs with documentation of loss of properties within the expected project affected areas.

The RAP identifies safeguard measures including compensation, resettlement and rehabilitation assistances to the PAPs consistent with JICA's Environmental and Social Considerations Guidelines (2014) (hereinafter referred to as "the JICA's Environmental Guidelines") to fulfil any policy gaps between Government of Nepal and JICA. JICA's environmental guidelines, “Section 7. Involuntary Resettlement of Appendix-3” mentions “It is desirable that the Resettlement action plan include elements laid out in the World Bank Safeguard Policy OP 4.12 ("OP 4.12"), annex A”.

The RAP is designed based on the following important items:

- Laws, Regulations, and Policies by the GON related to land acquisition and resettlement;
- OP 4.12 and its relevant Annex and Involuntary Resettlement Sourcebook (World Bank);
- ESMF and other good practices in Nepal;
- Civil design of the Project;
- Results of socio-economic survey and census of the PAPs;
- Results of inventory of losses (IOL) survey for land, PAPs assets attached to land and livelihoods;
- Results of replacement cost survey (RCS)
- Results of stakeholder meeting (SHM) and focus group meeting (FGM) with PAPs; etc.

The RAP will be updated after the finalization of technical designs, such as detailed design (DD), and further property survey and socio-economic surveys by GON. The RAP particularly addresses the following adverse impacts associated with the Project. The social considerations have been incorporated into road design, however, geological and topographical factors, as well as land use situation and settlement patterns, require the acquisition of private property for road construction.

(2) Right of Way (ROW)

As per Nepal Government's Road Standard, all roads that are designated as highways have a ROW of 25 m on either sides from its centerline. In the context of the Arniko Highway, GON had proclaimed the public road between Kathmandu to Kodari as a highway based on the Highway Act 2021. GON then has published a notice in the gazette on 11/11/2021 declaring the 25 yards (equal to 22.8 m) of widths in each side from the central line of the road as ROW which was later amended as 25 m.

In addition to the above mentioned incident, as per the Supreme Court's decision, the GON decided that in a section of the Arniko Highway between Sanga Chock to Banepa (Chandeshwori River) has 25 yards (or 22.8 m) as ROW (as per National Gazzette of 11 March 2002). Thus, ROW of whole Arniko Highway (144km) from Kathmandu to China border Kodari, has been declared several times in different sections as **Table 1.4-11**.

Table 1.4-11 Declaration on ROW of the Project

Time	Document	Ministry	ROW	Section	Grounds
1964/11/11 [2021]*	Rajpatra (Gazette)	Ministry of Physical Planning and Works (MoPPW)**	25 yards	Kathmandu-Kodari (Arniko Highway)	Public Road Act 2021(Article 2 &3)
1977/3/20 [2034]	Rajpatra (Gazette)		25 meter	Kathmandu-Bhaktapur	Public Road Act 2031(Article 3)
2001/11/27 [2058]	IEE Report		25 yards	Sanga (Chowk)-Banepa (Chandeshwari Khola) 20km+870 to 26km+585	Public Road Act 2031(Article 3)

*Bikram Sambat (Nepali Calender)
** Already restructured to MOPIT

In addition to the Government's declarations, due to past unclear situations and processes regarding ROW, several Supreme Court cases have been observed on ROW of SD Road as **Table 1.4-12**.

Table 1.4-12 The VDCs included in the Project Affected Area

Time	Complaints	Decision
2001/11/1 [2058]	Acquiring the land 25 m both sides from centerline of Arniko Highway without compensation of the land [Location: Bhaktapur]	Dismissed all the processes of land acquisition and coded that to use land compensation measures written in article 4 of Public Road Act, 2031
2005/1/30 [2062]	Acquiring the land 25 m both sides from centerline of Arniko Highway without compensation of the land from Sanga Bhanjhyang to Dhullikhel	

*Bikram Sambat (Nepali Calender)

According to the past record as above, ROW of the SD Road is considered as shown in **Figure 1.4-3**.

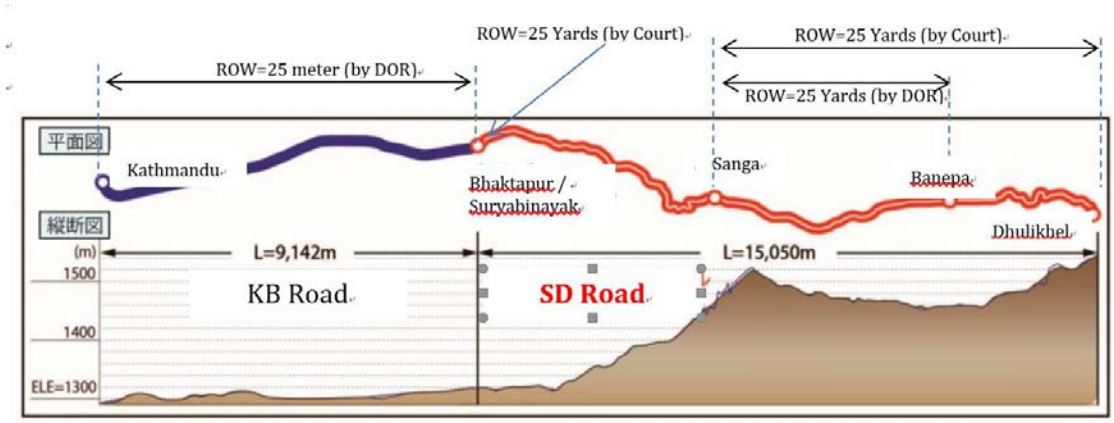


Figure 1.4-3 Declared ROW for the SD Road Sections

Though most people have set backed from the defined ROW, however they are still utilizing the remaining land as business purpose and agriculture activities. Some of them are paying land levy to local taxation offices. In such areas, they have constructed temporary structure for business purpose or cultivated for agricultural production and even rented to others.

Considering legal validity and court decisions as well as the principle of the JICA Guidelines for Environmental and Social Considerations, it is requested to apply ROW of 25 yards for the Project to cover adverse impacts appropriately and logically.

(3) Scope of the RAP

To set the scope of the RAP, available documents published from the DOR, JICA's reports prepared by the study team, and other relevant documents collected from different sources were reviewed while preparing the RAP. At the same time, formal and informal discussions and stakeholder meetings were also held at different levels and opportunities in order to access information related to the Project and opinions from PAPs. The RAP was prepared based on the methodology includes the census survey, the socio-economic survey including the cadastral survey, the inventory of loss (IOL) survey, the replacement cost survey (RCS) for potentially affected persons elaborated in the following chapters.

1.4.2.4 Socio-Economic Status

The field surveys regarding land acquisition and resettlement for the Project are intended to obtain the socio-economic information of the PAPs. The information obtained from household survey is useful for two major perspectives. First, the information formed the basis for the preparation for RAP, and second; they will be used it in course of monitoring and evaluation of project impact.

(1) Population

Of the total estimated households likely to have impacts on their land and structures are estimated as 361 households. For the Census / Socio-Economic survey, among the total households, 272 (75.0%) households could be reached to obtain detailed questionnaires on socioeconomic status as the sample survey. According to local people, some absentee's households were currently living outside from the project location, even in other countries, during the survey period for their jobs. Finally, all affected households and property will be surveyed during the detail design phase while updating the RAP.

Population Census 2011 of Nepal reports total population of the project affected VDCs and Municipalities as 154,873 where proportionate of male to female population is 77, 250 (49.9%), and 77,623 (50.1%), respectively. Average family size is 4.5 persons that is less than the national average.

The population of the project affected VDCs/municipalities are presented as **Table 1.4-13**.

Table 1.4-13 Household and Population of Affected VDCs & Municipality

VDC	No. of House Holds	Male	Female	Total	Ave. House Hold Size
Bhaktapur Municipality	17,639	41,081	40,667	81,748	4.6
Sipadol	2,278	4,862	5,014	9,876	4.3
Nangkhel	1,225	2,703	2,806	5,509	4.5
Chitapol	1,274	2,758	2,861	5,619	4.4
Nasikasthan Sanga	1,305	2,935	3,186	6,121	4.7
Ugratara Janagal	1,634	3,464	3,489	6,953	4.3
Banepa Municipality	5,540	12,325	12,439	24,764	4.5
Dhulikhel Municipality	3,279	7,122	7,161	14,283	4.4
Total	**34,174**	**77,250**	**77,623**	**154,873**	**4.5**

Source: Census 2011, Central Bureau of Statistics (CBS)

The socio-economic status of PAPs is based on the information obtained from 272 (75.0%) households of the total affected households/landowners. The total population of surveyed households is 1,680 where 862 (51.31%) are male and 818 (48.69%) female.

The population composition of project affected surveyed households is presented in **Table 1.4-14**.

Table 1.4-14 Distribution of Project Affected Households

District	VDC/Municipality	Households	Male	Female	Total
Bhaktapur	Bhaktapur Municipality	27	90	94	184
	Chitpol	22	69	60	129
	Nangkhel	26	90	74	164
	Sipadol	49	171	169	340
Kavre	Banepa Municipality	20	59	48	107
	Dhulikhel Municipality	23	87	71	158
	Nasikasthan Sanga	73	221	217	438
	Ugratara Janagal	32	75	85	160
Total		**272**	**862**	**818**	**1,680**

Source: Census/Socio-economic Survey, Jan-Feb 2015

The age distribution of PAPs was analyzed. The survey shows that the population between 0 to 14 years which is defined as 'minor age' covers 20.71% while other dependent aged group (>60 years) population covers by 9.82 % . More than two-third (69.46%) of the project affected population are known as economically active population age group (15-59 years).

The **Table 1.4-15** shows the distribution of different age group populations across the SD Road.

Table 1.4-15 Population Size by Age Group

Districts	VDC/ Municipality	HHs	Less than 4 Years	5-14 Years	15-59 Years	More than 60 Years	Total
Bhaktapur	Bhaktapur Municipality	27	12	15	135	22	184
	Chitpol	22	4	10	96	19	129
	Nangkhel	26	11	22	116	15	164
	Sipadol	49	32	43	243	22	340
Kavre	Banepa Municipality	20	8	23	69	7	107
		23	19	19	104	16	158
		73	26	68	293	51	438
		32	7	29	111	13	160
		272	**119**	**229**	**1,167**	**165**	**1,680**
%			**7.08**	**13.63**	**69.46**	**9.82**	**100**

Source: Census/Socio-economic Survey, Jan-Feb 2015

As indicated by the results of household surveys, most of the female in the project area are mainly responsible for caring and bearing children, daily house affairs, small domestic businesses, and agricultural works. During the stakeholder meetings or the focus group meetings, the presence of female participants was lower than male. The Socio-economic survey shows that 21 households (8% of surveyed households) are women headed.

(2) Ethnic Composition

Ethnic composition plays vital role still in various Nepalese societies that reflect directly in the socio-economic status and living standard of the people. Therefore, ethnicity, culture, and religions are also important factors needing attention when new projects are conceived, designed, and implemented in the area. The responses of these social attributes to outside interventions should be considered according to the social value and attitude prevailing in the societies as like tradition.

Among the total affected household, about 68 % of all households are Janajati (mainly Newar and Tamang by castes) ethnic groups along the project area where 11.03 % are Brahmin and 15.81 % are Chhetri. Few of Dalit[1] and others population were found residing nearly 5 percent across the project area.

Ethnic composition of the project affected households is shown in **Table 1.4-16**.

Table 1.4-16 Ethnic Composition of Affected Households (HHs)

District	VDC	HHs	Brahmin	Chhetri	Janjati	Dalit	Others	Total
Bhaktapur	Bhaktapur Municipality	27	-	-	26	-	1	27
	Chitpol	22	-	8	13	1	-	22
	Nangkhel	26	2	13	8	1	2	26
	Sipadol	49	1	10	37	-	1	49
Kavre	Banepa	20	6	3	6	1	4	20

165165

[1] A member of a South Asian group of people traditionally regarded as untouchables or outcastes

District	VDC	HHs	Brahmin	Chhetri	Janjati	Dalit	Others	Total
	Municipality							
	Dhulikhel Municipality	23	5	5	12	1	-	23
	Nasikasthan Sanga	73	6	-	66	1	-	73
	Ugratara Janagal	32	10	4	17	1	-	32
	Total	272	30	43	185	6	8	272
%			**11.03**	**15.81**	**68.01**	**2.21**	**2.94**	**100**

Source: Census/Socio-economic Survey, Jan-Feb 2015

(3) Occupational Status

The census/socio-economic survey shows that more than one third (35.3%) of populations depend on trade/business likewise agriculture and households work cover 17.9 and 18 % respectively. 13.7 % of the project affected population depends on different service sectors. Dependency on labor, foreign employment, and pension are also recorded. Occupational status is shown in **Table 1.4-17**.

Table 1.4-17 Occupational Status of Surveyed population

Occupation	Bhaktapur District				Kavrepalanchok District				Total	%
	Bhaktapur	Chitpol	Nangkhel	Sipadol	Banepa	Dhulikhel Municipality	Nasikasthan Sanga	Ugratara Janagal		
Agriculture	6	12	29	22	6	17	52	35	179	**17.9**
Business/ Trade	38	25	16	78	36	41	92	27	353	**35.3**
Service	20	17	21	26	9	8	27	9	137	**13.7**
Domestic work	24	14	13	29	6	2	68	24	180	**18.0**
Labour	7	5	6	7	2	6	6		39	**3.9**
Foreign Employment	4	6	3	4			10	1	28	**2.8**
Others	14	12	6	12	4	11	16	9	84	**8.4**
Total	**113**	**91**	**94**	**178**	**63**	**85**	**271**	**105**	**1,000**	**100**

Source: Census/Socio-economic Survey, Jan-Feb 2015

(4) Educational Status

The overall educational status of the project affected population is comparatively high. The census/socio-economic survey shows that about 88 % of the populations are literate. Of the total population, 44 percent of the literate populations are having higher degrees (+2 to Bachelor). Nearly 8 percent of the literate population can read and write only that means they gained or sustained their knowledge by non-formal education or somewhere else. However, 12 % project affected populations are mentioned illiteracy of them. **Table 1.4-18** presents the educational status of the project affected population surveyed.

Table 1.4-18 Educational Status of the Project Affected Population

District	VDC/ Municipality	Illiterate	Read/ write only	1-10 Class	Passed			Total
					Class 10	Certificate level	Bachelor level or above	
Bhaktapur	Bhaktapur Municipality	24	16	44	25	33	30	172
	Chitpol	17	9	37	20	27	15	125
	Nangkhel	10	13	67	25	31	7	153
	Sipadol	30	22	114	43	55	44	308
Kavre	Banepa Municipality	16	6	42	17	12	6	99
	Dhulikhel Municipality	11	12	49	23	26	18	139
	Nasikasthan Sanga	55	36	145	89	65	22	412
	Ugratara Janagal	26	10	67	28	15	7	153
Total		189	124	565	270	264	149	1,561
%		**12.1**	**7.9**	**36.2**	**17.3**	**16.9**	**9.5**	**100.0**

Source: Census/Socio-economic Survey, Jan-Feb 2015

(5) Skill Availability

Very limited members among surveyed PAPs seem to have acquired competitive skills on various activities from which they would increase their income. 52 persons out of 109 persons of PAPs have computer knowledge and 23 have different technical knowledges. In addition, 8 persons have sewing skill and another 7 have driving skill. Carpenter, mason and some other kinds of skill holders are also found in PAPs. **Table 1.4-19** presents the skills availability of the surveyed PAPs.

Table 1.4-19 Status of Skill persons of Surveyed households

District	VDC	Masonry	Carpenter	Sewing/cutting	House wiring	Driving	Technical work	Computer	Others	Total
Bhaktapur	Bhaktapur Municipality		1				2	8		11
	Chitpol							12		12
	Nangkhel	1		2		2		16		21
	Sipadol		2				9	1		12
Kavre	Banepa			3		1	10		2	16
	Dhulikhel			3		1	1	14	3	22
	NasikasthanSanga		1		1	2	1	1	5	11
	Ugratara Janagal					1			3	4
	Total	**1**	**4**	**8**	**1**	**7**	**23**	**52**	**13**	**109**

Source: Census/Socio-economic Survey, Jan-Feb 2015

The skill availability among PAPs will be a major factor for their consideration in being employed in the project construction and its related activities. The expectation of PAPs from the project is that the project should be given priority to them for employment during construction period.

(6) Household Income

Around 7% of affected households fall in the low income group. There annual income income is less than NRs. 50,000 per year. About 40.4 % of the project affected households are in a range of annual income between NRs 100,000 to 200,000 per year that falling medium level income group. Similarly (37.5% of the surveyed households have annual income between NRs 200, 000 to 5000,000. It can be said that around 15 % of the households are in a high income group with their annual income of over NRs 500,000. **Table 1.4-20** shows the average annual income of the project affected households by VDCs/Municipalities.

Table 1.4-20 Average Annual Income range of the Surveyed Households

VDC/ Municipality	< 0.05 Million NRP	0.1-0.2 Million NRP	0.2-0.5 Million NRP	> 0.5 Million NRP	Total
Bhaktapur	1	7	12	7	27
Chitpol	0	10	9	3	22
Nangkhel	0	9	12	5	27
Sipadol	2	14	24	9	49
Banepa	1	12	6	1	20
Dhunikhel	2	8	9	4	23
Nasikasthan Sanga	2	35	26	10	73
Ugratara Janagal	11	15	4	2	32
Percentage	**7.0**	**40.4**	**37.5**	**15.1**	**272**

Source: Census/Socio-economic Survey, Jan-Feb 2015

(7) Food Sufficiency from own Agriculture Production

Food sufficiency is measured in terms of months that the families' sufficiency of own farm production to household's needs. According the results of the survey, only 2.2% households have food sufficiency for the whole a year. A majority (81.99%) of the households have only food sufficiency less than 3 months by their own production because most of the households depend on business and wage based occupations. Nearly one-tenth of the households' have food sufficiency up to 3 to 6 months. The survey results on food sufficiency has categorically analyzed by the food sufficiency status up to 3 months, 3 to 6 months, 6 to 12 months and above 12 months.

The food sufficiency status of surveyed household is presented **Table 1.4-21**.

Table 1.4-21 Food Sufficiency Status among Project Affected Areas

District	VDC/Municipality	Less than 3 Month	3 to 6 Months	6 to 12 Months	12 or more the 12 months	Total
Bhaktapur	Bhaktapur Municipality	26			1	27
	Chitpol	21		1		22
	Nangkhel	25		1		26
	Sipadol	41	2	6		49
Kavre	Banepa Municipality	20				20
	Dhulikhel Municipality	20	1	2		23
	Nasikasthan Sanga	55	11	4	3	73
	Ugratara Janagal	15	11	4	2	32

District	VDC/Municipality	Less than 3 Month	3 to 6 Months	6 to 12 Months	12 or more the 12 months	Total
	Total	223	23	18	6	272
	%	**81.99**	**9.19**	**6.62**	**2.21**	**100**

Source: Census/Socio-economic Survey, Jan-Feb 2015

(8) Fulfillment of Food Deficiency

The households resort to several other supplementary sources to make up the food deficit. About 74 % households make their food deficit by business activities. Similarly 15% household by wage labor and 11 % households depend on remittance.

Table 1.4-22 is presented the fulfillment of food deficiency of survey households:

Table 1.4-22 Fulfillment of Food Deficiency

Districts	VDC/Municipality	Business	Labor Wage (Local)	Remittance	Total
Bhaktapur	Bhaktapur Municipality	19	2		2
	Chitpol	13	1		1
	Nangkhel	7	4		4
	Sipadol	40	-		
Kavre	Dhunikhel Municipality	16	-	1	1
	Nasikasthan Sanga	47	22	11	33
	Ugratara Janagal	14	2	11	13
	Total	**156**	**31**	**23**	**210**
%		**74**	**15**	**11**	**100**

Source: Census/Socio-economic Survey, Jan-Feb 2015

(9) Acceptance / Impression of the Project

Based on the interview survey, different acceptance / impression of the project were observed among PAPs as described in **Table 1.4-23**. PAPs has not given specific amount of compensation and assistance, therefore, the interview just provided simple alternative, such as “Good” and “Bad”. As a result, around 10% showed "Bad" impression while more than 85% selected "Good" or "Good and Bad". People who selected "Good and Bad" had intention that they have to consider conditions, such as compensation for land within ROW.

Table 1.4-23 AP’s Acceptance / Impression of the Project

District	VDC/ Municipality	Don’t Know	Bad	Good	Good and Bad	Very good	Total
Bhaktapur	Bhaktapur Municipality	1	2	1	23		27
	Chitpol		2	2	18		22
	Nangkhel	1	1	4	20		26
	Sipadol		5	5	39		49
Kavre	Banepa Municipality				20		20
	Dhulikhel Municipality		5		17	1	23
	Nasikasthan	6	7	12	48		73

District	VDC/ Municipality	Don't Know	Bad	Good	Good and Bad	Very good	Total
	Sanga						
	Ugratara Janagal	6	5	1	20		32
Total		14	27	25	205	1	272
	%	**5.15**	**9.93**	**9.19**	**75.37**	**0.37**	**100**

Source: Census/Socio-economic Survey, Jan-Feb 2015

(10) Physical Relocation

All the PAPs have agreed to physical relocation or set back their affected properties if they get proper compensation amount. However, some PAPs showed their opinion that compensation for land within ROW is needed for their relocation. ROW has been declared and court decision also support that the land within ROW is not eligible for compensation. Structures within ROW should be compensated, and PAPs that become landless due to the loss of land within ROW should also be compensated.

(11) Compensation Mode

Around 79 % of PAPs put first priority on cash compensation, while nearly 5 % of them have perceived structure for structure and land for land compensation in kind. Some people didn't have clear idea or opinion regarding the compensation mode.

According to the Land Acquisition Act 1977, the modality of compensation payment will be determined by the project proponent and the authoritative Compensation Determination Committee (CDC) in district level. The results of opinion from the affected households are shown in **Table 1.4-24**.

Table 1.4-24 Perception about Compensation Modes

District	VDC/Municipality	Not Answer	Cash	Land for Land	House for house	Land for land & house for house	Total
Bhaktapur	Bhaktapur	2	25				27
Bhaktapur	Chitpol		16	2	4		22
Bhaktapur	Nangkhel	2	18	3	2	1	26
Bhaktapur	Sipadol	3	46				49
Kavre	Banepa		19		1		20
Kavre	Dhulikhel	1	22				23
Kavre	Nasikasthan Sanga	6	41	11	7	8	73
Kavre	Ugratara Janagal		27		1	4	32
Total		14	214	16	15	13	272
%		**5.15**	**78.68**	**5.88**	**5.51**	**4.78**	**100**

Source: Census/Socio-economic Survey, Jan-Feb 2015

1.4.2.5 Stakeholder Meeting and Information Disclosure

During the survey, stakeholder meeting (SHM) has been conducted with aim to collect information and opinion from the residents nearby planned project sites based on the JICA's Environmental Guidelines and Nepali legal framework of EIA. The process may reduce or eliminate potential negative impacts of the

project for the local residents and prepare in advance to deal with the remaining impact caused by the project preparation, implementation and operation. Main objectives of the SHM are:

i) Dissemination of information on the Project plan to project-affected-people and local communities.
ii) Collection of opinions and comments of project-affected-people and local communities on the Project plan, particularly on the proposed impact mitigation measures.
iii) Promotion of the active participation of project-affected-people and local communities into the Project implementation from the early stage of the Project planning.
iv) In particular, promoting the participation of project-affected-people and local communities into the tasks relating to compensation, resettlement, and land clearance for the Project.
v) Ensuring the accountability of the tasks relating to land acquisition, compensation, resettlement, and livelihood restoration.

According to the JICA's Environmental Guidelines, it is required to organize 2 times of SHMs for a Category A project as this project. The first SHM, which is conducted at the time of discussing draft scoping document according to EIA preparation, should include the following items:

(i) Dissemination of information on the Project (background, development needs, etc.);
(ii) Explanation on anticipated impacts;
(iii) Collection of participants' opinions/comments on the Project.

The second SHM, which is conducted at the time of draft survey report with the results of scoping, should have the following items:

(i) Explanation on mitigation measure;
(ii) Promotion of public participation into the Project implementation.

In parallel with the stakeholder meetings, the following public involvement activities have been done to understand people's opinion and situation deeper.

(i) Government - Representative of PAPs Meeting
(ii) Focus Group Discussion

(1) Types of Consulted Persons

Each representative of the governmental organizations and the community groups such as the following organizations and groups were participated in the stakeholder meeting and other public participation opportunities.

- Village Development Committee (VDC/ Municipalities Representatives: though there are no elected representatives at present, but the VDC secretary/ Executive Officer has deputed as VDC/ Municipalities chief or office-in-charge by law, so the VDC secretary/ Executive Officer was included as a responsible source of information and major stakeholders in the area
- Political party representatives from different political bodies
- Facilitator of the discussion

(2) The First Stakeholder Meeting

1) Outline

The first SHM were organized at 2 districts in November 2014. In a SHM, firstly the project outlines including purposes, benefit, planned affected area, expected negative impacts are explained to the participants and followed by questions and answer session. At the same time, participants were informed that the timing of the census survey, socio-economic survey and IOL following the SHM is considered cut-off-date to determine eligible persons and properties.

The schedule and outline of each SHM is shown in **Table 1.4-25**.

Table 1.4-25 Overview of the 1st Stakeholder Meeting

Date	Interaction Location	Number of Participants		
		Male	Female	Total
9 Nov 2014	Chitpol-Palanse Bhaktapur	73	2	75
9 Nov 2014	Banepa, Kavrepalanchok	71	5	76

2) Issues Raised in the SHMs

The major queries from by the participants and its responses during the 1st SHM are summarized in **Table 1.4-26**.

Table 1.4-26 Summary of the 1st Stakeholder Meeting

Date	Location	Main Issues from Participants	Explanation to Participants
9 Nov 2014	Chittpol	Should be cleared about legal provision Pay compensation of all affected land and structures within 25 meter ROW each side from center line of the road Some people are still paying land levy and cultivating / utilizing of the land where the government declared ROW	The concerning authority will study the all legal provision The government has published 25 meter ROW each side from center line of the road. Therefore, the government will pay no compensation for land within the area of ROW. The concerning local government authorities in charge of the land use and land levy will provide provisions to the situation
9 Nov 2014	Banepa	The 75 fit ROW (equal to 25 yards) should declare along the Highway Compensation should be paid for all project affected land, structures, and business eateries etc. It should be paid based on the market price. The Project should pay attention to Severely Affected Persons (SAPs) in terms of compensation and assistances	It requires government decision RAP will regulates that the compensation for the project affected assets should be based on replacement cost It is general to pay attention to SAPs during discussing a RAP and the Project also consider it.

(3) The Second Stakeholder Meeting

The second stakeholder meeting will be held in following surveys. DOR shall organize the second stakeholder meetings to explain the result of scoping and surveys related to resettlement following ESMF procedures.

(4) Focus Group Meeting (FGM)

1) Outline

Besides the SHMs, there were held several rounds of informal meetings with representatives of Arniko Highway Struggle Committee (AHSC), political party representatives as well as PAPs. During the meeting with local people and representatives, they raised their concerning issues regarding ROW and compensation payment for the land within ROW. Intensive FGM with AHSC in two districts of Kavrepalanchok and Bhaktapur were organized in March 2015. The schedule and outline of FGM is shown in **Table 1.4-27**.

Table 1.4-27 Overview of the Focus Group Meeting

Date	Interaction Location	Number of Participants		
		Male	Female	Total
24 March 2015	Bhaisepati, Kavrepalanchok	7	5	12
24 March 2015	Jagati, Bhaktapur	9	7	16

2) Issues Raised in the FGMs

The major queries raised by the participants and responses provided from the Survey Team during the FGMs are summarized in **Table 1.4-28**.

Table 1.4-28 Summary of Public Consultation/meetings

Date	Location	Main Issues Raised in Public Meeting	Explanation from the Survey Team
24 March 2015	Sanga	Appropriate and reasonable compensation should be provided to the affected people Consultation with local people should be done at the time of construction Employment opportunity will be generated in construction period The Project should be rehabilitate all historical and cultural monuments such as temple, resting road side rest house (Chautara) etc. in an appropriate places	CDC will determine and distribute compensation without bias Opportunity will be given to the local labor in construction activities Recovery of historical and cultural assets will be discussed
24 March 2015	Jagati	The people who will be landless should be addressed Business disturbance allowance should be paid to affected people Government has issued double Land Holding Certificate without consensus of related road side people The Project should consider SAPs while providing compensation	RAP and concerning government agencies will make clear about the issues raised. It is general to pay attention to SAPs during discussing a RAP and the Project also considers it.

(5) Information Disclosure and Public Information

Information disclosure regarding the project is an important part of the project preparation and implementation to ensure that the PAPs are timely and fully informed of land acquisition, compensation and resettlement. This will also enable the PAPs to participate in and express their desires on resettlement policy and programs. Representatives of each district and VDCs in the project area, and leaders of the communities shall co-ordinate with DOR to implement information disclosure and public information appropriately.

The drafted RAP should be disclosed on the website of related VDCs as well as JICA's website. Following documents in implementation stage related to land acquisition and resettlement also have to be disclosed at district offices and VDCs for public interests.

The agencies and individuals affected by land acquisition and resettlement, the representative of local government including districts and VDCs in the Project site as well as the project owner shall participate in the public information meeting during the land acquisition processes such as property measurement survey, negotiation and compensation, and resettlement in the implementation stage.

The PAPs may ask for information about compensation policy anytime without having to wait for the public information campaign. PAPs may take part in the planning process and assist the project owner and local authorities in conducting public consultation, inform them of issues relating to compensation, assistance and resettlement that are under concern of PAPs through communication channels.

1.4.2.6 Legal Framework

Land acquisition and involuntary resettlement caused by the Project shall be planned, implemented, and monitored properly based on the JICA's Environmental Guidelines with World Bank's Operational Policy and Nepalese domestic laws and regulations represented by Environmental and Social Management Framework (ESMF) of DOR. DOR had developed a common tool of the safeguard policy, the Road Sector Wide Environmental and Social Management Framework (ESMF) and its contents may fulfill major safeguard policies/guidelines of international organizations, such as JICA, the World Bank (WB), and the Asian Development Bank (ADB).

Land policy in Nepal has been changed intricately during past historical regimes. As an epoch-making event, after Land Act (1964) was enacted, it is said that agricultural land reformation to individuals from royal owned land was promoted. However, prior to 1990, there was no official constitutional obligation for the State to pay compensation for the acquisition of personal property[2]. For the first time, Constitution (1970) expressed private property right clearly as "No person shall be deprived of his property save in accordance with the law", and following tentative Constitution (2007) elaborated more about expropriation of private property by the state for public purposes.

In addition to above mentioned policies, DOR had been done a feasibility study for the SD Road including Initial Environmental Examination (IEE) which includes rough survey on land acquisition and resettlement. The IEE report is also one of the resource to discuss the RAP.

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[2] *Profile on Environmental and Social considerations in Nepal, 6-1, JICA*

This chapter provides summary of major legal document regarding land acquisition and resettlement as following, based on IEE[3] report and other relevant documents. Any policy gaps between above mentioned international policies/standards and Nepalese country system would be coordinated and solved by project specific measures in the RAP.

(1) Domestic Law and Regulations

1) Land Acquisition Act (1977)

The Land Acquisition Act, 1977 (2034 BS) has been enacted to integrate the laws for Acquisition of Land, 1962, and partially updated in 1993 by its subsequent amendment. The section 3 of the Act empowers the government to acquire land at any place, for the purpose of public works by providing the required compensation to its owners. The Act obliges the government to consider the compensation for acquisition of land for the benefit of the local people. Article 12 established Compensation Fixed (Determination) Committee as a leading organization for fixing compensation unit price.

Steps of Land Acquisition plan as per Land Acquisition Act 1977 are presented in **Figure 1.4-4**.

Figure 1.4-4 Land Acquisition Process (Based on land Acquisition Act 1977)

2) Land Acquisition Guidelines (1989)

The Land Acquisition Guidelines and guidelines pursuant to section 16 and 17 of the Land Acquisition

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[3] *Initial Environmental Examination, Upgrading/Widening of Arniko Highway to Six Lane Standard, DOR, 2011*

Act 1977 specify two categories of affected families, namely Project Affected Families (PAF) and Seriously Project Affected Family (SPAF). A PAF consists of the members of a household including elderly dependents and minor children (under 18 years) residing under one roof and operating as a single economic unit, who are adversely affected by the project. SPAF is defined as a family who loses over 25% of its total land holdings or whose land is reduced to an uneconomic holding (less than 5.0 katha) or who is being displaced.

Under these guidelines the concerned officials, with the assistance of the project team, are to carry out assessments of project affected families to identify their standard of living and types of assets. Valuation of land and asset lost were to be based on comparative market values of similar assets in the vicinity. The guidelines also included arrangements for rehabilitation of project-affected families. For PAF's, the compensation package includes cash for assets acquired or damaged by the project and a rehabilitation grant (assistance allowance) to cover any suffering and hardship. For SPAF's, the compensation additionally include employment for one family member and provision of skill training.

The Guidelines specify the establishment of an Acquisition and Rehabilitation Committee (also known as Compensation Fixation Committee, "CFC") consisting of the concerned Chief District Officer (Chair), Land Revenue Officer, representative of the District Development Committee (DDC) and the Project Manager and others as deemed necessary. The Committee is responsible for acquiring land and paying compensation. In 1993, a second set of guidelines reduced the Acquisition and Rehabilitation Committee to a four-member Compensation Fixation and Rehabilitation Management Committee by dropping the Land Revenue Officer and other governmental appointees. The functions and powers of the committee were clarified, as were methods of payment and means of ensuring fair valuation of land quality.

3) Public Road Act (1974)

The Public Road Act, 1974 has been enacted to ensure the construction and operation of the road projects smoothly. Section 3 of the Act empowers GON to prohibit the construction of permanent structures (buildings) in the prescribed distance from the road, i.e. the Department of Roads (DOR) has the authority over everything within the boundaries of the road. The DOR may acquire temporarily the land and other property adopting compensatory measures during the construction, rehabilitation and maintenance of the public road (Sections 14 and 15). The Act obliges the DOR to plant trees on both sides of the road and handover it to the local bodies (VDC or municipality) for their management (Section 16). The Act also empowers the DOR to operate quarries and borrow pits and other facilities during the road construction (Section 17). In sum, the Act facilitates the construction of this road by even acquiring land and property including for the execution of construction materials and development of other facilities during road construction through compensation as negotiated and as well as to maintain greenery along the roadside.

4) Public Road Management and Land Acquisition Directives, DOR, (2002)

The DOR has published a directive for Public Road Management and Land Acquisition in 2002 for the use in road management and land acquisition in DOR's Sector Wide use. This Directive specifies two

categories of affected families, Project Affected Families (PAF) and Seriously Project Affected Family (SPAF). A PAF consists of the members of a household including elderly dependents and minor children (under18 years) residing under one roof and operating as a single economic unit, who are adversely affected by the project. SPAF is defined as a family who loses over 25% of its total land holdings or whose land is reduced to an uneconomic holding (less than 5.0 katha) or who is being displaced.

Under this Directive the concerned officials, with the assistance of the project team, are to carry out assessments of project affected families to identify their standard of living and types of assets. Valuation of land and asset lost were to be based on comparative market values of similar assets in the vicinity. The Directive also included arrangements for rehabilitation of project-affected families. For PAF's, the compensation package includes cash for assets acquired or damaged by the project and a rehabilitation grant (assistance allowance) to cover any suffering and hardship. For SPAF's, the compensation additionally include employment for one family member and provision of skill training.

5) Environmental and Social Management Framework, DOR, (2007)

This Environmental and Social Management Framework report (ESMF) is prepared for the Department of Roads (DOR) to compile in an overview and guidance manner, various safeguard and compliance aspects of environmental and social issues related with the Sector Wide Road Program and the Priority Investment Plan Study for Nepal's Strategic Road Network (SRN) planning for 2007 to 2016. The Study commenced in September 2005 and was completed in December 2006. The ESMF intends to provide technical and managerial inputs and guidance into the design of the strategic roads (both designated for rehabilitation and, to lesser extent, to new construction), through identification of key environmental and social issues related to the foreseen projects (hereunder referred as "SRN sub-projects"), mitigate potential impacts and concerns and, devise opportunities to enhance the benefits. The framework integrates in a step-wise approach the most important environmental and social considerations into all stages of project preparation, implementation, monitoring and operation and is applicable to all future sub-projects funded under the SRN program. The ESMF is applicable to all proposed subproject activities and through all stages of the subproject cycle, i.e. from pre-planning, planning and design, implementation to post-implementation. The design flow of ESMF activities will be coordinated and integrated into the project cycle.

6) Land Acquisition, Resettlement and Rehabilitation Policy (not yet enforced as of 2015)

The government, Ministry of Land Reform, has prepared Land Acquisition, Resettlement, and Rehabilitation Policy under technical assistance with ADB, however, the policy has not yet been enacted in Nepalese Gagett. The drafted policy emphasizes scientific standards for land valuation and extension of compensation equivalent to minimum market value of land. A provision in the policy allows the government to take action against those who try to disrupt land acquisition process or create hurdles for the project. In this regard, the policy has stressed on the need to first assessment of socio-economic impacts of a project. All expenses related to land acquisition, compensation and implementation of resettlement and rehabilitation plans should be considered as a project cost.

(2) JICA's Policy on Involuntary Resettlement

The policy provisions on involuntary resettlement of JICA are shown in the JICA's Environmental Guidelines. And item 3 of Article 2.6 in this guideline describes that "JICA confirms that projects do not deviate significantly from the World Bank's Safeguard Policies". Therefore, the main documents relevant to land acquisition and resettlement of the Project are:

- JICA Guidelines for Environmental and Social Considerations (2010)
- The World Bank's Safeguard Policies (Operational Policy / Bank Policy 4.12 and its Annex in particular)
- Involuntary Resettlement Sourcebook (the World Bank)

Item 2 of Article 1.6, "Requirement of project proponents" of the JICA's Environmental Guidelines describes that involuntary resettlement in case of Category A project must be fulfill Article 7, "Involuntary Resettlement" of Annex 1 "Environmental and social consideration required for intended project": "it is desirable that the resettlement action plan include elements laid out in the World Bank Safeguard Policy, OP. 4.12, Annex A".

JICA's fundamental policy on involuntary resettlement is shown in **Table 1.4-29**.

Table 1.4-29 JICA's Policy on Involuntary Resettlement

I. The Government of recipient country will use the Project Resettlement Policy (the Project Policy) for a JICA's project specifically because existing national laws and regulations have not been designed to address involuntary resettlement according to international practice, including JICA's policy. The Project Policy is aimed at filling-in any gaps in what local laws and regulations cannot provide in order to help ensure that PAPs are able to rehabilitate themselves to at least their pre-project condition. This section discusses the principles of the Project Policy and the entitlements of the PAPs based on the type and degree of their losses. Where there are gaps between the recipient country legal framework for resettlement and JICA's Policy on Involuntary Resettlement, practicable mutually agreeable approaches will be designed consistent with Government practices and JICA's Policy.
II. Land acquisition and involuntary resettlement will be avoided where feasible, or minimized, by identifying possible alternative project designs that have the least adverse impact on the communities in the project area.
III. Where displacement of households is unavoidable, all PAPs (including communities) losing assets, livelihoods or resources will be fully compensated and assisted so that they can improve, or at least restore, their former economic and social conditions.
IV. Compensation and rehabilitation support will be provided to any PAPs, that is, any person or household or business which on account of project implementation would have his, her or their:
Standard of living adversely affected;
Right, title or interest in any house, interest in, or right to use, any land (including premises, agricultural and grazing land, commercial properties, tenancy, or right in annual or perennial crops and trees or any other fixed or moveable assets, acquired or possessed, temporarily or permanently;
Income earning opportunities, business, occupation, work or place of residence or habitat adversely affected temporarily or permanently; or
Social and cultural activities and relationships affected or any other losses that may be identified during the process of resettlement planning.
V. All affected people will be eligible for compensation and rehabilitation assistance, irrespective of tenure status, social or economic standing and any such factors that may discriminate against achievement of the objectives outlined above. Lack of legal rights to the assets lost or adversely affected tenure status and social or economic status will not bar the PAPs from entitlements to such compensation and rehabilitation measures or resettlement objectives. All PAPs residing, working, doing business and/or cultivating land within the project impacted areas as of the date of the latest census and inventory of lost assets(IOL), are entitled to compensation for their lost assets (land and/or non-land assets), at replacement cost, if available and restoration of incomes and businesses, and will be provided with rehabilitation measures sufficient to assist them to improve or at least maintain their pre-project living standards, income-earning capacity and production levels.
VI. PAPs that lose only part of their physical assets will not be left with a portion that will be inadequate to sustain their current standard of living. The minimum size of remaining land and structures will be agreed during the resettlement planning process.
VII. People temporarily affected are to be considered PAPs and resettlement plans address the issue of temporary acquisition.
VIII. Where a host community is affected by the development of a resettlement site in that community, the host community shall be involved in any resettlement planning and decision-making. All attempts shall be made to minimize the adverse impacts of

resettlement upon host communities.

IX. The resettlement plans will be designed in accordance with recipient country's Involuntary Resettlement Policy and JICA's Policy on Involuntary Resettlement.

X. The Resettlement Plan will be translated into local languages and disclosed for the reference of PAPs as well as other interested groups.

XI. Payment for land and/or non-land assets will be based on the principle of replacement cost.

XII. Compensation for PAPs dependent on agricultural activities will be land-based wherever possible. Land-based strategies may include provision of replacement land, ensuring greater security of tenure, and upgrading livelihoods of people without legal land titles. If replacement land is not available, other strategies may be built around opportunities for re-training, skill development, wage employment, or self-employment, including access to credit. Solely cash compensation will be avoided as an option if possible, as this may not address losses that are not easily quantified, such as access to services and traditional rights, and may eventually lead to those populations being worse off than without the project.

XIII. Replacement lands, if the preferred option of PAPs, should be within the immediate vicinity of the affected lands wherever possible and be of comparable productive capacity and potential4. As a second option, sites should be identified that minimize the social disruption of those affected; such lands should also have access to services and facilities similar to those available in the lands affected.

XIV. Resettlement assistance will be provided not only for immediate loss, but also for a transition period needed to restore livelihood and standards of living of PAPs. Such support could take the form of short-term jobs, subsistence support, salary maintenance, or similar arrangements.

XV. The resettlement plan must consider the needs of those most vulnerable to the adverse impacts of resettlement (including the poor, those without legal title to land, ethnic minorities, women, children, elderly and disabled) and ensure they are considered in resettlement planning and mitigation measures identified. Assistance should be provided to help them improve their socio-economic status

XVI. PAPs will be involved in the process of developing and implementing resettlement plans.

XVII. PAPs and their communities will be consulted about the project, the rights and options available to them, and proposed mitigation measures for adverse effects, and to the extent possible be involved in the decisions that are made concerning their resettlement.

XVIII. Adequate budgetary support will be fully committed and made available to cover the costs of land acquisition (including compensation and income restoration measures) within the agreed implementation period. The funds for all resettlement activities will come from the Government.

XIX. Displacement does not occur before provision of compensation and of other assistance required for relocation. Sufficient civic infrastructure must be provided in resettlement site prior to relocation. Acquisition of assets, payment of compensation, and the resettlement and start of the livelihood rehabilitation activities of PAPs, will be completed prior to any construction activities, except when a court of law orders so in expropriation cases. (Livelihood restoration measures must also be in place but not necessarily completed prior to construction activities, as these may be ongoing activities.)

XX. Organization and administrative arrangements for the effective preparation and implementation of the resettlement plan will be identified and in place prior to the commencement of the process; this will include the provision of adequate human resources for supervision, consultation, and monitoring of land acquisition and rehabilitation activities.

XXI. Appropriate reporting (including auditing and redress functions), monitoring and evaluation mechanisms, will be identified and set in place as part of the resettlement management system. An external monitoring group will be hired by the project and will evaluate the resettlement process and final outcome. Such groups may include qualified NGOs, research institutions or universities.

Cut-off-date of Eligibility

The cut-off-date of eligibility refers to the date prior to which the occupation or use of the project area makes residents/users of the same eligible to be categorized as PAPs and be eligible to Project entitlements. In the Project, (e.g.: Cut-off dates for titleholders will be the date of notification under the Land Acquisition Act and for non-titled holders will be the beginning date of the population census; 04 October, 2010). This date has been disclosed to each affected village by the relevant local governments and the villages have disclosed to their populations. The establishment of the eligibility cut-off date is intended to prevent the influx of ineligible non-residents who might take advantage of Project entitlements

Principle of Replacement Cost

All compensation for land and non-land assets owned by households/shop owners who meet the cut-off-date will be based on the principle of replacement cost. Replacement cost is the amount calculated before displacement which is needed to replace an affected asset without depreciation and without deduction for taxes and/or costs of transaction as follows:

For example:

a. Productive Land (agricultural, aquaculture, garden and forest) based on actual current market prices that reflect recent land sales in the area, and in the absence of such recent sales, based on recent sales in comparable locations with comparable attributes, fees and taxes or in the absence of such sales, based on productive value;

b. Residential land based on actual current market prices that reflect recent land sales, and in the absence of such recent land sales,

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[4] Agricultural land for land of equal productive capacity means that the land provided as compensation should be able to produce the same or better yield the AP was producing on his/her land prior to the project. The production should be in the planting season immediately following the land acquisition. It can be for a future period if transitional allowance equal to the household's previous yield is provided to the AP household while waiting for the land to get back to the same productivity as the previous land.

based on prices of recent sales in comparable locations with comparable attributes; fees and taxes.
c. Existing local government regulations* for compensation calculations for building, crops and trees will be used where ever available.
d. Houses and other related structures based on actual current market prices of affected materials;
e. Annual crops equivalent to current market value of crops at the time of compensation;
f. For perennial crops, cash compensation at replacement cost that should be in line with local government regulations, if available, is equivalent to current market value given the type and age at the time of compensation.
g. For timber trees, cash compensation at replacement cost that should be in line with local government regulations, if available, will be equivalent to current market value for each type, age and relevant productive value at the time of compensation based on the diameter at breast height of each tree.

1.4.2.7 Policy Gap Analysis

Policy gaps related to land acquisition and resettlement were analyzed by comparing the JICA's Environmental Guidelines and the Nepali legal system. The Project shall consider both Nepali country system and JICA's requirements as follows;

(1) Compliance to Nepali country system, such as Land Acquisition Act, Public Road Act, Road Standard, and etc.
(2) Application of Environmental and Social Management Framework (ESMF) with a standard of World Bank's Safeguard Policy (Operational Policy, OP)
(3) Following to JICA Guidelines for Environmental and Social Considerations as well as relevant World Bank's Safeguard Policy, Resettlement Sourcebook, and etc.

Stopgap measures will be discussed in the RAP among above mentioned three pillars of resettlement policies. Image of policy gap and RAP is shown in **Figure 1.4-5**, while policy gap analysis concerning land acquisition and resettlement is shown in **Table 1.4-30.**

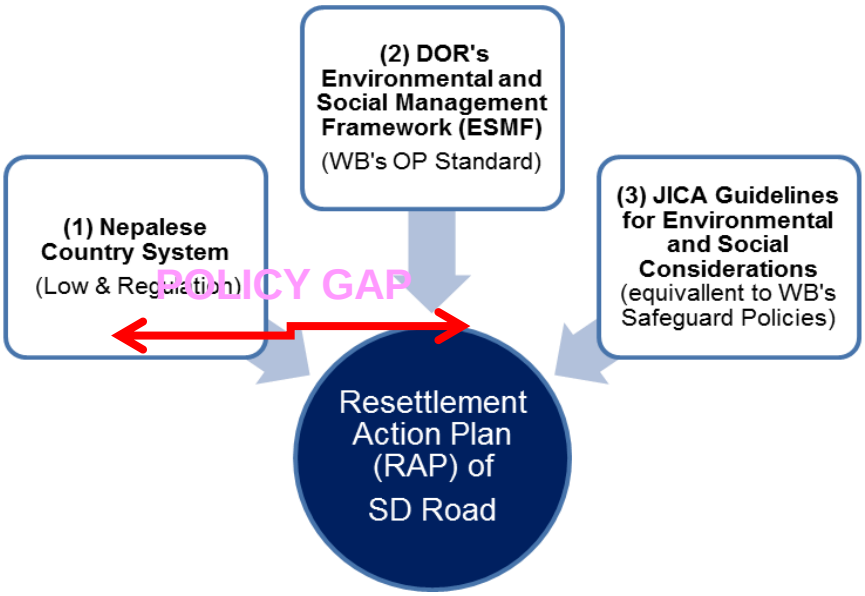


Figure 1.4-5 Image of Policy Gap and RAP

Table 1.4-30 Policy Gap Analysis between JICA Guidelines and Nepali Country System

No.	(A) JICA Guidelines for Environmental and Social Considerations with World Bank Safeguard Policy	(B) Nepali Law & Regulations	Gaps between (A) and (B)	Countermeasures for filling gaps
1.	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.	The adverse impacts can be minimized or avoided or dealt with positive and constructive ways (1.1.1, ESMF)	No significant gaps are observed. This item is not clearly mentioned in domestic laws, however, ESMF covered it.	Based on ESMF, Land Acquisition Act, and the JICA's Environmental Guidelines, land acquisition and resettlement shall be avoided and/or minimized during alignment decision process, structure planning, and any other discussion related to resettlement impact in the Project.
2.	When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses should be taken.	- The adverse impacts can be minimized or avoided or dealt with positive and constructive ways (1.1.1, ESMF) - Government of Nepal may, if it so deems necessary, acquire any land at any place for any public purpose, subject to compensation under this Act (Article 3, Land Acquisition Act)	No significant gaps are observed.	
3.	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.	Thus, the affected persons in the project will be entitled to various types of compensation and resettlement assistance that will help in the restoration of their livelihoods, at least, to the pre-project standards (7.3.1, ESMF)	No significant gaps are observed. This item is not clearly mentioned in domestic laws, however, ESMF covered it.	Based on ESMF and the JICA's Environmental Guidelines, RAP secures "improve or at least restore their standard of living, income opportunities and production levels to pre-project levels" by using appropriate entitlement matrix.
4.	Compensation must be based on the full replacement cost as much as possible.	When GON requires assets, national law does not specify about the provision of mandatory replacement cost. Therefore, ESMF strongly recommended that: Practical provisions must be made for the compensation for all lost assets to be made at replacement cost without depreciation or reductions for salvage materials. Efforts must be made to assess the real replacement costs of land to the extent possible. A procedure should be established for determining compensation rates accurately plus rigorous	There might be a gaps on determination of compensation rate between Nepali side and the JICA Environment Guidelines. In the past cases, deduction and/or using government fixed rate lower than market price are common.	Replacement Cost Survey (RCS) was conducted based on the standard of the JICA's Environmental Guidelines (the World Bank's definition and level of standards). The result is compared with the government's official unit price for determining validity. The result shall be respected for future determination process by CDC. Additional monitoring to support bridging from RAP to CDC's determination is required.

No.	(A) JICA Guidelines for Environmental and Social Considerations with World Bank Safeguard Policy	(B) Nepali Law & Regulations	Gaps between (A) and (B)	Countermeasures for filling gaps
		efforts to assess the replacement costs and market rates for all assets, including labour costs for construction.		
5.	Compensation and other kinds of assistance must be provided prior to displacement.	ESMF referred OP 4.12: The measures (i.e. the RP) include provision of compensation and of other assistance required for relocation, prior to displacement, and preparation and provision of resettlement sites with adequate facilities, where required.	No significant gaps are observed. This item is not clearly mentioned in domestic laws, however, ESMF covered it.	Based on the JICA's Environmental Guidelines, compensation, assistance, and relocation site have to be done and prepared prior to displacement.
6.	For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public.	ESMF regulated RAP preparation.	No significant gaps are observed. This item is not clearly mentioned in domestic laws, however, ESMF covered it.	The RAP is developed with sufficient adherence to the JICA's Environmental Guidelines.
7.	In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance.	- In Chapter 5, the section of 2.2.1: The Procedural Steps in Road IEEs and EIAs of ESMF, and other sections covers all conditions concerning public participation/consultation - Domestic EIA procedure supported by some conditions in ESMF requires public consultation meeting	No significant gaps are observed. This item is not clearly mentioned in domestic laws, however, ESMF covered it.	Based on the JICA's Environmental Guidelines, in case of the Category A projects, stakeholder meetings should be organized at least two times, at the time of the draft scoping and at the time of draft reporting, supplemented by focus group meetings. In addition to above mentioned meetings, the RAP proposed promotion of public participation in monitoring stage as well as implementation stage.
8.	When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people			
9.	Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.			
10.	Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.	5.1 and 7.5 of ESMF stipulated establishment of grievance redress mechanism (GRM)	No significant gaps are observed. This item is not clearly mentioned in domestic laws, however, ESMF covered it.	Based on the JICA's Environmental Guidelines, GRM is planned in the RAP.

No.	(A) JICA Guidelines for Environmental and Social Considerations with World Bank Safeguard Policy	(B) Nepali Law & Regulations	Gaps between (A) and (B)	Countermeasures for filling gaps
11.	Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits.	N/A *Cut-off date is recommended to set as the date of Census survey (7.2.3, ESMF)	There is no direct regulation of recommendation regarding the item.	Based on the JICA's Environmental Guidelines, the cut-off date is explained at the 1st time stakeholder meetings.
12.	Eligibility of benefits includes, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying.	In the proposed project, the absence of formal titles will not be a bar to resettlement assistance and rehabilitation. (7.3.1, ESMF)	No significant gaps are observed. This item is not clearly mentioned in domestic laws, however, ESMF covered it.	Based on the JICA's Environmental Guidelines, appropriate entitlements are discussed in the RAP for both formal and informal cases. In principle, both formal and informal settlers are eligible for compensation and other conditions, including assistances, rights to relocate to the resettlement site, etc.
13.	Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based.	N/A * EMSD just referred OP 4.12	Cash for land is the common way of compensation for both formal and informal land cases in Nepal, and PAPs also prefer to cash compensation generally.	PAPs shall be given compensation options based on the RAP to select "land for land" of "cash for land" as much as possible.
14.	Provide support for the transition period (between displacement and livelihood restoration).	N/A	The item is not clearly mentioned even in ESMF. Some kinds of assistance have a function to support such transition period.	The RAP may cover the non-registered cases and compensation for temporary business disturbance, income restoration at the early stage, or any other allowance are considered.
15.	Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty	8.3 of ESMF or the part of Entitlement Matrix stipulated the considerations scheme for such vulnerable groups	No significant gaps are observed. This item is not clearly mentioned in domestic laws,	Based on needs assessment through stakeholder meetings, socio-economic surveys, focus group

No.	(A) JICA Guidelines for Environmental and Social Considerations with World Bank Safeguard Policy	(B) Nepali Law & Regulations	Gaps between (A) and (B)	Countermeasures for filling gaps
	line, landless, elderly, women and children, ethnic minorities etc.		however, ESMF covered it.	meetings etc., special considerations for vulnerable groups are discussed and reflected in the RAP.
16.	For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared.	7.10 of ESMF stipulated the abbreviated RAP under the condition of fewer than 200 people	No significant gaps are observed. This item is not clearly mentioned in domestic laws, however, ESMF covered it.	Based on the JICA's Environmental Guidelines, the abbreviated RAP shall be prepared under the stipulated conditions
17.	Internal and external monitoring system must be established and implemented properly	8.8 of ESMF covers monitoring and evaluation	No significant gaps are observed. This item is not clearly mentioned in domestic laws, however, ESMF covered it.	Based on JICA's Environmental Guidelines, monitoring framework composed by internal monitoring, external monitoring, and evaluation is established in the RAP.

1.4.2.8 Compensation Policy, Eligibility, and Entitlement

(1) Compensation Policy

In principle, PAPs who have assets within or reside within the project affected areas before the cut-off date are entitled to compensation for their losses. Those who have lost their income and/or subsistence will be eligible for livelihood restoration assistance based on the criteria of eligibility defined by the project in consultation with the PAPs. If, by the end of the project, livelihoods have been shown not to be restored to pre-project levels, additional measures will be provided.

Fundamental compensation policies of the Project based on JICA's Environmental Guidelines are as follows:

- The compensation rates will be determined based on the results of independent appraisal of the land/crops/assets (associated with the land) in a timely and consultative manner based on the replacement cost survey. All fees and taxes on land and/or house transfers will be waived or otherwise included in a compensation package for land and structures/or houses or businesses. The local authorities will ensure that PAPs choosing relocation on their own, obtain, without additional costs, the necessary property titles and official certificates commensurate with similar packages provided to those who choose to move to the project resettlement sites
- Land will be compensated "land for land", or in cash, according to PAP's choice whenever possible.
- PAPs that are compensated by "cash for land" will be compensated in cash at the full replacement cost. These PAPs will be assisted in rehabilitating their livelihoods and making their own arrangements for relocation.

- Compensation for all residential, commercial, or other structures will be offered at the replacement cost, without any depreciation of the structure and without deduction for salvageable materials. Structures shall be evaluated individually.
- The PAPs will be provided with full assistance (including a transportation allowance) for transportation of personal belongings and assets, in addition to the compensation at replacement cost of their houses, lands and other properties.
- Financial services (such as loans or credits) will be provided to PAPs if necessary as a measure of livelihood restoration. The installment amounts and the schedule of payments will be within the repayment capacity of PAPs.
- Additional efforts, such as economic rehabilitation assistance, training and other forms of assistance, should be provided to PAPs losing income sources, especially to vulnerable groups, in order to enhance their future prospects toward livelihood restoration and improvement.
- The previous level of community services and resources, encountered prior to displacement, will be maintained or improved for resettlement areas

(2) Eligibility Criteria

1) Project affected persons (PAPs)

People directly affected by the project through the loss of land, residences, other structures, business, assets, or access to resources, specifically are:

- Persons whose agricultural land will be affected (permanently or temporarily) by the Project;
- Persons whose residential land/houses will be affected (permanently or temporarily) by the Project;
- Persons whose leased-houses will be affected (permanently or temporarily) by the Project;
- Persons whose businesses, occupations. or places of work will be affected (permanently or temporarily) by the Project;
- Persons whose crops (annual and perennial)/ trees will be affected in part or in total by the Project;
- Persons whose other assets or access to those assets, will be affected in part or in total by the Project; and
- Persons whose livelihoods will be impacted (permanently or temporarily) due to restriction of access to protected areas by the Project.
- Community owned assets, collective assets, enterprise, any other governmental and private organizations, whose properties, production measures, and livelihoods will be impacted (permanently or temporarily) due to land acquisition, restriction of access, any other direct/indirect impacts by the Project.

2) Vulnerable groups

Based on the census/socio-economic survey and ESMF, the vulnerable groups will generally include the following:

- Poor and poorest households as identified by pertinent national survey results;
- Poor landholders that have limited productive land (this will be determined by the minimum amount of farm land needed to be a viable farmer in the project area)
- Women headed poor households
- All Dalit and ethnic minorities/indigenous groups as categorized by GoN as vulnerable Community members who are less able to care themselves without family or other support
- Landless, squatters and encroachers.
- Any other groups identified by the socio-economic surveys and by meaningful public consultation.

3) Gender

During the project implementation, deep consideration should be given to the following gender issues:

- During the resettlement implementation stages, income restoration program, resettlement site preparation and any other opportunities of public hearing, women's voices should be carefully listened to know their rights and choices
- The female headed households will be encouraged and supported to fully participate in planning and implementation of income restoration programs as well as assistance.
- Job creation by the project implementation and operation should consider priorities on women.

4) Government Property

Government infrastructure and facilities affected by the Project will be repaired or replaced in consultation with the relevant department and ministry. There is no provision of compensation of the government land. DOR acquires government land and forest in coordination with other relevant authorities such as Ministry of Forest (MOF). Clearance of trees requires the permission of Department of Forestry (DOF). The legal provision is that the DOR is responsible to plant 25 seedlings in the government land against one tree cutting. The cut logs are the properties of DOF. DOR is responsible to establish nursery in an accessible areas of new plantation, supply seedlings, and bear the cost for five years to take care of new plantation to get the plant mature.

5) Allowances / Assistances

A) Allowances / Assistances

The households who lose their residential houses will be qualified for the displacement allowances. The displacement allowance will be as equal to 180 days minimum wage rate as established at the national or local level. The provision of displacement allowance is that the house owners are free to demolish the affected house and carry away to reuse the materials for new housing. The displacement allowance is a provisional compensation for financial difficulties of the transitional period.

B) Business / Cultivation Disruption Allowance

The household who loses own business due to the Project will be qualified for business disruption allowance equal to 180 days, as minimum wage rate as established at national or local level. Similarly, cultivation disruption allowance will be prepared to farmers who lost their productive land.

In addition, vulnerable people will receive special assistance and income restoration measures, such as livelihood enhancement training and employment opportunities during the project implementation.

6) Public Health

Health awareness programs for the local people as well construction labors shall be organized by the Project and contractor on a regular basis (prior to construction commencement and in an yearly interval) to provide knowledge to construction workers and local population on health including the dangers and consequences of sexually transmitted disease (STD) and HIV/AIDS. Additional training for awareness rising will be given by the professional health workers in association with social supervision consultant on health aspects of STD and HIV/AIDS and human trafficking.

The awareness program related to public health, HIV/AIDS and human trafficking will be organized inviting public health expert (especially a medical practitioner of the concerned districts and concern district police officer). The role of social mobilizer and resettlement expert will be to neutralize the conflicting relationship between contractors and local stakeholders, outside labors and local labors, in relation to competition over natural and economic resources.

(3) Entitlement

Based on JICA's principle policy, PAPs who are eligible for compensation/assistance are defined as below;

- PAPs who has legal rights on their land
- PAPs who does not have legal rights on their land, however, their rights will be certified according to legal framework of their country if they claim their rights
- PAPs whose legal rights on their land and their right of claim are not confirmed (e.g. lessee, tenant, worker, employee, illegal occupants, other building owner, etc.)

The entitlement policy of the RAP is based on Land Acquisition Act 1977 and Environment and Social Management Framework (ESMF). The eligibility for entitlement to compensation is determined by asset ownership criteria:

(i) Those who have formal legal rights to land (including customary and traditional rights recognized under the laws of the country. In the consideration, it is also useful to document how long they have been using the land or the assets associated with it);
(ii) Those who have no recognizable legal right or claim to the land they are occupying.

Persons covered under (i) are provided compensation for the land they lose, and other assistance. Persons covered under (ii) are provided resettlement assistance in lieu of compensation for the land they occupy, and other assistance, as necessary, to achieve the objectives set out in this policy, if they occupy the project area prior to a cut-off date and acceptable to JICA. Persons who encroach on the area after the cut-off date are not entitled to compensation or any other form of resettlement assistance. All persons included in (i) or (ii) are provided compensation for loss of owned or used assets other than land.

Based on the resettlement policy gap analysis and field surveys, PAPs' eligibility has been discussed as the entitlement matrix in **Table 1.4-31**.

Table 1.4-31 Entitlement Matrix

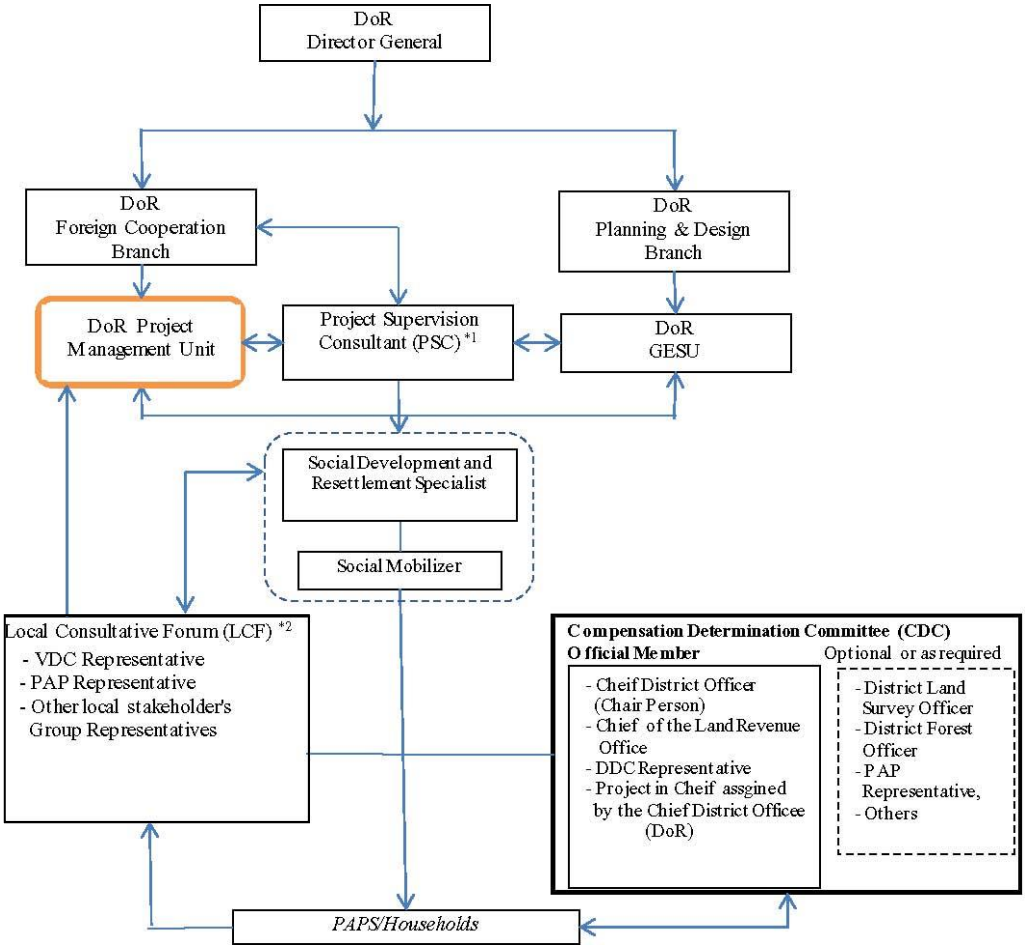
Type of Loss	Entitlement Unit	Description of Entitlements	Implementation Measures
1. House and Other Structure			
1.1 Loss of own house and residential plot	Families, households, structure owners	Cash compensation at full replacement cost, according to house type. For houses and structures the market cost of the materials and labour to build a replacement structure of a similar quality or better than the affected structure.	・ Valuation for structures undertaken by the project authorities on the basis of standard norms of Department of Urban Development and compensation rates determined by Compensation Determination Committee (CDC) should respect the results of replacement cost survey and the RAP supported by JICA's preparatory survey ・ Construction material can be salvaged by PAPs ・ Deduction from the full replacement cost is not allowed ・ Displaced households will receive a housing displacement allowance. ・ Notice of relocation will be given at least 35 days prior to the land clearance ・ Compensation and relevant assistance must be paid in advance at least before the notification of relocation
1.2 Loss of commercial establishment	Families, households, structure owners		In addition to above conditions of the case of 1.1: Owners of displaced commercial establishments will receive 180 days business disruption allowance as equal to 180 days minimum wage rate as established at the national or local level.
1.3 Loss of other private structures	Families, households, structure owners		In addition to above conditions of the case of 1.1: ・ Other structures include: fence, walls etc. ・ Only the case of loss of structures is not eligible for the displacement allowance.
2. Land			
2.1 Loss of private land	Families, households (Title holder)	・ Provide compensation at full replacement cost, or ・ Provide full title to land of equal area and productivity acceptable to owner in the vicinity. ・ Resettlement assistance in lieu of compensation for land occupied (land, other assets, employment) at least restore their livelihoods and standards of living to pre-displacement levels. ・ In the case of farmland, the PAPs will be entitled the cultivation disruption allowance equal to one-year production.	Valuation for land undertaken by the project authorities and compensation rates determined by Compensation Determination Committee (CDC) should respect the results of replacement cost survey and the RAP supported by JICA's preparatory survey A list of affected and entitled persons and the area of land loss will be prepared Notice to vacate will be served at least 35 days prior to acquisition. Compensation and relevant assistance must be paid in advance at least before the notification of relocation

Type of Loss	Entitlement Unit	Description of Entitlements	Implementation Measures
2.2 Loss of untitled land (including the land within ROW)	Families, households (Non-Title holder)	Resettlement assistance to those most vulnerable PAPs to restore pre-displacement level livelihoods. Vulnerable groups may include but not be limited to ethnic minority groups, women headed households, the most poor (based on poverty line and the local wealth ratings), the disabled, the elderly and landless families. Encroachers will not be entitled to any compensation for their affected unauthorized/illegal extensions over public land. Vulnerable encroachers with economic losses may be entitled to assistance as a vulnerable group.	・ Properties attached to the land are compensated by full replacement cost with the similar condition as the case of 1.1, 1.2 and 1.3 ・ A list of affected and entitled persons and the area of land loss will be prepared ・ Notice to vacate will be served at least 35 days prior to acquisition. ・ Compensation and relevant assistance must be paid in advance at least before the notification of relocation
2.3 Temporary loss of private land	Families, households	Compensation for crop, land productivity and other property losses for the duration of temporary occupation. Compensation for other disturbances and damages caused to property. Land should be returned to the owner at the end of temporary acquisition period, restored to its original condition, or improved as agreed with owner.	A temporary occupation contract will be signed with the affected landowner, specifying; ・ Period of occupancy; ・ Formula for the calculation of production losses (the market value of crops normally produced on the land) and annual inflation adjustments; ・ Frequency of compensation payment; and ・ Land protection and rehabilitation measures. ・ The land will be returned to the owner at the end of temporary acquisition, restored to its original condition.
3. Other Privately Owned Resources			
3.1 Loss of non-perennial crops	Owners	Advance notice to harvest crops is required. If there is not enough time to harvest, the crops will be compensated based on the replacement cost.	Crop market values will be determined by the CDCs coordinating with District Agriculture Office
3.2 Loss of privately-owned trees and perennial crops	Owners	Advance notice to harvest crops (or fruits) is required. If there is not enough time to harvest, the crops will be compensated based on the replacement cost.	・ Crop market values and production losses will be determined by the CDCs with assistance from a local resource specialist. ・ The Departments of Agriculture and Forestry will be requested to assist affected owners and communities for re-establishment of new trees and other perennial crops.
4. Community Structures and Resources			
4.1 Community buildings and Structures	Local Community	Restoration of affected community's structures to at least previous condition, or replacement in areas identified in consultation with affected communities.	・ Affected community buildings/ structures include: schools, temples, water points, stone spouts, irrigation canals, trails etc. will be rehabilitated by the Project.
5. Rehabilitation Assistance			
5.1 Displacement of household	Households	Housing displacement allowance for loss of own residential accommodation.	・ Displaced households will receive a displacement allowance equal to 180 days minimum wage rate as established at the national or local level. ・ Allowances will be paid at the time of serving the notice to vacate.
5.2 Displacement of commercial enterprise	Company / Households	Business disruption allowance for loss of commercial establishment.	・ The current business which require to be relocated from their residential houses or rented houses, will receive a business disruption allowance equal to 180 days minimum wage rate as established at the national or local level.

Type of Loss	Entitlement Unit	Description of Entitlements	Implementation Measures
5.3 Cultivation disruption to cultivation	Titleholder Tenant	Cultivation disruption allowance for severe disruption to household cultivation levels.	The cultivation disruption allowances will apply to; ・ Households with total landholdings of 0.25 ha and smaller who lose more than 10 percent of their landholdings; ・ Households with total landholdings more than 0.25 ha who lose more than 25 percent of their landholdings; ・ Households whose production levels are to be severely affected. ・ The cultivation disruption allowance will be equal to one season's production on the area of land lost, based on the norms of District Agriculture Office for the year of acquisition.
5.4 Vulnerable social categories	Vulnerable Groups	Women headed households, Dalit households and below poverty level.	A lamp sum amount of NRs 50,000 will be provided as a special assistance Assistance in re-establishment and improvement of livelihood. Preferential employment on road construction and maintenance to the extent possible.
6. Government Property			
6.1 Loss of Infrastructure	Relevant agency	Facilities will be repaired or replaced.	・ To be undertaken in consultation with the relevant department or ministry.
6.2 Loss of forest areas	Community Forest/Department of Forest	Mitigation by means of afforestation elaborated in EIA.	・ Cash compensation by DOR payable to the Community Forest/District Forest Offices equivalent to 25 sampling plantation to clearance of 1 tree with 15 cm diameter or larger. ・ To be undertaken in consultation with Community Forest Users/Department of Forestry.
7. Income Restoration Program			
7.1 Preference in employment in wage labour in the project activities	All PAPs	PMU and other relevant authorities cooperate with contractor will consider job creation and/or job arrangement regarding construction of the project.	・ Construction contracts include provision that PAPs will have priority in wage labor on project construction during implementation. ・ PAPs shall be given priority for post construction maintenance as mandated in local body agreement
7.2 Income Restoration Program	One member of each displaced household	Displaced PAPs who want to take income restoration program (IRP) and any cases that will be affected their means of life can apply to IRP.	・ IRP is designed and financed by the Project elaborated in the RAP
8. Damage caused During Construction			
8.1 Public and private building and structures, infrastructure, land crops and trees	Owners of properties	Appropriate counter measures should be taken by contractors cooperation with PMU to avoid damage and compensate based on negotiations	・ Where damages do occur to public or private property as a result of construction works, the affected families, groups, communities, or government agency shall be compensated for damages to crops and trees; damage land, structure, and infrastructure shall be restored to their former conditions.

1.4.2.9 Institutional Framework

An organizational setup for RAP implementation is necessary for effective coordination to ensure compliance with policies and procedures, land acquisition and resettlement activities and implementation of mitigation measures. To ensure the achievement of these activities, organization for RAP implementation and management will be established in both central and project level. DOR is the project owner who is also responsible for the environmental and social considerations. DOR will establish the project management unit (PMU) for the project as described in **Figure 1.4-6**.



Note 1): PSC is the actual implementation body for Social Impact Monitoring.

2): LCF is also the locally established as a "Grievance Redress" committee, communication link between the PAPs , and the Project as well as the PSC.

Figure 1.4-6 Proposed Organization Framework for RAP Implementation

(1) Central Level Arrangement

Organizational arrangement in the central government level for land acquisition and resettlement starts from the financial management for land acquisition and compensation from the Ministry of Physical Infrastructure and transport (MOPIT). The required money for compensation will send to the Project Management Unit (PMU) through the Department of Road (DOR). PMU takes responsible for overall project coordination including management of RAP implementation. The Geo-Environment and Social Unit (GESU) will lead the overall management of social environment issues including review, and approval of RAP and monitoring of timely and successful implementation of RAP.

(2) Project Level Arrangement

While central level arrangements are necessary for coordination of RAP activities, project level arrangements are required for effective RAP implementation. There will have a PMU headed by a Project In-Charge (PIC). The PIC is responsible to form CDC in association with Chief District Officer (CDO) of concern districts. CDC is chaired by CDO.

The compensation amount for those affected by the Project will be fixed by a five-member compensation committee formed under chief district officer called CDC. The CDC will formed under CDO of concern district, the other members are: Representative of District Development Committee (DDC), Chief of District Land Revenue Office, Mayor/VDC chairperson from respective Municipality/VDC and project Chief.

The committee can form a technical team to determine the compensation amount. The team should derive the compensation amount by working closely with members of families that are likely to be displaced. Those not satisfied with land acquisition, resettlement and rehabilitation processes can lodge complaints at the project office and complaint hearing offices at district and regional levels.

CDC determines the rate of compensation in consultation with PAPs and local stakeholders, categorizing land, and structures. The PIC will have a road section support team. Other relevant district officials will be deputed during the land and assets acquisition process when required. As the project authority, Project Management Unit (PMU) will resume overall responsibility for RAP implementation. This will require:

- Implementation of procedures to minimize adverse social impacts throughout the planning, design and implementation phases
- Implementation of procedures for the recording of all project affected persons by means of census and asset verification and quantification exercises;
- Establishment of procedures for the coordination of resettlement and compensation activities;
- Implementation of information dissemination campaigns
- Capacity building initiatives to create a supportive environment for the implementation of RAP activities;
- Coordination with other government line agencies, local stakeholders, NGOs to ensure effective delivery of mitigation and rehabilitation support measures.

1.4.2.10 Resettlement and Rehabilitation

(1) Resettlement Site

The most significant impacts on affected households are land and structures loss. The census / socio-economic survey's data, and opinion from PAPs at the time of stakeholder meeting provide that all the respondents have preferred cash compensation for all types of losses and PAPs didn't request the group relocation to a resettlement site. Most of the affected land is evaluated comparatively high because such lands are usually adjacent to the existing SD Road.

In Nepal, "cash for land" compensation is common in the past projects, and it is also expected that compensation for landless PAPs who once encroached ROW will be assisted by cash to find another place to live. PMU and CDC cooperating with local authorities have to be careful with the cash payment to avoid any improper cases that PAPs cannot find the appropriate land nearby by the amount of assistance money. For the public land in the bypass section and some curve improvement points are also compensated by cash in principle. If there is observed strong needs to prepare resettlement site by considerable numbers of PAPs in the following detailed design phases, PMU should consider the feasibility of the resettlement site preparation.

(2) Income Restoration Program (IRP)

The income restoration program (IRP) plays an important role in implementation of the RAP. When PAPs lose business bases, jobs and other income sources, regardless of whether or not they lose their houses; those who lose both houses and income sources are the Project's highest risks. Providing measures to restore livelihood and quality of the life are the core target of the RAP. The objective of IRP is to restore the livelihoods of PAPs to the same level or higher than before the Project implementation.

1) Target of IRP and Assistances

At least one member of each affected households will be provided income restoration measures under IRP according to the ESMF. Target of IRP should be widely open to all project affected households who want to participate in.

2) Needs Analysis and Options

In the early stage of resettlement implementation, PMU / District and VDC shall organize stakeholder meeting to obtain needs on livelihood restoration from targeted PAPs and analyze the needs to form effective package of income restoration program. Expected measures for livelihood restoration program are shown as below;

A) Vocational Training and Guidance

This measure is job training for the people affected by land acquisition by using vocational training facilities nearby if there is appropriate demands in the target group of PAPs. Vocational training may provide; leather shoe manufacturing; sewing equipment repair; domestic and industrial electricity; electric and welding; cooking; construction; cutting processing; cooling, milling; motorcycle repair, office informatics, etc. Training fees for each course will be paid from the project budget. The Project is required to coordinate with such possible facilities in different districts to organize vocational training for affected households and/or recruit their children for work in factories.

B) Job Arrangement

After the job training, according to the list of trainees and demands of each trainee, PMU will coordinate with practical job opportunities. Or, activities of agricultural and forestry promotions will be discussed to provide knowledge of crops, livestock, fertilizers, technology, productivity growth.

C) Loan Program

During implementation phase, PAPs will be interviewed about their demands for credit loan. If do, they will be assist to access sources of credit loan such as revolving fund organized by rural banks.

3) Institutional Arrangement for IRP

PMU / District and VDC will deliver the above mentioned skills training and other opportunities with cooperation between local resources, such as training institutions/professional.

4) Job Creation for the Project Implementation

Furthermore, employment priority will be given to PAPs during the road construction period. As far as

possible, the Project will provide job opportunities through contractor for the affected people during implementation, in order to enable families to earn supplemental income to restore their livelihood.

1.4.2.11 Grievance Redress Mechanism (GRM)

Agencies in charge of implementing the procedure for handling grievance during compensation and land acquisition in the project affected areas should be established as Grievance Redress Committee (GRC). Detailed procedures on handling grievances will be established for the Project to ensure that PAPs have the opportunity to present their complaints about compensation and resettlement. PAPs have formal option to appeal CDO and Ministry of Home Affairs in case of grievance under regulations specified in Land Acquisition Act 2034 (1997).

This mechanism will be designed to be simple, understandable, quick and fair. Handling complaints at each Project level will facilitate the smooth implantation of the Project. PAPs who do not agree with the decision on compensation, assistance and resettlement are entitled to raise complaints based on the legal regulations. Handling grievances against compensation, assistance, land acquisition and resettlement decisions and with the responsibility for resolving complaints, and validation and settlement procedures shall be implemented based on relevant laws, such as Land Acquisition Act, Road Law, etc.

Since grievances are commonly found in any projects related to land acquisition and resettlement, to ensure the grievances are timely and effectively addressed, following general measures could be used;

(1) Grievances/Complaints should be recorded and maintained by both local authority/PMU and internal/external monitoring agencies with regular update, to timely and satisfactory solve the grievances.
(2) In case of verbal complaints, Grievance Redress Committee (GRC) should record in written format to follow up the complaints.

There is the potentiality for two main types of grievances: grievances related to land acquisition and resettlement requirements, and grievances related to compensation or entitlement. The PAPs will have access to both locally constructed grievances redress committees specified under ESMF, i.e. Local Consultative Forum (LCF) and formal courts of appeal system. Under the latter system every PAP can appeal to the court if they feel that they are not compensated appropriately. They may appeal to appellate court within 35 days of the public notice given to them.

Proposed mechanism for grievance resolution is given below:

Stage 1:

Complaints of PAPs on any aspect of compensation, relocation, or unaddressed losses shall in first instance be settled verbally or in written form in field based project office. The complaint can be discussed in an informal meeting with the PAP by the concerned personnel to settle the issues at the local level. The community consultation, involvement of social/ resettlement experts will be helpful in this regard. It will be the responsibility of Project In-charge to resolve the issue within 15 days from the date of the complaint received.

Stage 2:

If no understanding or amicable solution reached or no response from the project office, the PAP can appeal to CDC. While lodging the complaint, the PAP must produce documents to support his/her claim. CDC will provide the decision within 15 days of registering the appeal.

Stage 3:

If the PAP is not satisfied with the decision of CDC or in absence of any response of its representatives, within 35 days of the complaint, the PAP, in his/her last resort, may submit its case to the court.

1.4.2.12 Organizational Responsibilities

For the RAP implementation, reasonable organization framework must be considered. It also discusses monitoring requirements, before concluding an overview of the major planning, administrative and logistical requirements for the successful implementation of the RAP.

As the project authority, DOR, especially its PMU should be retained overall responsibility for the management procedures of the RAP as well. Key activities to be undertaken to ensure effective implementation of resettlement, compensation and rehabilitation activities are:

- Implementation of procedures to (i) minimize adverse social impacts including acquisition of land and assets throughout the planning, design and implementation phases and (ii) accurate recording of all PAPs, by means of census and asset verification and quantification exercises, and the issuing of identification,
- Establishment of systems and procedure for coordination of resettlement and compensation activities,
- Establishment of GRC to address the social issues with participation of affected people,
- Capacity-building initiatives to create a supportive environment for the implementation of RAP activities, including training on accepted resettlement and rehabilitation practices, training in the establishment of compensation plans for affected household,
- Coordination with other government line agencies like Department of Forestry and Ministry of Local Development to ensure effective delivery of mitigation and rehabilitation support measures, and
- Disclosure of RAP in both JICA and Nepal side

1.4.2.13 Implementation Schedule and Activities

(1) Implementation Schedule

The RAP implementation activities mainly consist of the tasks of compensation distribution and associated rehabilitation and resettlement activities. The project authority will ensure that funds are delivered on time to CDC and the Construction Supervision Consultant (CSC) for timely preparation and implementation of RAP, as applicable. Generally, civil works contracts will not be awarded unless required compensation payment has been completed. In the context of the project compensation process as well as income rehabilitation measures may continue and be completed even after civil works has begun. **Table 1.4-32** shows the

tentative implementation schedule for RAP.

Table 1.4-32 Tentative Implementation Schedule for RAP

S.N.	Tasks	Year I												Year II				Year III			
		1	2	3	4	5	6	7	8	9	10	11	12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12
1	Obtained Detail Engineering Design from Technical team	♦																			
2	Cadastral Survey	♦	♦																		
3	Census/ Socioeconomic survey for RAP updating			♦	♦																
4	Submission of Final RAP to DOR and JICA for approval					♦															
5	Submit final report to CDO for compensation determination						♦														
6	Notice publication of affected land							♦													
7	Public Consultation and establishment of GRC								♦												
8.	CDC meeting and Compensation Determination									♦											
9	Inform APs for the compensation claim										♦										
10	Collect application from the PAPs for compensation											♦									
11	Verify the application and prepare final list of PAPs												♦	♦	♦						
12.	Pay compensation for eligible PAPs															♦					
13	Contract agreement with Contractors															♦					
14	Transferring the land ownership																	♦			
15	Internal Monitoring of RAP implementation progress												♦	♦	♦	♦	♦	♦	♦	♦	♦
16	External monitoring of RAP implementation														♦		♦		♦		♦

(2) Key Implementation Activities in Implementation Phase

1) Advance Actions

Upon grant processing, DOR will initiate advance action such as; (i) Establishment of the Project Office ii) recruitment of the Project Manager(PM) and information dissemination to affected people and local community (iii) Formation of CDC (iv) Mobilization of Construction Supervision Consultant (v) Establishment of GRC as required.

2) Mobilization of Construction Supervision Consultant (CSC)

The CSC will be mobilized to monitor the project construction activities and to implement the resettlement action plan (RAP). The Social/ Resettlement Expert to be mobilized by CSC will be responsible for implementing the resettlement activities in close coordination with the Project Implementation Unit, Project Manager, and CDC including local communities and affected persons.

3) Cadastral Survey and Updating Draft RAP

The cadastral survey will be implemented again with updated design and other information related to the

project affected areas. The cadastral survey is one of the very important works which is conducted during detail design phase after getting approval of detail design. The cadastral survey is the method of determining resettlement impact on land, structures, and other assets aligning with the reference of cadastral maps. It has to be carried out by land surveyor with the help of assistant surveyor and other resettlement team such as enumerator, social mobilizer, resettlement expert etc. It is the main part of the RAP implementation. **Table 1.4-33** summarizes the steps and processes of cadastral survey.

Table 1.4-33 Key steps and process of Cadastral Survey

No.	Steps and Processes
1	CSC hired a Surveyor team (Surveyor, assistant Surveyor, helper etc.) for Cadastral Survey
2	Surveyor with the help of District Survey Office will conduct field survey based on reference of topographical map and final engineering design drawing
3	Survey Team identifies/delineate the reference points in different section of the road alignment and determines the final sheets of relevant cadastral maps applicable for land acquisition.
4	Relevant cadastral sheets will be collected from Survey Office.
5	Survey Team will conduct total station survey to fix the land acquisition line in the cadastral sheets with the help of affected persons, local communities and other stakeholders. Resettlement Team with social Mobilizer will fully support the Survey team.
6	Based on total Station Survey across the road alignment the Survey Team draw lines in the cadastral map delineating the affected portion of land, parcel number and calculate the area to be acquired.
7	The Resettlement Team with the support of Cadastral Survey Team will conduct final inventory survey if left during feasibility study and collect relevant document of affected land parcels such as Type of land parcels Private or government, owners of affected land and other information as applicable.
8	Type of affected land status will be collected from Survey Office and Landowner list from Land Revenue Office then final list of affected persons and their assets will be prepared and finalized the RAP.
9	DOR will send the list of land parcels, area to be acquired and owners name to CDC then compensation determination process will start.

1.4.2.14 Cost Estimation

The land Acquisition Act 1977 indicates need of initial estimation of compensation amount and determination of compensation rate at two different stages by two different agencies. As per clause 7(2) 8 (2) of Land acquisition Act, preliminary estimation should be made by agencies / project owner (DOR) seeking land acquisition, and the compensation rate is finally determined by CDC accordance to clause 13 of the Act. As the act stipulates, the agency concerned after initial investigation on likely acquisition have to submit formal report to CDO requesting for land acquisition. Then the CDO with the support of CDC will determine the final compensation rate.

The RAP has been prepared based on the enumeration of PAPs and their affected assets along the road alignment. The valuation of affected assets and compensation cost estimated for the loss of assets is based on replacement cost survey (RCS). RCS principally based on market cost survey subject to be finalized by CDC in accordance with the provision of Land Acquisition Act.

(1) Cost for Land Acquisition

There are two major different types of property valuation systems in Nepal, namely unit price based on

government rate and based on current market rate. As being practiced, the Government rate usually use to be fixed by District Land Revenue Offices in accordance with the location of land, type of land, the rate of land quoted on current land transaction documents, and land levy paid by the public.

It is assumed that the current market price denotes the replacement cost by which the PAPs can purchase similar types of land nearby the project area with the compensation amount. The current market prices are estimated based on a RCS of the JICA Preparatory Survey. Each estimate replacement cost is derived from relevant information from the local peoples such as real estate planner, indirect affected persons, and direct affected persons in the Area.

All of the affected lands by the Project are located within the urban/semi urban areas and adjacent to highway. Therefore, cost of affected land is relatively high comparing to other infrastructure project of Nepal. The estimated compensation for private land is shown in **Table 1.4-34**.

Table 1.4-34 Estimated Compensation for Private Land

1 USD= 100.09 NRs

S.N.	VDC/ Municipality	Area (sqm)	Government Rate		Replacement Cost	
			NRs	USD	NRs	USD
1	Bhaktapur	670	29,501,494	294,750	42,144,991	421,071
2	Chitpol	79,114	976,743,592	879,850	1,367,913,194	1,256,928
3	Nangkhel	15,583	403,504,089	4,031,413	504,022,645	5,035,694
4	Sipadol	2,000	88,064,161	9,758,653	125,805,944	13,666,832
5	Banepa	4,222	89,632,018	2,580,331	132,788,174	4,278,269
6	Dhulikhel	24,300	624,709,860	225,720	1,111,850,920	374,250
7	Nasikasthan Sanga	13,615	258,265,352	895,514	428,211,983	1,326,688
8	Ugratara Janagal	1,191	22,592,290	6,241,481	37,458,720	11,108,512
Total		**140,695**	**2,493,012,856**	**24,907,712**	**3,750,196,571**	**37,468,244**

(2) Cost Estimation for Private Structures

Around 461 various types of house/structure likely to be demolished due to the Project implementation. The cost estimation for the house/structure is based on the RCS, however, final compensation would be determined by CDC. During the detail design, the engineer of Department of Urban Development and Building Construction (DUDBC), the authentic organization of government for house evaluation, will be requested to involve the house/structures evaluation process. Estimated costs for the houses/ structures are presented in **Table 1.4-35**.

Table 1.4-35 Estimated Compensation for Affected Structures

1 USD= 100.09 NRs

S.N.	Type of Structure	No. of Structures	Plinth Area in sqm.	Rate/sqm in NRs	Total Amount NRs	Total Amount in USD
1	Simple hut/Shed	17	442	5,382	2,378,844	23,767
2	Thatched roof, walls constructed with bamboo and mud/stone	29	501	5,920	2,966,020	29,634
3	Tile/iron roof, walls constructed with brick/ mud/stone	148	4,465	10,764	48,061,260	480,180
4	Iron sheet/roofing with stone/ brick wall/cemented plaster	166	5,321	16,146	85,912,866	858,356
5	RCC building	76	9,931	26,910	267,243,210	2,670,029
6	Movable kiosk/ fence/wall etc	25	871	5,382	4,687,722	46,835
	Total	**461**	**21531**		**411,249,922**	**4,108,801**

(3) Displacement Allowances

The displacement allowance basically covers that residential house which needs to be displaced from their current location physically. Displacement allowances are based on 6 months minimum wage rates as established at the national or local level. The minimum wage rate in the project area is NRs 500/day. The Socio-economic/Census survey shows that 336 residential houses are qualified to get the housing displacement allowance. Estimated cost for the displacement/ rehabilitation allowances is shown in **Table 1.4-36**.

Table 1.4-36 Housing Displacement Allowances

1 USD= 100.09 NRs

Allowances	No. of residential houses	Unit Cost NRs	Total Amount (NRs)	Total Amount (USD)
Housing displacement allowances	336	90,000	30,240,000	302,128
Total	**336**	**-**	**30,240,000**	**302,128**

(4) Business Disruption Allowances

The Business disruption allowance will be provided to those business owners who are required to relocate from their own business, even in the case of temporal impact. This allowance is based on 6 months minimum wage rates as established at the national or local level. The minimum wage rate in the project area is NRs 500/day. It is estimated that 150 business owners will be displaced from their current location. Estimated cost for the Business disruption allowance is given in **Table 1.4-37**.

Table 1.4-37 Business Disruption Allowances

1 USD= 100.09 NRs

Allowances	No. of residential houses	Unit Cost NRs	Total Amount (NRs)	Total Amount (USD)
Business Disruption Allowances	150	90,000	13,500,000	302,128
Total	**150**	**-**	**30,240,000**	**302,128**

(5) Support allowances for Vulnerable Households

Support allowance will be provided to the affected vulnerable households such as women headed, Dalit and below poverty level households. According to Census/socio-economic survey 56 household will receive this allowance at the rate of NRs 50,000 (USD 499.6) per households. Propose a support allowance is given in **Table 1.4-38**:

Table 1.4-38 Support Allowances for Vulnerable Households

1 USD= 100.09 NRs

Allowances	No. of residential houses	Unit Cost NRs	Total Amount (NRs)	Total Amount (USD)
Support Allowances	56	50,000	2,800,000	27,975
Total	**56**	**-**	**2,800,000**	**27,975**

(6) Income Restoration Program (IRP) Cost

The training cost for each participants of IRP is estimated NRs 45,000 (including lodging, food, transportation, trainer cost etc., so total training cost = 181 person (target number) x NRs. 45,000 = 8,145,000 ($ 81,377)

(7) RAP implementation cost

There are several RAP implementation activities need to be carried out during the project implementation period such as public consultation and information dissemination, CDC meeting, RAP updating, external monitoring of RAP etc. Estimated cost for RAP implementation is presented in **Table 1.4-39**.

Table 1.4-39 Estimated Cost for RAP implementation

1 USD= 100.09 NRs

S.N	Description	Quantity	Rate NRs	Cost NRs	Total Cost in USD
1	Information dissemination/ meeting with APs and other stakeholders with tea and snacks	10	15,000	150,000	1,499
2	CDC meeting and follow-up activities	10	25,000	250,000	2,498
3	GRC meeting	20	20,000	400,000	3,996
4	Public notification/ resettlement leaflet		Lump Sum	250,000	2,498
5	RAP updating if required		Lump Sum	800,000	7,993
6	External Resettlement Monitoring	6 month	200,000	1,200,000	11,989
	Total			**3,050,000**	**30,473**

(8) Other Rehabilitation Cost

The census/socio-economic survey shows that 1,078 electric poles and telecommunication poles are required to be relocated. The estimated cost for these poles is 5,390,000 (at the rate of NRs 5,000/pole).

In addition, lump sum amount of NRs 600,000 is estimated for rehabilitation of three stone spouts in Nasikasthan Sanga VDC. The above mentioned public utilities rehabilitation cost and other remaining compensation cost of trees and crops if required will be included in contingencies heading in the budget.

(9) Summary of Cost Estimation

The summary of total estimated cost for the RAP implementation is shown in **Table 1.4-40**.

Table 1.4-40 Summary of Cost for RAP implementation

No.	Cost Item	Unit	Quantity	Amount (NRs)	Amount USD
1.	Land*	Sqm	140,695	0	0
2.	Structure	Number	461	411,249,922	4,108,801
3.	Displacement	Household	336	30,240,000	302,128
4.	Business Disruption Allowance	Household	150	30,240,000	302,128
5.	Support Allowance for Vulnerable people	Household	56	2,800,000	27,975
6.	Livelihood Enhancement Skill Training	Person	181	8,145,000	81,377
7.	RAP implementation	LS		3,050,000	30,473
Sub-total				4,235,921,493	42,321,126
Contingencies(5 % of total cost)**				211,796,075	2,116,056
Grand Total				**4,447,717,568**	**44,437,182**

Note: * The cost of land calculated as per market price
**The contingencies amount will be used for community infrastructure, compensation payment for trees and crops if required during the project implementation period and other unidentified item during the project design phase.

1.4.2.15 Monitoring and Evaluation

Monitoring and Evaluation is the tools for ensuring effective RAP implementation. The RAP implementation activities need to be monitored in different stages of the project cycle. The frequency and nature of monitoring and evaluation may vary in different phases.

Regular monitoring is essential and only an instrument to understand the socio-economic condition of the affected household. Two types of monitoring, internal, and external will be administered in three levels: (i) process level (ii) output level and (iii) impact level of: (a) record and assess the project inputs and the number of persons affected and compensated and (b) confirm that former subsistence levels and living standards are being reestablished.

(1) Internal Monitoring (IM)

The internal monitoring (IM) of the project implementation is done by DOR, PCU, and PMU in regular basis with the help of Socia Officer in GESU and resettlement specialists from the Project consultant. A quarterly report of IM will be prepared by Social Officer of GESU in consultation with consultants and submitted to PMU and JICA. The PMU will maintain a record of all transaction in their resettlement database, followed by entitlement records signed by PAPs, and survey based monitoring of resettlement and land acquisition progress.

The local civil society / group will play an important role in monitoring providing feedback on community concerns, grievances, and requests. Internal monitoring focuses and ensures the followings:

- Verification of non-outstanding or unresolved land acquisition issues with respect to the project and that property valuation and economic rehabilitation in accordance with the provision of plan
- Information campaign, discrimination and consultation with affected persons

- Status of land acquisition and timely payments on land compensation
- Value of entitlement received equal to that of actual land and structure acquired
- Use of entitlement and check its misuse
- Compensation for affected structures and other assets
- Payments for loss of income
- Relocation of affected persons and supports provided
- Implementation of economic rehabilitation and income restoration measures
- Effective operation of the Grievance Redress Committees
- Funds for implementing land acquisition and economic rehabilitation activities as timely manner and sufficient for the purposes and spent in accordance with the plan

Project field offices will be responsible for monitoring the day-to-day resettlement activities. The local social mobilizers under resettlement experts will play an important role to assist the project field office in course of regular monitoring. The field-level monitoring will be carried out through:

- Review of census information for PAPs
- Consultation and informal interview with PAPs
- Informal sample survey of PAPs
- Key informants interview
- Public consultation meeting

A performance data sheet / monitoring sheet will be developed to monitor the project at the field level. Monitoring framework including monitoring elements is presented in **Table 1.4-41**.

Table 1.4-41 Proposed Monitoring Items for the Internal Monitoring

Indicators	Issue	Procedure	Timing	Responsibility
Process level monitoring				
RAP implementation in the project works	Employment of local labor including women and children	Site observation, attendance record, interaction with laborers and contractors	Monthly	Project/ social mobilizer / SDRS
	Campsite management including lodging arrangement and campsite facilities	Site observation, interaction with laborers, contractors	Monthly	Project/ social mobilizer/ SDRS
	Use of health and safety measures	Site observation, interaction with laborers, contractors	Quarterly	Project/ SDRS
	Temporary leasing of private land and house	Site observation, contractors, check contract agreement	Monthly	Project/ social mobilizer/ SDRS
	Discrimination of wage rate between male and female workers	Interaction with laborers, labor survey, record of wage payment	Monthly	Project/ social mobilizer/ SDRS
Output level				
Land Acquisition	Encroachment into public land like grazing land, temples etc	Visit the identified public land interact with local people, take photographs	Biannually	Project/ social mobilizer / SDRS
	Development of new settlements/slum along the roadside	Observation, recording of sites, photograph	Quarterly	Project/ social mobilizers/ SDRS
	Migration to the road side/displacement of local people	Review of land holding records, discussion with local people	Quarterly	Project/ social mobilizer/ SDRS

Indicators	Issue	Procedure	Timing	Responsibility
	Incidence of road accidents	Discuss with local people, health institutions' records	Biannually	Project/ SDRS
	Incidence of communicable diseases like respiratory, STD, HIV/AIDS etc.	Discuss with local people, health workers/ health post/ center such as National Referral Center of Nepal, records	Annually	Project/ social mobilizer/ SDRS
Input level				
Change in household level income and economic activities	Changes in the land price, land use and agricultural practices, productivity and crop export	Discuss with farmers and extension workers, agricultural statistics of District Agriculture Office	Annually	Project/ social mobilizer/ SDRS
Social safety	State of social harmony and social security like alcoholism, narcotism,	Police records, discussion with local residents	Annually	Project/ SDRS
	Changes in the living standard of people	Interview with families, VDC records, discussion with local leaders, CBOs	Annually	Project/ SDRS
Cultural impact	Condition of cultural and historical areas and aesthetic qualities	Visit the area, discuss with people, observation and	Annually	Project/ SDRS

Social mobilizer: Field Level staff hired by the Project Supervision Consultant.
SDRS: Social Development and Resettlement Specialist hired by the Project Supervision Consultant.

(2) External Monitoring

The external monitoring (EM) will be carried out by independent agencies contracted by the DOR. The external monitoring agency (EMA) will conducts actives as below:

- Review of internal monitoring Reports
- Review of compensation status
- Monitor Rehabilitation support program
- Information disclosure system
- Process and mechanism of compliance redress
- Employment status of the PAPs
- Effectiveness of Livelihood restoration program
- Effectiveness of Awareness in HIV/AIDS and human trafficking

Based on the above mentioned activities the external monitor will focus on:

- Evaluation of social and economic impact of land acquisition and economic rehabilitation of the PAPs.
- Verify the objectives of enhancement of economic condition PAPs, or at least restoration of income levels and standard of living of the affected persons.
- Furnishing creative suggestions and modifications in land acquisition and economic rehabilitation, if necessary.
- Making to ensure all resettlement and land acquisition activities are properly conducted.

External monitoring agency will require the following activities to be performed:

- Verification of internal monitoring to ensure the appropriateness of activities carried out by program implementation unit in the field.
- Conduct household survey of PAPs to monitor progress comparing with pre project, pre-resettlement standard.

- Evaluation of delivery system to the PAPs and assess impacts of entitlements to determine the approved RAP.
- Evaluation of consultation and grievance redress procedures to identify the levels of public awareness of grievance-redressed procedures, accessed by PAPs and households for information and rapid conflict resolution.
- Evaluation of actual operations of grievance committee to assist PAPs as required and to act as observers.
- Declaration of successful implementation for summing up of activities related to entitlements, distribution, and resettlement.
- Recommend follow up action relating to outstanding actions required to complete achievement of objectives of the RAP and resettlement policies, additional mitigation measures for PAPs.

Table 1.4-42 Proposed Monitoring Form for the External Monitoring

Indicators	Procedure	Timing
Employment of local labor including women and children	Site observation, attendance record, interaction with laborers and contractors	Annually
Campsite management including lodging arrangement and campsite facilities	Site observation, interaction with laborers, contractors	Annually
Use of health and safety measures	Site observation, interaction with laborers, contractors	Annually
Temporary leasing of private land and house	Site observation, contractors, check contract agreement	Annually
Discrimination of wage rate between male and female workers	Interaction with laborers, labor survey, record of wage payment	Annually
Encroachment into public land like grazing land, temples etc	Visit the identified public land interact with local people, take photographs	Annually
Development of new settlements/slum along the roadside	Observation, recording of sites, photograph	Annually
Migration to the road side/displacement of local people	Review of land holding records, discussion with local people	Annually

(3) Associated Social Issues and Action during Construction

Following items are proposed for any related organizations, companies, and local people.

- The child below 16 years of age have to be strictly prohibited to use as child labor
- Wage should be same amount for men and female workers for same types of work
- The contractor(s) have to be safety fast in any situations and works to avoid accidents
- Trainings will be provided to all construction workers about health and safety measures
- Fencing will be done to restrict public movement around the construction sites;
- Protective gear such as helmets, boots, gloves and masks will be provided to construction workers, supervisors and visitors

- Warning signs/posts will be installed for informing the local people about the potentially dangerous areas
- Only authorized persons will be given responsibility to operate machinery and other heavy equipment
- Temporary support structures will be constructed to avoid rock falls, erosion and landslides during construction. Soil excavation during monsoon in unstable areas will be minimized, if not totally avoided
- Adequate lighting and ventilation facilities will be maintained at all construction sites
- Emergency equipment like first-aid kits, flashlights, fire extinguishers, siren, emergency vehicles and phones will be made available at construction sites
- Qualified medical personnel will be appointed at the construction sites to oversee emergencies related to occupational health and safety
- An Emergency Response Contingency Plan will be prepared to appropriately deal with emergencies. The workers will be trained to follow the plan in case of accidents
- The contractor(s) or the client will obtain insurance against any possible injury to all project staff/workers including client's personnel. Furthermore, the responsible party will also obtain third party insurance against any possible injury to visitors and possible victims
- A health center will be established in the project area for attending health matters of workers and local population during construction phase
- The construction contractor is responsible for all preparatory works and ensuring drinking water and sanitation facilities required for construction workers before the commencement of work
- A solid waste collection and storage system will be established in all the construction related camps and construction sites. The collected waste will be segregated as to the property of the waste such as degradable, glass, metals, plastics, cloths and leather etc. and will be stored in separate bonded areas. These materials will be disposed as to the recommendations and approval of the project environmental officer. The contractor will be made responsible for the measure
- Garbage containers of adequate size will be placed at critical places in the construction related camps and construction sites. The garbage will be collected daily and segregated while storing. The contractor will be made responsible for the measure

2. Contents of the Project

2.1 Basic Concept of the Project

2.1.1 Overall Goal and Project Objective

In Nepal, where there are not sufficient trunk roads, development of land transport (road to be specific) is an urgent and important issue in order to secure smooth, safe and reliable transport including securing of stable and reliable road network for improving the trade and logistics. The objective road (SD Road) is seeing significant rise in the traffic volume due to completion and opening of Sindhuli Road to the already increased traffic volume caused by the rapid population increase in the capital Kathmandu.

In order to respond to such situation, the Government of Nepal set the goal of establishing a stable and reliable transportation network with consideration for the socio-economic development of the country in its higher most development plan "An Approach Paper to the Thirteenth Plan (APTP)". One of the targets mentioned in the Paper is the development of Mid-hill Highway. The project road is a part of this highway. The project aims to improve the Suryabinayak – Dhulikhel section on the Arniko Highway by widening the existing road to 2-lane dual carriageway from its present 2-lane single carriageway.

2.1.2 Survey Objective

The objectives of the survey are to;

- Understand the background, purpose and scope of a grant aid project,
- Study the project feasibility in terms of effectiveness and technology and economic justification,
- Conduct outline design for the minimum but optimal scope and size of the project required for achieving the outcomes of the cooperation,
- Estimate the cost of the project, and
- Propose the contents, implementation and maintenance plan as well as critical points to be undertaken by the GON in order to achieve the outcome and targets set for the project.

2.1.3 Target and Expected Outcome

The target and expected outcome of the project are as follows;

Target	The arterial road from Suryabinak to Dhulikhel will be improved
Expected Outcome	The travel time from Suryabinayak to Dhulikhel will be reduced

2.2 Outline Design of the Requested Japanese Assistance

2.2.1 Design Policy

The result of traffic survey conducted during the second field survey (July 2014), indicates that the average daily traffic volume on the objective road exceeds ten (10) thousand vehicles per day. Traffic volume is expected to have been further increased due to inflow from the newly opened (July 2015) Sindhuli-Bardibas Road and soon exceed the capacity of this currently two lane road, which will not only create severe traffic congestions but also become an obstruction to safe and smooth traffic operation.

The design envisages increasing the traffic capacity by widening the existing road from its present 2-lanes single carriageway to 2-lanes dual carriageway (4 lanes) for an approximate 16km stretch (Suryabinayak to Dhulikhel) including reconstruction of four existing bridges. The project also plans to improve the geometric conditions by improving the alignments of sections that currently do not meet the standards of Asian Highway and/or Mid-hill Highway. At Sanga areas, where consecutive sharp curves associated with steep vertical grades are prominent, a bypass is planned taking into consideration that improving the existing alignment is technically complicated, environmentally unfriendly and economically unattractive.

Enhancement of accesses for traffics to and from the abutting properties is also addressed by provision of service tracks. However, it is limited to built-up areas (Suryabinayak, Banepa and Dhulikhel). The design also undertakes improvement of major existing intersections, provision of footbridge and bus laybys are also included in the outline design with the purpose to secure safety of traffics and pedestrians.

Consideration is given in the design for minimization of land acquisition by utilizing the existing road reserve to the possible extent. At Sanga bypass and other sections where the alignments undergo improvement, consideration is given to avoid facilities such as temple, holy and religious trees, cultural buildings etc. in addition to minimization of land acquisition.

Last but not the least, environment, cost, construction efficiency and maintenance and operation capacity of the DOR is taken into construction for planning of structures for spanning a river and bridges and culverts. The specific policies applied on each items is discussed in the following sections.

2.2.1.1 Traffic Condition

Traffic volume on the objective section is continuously increasing. The volume at Suryabinayak, the start point of this project, was 15,000 vehicles per day in 2007 (source: Kathmandu – Bhaktapur Road Improvement Project) and 18,000 vehicles per day in 2014 as given by the traffic survey conducted under this survey, showing an average annual growth of 2.0%. On the other hand, according to the traffic demand forecast, the traffic growth is predicted to be about 5.8% in the coming years and is soon reach the capacity of the existing road. **Table 2.2-1** shows the traffic growth rate, while **Table 2.2-2** shows the future traffic volume and congestion rate. Although for the present traffic volume, the existing road is yet to be saturated (overcome capacity). However, the Suryabinayak – Banepa stretch is predicted to saturate in year 2020. The stretch between Banepa and Dhulikhel also reaches near saturation (99.2%). Given that the road is widened to four lanes, the road is not saturated even in year 2030.

Table 2.2-1 Future Traffic Growth Rate

Vehicles	Average Annual Daily Traffic(Veh/day)		Growth Rate	Annual Growth Rate
	2011	2022		
All vehicle	26,599	49,206	185.0%	105.8%
Motorbikes	16,997	28,601	168.3%	104.8%
Cars	4,503	10,350	229.8%	107.9%
Trucks	3,494	7,421	212.4%	107.1%
Bus	1,605	2,834	176.6%	105.3%

Note: Growth rate calculated based on estimated future traffic volume of Kathmandu Valley for year 2011 to 2023 in the Improvement of Data Collection and Preparatory Survey for Improvement of Urban Transport in Kathmandu Valley, 2012

Table 2.2-2 Result of Future Traffic Saturation Rate

No. of Lanes	Section	Current Traffic Volume (Saturation Rate)	Future Traffic Volume (Saturation Rate)	
			2020	2030
2 Lanes	Suryabinayak – Sanga (Capacity: 16,000 pcu/day)	14,309 (89.4%)	22,746 (142.2%)	42,541 (265.9%)
	Sanga – Banepa (Capacity: 16,000 pcu/day	14,243 (89.0%)	22,578 (141.1%)	42,010 (262.6%)
	Banepa Bazaar (Capacity: 12,800 pcu/day)	10,740 (83.9%)	17,440 (136.2%)	32,193 (251.5%)
	Banepa – Dhulikhel (Capacity: 16,000 pcu/day)	9,650 (60.3%)	15,879 (99.2%)	29,297 (183.1%)
4 Lane	Suryabinayak – Sanga (Capacity: 45,600 pcu/day)	14,309 (31.4%)	22,746 (49.9%)	42,541 (93.3%)
	Sanga – Banepa (Capacity: 45,600 pcu/day	14,243 (31.2%)	22,578 (49.5%)	42,010 (92.1%)
	Banepa Bazaar (Capacity: 36,480 pcu/day)	10,740 (29.4%)	17,440 (47.8%)	32,193 (88.2%)
	Banepa – Dhulikhel (Capacity: 45,600 pcu/day)	9,650 (21.2%)	15,879 (34.8%)	29,297 (64.2%)

2.2.1.2 Applied Criteria, Data, and Lessons Learnt from Previous Projects

(1) Applied Criteria

According to the discussion with the DOR, the standard to be used for the design purpose of road and bridges under this project is basically that of the Asian Highway, as the objective section of this project is designated as a part of Asian Highway. However, for items not available in the Asian Highway Standards, DOR agreed use of other standards listed hereunder or other international standards that are equivalent to these standards.

- ✧ Asian Highway Standard (Road classification, design speed etc.)
- ✧ Policy on Geometric Design Highways and Streets 2004 (AASHTO)
- ✧ Indian Road Congress (for loads acting on structures)
- ✧ Guide for Design Pavement Structures 1993 (AASHTO)
- ✧ Japan Road Ordinance (Japan Road Association)
- ✧ Specification for Highway Bridges (Japan Road Association)
- ✧ Specification for Box Culverts (Japan Road Association)
- ✧ Guideline for Design of Pedestrian Bridges and Underpass (Japan Road Association)

(2) Data and Lessons Learnt from Previous Projects

The available documents listed in **Table 2.2-3** and relevant information collected from past and on-going projects are collected and utilized. In addition, the lessons learnt from the projects listed in the table are appropriately reflected in the planning procedure.

Table 2.2-3 List of Previous Projects Relevant to this Project

Types	Project	terms
Development Survey	Sindhuli-Bardibas Road Construction Project	1986～88
	The Study on the Disaster Risk Management for Narayangharh – Mugling Highway	2007～09
Grant Aid Projects	Sindhuli-Bardibas Road Construction Project（First Section）	1995～97
	Sindhuli-Bardibas Road Construction Project（Fourth Section）	1997～2001
	Sindhuli-Bardibas Road Construction Project（Fourth Section）	2003
	Sindhuli-Bardibas Road Construction Project（Second Section）	2000～08
	Sindhuli-Bardibas Road Construction Project（Third Section）	2009～11
	Sindhuli-Bardibas Road Construction Project on Third Section (2/2)（first part）	2011～15
	Sindhuli-Bardibas Road Construction Project on Third Section (2/2)（first part）	2011～15
	Sindhuli-Bardibas Road Construction Project（Second Section） for slopes	2012～15
	Kathmandu－Bhaktapur road Rehabilitation Plan	2008～11
Technical Assistance	Road Maintenance and Operation Enhancement Project	2011～15
Experts	Road Planning and Maintenance and Operation Advisor	2003～11
Basic Study	Study on road rehabilitation projects under financial assistance in Africa (Ethiopia, Ghana, and Tanzania)	2013

2.2.1.3 Policies of Road Planning

(1) Road Classification and Design Speed

The objective road is a part of Arniko Highway, which is designated as a part of Asian Highway 42 (AH42). The objective section of the road is classified functionally into 'Class I' under the Asian Highway classification taking the above matter into consideration.

Design speed for the objective road is based on the standards of Asian Highway. The speeds shown in **Table 2.2-4** for classification 'Class 1' are applied such that the design speed for rolling terrain is 80km/h while the design speed along mountainous and steep terrain is 60 km/h. However, as the existing road was constructed in the 60s, it has many sharp curves and steep grades. The alignment requires significant change in order to meet the geometric requirement with respect to the design speed. This will necessitate huge area of land acquisition. Therefore, with an aim to minimize the land acquisition area, for certain areas the design speed is reduced accordingly.

Table 2.2-4 Road Classification, Terrain Conditions, and Designed Speed

Topography / Classification	Flat Area	Rolling Area	Hilly Region	Mountainous Region
Primary	120	100	80	60
Class I	100	**80**	**60**	**60 (40)***
Class II	80	60	50	40
Class III	60	50	40	30

** Value inside parenthesis is taken from Nepal Road Standard-2070*

(2) Road Reserve (Right of Way)

In Nepal, ROW (Right of Way) of a national road is 25m from the center of a road. The project road is a part of Arniko Highway (national road) and therefore the same width should apply. However, there are sections where the ROW is set as 25 yards following the precedent from the Supreme Court and there are

sections where many houses have completed set back based on the 25 yards standard.

Based on above situation and following discussion with the DOR, the ROW to be applied for the objective sections of this project is set to 25 yards.

(3) Delineation

The project road is a main arterial road consisting of sharp bends and steep slopes that don't meet the standards at several locations. Improvement of these alignments is indispensable for upgrading the existing road. There are many holy trees, shrines, religious facilities, holy ponds along the road. These objects will be taken as control points and effort will be given to avoid them.

The alignment at Sanga area and Sanga Pass has consecutive sharp curves and steep grades and is a bottleneck section where occurrence of traffic congestion due to slower traffics and traffic accidents are frequent. Widening/improvement of the existing road of this section is likely inflate the construction cost and increase the adverse impact on the environment, as it is thought to require massive earthwork and use of multiple bridges along with provision of huge retaining walls. Furthermore, the construction efficiency of this section is expected to fall drastically as it is very difficult to secure space for construction roads and yards. Therefore, provision of a bypass (road along the mountain at the north side of the existing road) shall be studies.

(4) Service Tracks

In the application forwarded by the GON to the GOJ for the grant aid assistance of Japan, construction of service tracks was mentioned as to be undertaken by the GON. However, service tracks in the built-up areas are planned to be undertaken by this project for the following reasons;

i) Early realization of project outcomes,

ii) Securing of adequate road functions,

iii) Logical and ideal road planning and design, and

iv) Executing road construction while maintaining the conveniences and security of the locals

The service tracks will have a width sufficient enough to allow vehicles to pass when there are vehicles stopped/parked for uploading and/or offloading.

(5) Improvement of Intersections

At present, there is severe shortage of stable and uninterrupted power supply in Kathmandu Valley that is evident from the planned load shedding that exceeds ten hours a day. Under current situation, sustained power supply and persistence of facility management and operation cannot be secured. Therefore, provision of facilities such as traffic lights and streetlamps are excluded from the scope of this project. However, taking the needs and ease of construction in the future into consideration, underground pipes for such facilities are included in the project. Until then, traffic police will have to be deployed for traffic control and management and secure the safety of cars and pedestrian.

(6) Assessment of Existing Pavement and Pavement Design

It is believed that the present pavement is more than ten (10) years old. At many sections, the pavement is observed to have distresses, namely potholes, rutting and alligator cracks. Therefore, it is considered better to reconstruct the base course and the wearing (surface) course than just doing an overlay of surface course. On the other hand, since long period has passed after the road had been constructed and there are no design or construction documents to understand the change of load conditions applied during the construction, the existing subbase is considered no more useable as the base course.

For reasons mentioned above, following policies is applied for the pavement design;

- The existing pavement including the base courses for the entire stretch to be widened under this project will be subject to removal. The Califonia Bearing Ratio (CBR) values to be used in the pavement design will be taken from outside (area to be newly widened) the existing road,
- Flexible pavement (asphalt concrete) which is very common and widely used in Nepal will be applied,
- The calculation of pavement composition will be based on AASHTO method,
- The equivalent single axle load (ESAL) and resiliency of the subgrade will be calculated based on the results obtained from traffic survey and geo-technical investigation carried out under this project,
- Previous JICA projects (especially KB road) and basic study "Study on Road Rehabilitation Projects under Financial Assistance in Africa (Ethiopia, Ghana, and Tanzania) will be referred,
- For durability assurance, the minimum thickness of asphalt pavement to be applied on the main road will be above 10cm.

(7) Drainage Plan

The following policies are applied regarding plan of road surface drainage;

- Drainage facilities will be provided in built-up areas to transport the surface rain water and drain at a designated outlet. The facilities will be of the similar size or capacity as that of the existing facilities.
- Provision is limited to facilities for road surface drain purpose. Plan and provision of facilities for sewage and domestic effluent currently being drained out into the road drainage facilities, shall be executed by the GON.
- In the absence of the drawings and relevant documents, it is difficult to predict whether the existing cross-drainage facilities can withstand the load from the increased traffic, particularly heavy vehicles. Therefore, these facilities are planned to be replaced with new ones. The size and capacity, as well as draining facilities, similar or larger than the existing facilities is applied.
- Currently, portions of road in Jagati and Banepa often experience water logging during

monsoon. The logging is attributed to insufficient draining capacity of the existing road drainage facilities combined with lack of proper and timely maintenance of these facilities and the outlets and above all lack of a water canal for draining water coming from outside the road reserve. The most effective solution is to address the latter issue that is to provide water canal outside the road reserve and improve the outlets. This is not included in the project scope and the issues will have to be resolved by the GON. The issue of water logging on the main road is dealt with in this project by raising the main road profile. For water logging on service tracks, the road drainage facilities are rehabilitated which is deemed to contribute lowering the effects.

(8) Renovation of Existing Bridges

The four (4) bridges within the objective section of this project are considered to be old and its soundness is a question of concern due to the fact that more than forty (40) years have passed since they were constructed. Field reconnaissance identified various damages on these structures. Therefore, these structures will be reconstructed. The design of these structures is based on considerations for expected heavy traffics, sustainable maintenance, cost, construction efficiency road alignment etc.

(9) Footbridges

Footbridges will be provided for sustaining traffic functions of main roads and for enhancing safe road crossing of pedestrians including bicycles. The policies that apply are;

- The locations will be limited to where service tracks exists (are provided) and where provision of the facility is expected to immensely contribute to realization of project outcomes,
- Consideration for multi-purpose use will be given by providing slopes for bicycle users,

(10) Bus Laybys

- Bus laybys will be provided at the existing locations,
- It will be provided between the service track and the sidewalk on sections where the service tracks are to be provided by this project,
- Bus laybys elsewhere will be provided beside the main road.
- Bus shelters and ancillaries will not be provided in both cases and will be undertaken by the GON necessarily.

(11) Traffic Safety Facilities

Widening of the objective road is expected to bring about raise (improvement) in travel speed on one hand and the rise in fatal accidents on the other. Therefore safety concerns need particular attention. Following policies are taken for the purpose, combined with the policies applied by the KB Road Construction Project.

Median is provided for the entire section to separate the anti-direction vehicles physically and enhance safety (particularly head-on collisions). In addition, fences are provided along the median to prevent possible road crossing by pedestrians.

In residential and commercial areas, footpath (sidewalk) is provided on service tracks to facilitate safe movement for pedestrians and unorderly and unnecessary use of main roads.

Provision of traffic signals, traffic lights and its foundations is not included in this project taking into considering the planned light shedding in Kathmandu valley. However, in order to facilitate provision of these facilities in the future, conduits for these facilities are planned to be provided under this project.

Pedestrian crossings (Zebra crossings) are planned on places shown below;

- nearby existing pedestrian crossings
- nearby bus laybys where footbridges are not provided
- nearby educational facilities and medical facilities
- nearby junctions and access roads
- other places where crossing is required for traffic safety

2.2.1.4 Policies against Natural Conditions

(1) Climate Condition

The project area is located in Kathmandu valley. The climate in Kathmandu valley is tropical where the monsoon lies between June and September. December to February is relatively dry. 80% of rainfall is concentrated during monsoon. Maximum temperature in the hottest season, June to September, is 27~28 ° C and is 10 ° C in January. There is a vast difference in temperature between daytime and night time, with high relative density throughout the year.

Measures or considerations to be taken against rainfall in regards to planning and design for this project are as follows;

- In mountain area such as Sanga, large scale embankment and cutting soil may be required. For such sections, plans and designs of collapse protective barrier, and materials for preventing slope erosion will be applied,
- Establishment of construction plan of embankment, subgrade, improvement of embankment section, and pavement taking the rainy season into consideration,
- Construction order of drainage facilities (including cross-drainage) considering rainy season.
- Construction of substructures of bridge considering rainy season.

As shown above, material selection and slope protection require additional care during its design and planning, and construction of bridge foundation and earthwork should be avoided in rainy season. Annual rainfall in Kathmandu is relatively low (about 1,500mm), however considering that 80% of it falls in the rainy season and the recent trend of abnormal weather occasionally seen in various parts of the world, it is utterly important to take this issue with immense concern.

(2) Earthquake

Nepal is located in between the Indian Plate and Eurasia plate where the Indian Plate is thrusting the

Tibetan plateau and Himalayas towards Eurasia plate. This tectogenesis phenomenon occasionally causes earthquakes in Nepal. One of the evidence of such earthquake is the one recently occurred 77km away northwest to Kathmandu on 25th April, 2015.

The objective road is designated in Nepal as a part of Asian Highway and will be the backbone in terms of logistics and as such the stretch (road) is expected to function as an emergency transport road during earthquakes. Therefore, it is important that it is resistant to earthquake and its design should be done carefully and in accordance with the seismic design criteria of Nepal. Therefore, in regards to design of structures, particularly bridges, the following considerations will be taken;

- The bridge will as far as possible be continuous,
- The slabs (decks) will be combined in case of multi-span simply supported bridge,
- Providing unseating preventing facilities,
- Prevent buckling by inserting adequate hoops in pedestal.

2.2.1.5 Policies against Socio-economic Conditions

The project road connects to the Sindhuli- Bardibas Road, which was newly constructed and opened to general traffics in 2015 and Kathmandu－Bhaktapur road (KB Road) that was expanded in 2007, both under the Japanese grant aid projects. Communities and cities such as Suryabinayak, Jagati, Nalinchok, Sanga, Banepa, and Dhulikhel are located along the project road. These communities and cities have been transforming into and functioning as bed towns following expansion of the KB Road in accountability of reduction of travel time to Kathmandu. Large part of other area is used as rice field and farm lands. There are several brick factories, an amusement park, religious facilities and tourist attraction places.

This project is expected to contribute to the development of agriculture, environment, industries and residential environment. Subsequently, followings considerations will be taken in the improvement of the road;

- The geometric conditions will be consistent with the criteria as necessitates by the design speed to ensure safety of traffics and pedestrians to comply with the expected increase in the design speed,
- Road drainage facilities, similar in size or capacity equal or higher than that of the existing drainage facilities, will be provided and adequately connected to the existing drainage system.
- Major intersections will be improved to secure smooth and safety traffic. The improvement will reflect the future traffic volume and future city planning.
- Service tracks will be provided in urban areas (built-up areas) to secure smooth and safety traffic access of alongside residents.
- Footbridges will be provided to secure safety of pedestrians considering that the project road will also serve as a community road in the urban area.
- Bus laybys at the existing bus stops will be provided in order to ensure safety of bus users. For

roads with service track, provide bus laybys outside the service track (between service track and footpath) to put enough distance from main road.

2.2.1.6 Policies against Control Points for Delineation of Alignments

Many kinds of obstructions, such as houses, trees, electric poles, and signboards above the ground and communication cable, water pipes, and sewer pipes underground were found on the project road. The objects and utilities that are going to be affected by the project shall be relocated under the responsibility of the GON.

Underground facilities are crucial for communities and villages, and damages on them may cause huge adverse impact on the society through power outage, severance of water supply, and communications failure. In addition, lack of proper and timely maintenance of these facilities after construction will bring about unfavorable conditions to the project road. Therefore, discussion should be held with the owner of these objects and relocate the facilities in areas not influential to the project road.

2.2.1.7 Policies of Environmental and Social Consideration

- Confirm the status of land acquisition and take necessary procedures required for Japan's grant aid projects categorized as 'A' in "JICA's Environmental and Social Consideration. Guideline (April 2010)".
- Formulate EIA draft report and RAP planning report in conformity with the Guideline.
- Confirm the procedures of Government of Nepal including obtaining of permits, assist in the preparation of document and processes and follow-up necessarily.

2.2.1.8 Policies of Construction and Procurement Condition

The result of construction condition survey and basic procurement policies of labor, construction materials, and construction mechanics are shown below;

(1) Construction condition

Based on the thirteenth national development project of Government of Nepal, many road constructions are undergoing that are supported by fund from national budget and donors including Japan. Simultaneously, restoration projects from natural disaster (earthquake) occurred in April 2015 is expected to commence in the near future. Therefore, price hike of construction materials (cement, reinforcing steel, and aggregates) that are likely to have high demand for the restoration and other projects may inflate the ratio of price hike beyond expectation and should be noted accordingly.

(2) Procurement Condition

1) Recruitment

Labors for general road construction can be procured from around Kathmandu valley and its neighbor. However, skilled labors having knowledge and construction experience of long span bridge and special slope stability/protection measures are not readily available. Therefore, in such case, the Japanese engineers will have to educate the local labors by properly and specifically giving instructions to them.

2) Materials

Natural materials (aggregations and embankments) and general construction materials such as reinforcement steel and cements are available in the local market. Safety barrier (guard rails) and other metallic processed items are procurable from India. However, materials for bridge construction (PC related materials, bearing, expansion device) are desirable to be procured from Japan from the perspective of quality control.

3) Machines and Equipment

General construction machines for earthworks, pavement, and concrete construction are available in the local market. On the other hand mixture plant, ready-mixed concrete, its related machines, and other specific machines (foundation pile machine, machines for girder production and erection) are deemed proper to be procured from Japan as the procurement reliability and availability is high.

2.2.1.9 Policies for Utilization of Local Firms

There are many local construction firms and they are classified into A~D. However the number of firms are thought capable of complying to the requirement of construction period and/or ensuring quality is limited to about 20% in class A (40 firms), and 10% in class B (45 firms). These local firms have been engaged in construction of roads and RC bridge (spread foundation). However, it is deemed to be extremely difficult for these firms to confirm to the requirements such as the work period and quality assurance as the components of the project consist of construction of specific structures (high pier PC bridges, box culverts, special slope stability measures, or works that demand high technics and abundant experience in a mountainous areas Therefore, the method of utilizing the local firms by the Japanese contractor will limit to partial subcontracting, employing labor and leasing machines.

2.2.1.10 Policies of Operation and Maintenance

DOR, the implementing agency of this project has experience in executing construction of Kathmandu - Bhaktapur Road and Sindhuli – Bardibas Road under the grant aid of Japan grant aid and is believed to have accumulated management capacity high enough to implement this project smoothly. In addition, the DOR is also thought to have enhanced its capacity regarding operation and maintenance of roads through the technical cooperation project of Japan "Sindhuli-Bardibas Road maintenance and Operation Capacity Development Project" where capacity development has been materialized for establishing methods for slope stability and application of response measures against natural disasters.

This project aims to share the important points for inspection methods and items of PC bridges and RC footbridges during construction. Therefore, after the implementation of this project, bridge management and operation capacity of the DOR is expected to be enhanced.

2.2.1.11 Policies for Establishing the Grades of Facilities

The project objective is to construct (widen) the existing arterial road between Suryabinayak and Dhulikhel. In order to achieve this objective, proper grades on individual facilities that will be constructed need to be settled for this project. Basic policies of grade settlement are shown below;

(1) Road Standard and Criteria Applied

The project road between Suryabinayak and Dhulikhel is located on Arniko Highway, which is classified as a national road, and is also a part of Asian Highway and Mid-hill Highway. Therefore, the design speed and geometric conditions is applied to be in line with the standards of Asian Highway. Pavement design, structural design etc., which are not covered by the Asian Highway standards, will be based on international standards, namely ASSHTO. Live loads, seismic force and thermal loads that are required to be adaptable to the local requirements will be based on the Indian criteria. Stability calculations will on the other hand based on Japanese specification for highway bridges.

(2) Policies on Design and Construction Planning

Facilities constructed under this project include expansion of existing road, construction of new bridge, rehabilitation of existing bridges, improvement of major intersections, construction of service tracks, construction of pedestrian bridges, construction of bus laybys, and traffic safety facilities. Design and construction planning of these facilities are based on the data obtained from topography survey, geo-technical investigation, traffic survey etc. and information gathered through meetings/discussions and hearings with related authorities.

(3) Policies on Maintenance and Operation after Construction

Design period of pavement has been taken as ten (10) years. This is based on the standard of the GON. The period is considered to be adequate enough for the DOR to perform proper maintenance and operation. The project road is classified as a national road and has top priority for maintenance and operation. With regards to bridges and other structures, concrete type that is basically maintenance free has been applied.

2.2.1.12 Policy on Construction Method and Construction Period

(1) Policy on Construction Method

The improvement in this project consists mainly of widening the existing road although there are several sections that require realignment. The objective road is a highway and passes across three urban areas and attracts significant number of through traffics and traffics generated and attracted within these urban areas. It is therefore important to secure the existing traffics. The policies for its measures are as follows;

- Where service tracks are provided, the service tracks are constructed first. It is then used for existing traffics during construction of the main road.
- Where service roads are not provided, sections undergoing realignment and the widening portion are first constructed. Traffics will be diverted to these portions during the construction of the main road.
- The construction period of box culverts at rivers and footbridges is considered to be relatively long. These structures will be divided into two parts and construction will be carried out alternatively.

(2) Policy on Construction Period

The project consists of improvement of the existing road of 14km and construction of a new road of

1.4km. Considering the procurement conditions of construction work labor, material and machines, necessity of securing existing traffics, and reduction of cost, it is inappropriate to construct the whole route at the same time. Therefore, the route is divided in to 10 sections and 2 phases based on the level of construction priority. Suryabinayak-Sanga with a length of 6.58km will belong to Phase 1. Sanga-Dhulikhel (8.34km) section will belong to Phase 2. The conditions for construction period are as follows;

- Construction machines and equipment shall be commonly used within the sections as well as in other sections,
- The construction days of each work is calculated by the work volume and the capability of construction
- Large-scale earthwork and construction of box culvert at rivers will avoid monsoon period

2.2.2 Basic Construction Plan

2.2.2.1 Project Scope

Major project scopes are shown in **Table 2.2-5**. The scopes consist of widening of existing road, from Suryabinayak to Dhulikhel (approx. distance 16km), construction of new bridge, replacement of 4 existing bridges, provision of 20m long box culvert for underpass at Sanga Pass, construction of 6 pedestrian bridges, and improvement of intersection at 6 locations, among others.

Table 2.2-5 Project Scope

Items	Scope	Remarks
Widening of Existing Road	2-lane single carriageway to 2-lane dual carriageway, L=12.91km	Exclusive of approx. 2km bypass road at Sanga (new construction of a bypass).
Bridge (New Construction)	Pre-stressed Concrete Bridge (4 lane., L=198m)	Sanga area (5+520 ～ 5+718)
Bridge Replacement (replace by box culvert)	N=4 locations (length varies)	Jagati (1+700), Bhiktesor (10+540), Banepa (7+850 and 12+100)
Underpass Box Culvert	1 No. ,L=10m	Sanga Pass (Sta.6+375)
Pedestrian Bridge	Reinforced Concrete Bridge, N=6locations, L=varies	Suryabinayak (0+100), Jagati (1+50), Banepa (11+0 , 11+340 and 11+820), and In front of Kathmandu University (13+270)
Improvement of Intersection	6 locations	Suryabinayak (0+000), Jagati (1+200), Sanga (4+900), Banepa (11+480), In front of Kathmandu University (13+330), and Dhulikhel (14+900)

2.2.2.2 Geometric Condition

The geometric conditions set in the Asian Highway Standards will apply for the design works of the objective road. DOR agreed to the conditions as mentioned in **Table 2.2-6**.

Table 2.2-6 Geometric Condition (Asian Highway Standard)

Items		Conditions (Classification: Class I)		Remarks
Design Speed		80km/h	60km/h	80km/h: 0+000～4+830, 6+580～12+200 60km/h: 4+830 ～ 6+580, 12+200 ～ 14+920
Width（m）	Lane	3.5	3.5	Values for design speed 80km/h has been adopted for entire stretch
	Shoulder	3.0	2.5	
	Median	3.0	2.5	

Items	Conditions (Classification: Class I)		Remarks
Minimum Horizontal Radius (m)	210	115	
Camber (Crossfall) （%）	2	2	
Maximum Vertical Grade (%)	5	7	
Clearance	5.0	5.0	Vertical clearance

2.2.2.3 Road Planning

(1) Route Planning

This project aims to widen the existing road from its current 2-lanes single carriageway to 2-lane double carriageway from Suryabinayak to Dhulikhel. The approximate length is 16km.The existing road, which was constructed in the 60s, have many sharp horizontal curves and steep vertical grades that does not meet with the Asian Highway Standards to which the road has recently been categorized into. This is most significant in the mountainous area where these locations are frequent and continuous. On the other hand, there are many locations that need to be treated as control points such as houses, temples, shrines, holy trees and other religious facilities along the road.

However, following establishment of Land Acquisition Act in 1977 proclaiming the new ROW width for the highways, DOR insists that apart from relatively big shrines/temples, there is no need to consider objects that are within 25 yards from the center of the existing road on each side as the control point.

Subsequently, this survey identifies the following facilities as control points if it is not within the 25yard ROW and the improvement plan is so established as to ensure minimal impact on these facilities.

- Settlements or alongside houses (in particular houses that have completed shift back in compliance with the ROW established by the Land Acquisition Act 1977 of Nepal)
- Sections where large scale earthwork (cut and fill) is anticipated (mountainous area)
- Facilities for recreation/leisure purpose such as Amusement parks, tourist attractive spots etc.
- Big shrines/temples, holy trees etc.

(2) Preliminary Comparison

Following four options can be considered.

Option-0: Do nothing and retain current condition

Option-1: Widening of existing road

This is an option that will undertake widening of the entire stretch of the project road with improvement of existing alignment that does not meet the new standards. This implies to the existing road at Sanga area also.

Option-2: Widening of existing road and bypass-I provision (Nalinchowk - Sanga Pass)

The basic concept of this plan is widening of the existing road and providing a bypass at the mountainous area near Sanga where the existing alignment needs improvement.

Option-3: Widening of existing road and bypass-II provision (Nalinchowk – Sanga built-up area)

The options for the entire stretch of the objective road (approx. 16km) are illustrated in **Figure 2.2-1** and

the detail of the options at Sanga is shown in **Figure 2.2-2**.

Optimum route from among the options was selected through a comparison of the options followed by comprehensive evaluation taking factors such as impacts on social and natural environment, traffic functions, traffic safety, socio-economic activities, construction and maintenance cost etc. into consideration. The result of the comparative study is shown in **Table 2.2-7**.

As explained in **Table 2.2-7**, Option-0 is unable to correspond to the rapid increase of traffic volume caused by the increasing traffic demand of Kathmandu Valley combined with the vehicles to/from Sindhuli Road that was recently opened for traffic. This is feared to contribute to further increase of traffic congestion and traffic accidents, making the objective road dysfunctional as an inter-regional arterial. On the other hand,

Option-1 is deemed to have severe adverse impact on the natural environment and will also inflate the project cost as widening and alignment improvement will require massive earthworks (large-scale cut and fill) and provision of structures. In addition, this option will require special consideration for securing safety during construction and detour of existing traffic because there is no alternative road for detour during construction and in that matter partial utilization of the existing road is inevitable. Option-3 on the other hand requires new additional resettlement at the end of the bypass where it meets with the existing road. Therefore, Option-2 is recommended to be adopted. However, this option will be subjected to further study to check ways to minimize the number of resettlements as well as to lower the construction cost. The comparison is shown in **Table 2.2-8**.

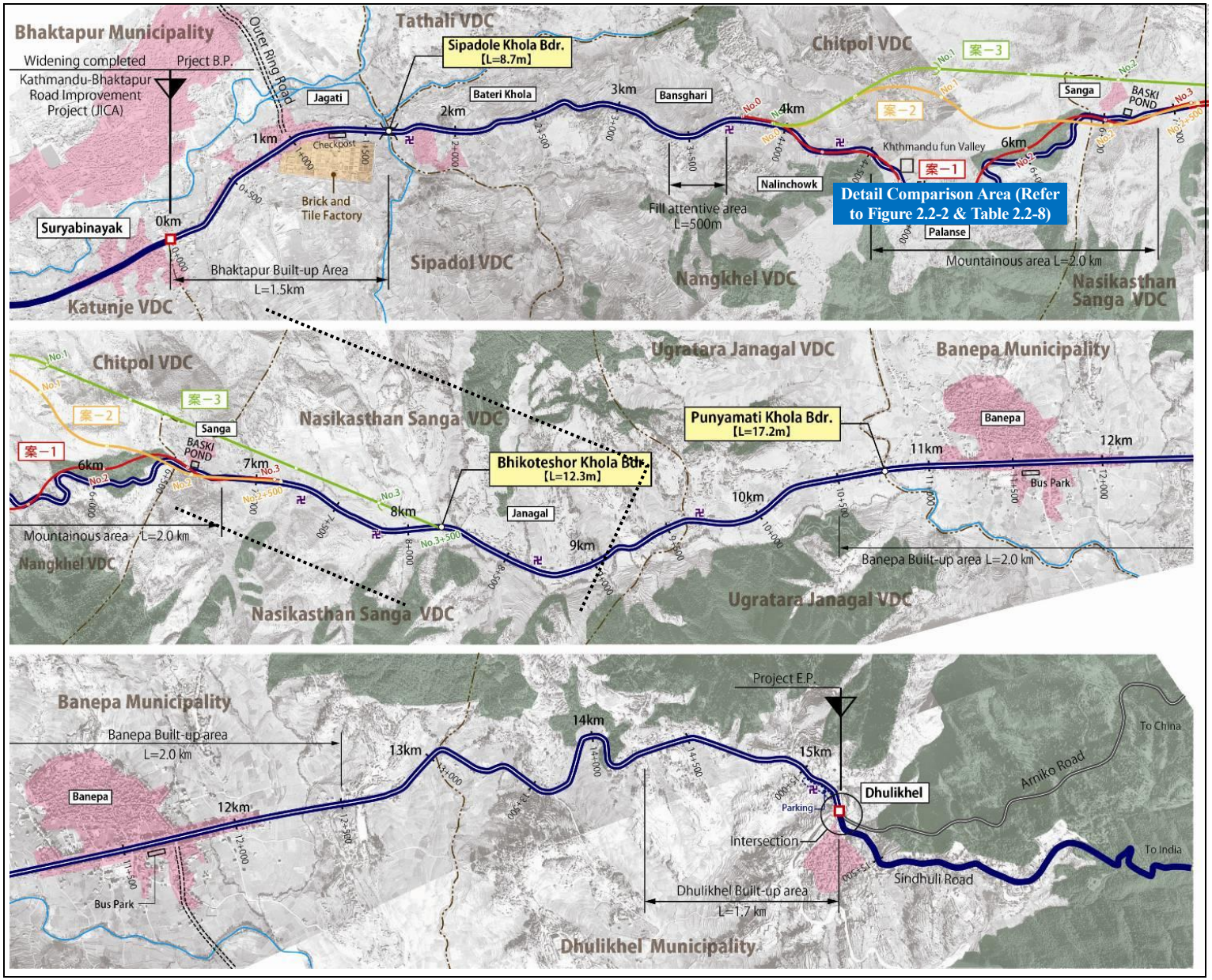
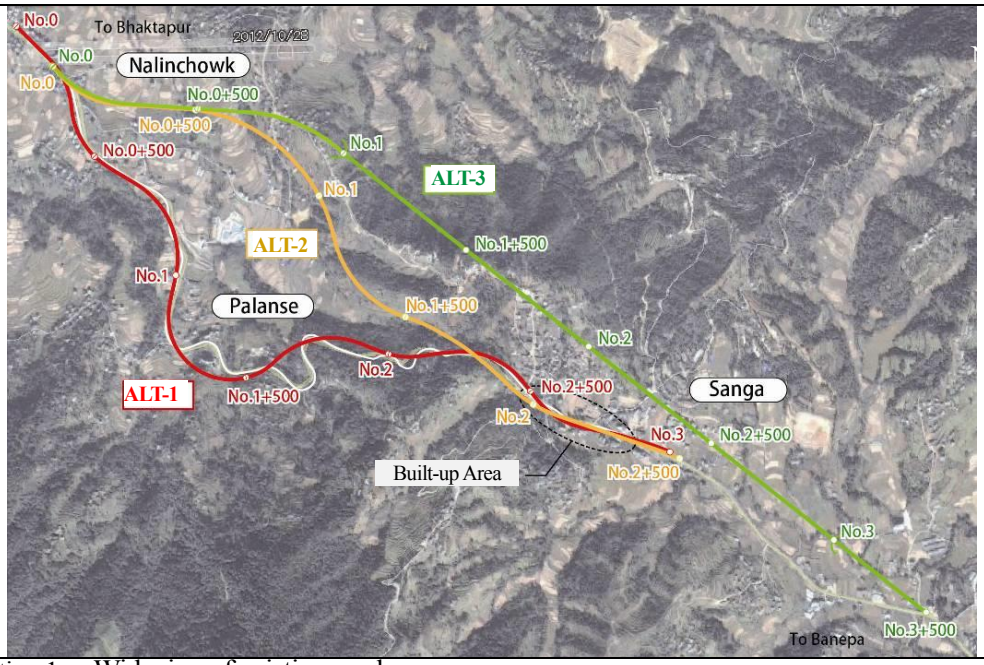


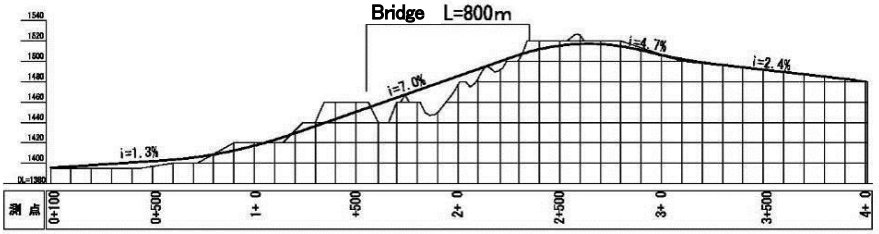
Figure 2.2-1 Comparison of Options

PLAN

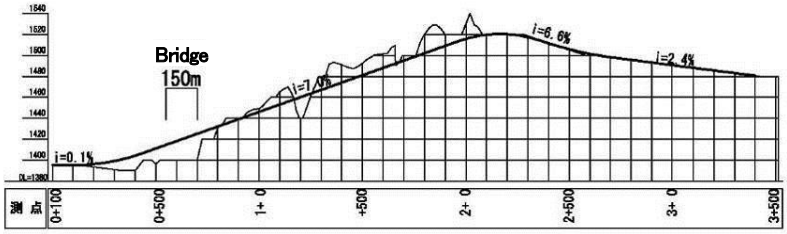


PROFILE

Option-1: Widening of existing road
Realignment : approx. 3.0km, length of major structures (bridge) : approx.800m
Note:Plan&Profile for sections other than Sanga are common



Option-2: Existing road widening and bypass-I provision (between Nalinchowk and Sanga Pass)
Realignment : approx. 0.5km, Bypass : approx. 2.0km, major structures (bridge) : approx.150m
Note:Plan&Profile for sections other than Sanga are common



Option-3: Existing road widening and bypass-II provision (Nalinchowk – built-up area at Sanga Pass)
Realignment : approx. 0.2km, Bypass : approx. 3.3km, major structures (tunnel) : approx. 1,800m
Note:Plan&Profile for sections other than Sanga are common

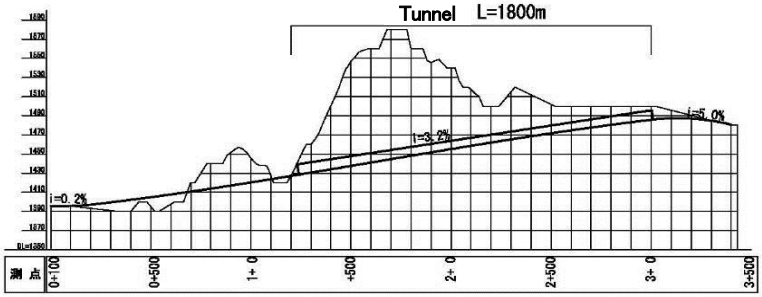


Figure 2.2-2 Detailed Comparison (Plan and Profile)

Table 2.2-7 Comparative Study of Improvement Methods

Evaluation 'A': Best, 'B': 2nd Best, 'C': Applicabe in absence of alternates、D: Not desirable

Options	Option-0 (Do nothing/retain current condition)	Option-1 (Widening of existing road)	Option-2 (Existing road widening + bypass-I) *(Nalinchowk and Sanga Pass)*	Option-3 (Existing road widening + bypass-II) *(Nalinchowk–built-up area at Sanga Pass)*
Description	No improvement to be done (Adverse impact on natural and social environment is zero. Improvement cost is not incurred	Widening to 4-lane road to accommodate increasing traffic volume and improvement of the alignments of the existing road corresponding to the road class. Existing road widening: approx.16km Of which, realignment: approx.3.0km (Major structure) :bridge approx. 800m	Construction of a bypass road which has high possibility of avoiding construction difficulties and huge construction costs expected for Option -1. Existing road widening: approx.0.5km Bypass: approx. 2.0km (Major structure : bridge approx.150m)	Construction of a bypass road including tunnel, which will start at the same level of the existing road and meet with the existing road in Sanga. Existing road widening: approx.0.2km Bypass: approx.3.3km (Major structure : Tunnel approx.1,800m)
Impact on Social Environment	A Resettlement is not required. Additional land acquisition is also not required.	C Resettlement and land acquisition is required due to widening and improvement of road alignment of the existing road.	A Resettlement along existing road due to widening is required. Additional land (paddy fields) acquisition and resettlement is required for bypass construction. However, resettlement is minimal.	B Resettlement for widening required along existing road. Additional land (paddy fields) acquisition and resettlement is required for bypass construction. Resettlement can be avoided along tunnel section but new resettlement will be required at the end point.
Impact on Natural Environment	A None	C Very high (large scale of cutting of mountainous slopes and felling of trees are needed)	B Less than that of Option-1 (large scale of cutting of mountainous slopes and felling of trees are limited)	B Least (provision of tunnel minimizes massive cutting of mountainous slopes and felling of trees)
Impact on Livelihood	D Severe traffic congestion is anticipated following increase in future traffic volume and increasing consumption inefficiency and emission of air pollutant with the retardation of speed enforced by traffic congestion. Noise from vehicular mobility against abutting houses will rise.	B Chances of severe traffic congestion due to increase of future traffic volume is less. Improvement of vertical grade will reduce congestion and contribute to reducing emission of air pollutants. However, noise pollution along abutting houses will not see drastic improvement.	B Chances of severe traffic congestion due to increase of future traffic volume is less. Improvement of vertical grade will reduce chances of congestion and contribute to reducing of emission pollutants. Use of bypass will drastically improve the noise pollution on the existing road.	A Chances of severe traffic congestion due to increase of future traffic volume is less. Improvement of vertical grade will reduce chances of congestion and contribute to reducing of emission pollutants. Use of bypass will drastically improve the noise pollution on the existing road.
Traffic Safety	D Consists of continuous sharp curves and steep vertical grades and risk of traffic accident at downslope and/or during takeover is high.	C Provision of median, improvement of sharp curves and steep vertical grade and easiness in overtaking due to expansion of existing road will reduce fatal accident risks. However, risk of accident is high during construction period as part of the existing road will be utilized as construction road.	A Provision of median, improvement of sharp curves and steep vertical grade and easiness in overtaking due to expansion of existing road will reduce fatal accident risks.	B Provision of median, improvement of sharp curves and steep vertical grade and easiness in overtaking due to expansion of existing road will reduce fatal accident risks. Risk of fatal accidents within the tunnel is high due to over speeding and poor ventilation of exhumed fume.
Traffic Function	D **Safe and smooth driving gets difficult** due to congestion that develops with respect to the increase of traffic volume.	B **Traffic capacity is increased** and design standards met. As such, safe and smooth driving is enhanced.	B **Traffic capacity is increased** and design standards met. As such, safe and smooth driving is enhanced.	A **Traffic capacity is increased** and design standards met. Functionally more desirable as the vertical grade is gentle compared to other options.
Impact on Social Activities and Regional Development	D Safe and smooth transport will be difficult causing **retardation of socio-economic activities** ultimately impeding the regional as well as national development.	A Enhancement of safe and smooth transport will **enhance socio-economical activities and regional development** contributing development of the country. Employment opportunity of local labors and local procurement of material will increase.	A Enhancement of safe and smooth transport will **enhance socio-economical activities and regional development** contributing development of the country. Employment opportunity and local procurement of material will increase.	B Enhancement of safe and smooth transport will **enhance socio-economical activities and regional development** contributing to the development of the country. Employment opportunity and local procurement of material will increase. Provision of tunnel will limit the regional development alongside the road.
Construction Costs	A No cost required	C Although land acquisition cost is minimal, cost for massive earthwork and structures contribute to high construction cost.(**1.07 times than that of Option-2**)	B Land acquisition cost is required. However, construction cost is minimal as cost for structures is low. (**Approx. 15.2 Billion Japanese Yen**)	B Although land acquisition cost is required it is less as land acquisition is not required for tunnel. (**1.0 2times than that of Option-2**)
Maintenance Costs	D Maintenance cost is **high.** Existing pavement has low durability and is susceptible to severe deterioration with respect to the increase in traffic volume as well as for reasons caused by poor drainage.	B Maintenance cost is **relatively high** as application of structures (bridges, retaining walls, slope protection structures etc.) is abundant.	A Maintenance cost is **relatively low** as application of structures is not abundant.	C Maintenance cost is **high** as application of facilities (lights, jet fans, surveillance and disaster tackling equipment) inside the tunnel needs regular maintenance.
Relative Comparison with Option-2	D	C	(RECOMMENDED)	C
Observation Points	Impact on social and natural environment and construction cost is minimal as no improvement works will be executed. However, impact on social environment, pollution, traffic safety, traffic function, socio-economic development, maintenance cost etc. is high.	This option is inferior than the recommended option in terms of the severity of social impact due to relocation of alongside houses, adverse impact on natural environment from massive earthwork and application of structures, traffic safety during construction, and construction/maintenance cost	Adverse social impact is small as number of relocation of alongside houses is small. In addition, construction/ maintenance cost and adverse impact on living environment/ pollution, traffic safety, socio-economic activities, regional development are appropriately balanced making this the most superior option.	Living environment/pollution and road function is superior to the recommended option, but is inferior in terms of the severity of adverse impact on society, socio-economic activities, regional development and construction and maintenance cost.

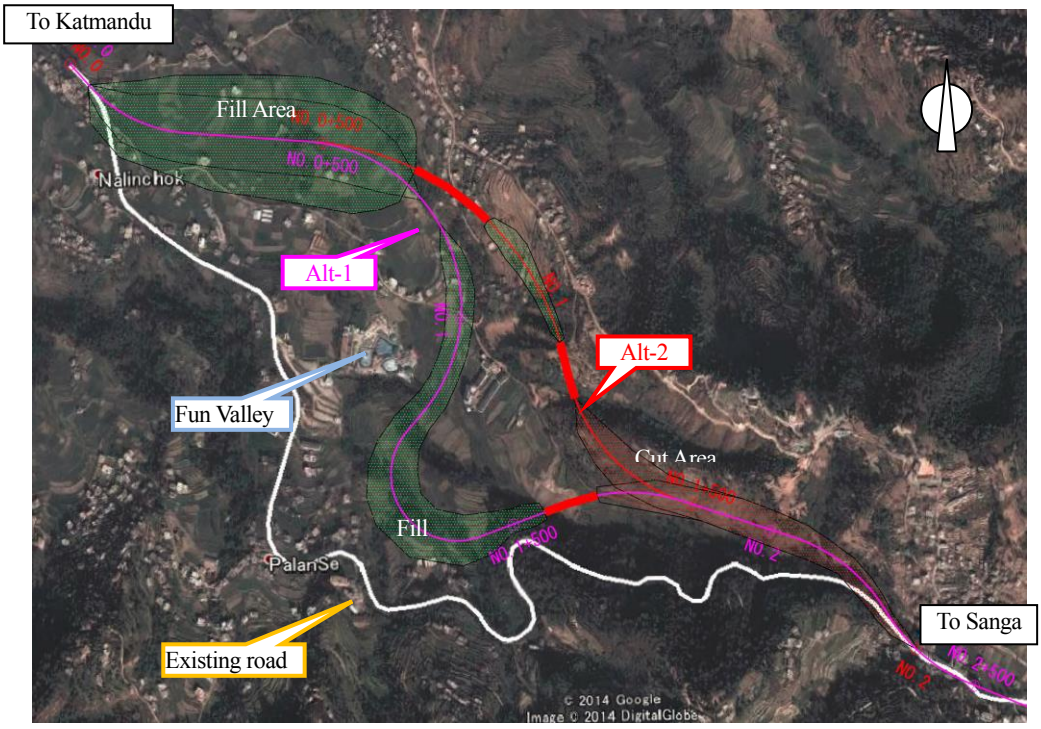
【Overall evaluation】Option-2 is recommended as it is has been comprehensively evaluated as the optimum option.

(3) Secondary Comparative Study (Detail Study of Option-2 between Nalinchowk and Sanga

Option-2 has been selected from the comparative study carried out in the previous section. The basic concept of this option is widening of the existing road and providing a bypass at the mountainous area near Sanga where the existing alignment needs improvement. Topography survey and geo-technical investigation was carried out at the route. Secondary comparison, a more detailed one, was carried out based on the information obtained from the survey and investigations and the optimum route for this section was selected.

Two alternatives as shown in **Table 2.2-8** are considered. A new alignment indicated as ALT-1 in the figure in the table below is proposed and compared with ALT-2. ALT-2 is the alignment indicated in Option-2 in the previous section.

Table 2.2-8 Secondary Comparison for Option-2 Selected in the Preliminary Comparison

	Alt-1 : Passing beside Fun Valley (Length L=2.4km)		**Alt-2 : Passing along the hill (Length : L=2.0km)**	
Plan				
Geometric Condition	Inferior than Alt-2 (horizontal curvature is 115m and vertical grade 6.7%, design speed 60km/h).	Δ	Superior than Alt-1. (Horizontal curvature is smoother (500m) although vertical grade is slightly steeper (7.0%), design speed 60km/h).	○
Environment	Number of affected houses is small Required land area is almost equal to Alt-2	○	Number of affected houses is large Required land area is almost equal to Alt-1	Δ
Cost	Requires approx. 100m long bridge	○	Requires two bridges approx. 150m and 100m long. Embankment height is 30m and requires stability analysis	Δ
Evaluation	**Recommended**		Not Recommended	

(4) Alignment Planning

The objective of this project is to widen the existing road and as the ROW already exists (25 yards from the center of the existing road), the alignment is planned such that it follows the existing alignment to the

possible extent. However, excepting the Sanga Bypass section, there are approximately 36 locations where the existing alignment is in poor condition with sharp curves that will be unable to fulfil the new geometric standards adopted with respect to the increase in the design speed. These alignments will be improved. Whereas at Sanga bypass section, the alignment will be newly planned as the bypass route running along the mountain at the north of the existing road, as has already been mentioned in the previous section.

As for the vertical alignment, it will also basically follow the elevation of that of the existing road. However, the elevation will be altered wherever it is deemed necessary. These are locations; like Jagati and Banepa, where the abutting properties are suffering from inundation during monsoon, like at the east of Banepa and in front of Kathmandu University, where the vertical grades are too steep and like at sections where there is need for to enhance road drainage. On the other hand, taking into consideration that the objective road is an access controlled road, the proposed height of the road will be elevated necessarily at sections where service tracks are planned to be provided. In such a case however, the proposed height of the service track will be maintained to the height of the existing ground.

(5) Cross Section

Based on the basic policies mentioned in Section 2.2.1 , the existing road will is planned to be expanded from its 2-lane single carriageway to 2-lane dual carriageway. The widths of carriageways, shoulders, medians, marginal strips etc. will be based on the requirements of Asian Highway as mentioned in Section 2.2.2.2 . In order to mitigate the adverse environmental impact, the width of shoulders and medians will be shrunk necessarily in a range not influential to smooth and safe transport. A 1.5m wide space for pedestrian use is planned to be provided along sections where service tracks will not be provided.

The typical cross section of each section is provided in figures from **Figure 2.2-3** to **Figure 2.2-8**.

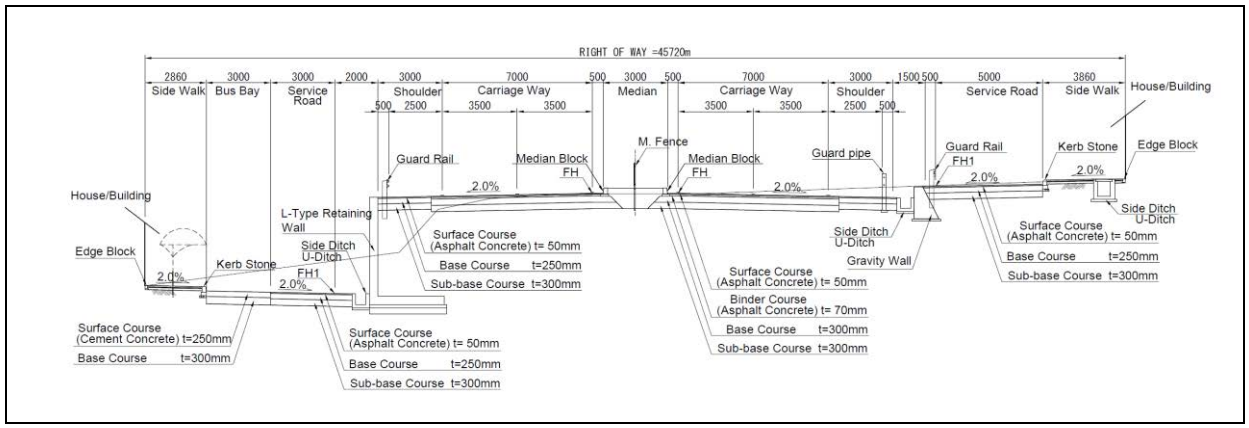


Figure 2.2-3 Typical Cross Section (Start Point - Jagati)

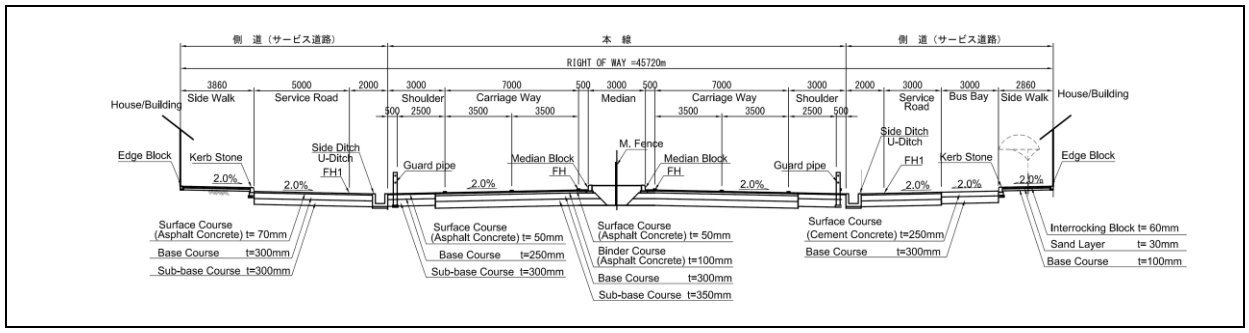


Figure 2.2-4 Typical Cross Section (Jagati - Sanga)

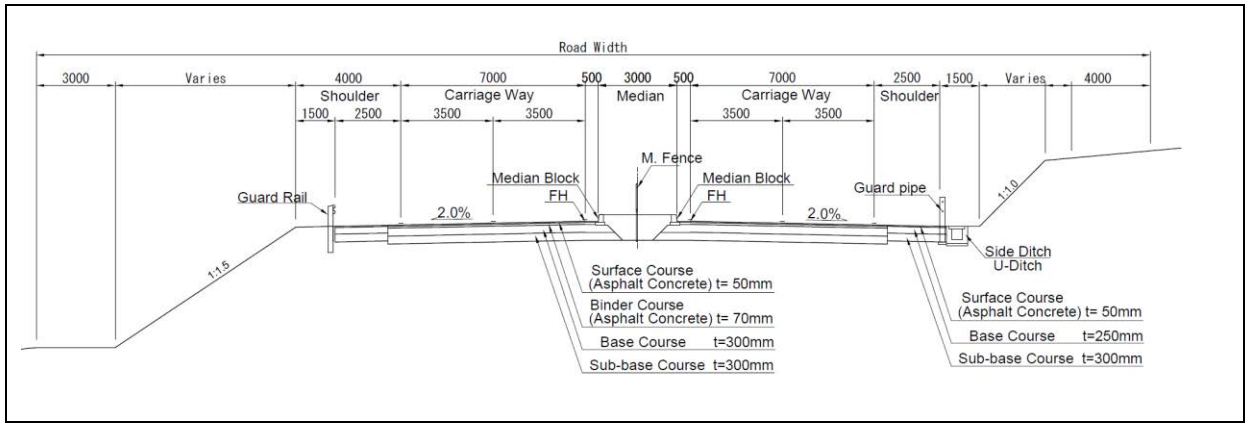


Figure 2.2-5 Typical Cross Section (Without Service Tracks)
（Jagati – Nalinchowk, Sanga Pass – Banepa）

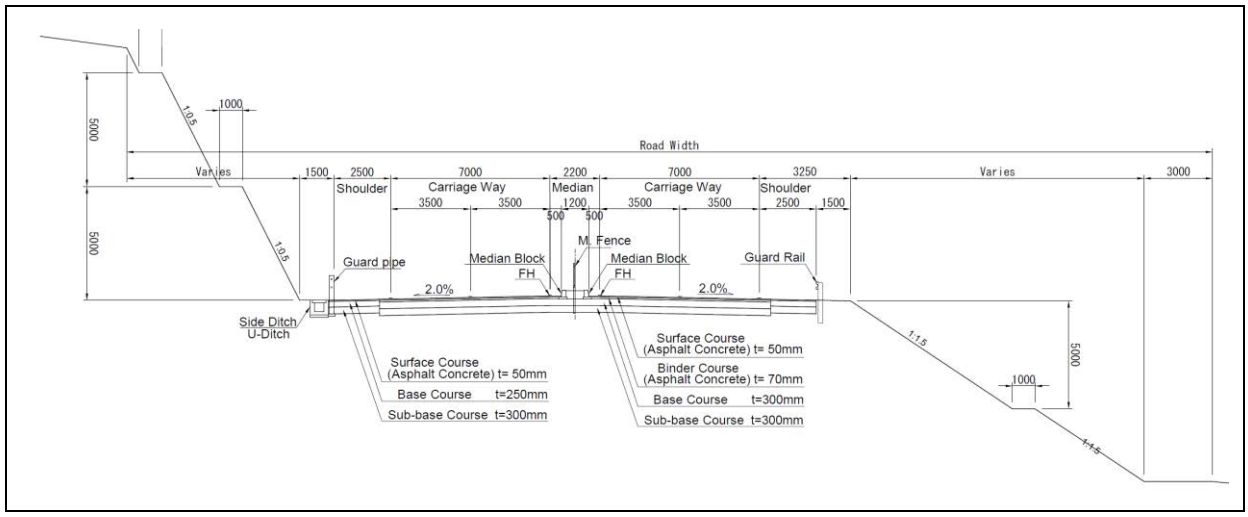


Figure 2.2-6 Typical Cross Section (Nalinchowk – Sanga Alternative Route: Earth Section)

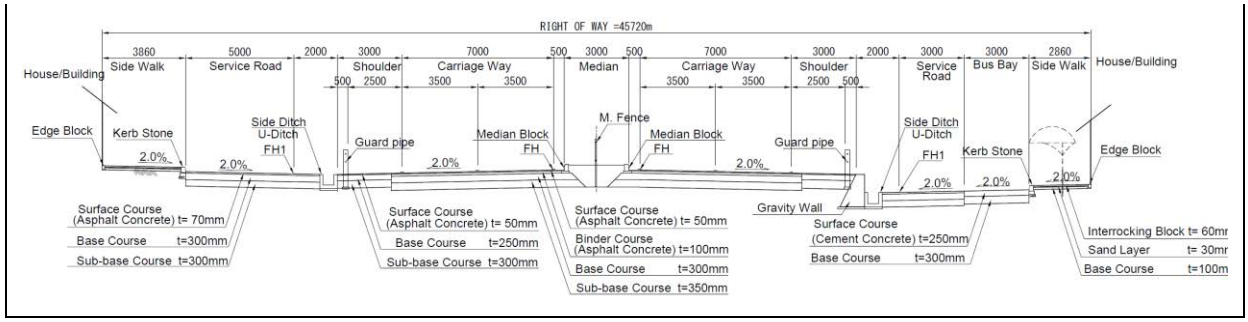


Figure 2.2-7 Typical Cross Section（Banepa Bazar）

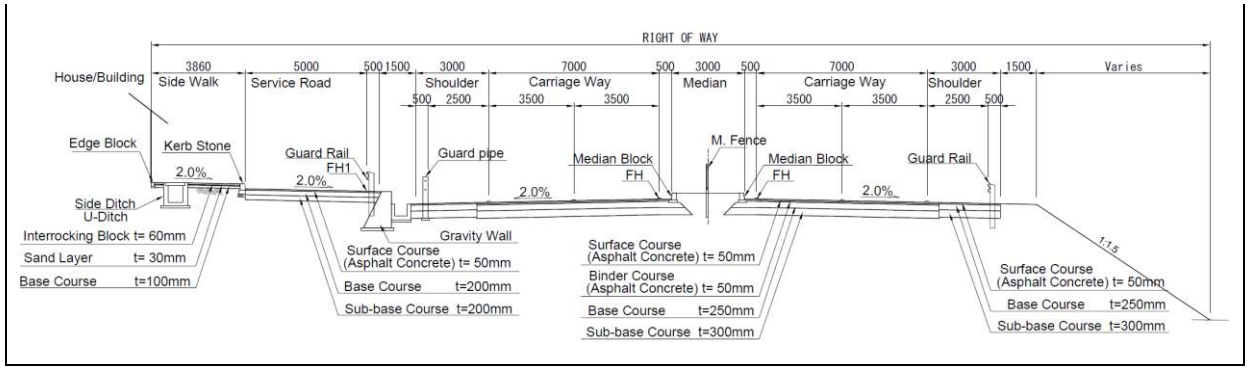


Figure 2.2-8 Typical Cross Section（Dhulikhel Built-up Area）

(6) Planning of Service Tracks

Based on the policies mentioned in Section (4), service tracks are planned to be provided at built-up areas such as between Suryabinayak and Jagati, in Banepa Bazar and in Dhulikhel. The areas where it is planned are given in **Table 2.2-9**. The width of the service track will be 5m, which is determined such that traffic is not obstructed even in an existence of vehicles stopped for loading and unloading to shops and offices alongside. A mounted sidewalk is provided on the outer side of the service tracks to secure safe mobility space for pedestrians. Excluding a portion along the curved sections, the sidewalks will have a maximum width as far as the existing road reserve allows. Bas laybys to be provided at service

tracks will be located at the outer side of the tracks (between service track and sidewalk). The service track will have an asphalt pavement. The pavement composition is as mentioned in Section 2.2.2.5 .

Table 2.2-9 Scopes of Service Tracks

No.	Station	Side (L/R)	Length (m)	Remarks
1	STA.0+000～STA.1+850	L	1,850	Suryabinak～Jagati
2	STA.0+000～STA.1+880	R	1,880	
3	STA.10+015～STA.12+190	L	2,175	Banepa
4	STA.10+160～STA.12+200	R	2,040	
5	STA.14+630～STA.14+920	L	290	Dhulikhel
Total Length (m)			8,235	

2.2.2.4 Intersection Plan

(1) Identification of Objective Intersections

Table 2.2-10 shows intersections identified for improvement. As mentioned in the policies for improvement of major intersections in Section (5), intersections that are in built-up areas where traffic volume is high and/or locations where future traffic volume is expected to increase significantly are identified. Out of seven identified intersections, six are existing intersection while the intersection at Nalinchowk is a new one where the start point of the bypass route meets with the existing road.

Table 2.2-10 List of Objective Intersections

No.	Station	Location	Remarks
No.1	STA. 0+ 00	Suryavinayak	Existing intersection
No.2	STA. 1+ 99	Jagati	Existing intersection
No.3	STA. 4+807	Nalinchok	New (Start point of Bypass)
No.4	STA.10+939	Banepa	Existing intersection
No.5	STA.11+478	Banepa	Existing intersection
No.6	STA.13+335	Bodol	Existing intersection（near Kathmandu University）
No.7	STA.14+907	Dhulikhel	Existing intersection (entrance to Sindhuli Road)

(2) Design Conditions

The basic requirements for the improvement will be as follows;

- Basic intersection type will be an at-grade intersection,
- Design will be based on the AASHTO's intersection design method,

- Design vehicle will be SU-9 (Ordinary vehicles) as classified by AASHTO due to the fact that plying of semi-trailers is negligible and most of the heavy vehicles are India's TATA trucks, and
- The objective road (SD-Road) is taken as the main road and other connecting roads are sub-roads.

(3) Intersection Types

Intersection types to be applied for each location are shown in **Table 2.2-11**. Fundamentally, 3-legged (T-shape) type and 4-legged (Cross type) intersections will be applied to fit with the existing type and terrain. The intersection at Nalinchowk is a new intersection formed due to provision of a bypass route, where a T-shaped intersection will be planned. The intersection in Banepa currently has a monument at the middle of the intersection and the vehicles go around the monument to take turns. This type will be converted into a 4-legged (Cross type) intersection.

The intersection at Dhulikhel is currently a 3-legged (T-shaped) non-signalized intersection. The present control system provides priority to the SD Road, while traffics on the Sindhuli Road have to yield. This intersection is planned to be converted into roundabout type taking into consideration that the location is the entry point to Sindhuli Road and the wide area around the intersection is available.

Table 2.2-11 Intersection Types to be Applied

No.	Station	Location	Remarks
No.1	STA. 0+ 00	Suryavinayak	Existing: 4-legged (cross type) intersection Plan: 4-legged (cross type) intersection
No.2	STA. 1+ 99	Jagati	Existing: 4-legged (cross type) intersection Plan: 4-legged (cross type) intersection
No.3	STA. 4+807	Nalinchok	Existing: Non-existent Plan: 3-legged (T-shape) intersection
No.4	STA.10+939	Banepa	Existing: 4-legged (cross type) intersection Plan: 4-legged (cross type) intersection
No.5	STA.11+478	Banepa	Existing: Rotary Plan: 4-legged (cross type) intersection
No.6	STA.13+335	Bodol	Existing: Connecting road Plan: 3-legged (T-shape) intersection
No.7	STA.14+907	Dhulikhel	Existing: 3-legged (T-shape) intersection Plan: Roundabout

(4) Control Method

Taking the present situation of power supply in Kathmandu Valley, securing uninterrupted supply of power and endorsing sustainable maintenance is considered to be difficult. Therefore, provision of traffic signal is not considered under this project. However, in order that the signals would be provided by the government of Nepal in future, the improvement plan will take this matter into consideration and provide necessary facilities for the ducts and cables for the signals. For the meantime, the safety of traffic and pedestrians will be secured by traffic police.

2.2.2.5 Pavement Design

(1) Design Period

The design period of expressways and urban roads in Nepal are generally 10 years and 15 years. The

design period of KB Road that connects with the objective road is also 10 years. Therefore, the design period to be applied for the objective road is also taken as 10 years after the road is open to traffic. The objective road is expected to commence service (completion year of improvement) from 2019.

(2) Traffic Volume

Traffic surveys were conducted under this survey during the second field survey (September 2015). The surveys were conducted both on weekday and weekend. The weekday traffic count data where the traffic volume was greater than that of the volume on a weekend will be used for the design of pavement. The weekday traffic count results are shown in **Table 2.2-12**. The design traffic volume is calculated based on this traffic volume and the traffic growth rate, which is mentioned in the next section. It is to be noted that the passenger cars and further lighter vehicles have been dropped out due to the fact that its influence on the design is negligible.

Table 2.2-12 Traffic Count Result (Weekday)

(Unit :average daily traffic)

Section	Station	Bus	Light Truck	2-axle Trucks	3-axle Trucks
Start point – West Banepa	0+0-11+200	1,269	846	1,385	72
Banepa (West-East)	11+200-14+200	1,369	573	1,515	44
East Banepa - Dhulikhel	14+200-End point	855	426	1,009	21

(3) Traffic Growth Rate

Growth rates for each vehicle is as listed in **Table 2.2-13**. These growth rates come from the values predicted in the future traffic demand. The growth rates are assumed constant over the design period.

Table 2.2-13 Traffic Growth Rate

Vehicle Types	Bus	Light Truck	2-axle Trucks	3-axle Trucks
Growth Rates	5.3%	5.3%	7.1%	5.3%

(4) Equivalent Single Axle Load

Indian vehicles, particularly trucks are prominent on the objective roads. Dimensions and capacity of these vehicles vary that of American or Japanese vehicles. Therefore, the Equivalent Single Axle Load (ESAL) Factors to be used are determined based on the standard values in use in Nepal. **Table 2.2-14** shows vehicle types and its corresponding ESAL factors.

Table 2.2-14 ESAL Factors

Vehicle Types	Bus	Light Truck	2-axle Trucks	3-axle Trucks
ESAL Factors	0.5	1.0	4.75	6.5

(5) Subgrade Capacity

Under the geo-technical investigation, California Bearing Capacity (CBR) Tests of existing subgrades

have been conducted at 12 locations. The CBR values to be applied in the calculation are adopted by dividing the objective road into 4 sections with respect to the type of topography and geology. CBR values of all 12 locations and the values taken for the pavement design are shown in **Table 2.2-15**.

Table 2.2-15 CBR Values

No.	Station	Location	CBR（%）	Adopted CBR（%） (Section)
1	0+200	Suryabinayak	7.1	7.1 (0+000 ～ 9+150)
2	1+250	Jagati	9.3	
3	3+400	Nalinchowk	7.5	
4	4+550	Jorpati	7.6	
5	8+150	Sanga	11.5	
6	9+150	N/A	7.9	
7	10+300	Banepa	4.5	4.5 (9+150 ～ 11+200)
8	11+200	Banepa	4.9	
9	13+000	KTM University	5.0	5.0 (11+200 ～ 14+200)
10	14+200	N/A	10.6	
11	14+900	N/A	9.6	9.1 (14+200 ～ End point)
12	15+400	Dhulikhel	9.1	

(6) Pavement Design

1) Design Conditions

- AASHTO Guide for Design of Pavement Structure, 1993, application of which has already been agreed upon with the DOR, shall be applied.
- The objective road will be divided into several sections taking the traffic volume and CBR values into consideration. The composition of pavement for each of these sections will be calculated.
- The Structural Number (SN) required for the asphalt pavement of each section will be calculated from the following formula.

Basic Design Equation for Flexible Pavement

$$\log_{10}(W_{18}) = Z_R \times S_0 + 9.36 \times \log_{10}(SN+1) - 0.20 + \frac{\log_{10}\left\{\frac{\triangle PSI}{4.2-1.5}\right\}}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32 \times \log_{10}(M_R) - 8.07$$

Source: AASHTO

where

W_{18} = predicted number of 18-kip equivalent single axle load (ESAL) applications,
Z_R = standard normal deviate corresponding to level of reliability,
S_o = combined standard error of the traffic prediction and performance prediction,
ΔPSI = difference between the initial design serviceability index, p_o, and the design serviceability index, p_t, and
M_R = resilient modulus of roadbed soil (psi).

SN is equal to the structural number indicative of the total pavement thickness required:

$$SN = a_1D_1 + a_2D_2m_2 + a_3D_3m_3$$

Where

a_i = i^{th} layer coefficient,
D_i = i^{th} layer thickness (inches), and
m_i = i^{th} layer drainage coefficient.

i=1 : Surface Course

- The objective road is a high-graded high standard road. Therefore, taking this into consideration in combination with the present maintenance situation of Nepal, the minimum pavement thickness is taken to be 10cm.

2) Design Inputs

Items with simple description and the input values are as mentioned in **Table 2.2-16**.

Table 2.2-16 Design Inputs

Item	Description	Design Condition	Values Adopted
Section	Divide objective road into several sections with respect to traffic volume, CBR and calculate pavement thickness for each section	(1) 0+000～8+150(Sanga) (2) 8+150(Sanga)～9+150 (3) 9+150～11+200（Banepa） (4)11+200～14+200（Banepa Bazar） (5)14+200～End point (Dhulikhel)	N/A
Performance Period	The period of time that an initial pavement structure will last before it needs rehabilitation.	10 years – 20 years	10 years (2020-2029)
Traffic Load (W18)	The traffic load is expressed by cumulative number of 18-kip equivalent single axle load (ESAL) applications (w_{18}) during the performance period. This is calculated based on the future traffic volume which is converted to 18-kip ESALs applying the axle load equivalency factors used in Nepal	Directional factor : 0.5 Distributional factor: 0.8	Section (1) =22,088,357 Section (2)= 22,088,357 Section (3)= 22,088,357 Section (4)=22,485,881 Section (5)=14,902,396
Reliability (R)	Means of incorporating some degree of certainty into the design process.	R=80～99 % Standard normal deviation corresponding to level of reliability (Z_R) = -0.841～-0.327 Combined standard error of the traffic prediction and performance prediction (S_o) = 0.45	R=80% Z_R=-0.841 S_o=0.45
Performance Criteria	The Present Serviceability Index (PSI) is used to represent pavement performance. The total change in PSI (ΔPSI) is defined as the difference between initial serviceability index (p_0: value immediately after construction) and terminal serviceability index (p_t: lowest index that will tolerate before rehabilitation, resurfacing or reconstruction)	p_0 = 4.2 pt = 2.5	p_0=4.2 pt=2.5 ΔPSI=1.7

Item	Description	Design Condition	Values Adopted
Roadbed Soil Property (M_R)	The resilient modulus (M_R) is used. The AASHTO Guide introduces the equation estimating M_R from CBR as M_R = 1,500 x CBR	CBR of each section Section (1)=7.1% Section (2)= 7.1% Section (3)=4.5% Section (4)=5.0% Section (5)=9.1%	M_R value of each section Section (1)=10,650 Section (2)=10,650 Section (3)=6,750 Section (4)=7,500 Section (5)=13,650
Layer coefficient	The pavement strength is expressed by the structural number (SN) which is calculated as : $SN = a_1D_1 + a_2D_2m_2 + a_3D_3m_3$ where a_i=ith layer coefficient D_i=ith layer thickness (inches) m_i=ith layer drainage coefficient	Wearing course: a_1=0.42 (E_{AC}=425,000 psi) Binder course : a2=0.39 (E_{AC}=400,000 psi) Base course:a_3=0.134 (CBR=80) Subbase course:a_4=0.11 (CBR=20)	a_1=0.420 a_2=0.39 a_3=0.134 a_4=0.11
Drainage Condition	The factor to modify the SN considering the effects of drainage.	M_3=m_4=1.0 (water removed within 1 week, and pavement structure is exposed to moisture levels approaching saturation during 5% of the year)	M_3=1.0 M_4=1.0

3) Results

The results of the pavement calculation of each section carried out with the design inputs mentioned above are as shown in **Table 2.2-17**.

Table 2.2-17 Results of Pavement Design on each Section of the Main Road

Section			Length (m)	Accumulated Annual Load for 10 years(W18)	Subgrade CBR(%)	Calculation						
						Wearing Course (cm)	Binder Course (cm)	Base Course (cm)	Subbase Course (cm)	Required (SN) 'A'	Calculated (SN) 'B'	Judgement (A＜B)
0+000	～	8+150	8150	24,849,395	7.1	5	7	30	30	4.85	4.85	OK
8+150	～	9+150	1000	24,849,395	7.1	5	7	30	30	4.85	4.85	OK
9+150	～	11+200	2050	24,849,395	4.5	5	10	30	35	5.62	5.75	OK
11+200	～	14+000	2800	25,296,616	5	5	10	30	35	5.45	5.53	OK
14+000	～	14+920	920	16,765,196	9.1	5	5	25	30	4.19	4.27	OK

(7) Pavement Design of Service Tracks

The design condition and input data for the calculation of pavement thickness of service tracks at built-up areas that are planned to be provided for access to/from the abutting properties are similar to that used for the calculation of pavement of the main road. However, forecasting traffic volume of the service tracks from the traffic volume obtained from the traffic survey is literally not possible. Therefore, traffic volume on the service tracks is assumed as 1 percent of the weekday average daily traffic on the main road on its corresponding sections and the minimum thickness is set as 5cm.

Table 2.2-18 presents the pavement compositions of service tracks on each section.

Table 2.2-18 Results of Pavement Design on each Section of the Service Tracks

Section		Length (m)	Accumulated Annual Load for 10 years(W18)	Subgrade CBR(%)	Calculation						
					Wearing Course (cm)	Binder Course (cm)	Base Course (cm)	Subbase Course (cm)	Required (SN) 'A'	Calculated (SN) 'B'	Judgement (A＜B)
0+000	～1+720	1720	2,766,143	7.1	5	-	25	30	3	4	OK
6+260	～6+670	410									
10+160	～11+200	1040	2,766,143	4.5	7	-	30	30	4	4	OK
11+200	～12+100	900	2,809,033	5.0	7	-	30	30	4	4	OK
14+640	～14+920	280	1,864,567	9.1	5	-	20	25	3	3	OK

(8) Pavement Design of Bus Laybys

Bus laybys are subject to static load from heavy vehicles and its pavement is susceptible to damages from repeated action of sudden stops and take-offs. Therefore, rigid pavement (concrete pavement), which is considered to be strong against oil and wearing will be applied. As standards for rigid pavement is not available in Nepal, following pavement compositions and conditions have been referred from the standards of Japan.

- It will have a thickness of 25cm or above,
- It will be supported by a 35cm or above thick base course,
- The bending strength of the concrete slab will 4.5kg/cm^2,
- The concrete slab will be appropriately reinforced with steel (approx. 3kg/m^2)

2.2.2.6 Drainage Plan

(1) Surface Drainage

As mentioned in the policies in Section (7), the surface drainage of the objective road is planned in a manner that the existing drainage facilities are fully utilized. There are two types of drainage systems on the existing road. The first one is that where the surface water is collected in the side ditches provided at the sides of the road and transported to the designated outlet and the second one is draining the water naturally.

Drainage in this project is planned in similar ways. Natural drainage will be applied along roads that are like dykes, constructed by filling along paddy fields or open land. Built-up areas, cut sections and sections where the vertical grades are steep (above 3%), on the other hand, will have side ditches provided. Side ditches will be provided at the sides of the planned road. However, where service tracks are to be provided, it will be provided in between the main road and the service track to allow collection of rain water at both sides. Currently, side ditch is seen provided at the right shoulder in Suryabinayak and Jagati. This collects both rainwater flowing in from the mountainside at the south of the road and wastewater discharged from alongside household. Widening the existing road will necessitate relocation of these side ditches. The existing ROW is only enough for widening and provision of service track and sidewalks and as such there is no sufficient space for relocation. Therefore, side ditches, similar in its existing sizes are provided under the sidewalk. **Figure 2.2-9** illustrates the location where side ditches are

to be provided.

Where service tracks will not be provided, side ditch will still be provided as shown in **Figure 2.2-10**, if it is a cut section.

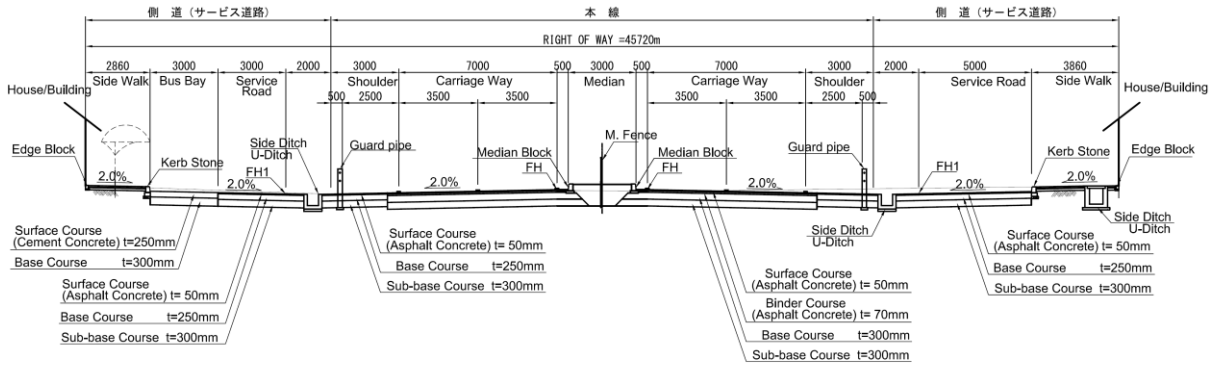


Figure 2.2-9 Drainage Facilities Where Service Tracks are Provided

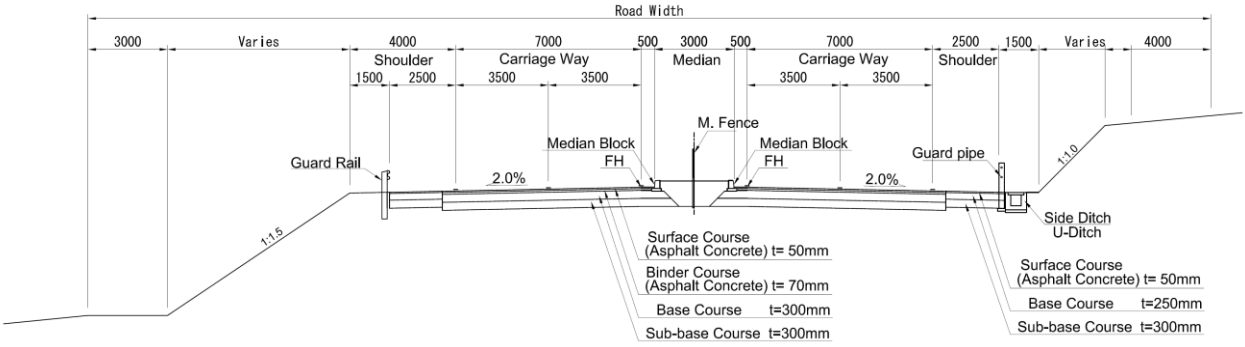


Figure 2.2-10 Drainage Facilities at Cut Sections Where Service Tracks are not Provided

(2) Cross Drainage

Cross drainages have been confirmed at 22 locations along the objective road. All these existing cross drainage facilities need to be reconstructed following widening of the existing road. The facilities will be replaced by structures. The dimension of these structures will be same or bigger than the exiting one. The locations, type of structure and its dimensions are as shown in **Table 2.2-19**.

Table 2.2-19 Location, Type and Dimension of Cross Drainage

No.	Station	Structure (Culvert)	Dimension (m)	No.	Station	Structure (Culvert)	Dimension (m)
1	0+311	Box	3000*3000、L=80.0	12	8+943	Box	2000*2000、L=41.0
2	0+761	Pipe	D900、L=46.7	13	9+198	Pipe	D1200、L=40.0
3	0+106		D900、L=46.3	14	9+358	Box	2000*2000、L=40.0
4	2+964		D1200、L=51.0	15	9+416	Pipe	D1200、L=34.0

No.	Station	Structure (Culvert)	Dimension (m)	No.	Station	Structure (Culvert)	Dimension (m)
5	5+016		D1500、L=30.0	16	9+547		D1200、L=35.0
6	5+246		D2000、L=63.0	17	9+703		D900、L=40.0
7	5+425		D2000、L=71.0	18	9+990	Box	1500*1500、L=59.0
8	6+096		D1200、L=30.0	19	11+538		2000*2000、L=46.0
9	7+117	Box	3000*2500、L=53.0	20	12+761	Pipe	D1500、L=63.0
10	8+373		2000*2000、L=52.0	21	13+090		D1200、L=48.0
11	8+856		2000*2000、L=43.0	22	13+645		D1500、L=63.0

2.2.2.7 Planning of Bridge

The project plans to provide a road bridge and four pedestrian bridges. It will also renovate four existing bridges. The road bridge is planned to be provided at Sanga to span a valley. Pedestrian bridges are planned to be provided where service tracks are planned for facilitating safe road crossing by pedestrians and bicycle users. This section will cover the bridge at Sanga. Planning of pedestrian bridges will be discussed in the next section, while plans for renovation of existing bridges will be discussed in Section 2.2.2.8 .

(1) Applicable Standard

Based on the approval from the DOR, the design of bridges will be designed based on the following Japanese Standards. However, the live load, seismic load and thermal effect will be studied separately.

- Specification for highway bridges, Japan Road Association 2012
- Road Earthwork Manual – culvert, Japan Road Association 2010
- Road Earthwork Manual – Retaining Wall, Japan Road Association 2012
- Special type structure (as reinforced embankment) specificaitions

1) Live Load

Utilization status of live load in Nepal is as follows.

Detail design of this road by Nepal government (2011) : IRC Class A

Katmandu – Bhaktapur Road (2007) : AASHTO HS20-44

The result of comparison of live load is shown in **Table 2.2-20**. Type-B (same as AASHTO HS20-44 * 1.25) of Specification for highway bridges is recommended.

Table 2.2-20 Comparison of Sectional Force of live load

	Specification for highway bridges (Japan) (Type B)		AASHTO (HS20-44)		IRC (Class A)	
	Sectional force	Rate	Sectional force	Rate	Sectional force	Rate
Bending Moment	22.6 (KN-m)	122 %	18.6 (kN-m)	100 %	17.3 (kN-m)	93 %

Source: JICA survey team

2) Seismic Load

The Record of earthquake at Katmandu basin is shown in **Table 2.2-21**. Large scale earthquake must be considered for bridges.

Table 2.2-21 Record of Earthquake at Katmandu Basin

Day/Month/Year	Epicenter		Depth (km)	Magnitude	Peak Ground Acceleration (gal)
	Latitude	Longitude			
26/08/1833	28.00N	85.00E	38	7.0	137
04/10/1833	27.00N	85.00E	84	7.0	75
18/10/1833	27.00N	84.00E	151	7.0	47
07/07/1869	28.00N	85.00E	45	7.0	121
15/01/1934	27.55N	87.09E	177	8.4	88
27/05/1936	28.50N	83.50E	199	7.0	38
04/09/1954	28.30N	83.80E	163	6.5	34
20/08/1988	26.75N	86.62E	197	6.5	36
25/04/2015 *1	28.01N	84.71E	15	7.8	-

*Source: The Study on Earthquake Disaster Mitigation in the Kathmandu Valley, March 2002 JICA *1: Wikipedia*

Utilization status of seismic load is Nepal as follows.

Detail design of this road by Nepal government (2011) : K=0.1
(An application standard is unclear)

Katmandu – Bhaktapur Road (2007) : IRC:6-2000 (α=0.08)

IRC:6 was revised in 2010 with introducing response spectra as shown in **Figure 2.2-11** against large scale earthquake. And it has earthquake strength near Suryabinayak-Dhulikhel Road (Zone V is shown in **Figure 2.2-11**). Utilization of IRC:6-2010 is recommended.

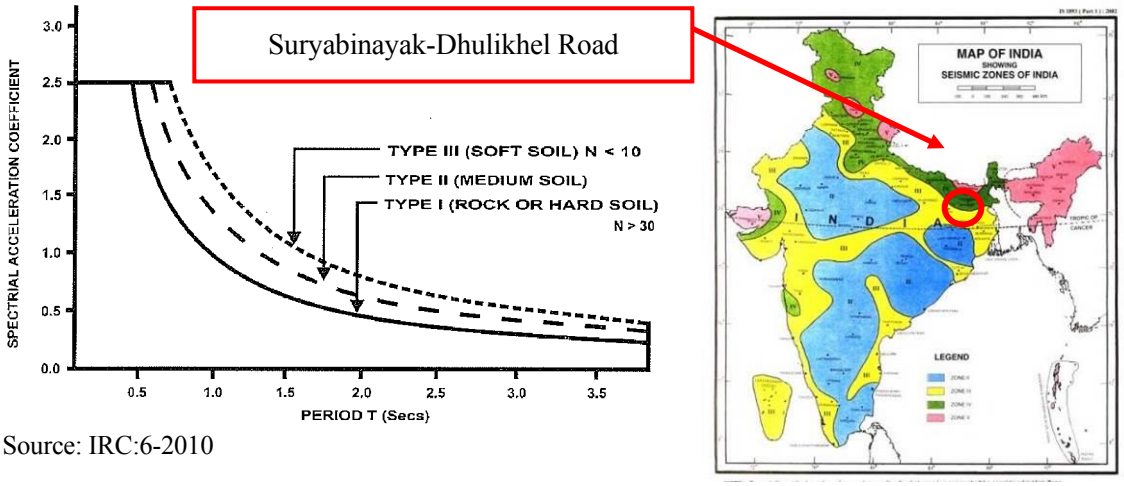
Result of above consideration, horizontal seismic force (large scale earthquake) is shown as below.

Horizontal seismic force k= (Z/2) * (I) * (Sa/g)

Z: Zone Factor = 0.36 (Zone V)

I: Importance Factor = 1.2 (Important Bridge)

Sa/g: Response Spectra = Figure 2.6.7



Source: IRC:6-2010

Figure 2.2-11 IRC: 6-2010 Response Spectra

3) Thermal Effect

The values for temperature difference (thermal effect) to be applied are taken from the Specification for Highway Bridges, Japan and are as follows;

- Concrete bridges : between -5 degrees Centigrade and +35 degrees Centigrade

(2) Design Conditions

Table 2.2-22 shows the conditions applied for the calculation and design of the bridge.

Table 2.2-22 Design Conditions

Classification of objective road	Class I (Asian Highway)
Design speed	40 km/hr
Design live load	B-load
Bridge length	198.0m
Total width	22.09m～23.10m
Deflection angle	80°～ 66°
Curvature of radius	∞ ～ 180m
Vertical grade	7.0%
Crossfall	2.0% (crossfall) ～ 4.72% (superelevation)
Seismic intensity	0.12

(3) Superstructure

1) Superstructure Type

The bypass route at the mountainous area in Sanga passes over a valley, stream and several track roads.

The bridge approximately 200m long is deemed to be required for spanning the valley. The valley is relatively deep which will probably require piers of height exceeding 30 meters. In addition, the vertical grade is 7%. On the other hand, there is a recreational facility and a tourist attractive place nearby. All these factors need to be addressed to select the bridge type. Therefore, a comparative of alternatives will be carried out to select the optimum bridge. The selection will be determined not only from the perspective of structural approaches but taking factors such as construction and cost efficiency, aesthetics and environment and social consideration into consideration,

The selection of bridge type is analyzed based on the follows condition.

(a) Basic condition for planning the bridge span

The location of abutments will be determined from the limitation in applying reversed T-shape abutments (applicable height is approximately 12m). In case a simple support type is selected, the bridge will be divided into equal spans.

(b) Selection standard of structural type

Superstructure type is selected depending on the applicable span length. Curved alignment at the end side will be considered.

The following alternatives that meet the above conditions are selected.

Alt-1 : 6 span Post Tension T-shaped Girder Bridge (span length 33m)

Alt-2 : 6 span Steel Plate Girder Bridge (span length 33m)

Alt-3 : 5 span Steel Box Girder Bridge (span length 40m)

Alt-4 : 4 span Steel Box Girder Bridge (span length 50m)

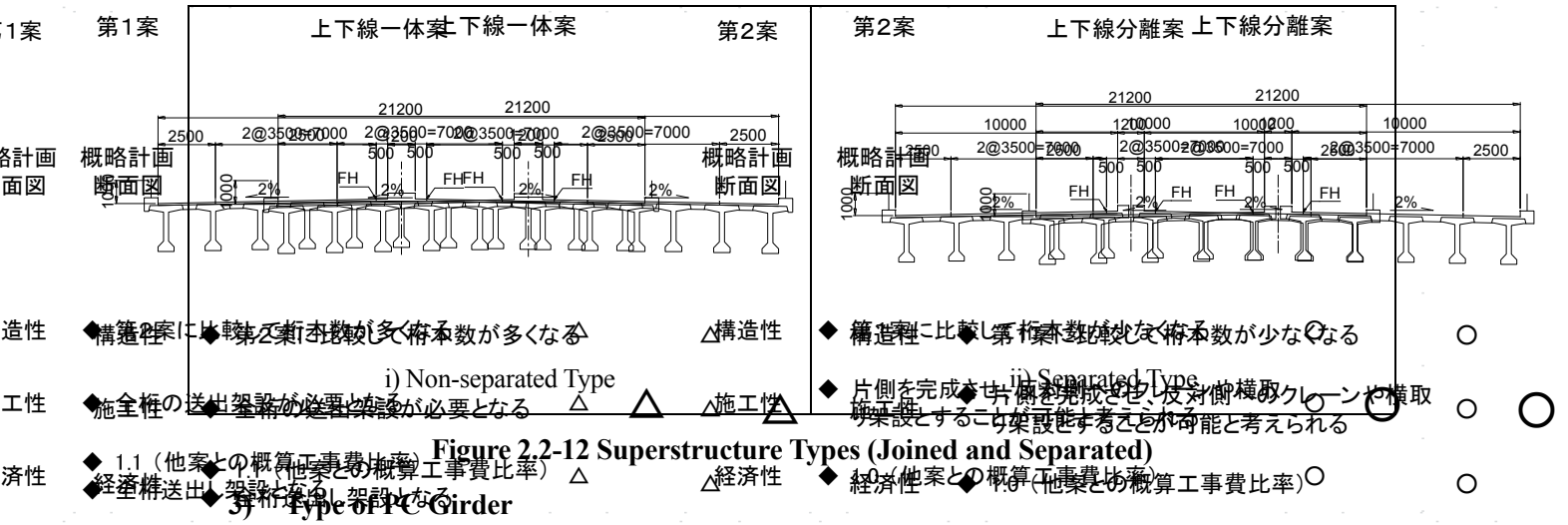
Alt-5 : 3 span Steel Truss Bridge (span length 65m)

Alt-6 : 3 span Continuous Prestressed Rigid Frame Bridge (span length 54m and 88m)

From the results shown in the comparative analysis in , although the number of piers is highest, Alt-1 (6 span Post Tension T-shaped Girder Bridge) is selected as the optimum alternative because the major material is readily available in the local market, it is construction efficient and is maintenance free and above all it is most economical.

2) Comparison of Non-separated or Separated Section

As shown in **Figure 2.2-12**, superstructure can either be joined or separated by direction. This project aims to apply the latter type as it has less number of girders and can be constructed separately making it construction and cost effective.



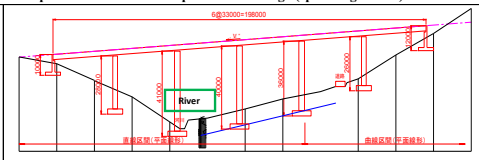
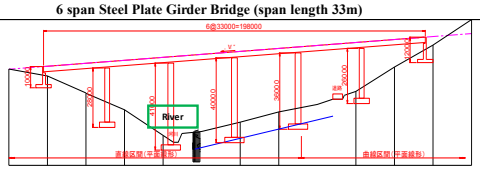
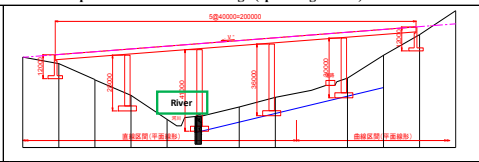
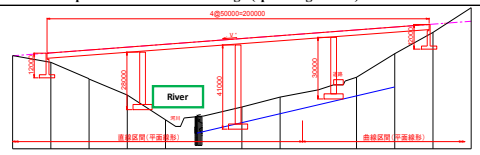
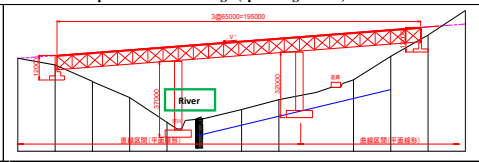
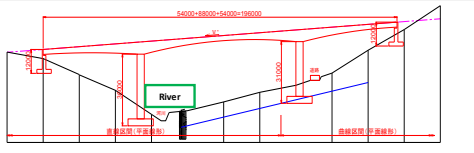
i) Non-separated Type ii) Separated Type

Figure 2.2-12 Superstructure Types (Joined and Separated)

3) Type of PC Girder

Heavy cranes and trailers are unprocurable in Kathmandu, if not extremely difficult. It is also very difficult to be procured from a third country. In addition, the access roads near the site have steep vertical grades (over 9%) Therefore, a segment type post tension T-shaped PC girder is adopted as it can be easily transported and erected. Consideration has been taken for the appropriateness of weight and length for ease in transporting.

Table 2.2-23 Comparison of Superstructure Type

ALT-1 **6 span Post Tension T-shaped Girder Bridge (span length 33m)**				**ALT-2** **6 span Steel Plate Girder Bridge (span length 33m)**			
Side View				Side View			
Procurement	Large portion of major material is locally procurable	A	RANK	Procurement	Major material needs to be procured from Japan or a third country	B	RANK
Construction Efficiency	Construction efficiency high as it can be assembeled and erected by a erection beam method(no bents required)	A	1st Adopted	Construction Efficiency	Construction efficiency is low as it requires erection of high bents in the valley as a support	C	6th
Potential Impact	Realignment of a portion of a river (narrow in width) is required.	C		Potential Impact	Realignment of a portion of a river (narrow in width) is required.	C	
Maintenance	Being a concrete bridge, it is maintenance free	A		Maintenance	Needs regular paint coating	C	
Aesthetics	Number of piers is highest and has poor aesthetics	C		Aesthetics	Number of piers is highest and has poor aesthetics	C	
Construction Cost	1.0 (assuming the construction cost of this Alternative as 1.0)	A		Construction Cost	1.2 times the cost of ALT-1	B	
ALT-3 **5 span Steel Box Girder Bridge (span length 40m)**				**ALT-4** **4 span Steel Box Girder Bridge (span length 50m)**			
Side View				Side View			
Procurement	Major material needs to be procured from Japan or a third country	C	RANK	Procurement	Major material needs to be procured from Japan or a third country	C	RANK
Construction Efficiency	Construction efficiency is low as it requires erection of high bents in the valley as a support	C	3rd	Construction Efficiency	Construction efficiency is low as it requires erection of high bents in the valley as a support	C	3rd
Potential Impact	Temporary detouring of river (narrow in width) and tracks during construction period are required	A		Potential Impact	Shifting of a portion of existing track is required	B	
Maintenance	Needs regular paint coating	C		Maintenance	Needs regular paint coating	C	
Aesthetics	Number of piers is high and is conspicuous than ALT-4 to ALT-6	B		Aesthetics	Number of piers is less than ALT-1 to ALT-3 and is less conspicuous	A	
Construction Cost	1.4 times the cost of ALT-1	C		Construction Cost	1.5 times the cost of ALT-1	C	
ALT-5 **3 span Steel Truss Bridge (span length 65m)**				**ALT-6** **3 span Continuous Prestressed Rigid Frame Bridge (span length 54m and 88m)**			
Side View				Side View			
Procurement	Major material needs to be procured from Japan or a third country	C	RANK	Procurement	Large portion of major material is locally procurable	A	RANK
Construction Efficiency	Construction efficiency is low as it requires erection of high bents in the valley to support assembling of the truss	C	5th	Construction Efficiency	Constuction efficiency is low as it requires cantilever method	C	2nd
Potential Impact	No impact on river (no realignment is required)	A		Potential Impact	Temporary detouring of river (narrow in width) and tracks during construction period are required	B	
Maintenance	Needs regular paint coating	C		Maintenance	Being a concrete bridge, it is maintenance free	A	
Aesthetics	Number of piers is least but the truss is conspicuous	C		Aesthetics	Aesthetically superior as it has the least number of piers and altering grider height	A	
Construction Cost	1.6 times the cost of ALT-1	C		Construction Cost	1.5 times the cost of ALT-1	C	
Evaluation: A=Excellent, B=Good, C=Fair							

4) Bearing Condition

The bridge is designed to have free bearings on all piers and free bearings on both the abutments for the following reasons;

i) Spanning over a deep valley, the piers of this bridge are relatively high and as such thermal stress of girders and piers due to temperature change is small,

ii) Free bearing of the abutments help increase the frequency of the structural oscillation which helps in reducing the seismic force.

iii) Combining the bridge deck with the piers will help avoid need for provision of an expansion joint

at the middle pier. This will reduce the burden of maintenance.

5) Unseating Prevention Device

Unseating prevention device is provided for enhancing seismic capacity. There are three major measures, namely i) girder attachment, ii) restricting displacement, iii) securing seating length of girders. There is a recreational park (Kathmandu Fun Valley), a couple of shrines and a large statue of lord Shiva near the objective bridge. The first method, where the girders will be fixed to the substructures using a PC cable is adopted. This is considered to be simple and slender, durable, aesthetical and overall, easy to maintain.

6) Cross Section

Figure 2.2-13 shows the cross section. It is a 2-lane dual carriageway. Lane width is 3.5m, similar to the width at other sections. Outer shoulder has a width of 2.5m, applied in accordance with the Nepal Road Standard 2070 that allows narrowing the width in mountainous areas. The width of 0.5m and 0.445m are applied for the inner shoulders and hand rail respectively. The cross section has a cross fall of 2.0%.

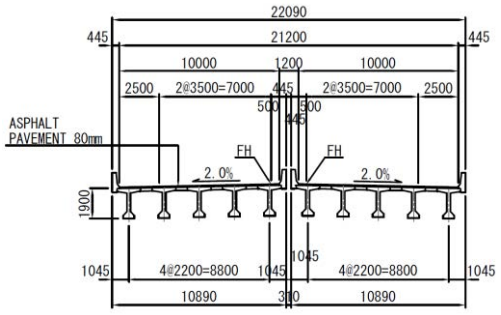


Figure 2.2-13 Cross section at Bridge Section

(4) Foundation

There are two types of foundation; spread foundation and pile foundation. The former foundation has been adopted for the substructures of this bridge. The reasons are, but not limited to;

- The geo-technical investigation carried out at the valley near the bridge location confirms bed rock layer at a relatively shallow (about 8m) depth from the earth surface,
- Piles are usually driven beyond the bearing layer (bed rock) to a depth equivalent to its diameter. For this heavy vehicle is required and heavy vehicles are not procurable locally while it is considered difficult to be procured from a third country as well,
- Excavation for foundation is required from the earth surface to a depth of 8m. Open excavation can be applied as the N value of the layer is more than 10 fairly enough to maintain the stability of the excavated slopes,
- Reliable construction of the foundation can be endorsed as confirmation of the bed rock during excavation is possible,
- Spread foundation can be constructed with the use of small cranes, back-hoe, concrete work related vehicles, dump trucks etc. and does not require heavy equipment. This is advantageous considering the site conditions. The bridge is located in a mountainous area and the foundation work is required at the valley in between the mountains where the applicable access roads are the existing tracks that are narrow and steep, and

- Steep slopes (40 degrees) without plants (trees) along with scattered protruding of rocks, as can be ascertained from the photos below, prove that the bed rock layer is relatively shallow.

		
i) Slopes		ii) Valley

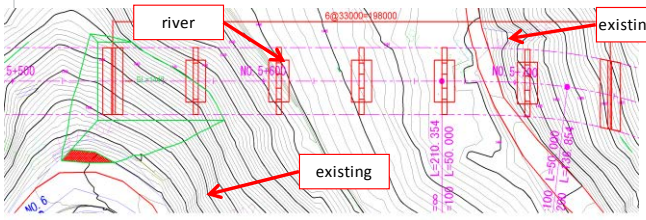
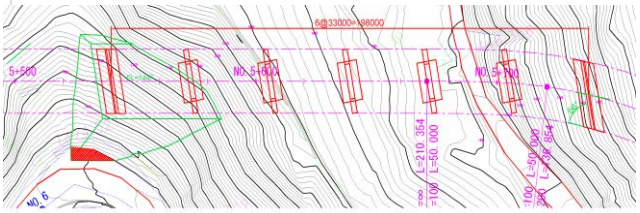
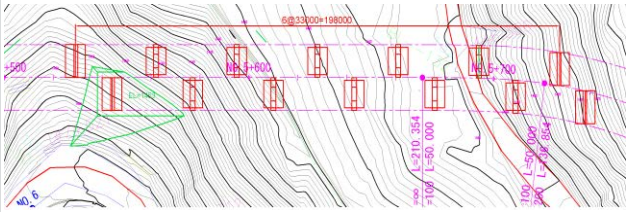
Photo 2.2-1 Ground Condition of Bridge Site

(5) Substructures

1) Arrangement (Skewness and Separation)

The alignment at the bridge runs slightly at an oblique angle with respect to the valley (river) and the community roads in the valley. The way the substructures are arranged may have significant impact on the river, the community roads and landscape. Here comparison of substructures is done to select substructure type that is most effective to obliqueness and has less impact on the river and the existing roads. Three possible alternatives were taken and compared in terms of structural properties, construction efficiency, impact on the surrounding features, aesthetics, and cost **Table 2.2-24** shows the comparison, and from its result, Alternative-2 is selected.

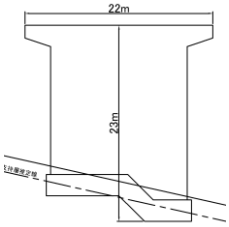
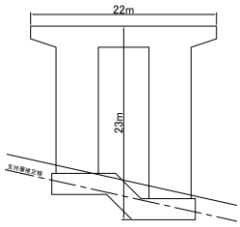
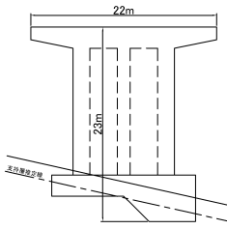
Table 2.2-24 Comparison of Substructure Arrangement

Aternative-1 (Non-separated Perpendicular Piers)			
Schematic Illustration (Plan)			RANK 2nd
Structural Properties	Skew angle at the end is about 80 degrees and is generally applicable	B	
Construction Efficiency	Combined application of launching erection and lateral sliding erection is possible	B	
Impact on Features	Realignment of a portion of river is required. Impact on roads from excavation is severe than Alternative-2	C	
Aesthetics	Number of piers is minimum but is not in conformity with the topography	B	
Construction Cost	1.02 times the cost of Alternative-2	B	
Evaluation	Aesthetics is high and is cost efficient		
Aternative-2 (Non-separated Skewed Piers)			
Schematic Illustration (Plan)			Rank 1st (Adopted)
Structural Properties	Skew angle at the end is small and may have small effect on the superstructure	C	
Construction Efficiency	Combined application of launching erection and lateral sliding erection is possible but launching erection method may be slightly complicated due to skewness	C	
Impact on Features	Realignment of a portion of river is required. Impact on roads from excavation is severe than Alternative-2	B	
Aesthetics	Number of piers is minimum and are in conformity with the topography	A	
Construction Cost	1.00 (assuming cost of this alternative as the base)	A	
Evaluation	Aesthetics is high and is cost efficient but inferior in terms of structural properties and construction efficiency		
Aternative-3 (Separated and Perpendicular Arrangement)			
Schematic Illustration (Plan)			RANK 3rd
Structural Properties	Skew angle at the end is about 80 degrees and is generally applicable	B	
Construction Efficiency	Combined application of launching erection and lateral sliding erection is not possible and only launching erection method is applicable	C	
Impact on Features	Impact on river and roads from excavation is small	A	
Aesthetics	More piers than other alternatives	C	
Construction Cost	1.07 times the cost of Alternative-2	C	
Evaluation	Inferior in terms of cost effectiveness		

2) Piers

The comparative study of substructures in the previous section selected non-separated skewed piers (Alternative-2). Three types of structures can be applied for such substructure. They are; i) Wall Type, ii) Double Column Type, and iii) Hollow Type. A comparative study as shown in **Table 2.2-25** of these types is carried out to select the optimum type of pier.

Table 2.2-25 Comparison of Applicable Pier Types

Pier Type	Type- 1 (Wall Type)		Type-2 (Double Column Type)		Type-3 (Hollow Type)	
Schematic Diagram						
Adaptability to Topography	・Application of uneven footing is easy by adjusting the wall height and is thus highly adaptable to inclined topography	A	・Application of uneven footing can face constraints due to inclined topography	C	・Application of uneven footing is easy by adjusting the wall height but massive footing will be required.	B
Structural Property	・Adjustment of wall height is easy	A	・Column heights differ and is structurally not desirable	C	・Adjustment of wall height is easy	B
Construction Efficiency	・Construction efficiency high for the structure is simple	A	・Requires falsework and therefore construction efficiency slightly low	B	・Hollow structure is quite complicated compared to other types	C
Aesthetics	・Walls can be slender and aesthetics is excellent	A	・Too many columns will lower the aesthetics	C	・Needs thick walls	B
Estimated Cost	1.00 (Assuming 1.0)	A	1.14 times Type-1	B	1.21 times Type-2	B
Evaluation	**Excellent (Adopted)**		Fair		Good	

3) Abutment

The locations of the abutments were determined assuming the application height as 12m. Adverse T type abutment was applied as it is considered to be most suitable for heights exceeding 7m.

(6) Outline of the Bridge

The outline of the bridge is summarized in **Table 2.2-26**. This reflects the results of all the comparative studies mentioned above, the outline of the bridge is given as mentioned

Table 2.2-26 Outline of the Bridge

Superstructure	Type			post tension T-shaped PC girder (Segment)
	Material	Main Girder	Concrete	σck=40N/mm^2 (Main Girder), σck=30N/mm^2(cross beam)
			Metal	12T12.7B(Main Girder), 1T28.6(cross beam), Fe-415(Steel)
		Deck	Concrete	σck=30N/mm^2(between girders), σck=24N/mm^2(Handrail)
			Steel	Fe-415
		Pavement		Asphalt Pavement t=8cm
	Bearing Type			Elastometric (Rubber) bearing
	Unseating Prevention Device			Girder attachment (PC Cable)
Substructure	Type	Body		Abutments: Reversed T-Shaped Piers: Wall type
		Foundation		Spread Footing (Gneiss Rock)
	Material	Concrete		σck=24N/mm^2
		Steel		Fe-415
Applied Standard				Specification for highway bridges, Japan Road Association 2012

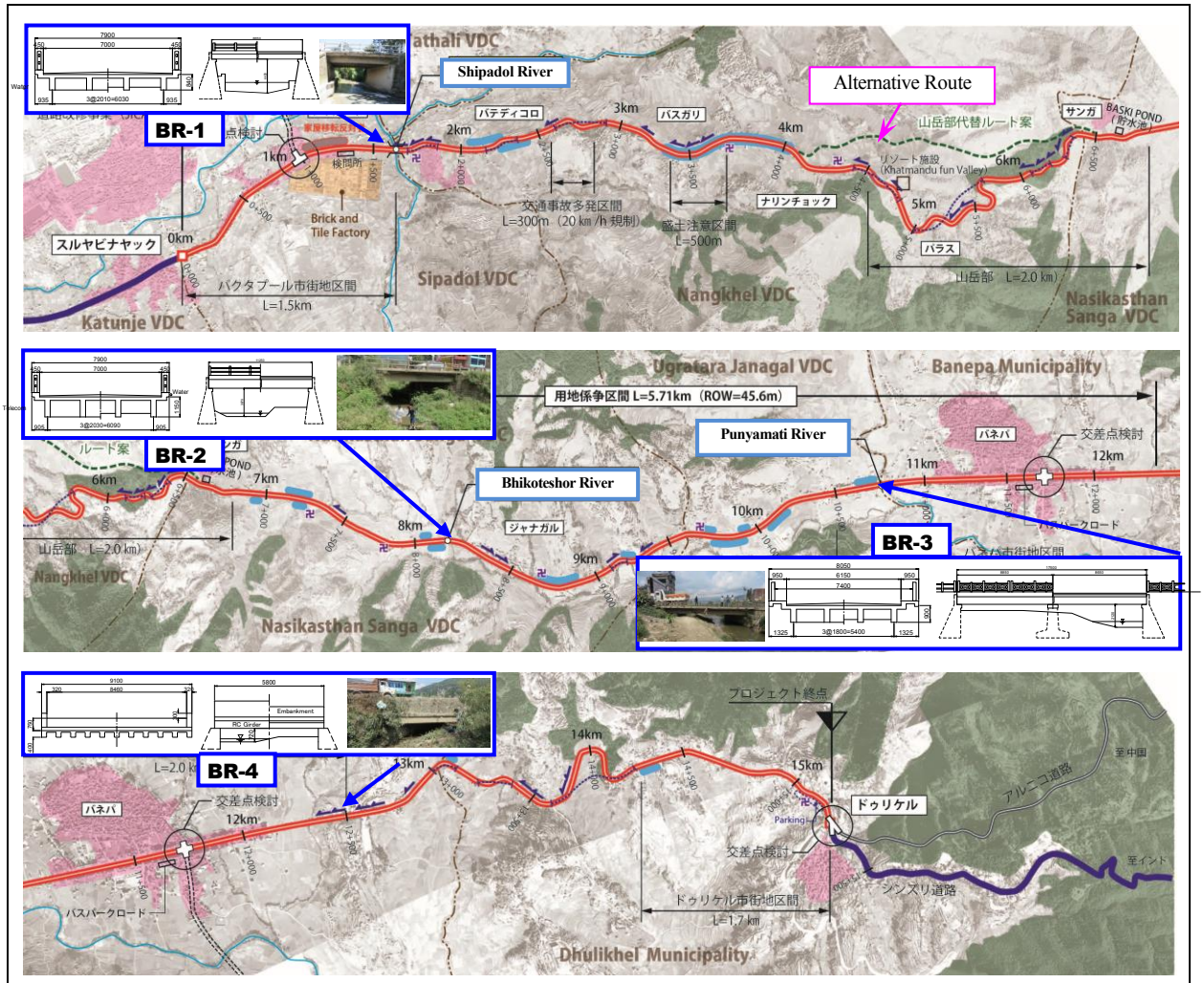
2.2.2.8 Reconstruction of Existing Bridges

(1) Identification and Site Reconnaissance of Existing Bridges

As explained in the basic policies for renovation of existing bridges in Section (8), four bridges have been identified that need to be improved during widening of the road. These bridges are old and have not been renovated since its construction approx. 40 years ago. The whereabouts of design drawings, as-built drawings or any other relevant documents of these bridges is unknown. Site reconnaissance conducted confirmed some defects on the prime members (parts) of the structure. The defects, its age combined with the change pattern of the loads- traffic load and earth pressure condition differs from its design condition and this will further alter after widening of the road - could be structurally risky if it is used without undertaking some kind of renovation works.

Bridges identified and the outlines of each bridge are shown in **Table 2.2-27**.

Table 2.2-27 Identified Existing Bridges and Outline of each Bridge



Bridge	BR-1 (Sipadole)	BR-2 (Bhikteshor)	Br-3 Punyamati)	BR-4 (Chandeshori)
Constructed Date	Unknown	Unknown	Unknown	Unknown
Length	8.65 m	11.25 m	17.5 m	5.8 m
Width	7.0 m	7.0 m	7.4 m	8.46 m
Type	RC-T Girder	RC-T Girder	RC-T Girder	RC-T Girder

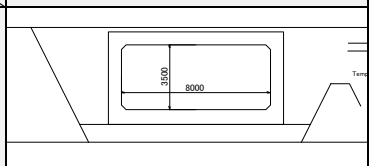
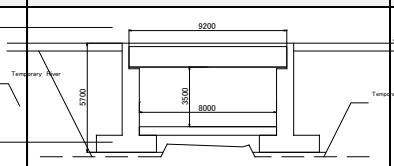
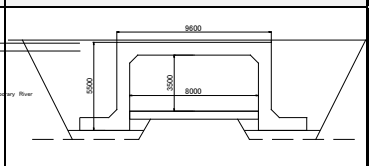
Abutment	Unknown	Unknown	Unknown	Unknown
Pier	None	Wall Type	None	None
Foundation	Unknown	Unknown	Unknown	Unknown
River Width	5.8 m	9.3m	15.8 m	4.5 m

(2) Comparative Study of Applicable Structures

As can be understood from the outline of the bridges mentioned in **Table 2.2-27**, opening width of all bridges (length of the bridges) are less than 20m. The height of the bridge from the riverbed is also lower than 5m. In such case, it is not necessary that the structure to be provided has to be a bridge (reconstruction of another bridge) as other structural types could be more economical and efficient. Therefore, structures that are deemed applicable for the improvement are taken and comparison is carried out as shown in **Table 2.2-28**. The factors such as structural characteristics, topographical and geological conditions of the sites, characteristics of rivers, construction efficiency and cost and maintenance ability are taken as evaluation factors.

The comparative study result indicates that the box culvert supersedes other structures.

Table 2.2-28 Comparison of Applicable Structures

Types	Type-1 (Box Culvert)		Type-2 (RC Bridge)		Type-3 (Portal Culvert)	
Schematic Diagram						
Costruction Efficiency	◆ Detour of existing river ◆ Demolition of existing bridge ◆ Construction of box culvert	A	◆ Divert water flow (use half width of river) ◆ Demolition of existing bridge ◆ Construction of abutment ◆ Diversion of water to the other side ◆ Construction of remaining abutment and erection of superstructure	B	◆ Divert water flow (use half width of river) ◆ Partial demolition of existing bridge ◆ Construction of sidewall ◆ Diversion of water to the other side ◆ Construction of remaining abutment and top slab	C
Impact on River	◆ Strong against occurance of erosion and/or scouring of river bed and/or around the structure	A	◆ Measures against erosion of river bed and around the abutments are required	B	◆ Measures against erosion of river bed and around the abutments are required	B
Construction Efficiency	◆ Additional time required for detour of river channel	B	◆ No need for detour of existing river	A	◆ No need for detour of existing river	A
Maintenance	◆ No special maintenance is required	A	◆ Regular maintenance of joints and bearings are required	B	◆ No special maintenance is required	A
Construction Period	◆ Longer	B	◆ Shortest (construction of girders can be done simultaneously with the abutment)	A	◆ Longest (Top slab and side walls can not be constructed simultaneously)	C
Estimated Cost	Assuming cost is 1.0	A	1.16 times the cost of Type-1	C	1.07 times the cost of Type-1	B
Evaluation	**RECOMMENDED**		Not Recommended			

(3) Applicable Standards

Japanese Specification for Design of Box Culvert 2014 will be applied for the design of box culverts adopted for improvement of existing bridges. Application of this specification has been discussed and agreed upon with the DOR with the exception for determining the design discharge and the freeboard, which it insists to refer to the standards of Nepal.

(4) Design Discharge and Freeboard

Design discharge and freeboard at each box culvert is shown in **Table 2.2-29**. These values are

determined based on the Nepal Bridge Standards 2067.

Table 2.2-29 Design Discharge and Freeboard

River Name (Location)	Sipadole (Jagati)	Bhikteswor (Bhikteswor)	Punyamati (Banepa)	Chandeshori (Banepa)	Remarks
Design Discharge	46 m^3/sec	12 m^3/sec	94 m^3/sec	12 m^3/sec	
Freeboard	1.0m	1.0m	1.0m	1.0m	Freeboard for design discharge less than 200m3/sec is 1.0m

(5) Embankment and Bed Protection

Embankment and bed protection will be provided for a distance of 5m from the edges of the culvert at both the upstream and downstream direction.

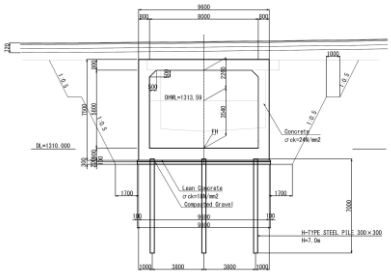
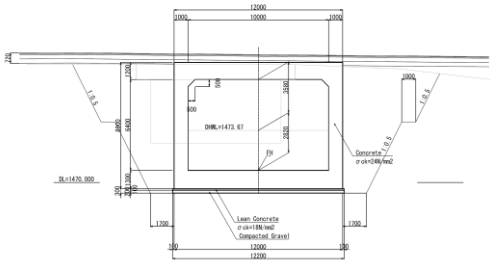
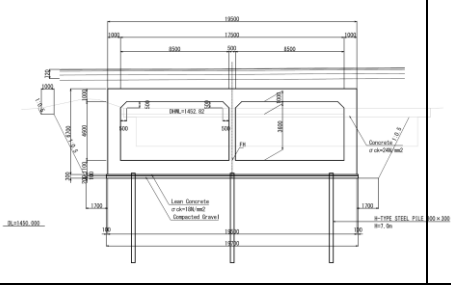
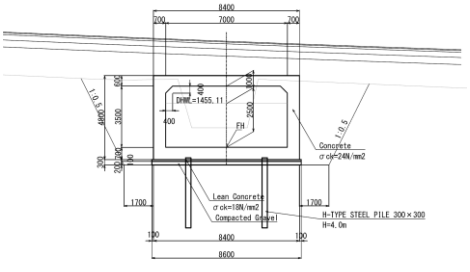
(6) Foundation

Geo-technical investigation confirmed bed rock at the river bed at Bhikteshor River and at about 4m to 7m below the river bed at other rivers. Therefore, pile foundation is provided at all but in Bhikteshor. Considering the difficulty in procuring heavy equipment, H-steel piles, which can easily be driven by the help of general equipment (regular) using vibration driving method, are applied

(7) Outline of Applied Culverts

Table 2.2-30 shows the outline of the culverts applied for improvement of each existing bridge.

Table 2.2-30 Outline of Culverts Applied

No	Station	River Name (Location)	Design Discharge (m^3/sec)	No. of Cells	Opening		Length (m)	Pile Foundation (H-Steel 300x300)
					Width (m)	Height(m)		
C1	01+714	Sipadole (Jagati)	46	1	8.0	5.8	50.39	L=7.0m, 50Nos.
C3	07+857	Bhikteswor (Bhikteswor)	12	1	10.0	6.4	50.19	None
C4	10+534	Punyamati (Banepa)	94	2	8.5	4.6	48.53	L=7.0m, 32Nos.
C5	12+094	Chandeshori (Banepa)	12	1	7.0	3.5	52.27	L=4.0m, 27Nos.
C1				C3				
C4				C5				

2.2.2.9 Pedestrian Bridges (Footbridges)

(1) Identified Locations

The project plans to provide pedestrian bridges (footbridge) based on the policies mentioned in Section (9), at six locations as listed in **Table 2.2-31**.

Table 2.2-31 Locations of Pedestrian Bridges

No.	Station	Location	Remarks
1	STA. 0+100	Suryabinayak	Start point
2	STA. 0+960	Jagati	
3	STA.11+000	Banepa	
4	STA.11+340	Banepa	
5	STA.11+820	Banepa	
6	STA.13+270	Bodol	Near Kathmandu University

(2) Applicable Standard

In addition to the specification for highway bridges, Japan Road Association 2012, the following standards were applied;

i) Standard for Graded Road Crossing (1979, Japan)

ii) Guidelines for Pedestrian Bridges and Underpass pedestrian ways

(3) Design Requirements

Following conditions were undertaken;

- Provision of stairway at both sides of the bridge (one side stairway and the other side stairway with slope at the middle for bicycle use)
- Slope of 1:2 (V:H) is applied for stairway and 1:4 for stairway with slope
- Landing or horizontal space 1.7m in length is provided at heights exceeding 3m
- Total width of stairway 2.1m
- Handrails height will be 1.0m or more
- Vertical clearance of 5.0m from the road surface is applied in based on the standard of Nepal
- Live load 400kg/cm2 will be applied
- Unseating prevention device (anchor bolt (method to prevent displacement) will be provided

(4) Footbridge Type

Three types of bridges were chosen taking into consideration the upgraded road cross section, land use pattern, bridge types provided by previous projects, present maintenance capacity of the DOR and requirements mentioned above. They are;

i) Type-1: 4-span RC girder bridge,

ii) Type-2: 2-span PC girder bridge, and

iii) Type-3: 2-span metal box girder bridge

From these three types, the first one, 4-span RC girder bridge type, is selected for the following reasons.

- As this bridge is divided into 4-spans, each girder is lighter than the superstructures of other types and can be easily erected by a crane. Therefore, construction efficiency is highest.
- Being is concrete bridge, it is maintenance free. However, this is inferior to Type-2 in that maintenance is regularly required for the bearings and expansion joints.
- This is highly cost effective. Construction cost of Type-2 and Type-3 are about 1.2 times and 1.3 times compared to this type.

Figure 2.2-14 illustrates the outline of the footbridge.

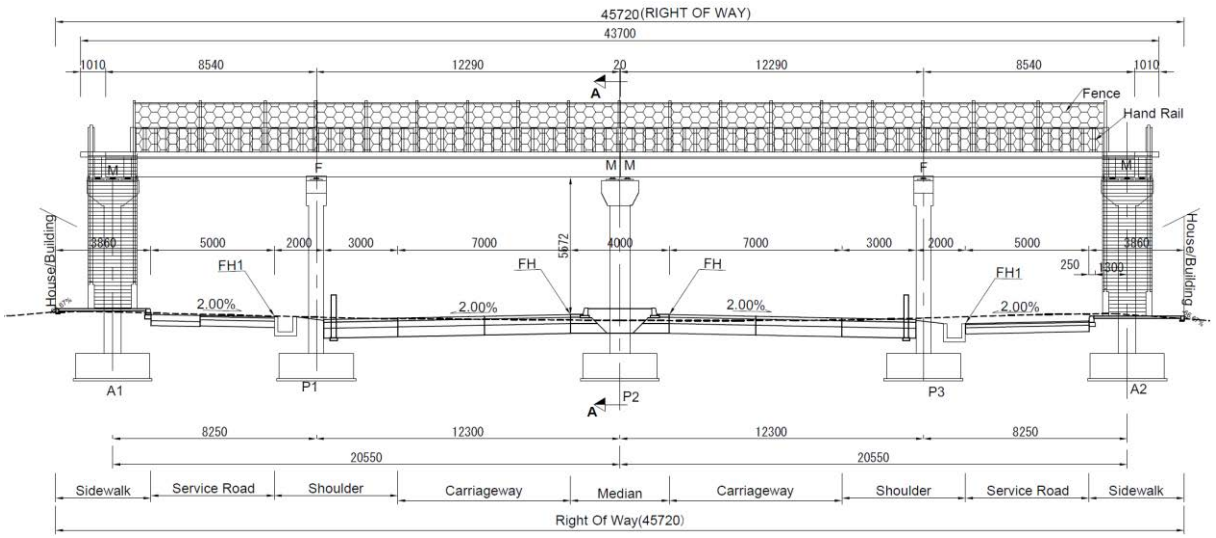


Figure 2.2-14 Outline of Footbridge

2.2.2.10 Slope Stability

The standard of Nepal requires application of slopes 1:2 (V:H) for embankment (fill) eight up to 12m. This slope will occupy wide area of land if the height of the embankment is high. The ROW of the objective road already exists and it is desirable that the improvement of road be done to the possible extent within the existing road reserve. Therefore, in order to minimize the land acquisition area, with approval from the DOR, the standard of Japan was applied, which allows the slope of 1:1.5. Vegetation has been provided on the slope faces for enhancing stabilization. Near the abutments where the fill height is very high and even application of this slope is deemed to require significant area of land acquisition, reinforced earth retaining wall were used with its slope 1:0.5.

The slope applied in case of cut slopes is 1:1.0, also with an aim to minimize the land acquisition area. At Sanga Bypass, where the alignment runs along a mountainous area, concrete framework has been planned against possible slope failures and rock fall.

2.2.2.11 Retaining wall

Gravity walls or L-shaped walls has been planned between the main road and the service track when there is a big difference in height in order to minimize the acquisition of land area. Gravity walls apply to

the height 3.0 or less and L-shaped walls for those exceeding 3.0m.

2.2.2.12 River Training Works

There are two locations where the streams are anticipated to partially invade the road reserve. The streams (water channels) at these locations have been diverted outside the road reserve and its slopes reinforced by wet stone masonry walls and gabions as shown in **Figure 2.2-15**.

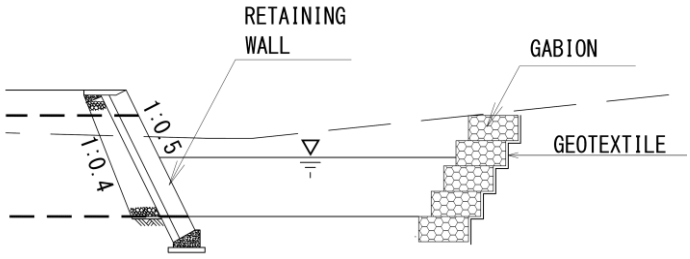


Figure 2.2-15 Outline of River Training Work

2.2.2.13 Box Culvert at Underpass

The profile of the objective road at Sanga Pass runs lower than the existing level. A box culvert is thus provided such that an underpass to allow through traffic inside the culvert and other roads on top of the culvert. The outline of the design of this culvert is as follows.

(1) Applicable Standard

Specification for Design of Culverts 2014, Japan was applied.

(2) Design Requirements

The following conditions were applied;

- Location : Sta. 6+372
- Opening Dimension: 2-cell 13.0m x 6.9m
- Length:10.0m
- Design Load: 25kN/m2
- Foundation: Spread footing

(3) Cross Section

Typical cross section of the box culvert (underpass) stretch is shown in **Figure 2.2-16**.

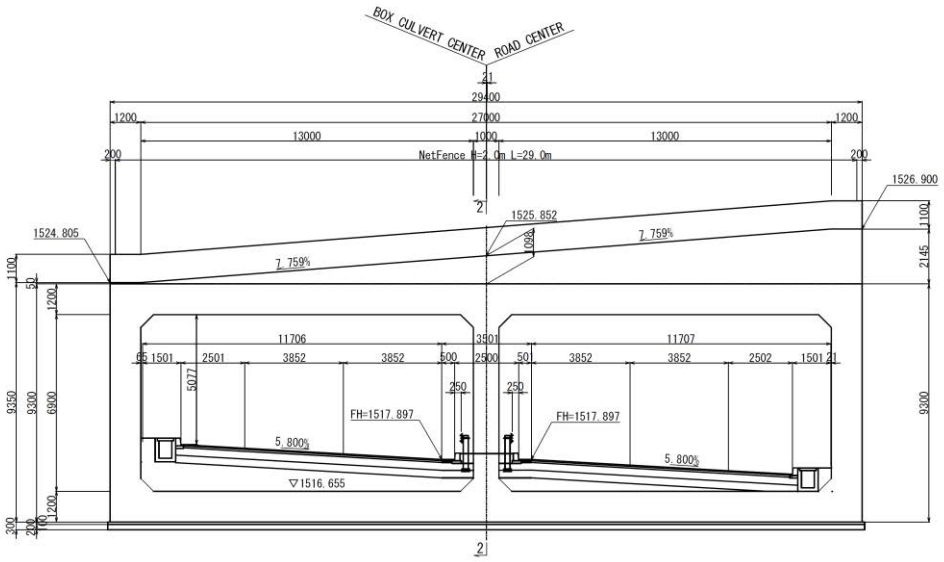


Figure 2.2-16 Typical Cross Section of Underpass

2.2.2.14 Road Ancillary Plan

(1) Bus Layby

Bus laybys were planned based on the policies mentioned in Section (10) Altogether, laybys were planned at 12 locations, basically on the existing locations. The width of the layby is 3m. When the layby is beside a service track, a portion (2m) of the service track has been used in addition to an additional meter of width. The deceleration and acceleration lanes have been taken as 3m and 5m respectively.

When the layby is provided beside the main road, the layby width is obtained by widening the road and no portion of the main road is used as in the case of laybys besides the service track. Deceleration lane and acceleration lane on these laybys has been taken based on the design speed and are 9m and 15m respectively. Storage length has been provided taking the existing condition into consideration.

The locations of the laybys and storage length of each laybys are shown in **Table 2.2-32**.

Table 2.2-32 Locations of Bus Laybys

No.	Left Side		Right Side		Remarks (Installation beside)
	Station	Storage Length (m)	Station	Storage Length (m)	
1	STA. 1+140	30	STA. 1+140	30	Between main road and service track
2	STA. 3+760	15	STA. 3+760	15	Main road
3	STA. 4+660	15	STA. 4+660	15	Main road
4	STA. 6+420	45	STA. 6+394	45	Service track
5	STA. 7+800	15	STA. 7+800	15	Main road
6	STA. 9+0	15	STA. 9+160	15	Main road
7	STA. 10+200	15	STA. 10+200	15	Between main road and service track
8	STA. 11+300	15	—	—	Between main road and service track

No.	Left Side		Right Side		Remarks (Installation beside)
	Station	Storage Length (m)	Station	Storage Length (m)	
9	STA. 11+900	15	STA. 11+900	15	Between main road and service track
10	STA. 13+300	15	STA. 13+300	15	Main road
12	STA. 14+000	15	STA. 14+000	15	Main road

(2) Fences

Stretch where the vertical height between the main road and the service track exceeds 3m, guard rails have been planned. Other stretches have been planned with guard pipes. Fence for preventing pedestrians from crossing the road from undesignated location has been planned at the median.

(3) Road Markings

The following road markings have been planned based on the standard of Nepal.

- Lane lines: 15cm wide white continuous lines
- Shoulders: 15cm wide white continuous and broken lines
- Others: Zebra crossings, arrows

(4) Traffic Signs

Traffic signs have been planned at 214 locations. The signs include regulatory signs and warning signs. Information signs are not under the scope of the project.

2.2.3 Outline Design Drawings

The design drawings prepared based on all above topics are attached at the end of the report. The contents (list) of the drawings are given in **Table 2.2-33**.

Table 2.2-33 List of Outline Design Drawings

Code	Drawing Title	Code	Drawing Title
GN	Location Map	**CD**	Cross Drainage (Box Culverts)
GN	General Notes	**PB**	Outline of Pedestrian Bridges (Footbridges)
TP	Typical Cross Sections	**RW**	Outline of Cantilever and Gravity Retaining Walls
PL	Plan and Profile	**PS**	Outline of Pavement Structures
IP	Intersection Improvement Plan	**DR**	Outline of Drainage Structures
BR	Bridge Outline Drawings	**CT**	Outline of Cross Road Treatment
PB	Sanga Pass Improvement	**BL**	Bus Laybys
SP	Slope Protection Beyod Sanga	**RA**	Outline of Road Ancillaries

2.2.4 Implementation Plan

2.2.4.1 Implementation Policy

Implementation plan of this project has been carried out under the assumption that the project will be implemented under the framework of Japan's Grand Aid Scheme. Basic policies for implementation of the Project are summarized in the followings;

i) The implementation plan is formulated that divides the construction into 10 sections (lots) taking into considering the road characteristics such as road widths, presence/absence of service tracks, requisite structures (bridges, culverts, slope protection measures etc.). The construction sections and its scopes are shown in **Table 2.2-34** and **Figure 2.2-17**.

ii) The sections are planned to be constructed in two consecutive phases. The first priority is given to sections 1- 4. Sections 5-10 will then follow.

Table 2.2-34 Construction Sections and its Scopes

Sec-tion	Station	Length (m)	Road Characteristics				
			Road Width (m)	Service Road	Foot Bridge (Nos.	Box Culvert (Nos.)	Others
1	00+000 - 1+860	1,860	24.0	Both Sides	2	1	Urban area, Retaining wall between main road and service road
2	1+860 - 4+830	2,970	23.0	-	-	-	Many horizontal alignment improvement locations
3	4+830 - 6+250	1,420	21.2	-	-	-	New route, New and long bridge, Reinforced earth embankment, Massive cut & fill, Borrow pit
4	6+250 - 6+580	330	21.2 - 23.0	Both Sides	-	-	Box culvert (underpass) and retaining wall for grade separation, Massive cut
5	6+580 - 10+020	3,440	23.0	-	-	1	Many horizontal alignment improvement locations, River training works at 2 locations
6	10+020 - 12+200	2,180	24.0	Both Sides	3	2	Urban area, Retaining wall between main road and service road
7	12+200 - 13+210	1,010	23.0	-	-	-	Drastic horizontal alignment improvement
8	13+210 - 13+350	140m	24.0	Both Sides	1	-	Intersection at entrance of KTM University
9	13+350 - 14+600	1,250m	23.0	-	-	-	Drastic horizontal alignment improvement, Massive cut & fill

Section	Station	Length (m)	Road Characteristics				
			Road Width (m)	Service Road	Foot Bridge (Nos.	Box Culvert (Nos.)	Others
10	14+600 - 14+920	320m	24.0 m	One side	-	-	Urban area, Retaining wall between main road and service road

Note: Box culverts here are the structures that replaced the existing bridges on the rivers.

iii) Maximum use of local material and labor is considered with an aim to enhance socio-economic activities of the area and to create job opportunities

iv) Construction method and construction schedule will be determined that best fit with influential conditions in and around the project area, namely climate, topography, geology, characteristics of river, availability of access roads, locations of borrow pits and disposal area, procurement areas etc.

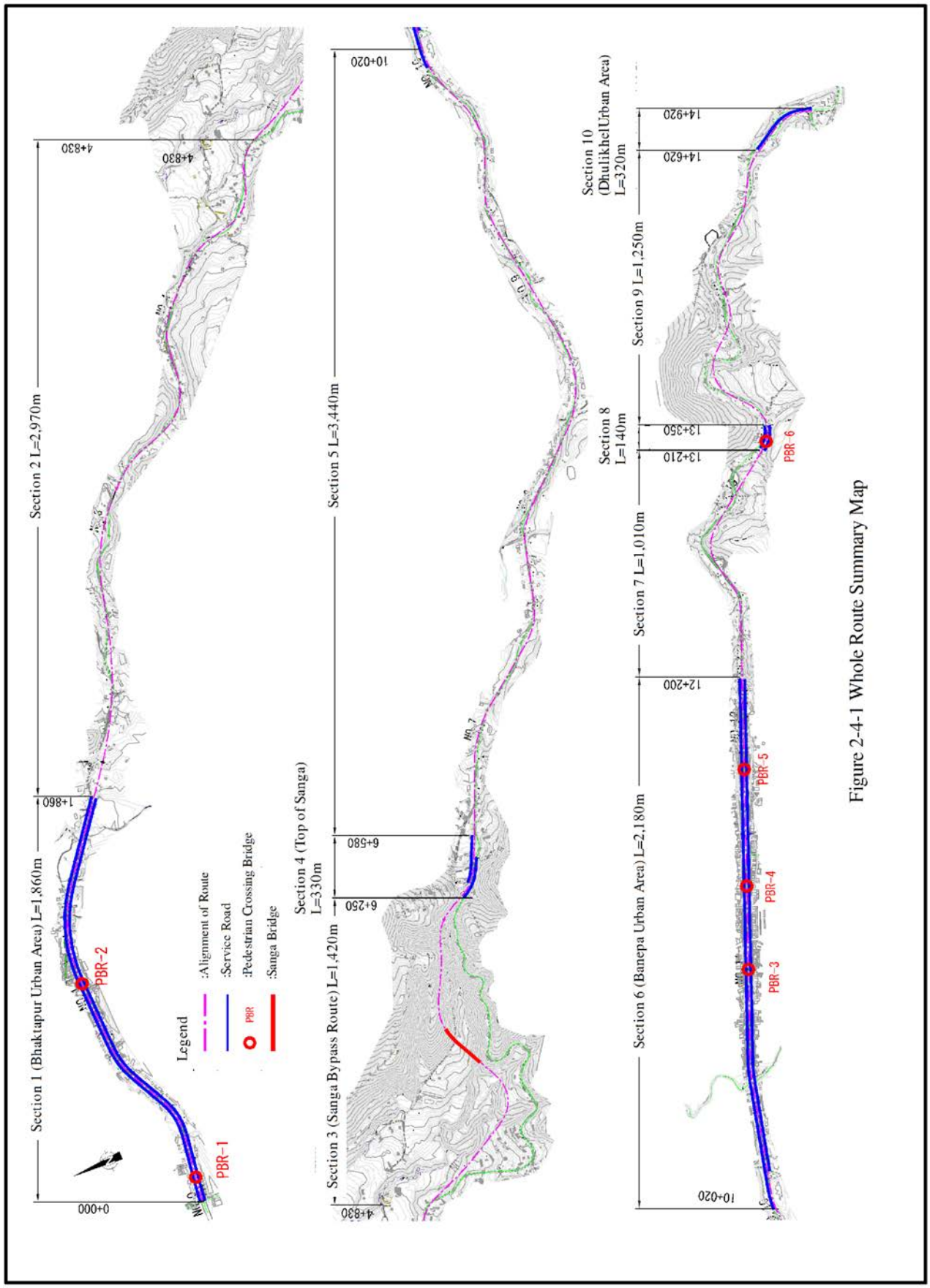


Figure 2.2-17 Outline of the Objective Road

2.2.4.2 Condition for Implementation and Procurement

(1) Compliance with the Labor Law

The contractor will manage labor properly with adequate safety control plan and prevent conflict with the local labor. In all circumstances, it will abide by the labor laws and regulations in force in Nepal.

(2) Construction during Monsoon Period

Monsoon at the project area lies between June and September. Construction of large-scale earthwork, substructure of bridge at Sanga, river training works and the underpass box culvert at Sanga Pass will be avoided to the possible extent during this period.

(3) Securing Existing Traffic during Construction

This project plans to widen the existing road. Therefore it is important to establish a method to secure the existing traffic during construction period. Safety and construction procedures differ in cases of construction with and without the service tracks and are as explained in the sections below.

On the other hand, the secured space for existing traffic is expected to be congested during the construction as the existing traffics will be mingled with construction-related traffics as well as pedestrians. Therefore, traffic controllers will be deployed at both ends of the construction zone and safety facilities will be provided for securing traffic safety and smooth passage for pedestrians.

Furthermore, securing existing traffic during construction of box culverts for crossing rivers will be carried out in turns – the first half and then the next half.

1) Securing Existing Traffics with Construction of Service Tracks

The service tracks as highlighted by pink in

Figure 2.2-18, is first constructed. Then the existing traffic will be allowed to use these roads and construction of the remaining section will be undertaken.

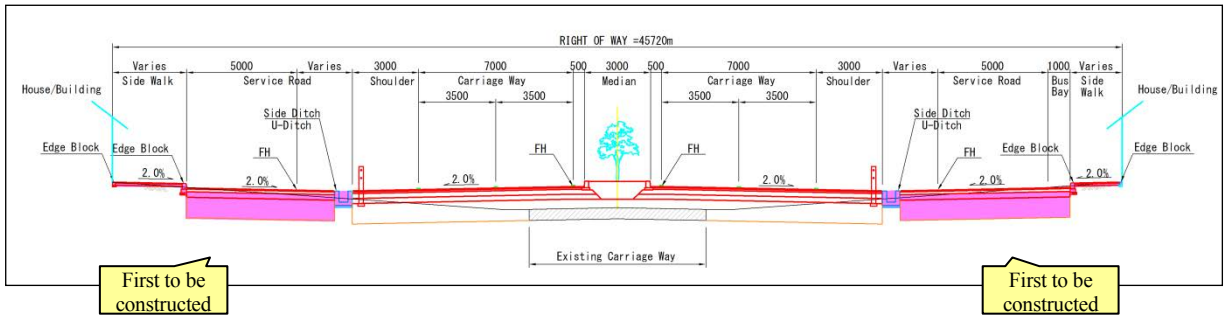


Figure 2.2-18 Typical Cross Section (with service road)

2) Securing Existing Traffics without Construction of Service Tracks

The widening portion as highlighted by pink in **Figure 2.2-19** will be initially constructed up to the sub base course. Then the traffics will be diverted to these sections to undertake the improvement of the remaining section (existing carriageway). After completion of this section the pavement of the section highlighted in pink will be undertaken. In addition, the temporary road for construction will be provided at

the foot of slope.

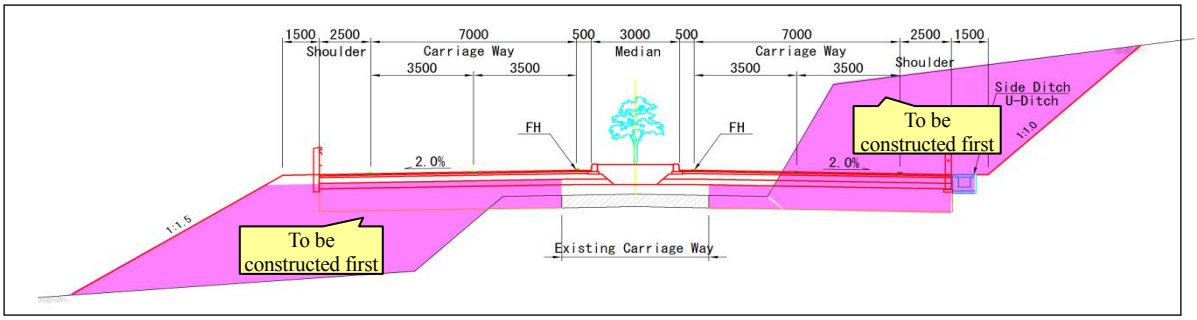


Figure 2.2-19 Typical Cross Section (without service road)

3) Securing Existing Traffics during Construction of Underpass

Outline of the method to be applied for securing existing traffic during construction of underpass at Sanga Pass is roughly shown in **Figure 2.2-20**. Here, first the service tracks, cross drainage facilities and stone masonry walls of the service tracks are constructed. The existing traffics are then diverted to the completed service tracks to construct the box culvert.

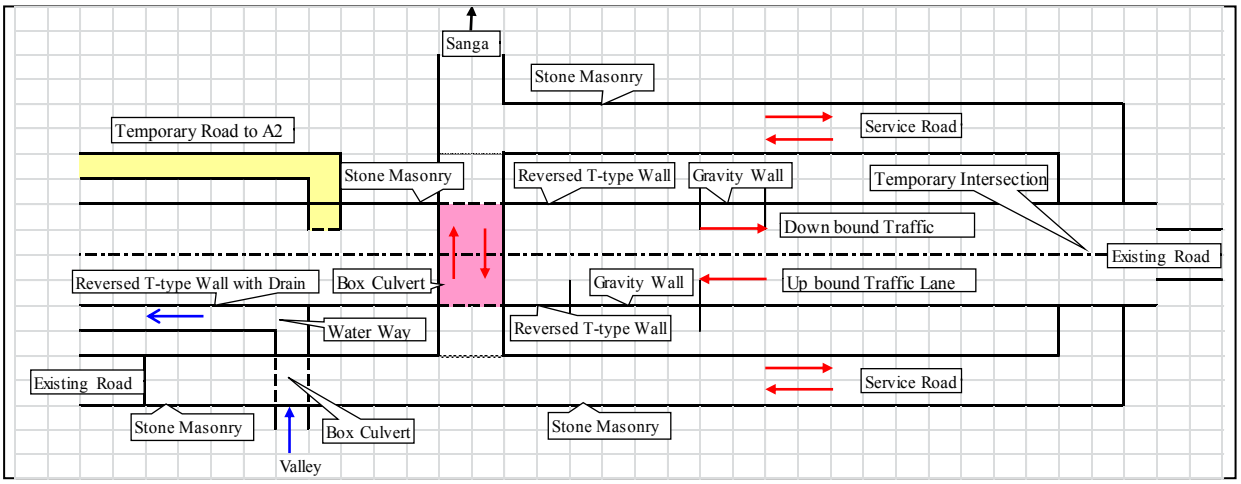


Figure 2.2-20 Schematic Diagram of Construction Method at Sanga Pass (Underpass)

(4) Borrow Pit

Large volume of soil is required in the process of widening and improvement of the objective road. Replacement of poor soil is estimated to require approximately 220,000 $m^3$of good soil, while volume that will be required for fill and for subgrade are approximately 426,000m^3 and 143,000m^3 respectively. When considering the quality and construction schedule, the soil that is seen to be in shortage is the soil for fill as transporting soil from borrow pits far away from the project site is not only time consuming but is also expensive. Therefore, soil for embankment for Section-3 is planned to be taken from the hill nearby Kailashnath Mahadev in Sanga, where the proposed road passes. As soil is planned to be taken from this hill, a large area of the hill will have to be excavated. Therefore, the GON will have to acquire land beyond the width of the road reserve. The area to be excavated and the area to be acquired are shown in **Figure 2.2-21** to **Figure 2.2-23**.

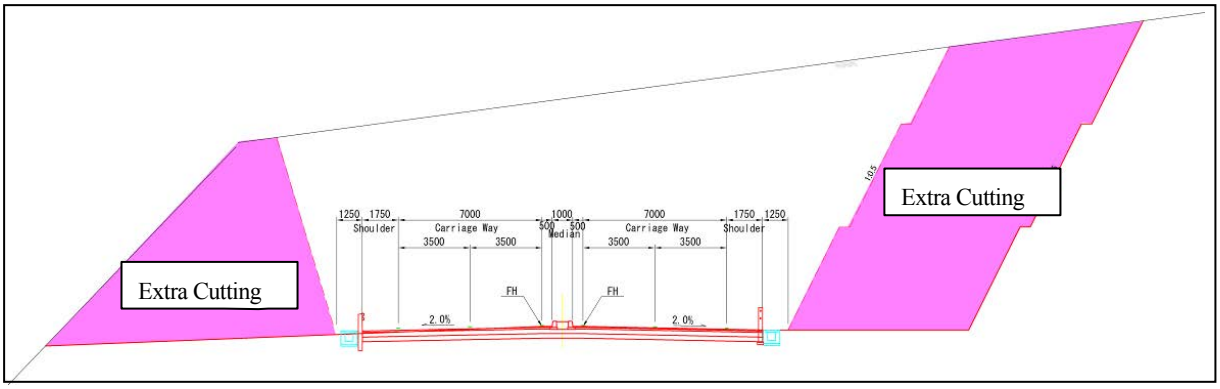


Figure 2.2-21 Cross Section at Proposed Borrow Pit

Figure 2.2-22 Proposed Borrow Pit (Cutting Area) Location Map

Figure 2.2-23 Existing Condition of Proposed Borrow Pit

(5) Disposal Area

The assumed disposal materials of the Project are asphalt concrete and common concrete, and the quantities of these materials are approximately 10,000m^3 and 8,000m^3 each. In addition to this, soil that is unsuitable (top soil) for fill is approximately 170,000m^3. All these soil will have to be disposed at a designated area. The disposal materials transported by dumper shall be dumped up at the excavated area, after that, backfilled by soil.

The proposed disposal site is a privately owned land and is located at Chaukat (around 2.5km from Banepa) along Panauti Road. The land is presently vacant. The soil to be disposed should be transported by dumpers and dumped which should then be and levelled necessarily. The disposal land should be provided to the contractor gratis by the GON.

2.2.4.3 Scope of Works

For the implementation of the Project under the grant aid of Japanese government, the scope of works to be undertaken by the Japanese and Nepalese governments are shown in **Table 2.2-35**.

Table 2.2-35 Scope of Works undertaken by the Japanese and Nepal Governments

Item	Details	To be Undertaken by		Remarks
		Japan	Nepal	
Consulting service	Detailed design about whole sections of target road, Preparation of tender documents, Assistant to DOR in tender process	○		
Acquisition of road site, Compensation of houses	Land acquisition for existing road widening and new road, Removal houses in ROW		○	Before Construction
Removal and relocation of construction obstacles	Religion facilities (temples, shrines and monuments), Electric poles, Electric cables, Telephone cables, Drinking pipes, Communication cables		○	Ditto
Removal of construction obstacles	Felling of tree, grubbing up roots and disposal		○	Ditto
Preparatory works	Secure of site necessary for construction (construction yard, temporary place of surplus soil, disposal place)		○	Before main construction
	Construction and removal of construction yard	○		
	Procurement and transport of construction materials and equipment	○		
	Custom clearance	○	○	
Main construction	Road works (including service roads), Bridge works (including pedestrian crossing bridge)	○		Including Construction supervision
Temporary works with main construction	Temporary road for construction, Safe facilities with the securing of existing traffic	○		Ditto
Supplementary works with main construction	Vegetation construction in median strip		○	After main construction
	Building of bus stop customs shed		○	Ditto

2.2.4.4 Consultant Supervision

(1) Basic Policies of Consultant Supervision

The basic policies of construction supervision are set as follows:

- This construction consists of road works (main road, service roads, intersections), bridge works (one long span bridge and footbridges) and structural works (large/small box culverts, retaining walls, reinforced embankment, slope frames, revetments etc.). In addition, this construction will be divided in to 10 sections and 2 phases, and several sections in each phase will be constructed simultaneously. Therefore, considerable numbers of Japanese and local engineers are deemed to be required for construction supervision.
- The construction supervisors (engineers) will perform the operations described in the next section (Consultant Supervision works). Especially, schedule control is important for completing several sections within the construction period.

  - As the PC Bridge with high piers planned at Sanga and the slope frame method by placing concrete and reinforced embankment are unfamiliar to Nepal. Japanese supervisors in association with the contracts will transfer the technologies to the engineers of the GON.

(2) Consultant Supervision Works

The supervisors dispatched to the site will perform the following construction supervision works.

1) Approval of Construction Plans and Construction Drawings

Supervisors will inspect and approve the construction plans, schedules, and shop drawings submitted by the contractor(s), checking that they conform to the requirements set out in the contract documents, contract drawings, specification etc.

2) Schedule Control

Supervisors will receive progress report from the contractor, and give instructions as required to ensure completion of the project on schedule.

3) Quality Control

Supervisors will examine the quality of, and approve construction materials and construction method making reference to the contract drawings and specifications.

4) Inspection of Completed Construction Works

Supervisors will inspect and approve the completed works and record drawings and approve final payment.

5) Issuing of Certification

Supervisors will issue the necessary certificates for payment to the contractor, for completion of construction and for expiry of the warranty period.

6) Submission of Reports

Supervisors will inspect the monthly reports and record drawings prepared by the contractor and submit

them to the Nepalese authorities, JICA and others. Furthermore, the supervisors will prepare the final report at completion of construction and submit it to JICA.

(3) Consultant Supervision System

Considering the construction contents and time schedule, number and duration of employment of Japanese engineers in construction supervision services will be set as mentioned in **Table 2.2-36**. In addition, local engineers shall be employed as much as possible to assist the Japanese engineers as well as for conducting technical transfer.

Table 2.2-36 Japanese Engineer and Major Task

Engineers	Dispatch Schedule and Major Tasks
Overall Supervisor	The engineer will visit at the time of the start and completion of construction and will attend the quality meetings held regularly.
Sub Overall Supervisor	The engineer will attend the quality meetings held regularly and the warranty inspection held one year after completion of the construction.
Resident Engineer	The engineer will be assigned permanently until the completion of the construction and will conduct supervision of construction in general.
Bridge Engineer	The engineer will be dispatched for bridges construction period with aim of technical and quality control of bridge building work.
Structure Engineer	The engineer will be dispatched for structures construction period with aim of technical and quality control of structure building work.

2.2.4.5 Quality Control Plan

As there is no adequate quality control plan in Nepal, the plan in the Project follows the Japanese control standards and test methods. Besides, the quality meeting led by the control person in charge of the contractor and the consultant would be held regularly during construction.

The quality control plan is shown in **Table 2.2-37**.

Table 2.2-37 Quality Control Plan

Item			Test Method	Frequency
Road Earthwork	Materials		Compaction Test	Beginning, Every Material Lot
			CBR Test (Subgrade)	Ditto
	Construction		Field Density Test	Once/1,000m^3 (Filled up ground) Once/1,000m^3 (Subgrade)
			Proof Rolling (Subgrade)	Overall Width and All Sections
Subbase Course and Base Course	Materials		Modified CBR Test	Beginning, Every Material Lot
			Sieve Analysis Test	Ditto
			Liquid Limit & Plastic Limit Test	Ditto
Subbase Course	Construction		Field Density Test	10 places /10,000m2
			Proof Rolling	Overall Width and All Sections
Base Course	Construction		Field Density Test	10 places /10,000m^2
			Grading Test (2.36mm Sieve)	Once or Twice per Day
			Grading Test (75μm Sieve)	Ditto
Hot Mix	Mate-	Bitumen	Quality Certificate & Chemical	Beginning, Every Material Lot

Item			Test Method	Frequency
Asphalt	rails		Analyses	
		Aggregate	Sieve Analysis Test	Ditto
			Density and Absorption Test	Ditto
			Clay Portion Test	Ditto
			Configuration Test	Ditto
	Mixing at Plant		Marshall Stability Test	Every Mix Portion
	Construction (Paving)		Field Density Test (Sampling)	10 places /10,000m2
			Temperature in Compaction	Each Two Times in AM and PM
Concrete	Mate-rails	Cement	Quality Certificate, Chemical & Physical Analyses	Beginning, Every Material Lot
		Water	Chemical Analyses	Ditto
		Admixture	Quality Certificate & Chemical Analyses	Ditto
		Aggregate	Alkali-aggregate Reaction Test	Ditto
			Sieve Analysis Test	Ditto
			Density and Absorption Test	Ditto
			Clay Portion Test	Ditto
			Sodium Sulfate Soundness Test	Ditto
	Mixing at Plant		Compressive Strength Test	Every Mix Portion
	Construction (Placing)		Slump Test	Once per Day
			Air Content Test	Ditto
			Compressive Strength Test (7 days, 28days)	Once per Day or Once / 20-150m^3
Reinforce Embank -ment	Mate-rails	Geo-textile	Quality Certificate	Beginning, Every Material Lot
		Steel Unit	Appearance Inspection	Ditto
		Fill Material	Compaction Test	Ditto
	Construction		Field Density Test	Once / 500m3
Re-bar / PC Cable	Materials		Mill Sheet, Tensile Strength	Every Material Lot
PC Cable	Materials		Calibration of Pre-stressing Device	Before First Pre-stressing
	Control of Pre-stressing		Pre-stressing Control Diagram	Each Pre-stressing

2.2.4.6 Procurement Plan

(1) Construction Materials

Considering the present procurement conditions, the procurement plan of major construction materials is set as shown in **Table 2.2-38**.

Table 2.2-38 Procurement Plan of Major Construction Materials

Description	Specification	Supply Source			Remarks
		Nepal	Japan	Third Country	
Cement	Portland Cement	○		○*	*insufficiency of supplies
Straight Asphalt		○			Import from India
Aggregate for Concrete		○			Existing quarry site
Aggregate for Asphalt Mixer		○			Ditto
Base Course	M-40	○			Ditto
Sub Base Course	C-40	○			Ditto
Boulder for Masonry		○			Ditto
Broken Stone for Gabion Box		○			Ditto
Sand, sandy soil		○			Ditto, borrow pit

Description	Specification	Supply Source			Remarks
		Nepal	Japan	Third Country	
Sodding		○			
Deformed Bar		○			
Guard Rail	Without post			○	Import from India
Steel Fence for Median	With painting	○			
Stainless Fence for Pedestrian Bridge		○			
Steel Pipe for Guard Pipe	D=65mm	○			
Gabion Box		○			
Reinforced Embankment -related Material				○	Import from India
PC-related Material	Cable, Sheath, Anchor		○		Quality Security
Shoe-related Material	Rubber Shoe, Anchor Bar		○		Ditto
Expansion Joint			○		Ditto
Interlocking Block	For Sidewalk	○			
RC Pipe Culvert	D600-1,200mm	○			
PVC Pipe	D50-150mm	○			
Withstand Pressure Pipe	D1.2, 1.5, 2.0m	○			Quality Security
Fuel		○			Import from India
Wood & Play wood for Form		○			
Steel Form for Girder	PC & RC Girder		○		Quality Security
Support & Falsework Material		○			

(2) Construction Equipment

Procurement plan of major construction equipment is set as shown in **Table 2.2-39**.

Table 2.2-39 Procurement Plan of Major Construction Equipment

Description	Specification	Supply Source			Remarks
		Nepal	Japan	Third Country	
Bull Dozer	15ton, 21ton	○			
Bull Dozer with ripper	21ton	○			
Back Hoe	0.2m^3, 0.35 m^3, 0.6m3, 1.0 m^3	○			
Wheel Loader	2.1m^3	○			
Dump Truck	10ton	○			
Truck with low bed	20ton	○			
Truck Crane	4.9ton, 20ton, 25ton, 35ton	○			
Vibratory hammer	45kW		○		Procurement Certainty
Giant Breaker	600-800kg, 1,300kg	○			
Motor Grader	B3.1m	○			
Road Roller, Tire Roller	10-12ton, 8-20ton	○			

Description	Specification	Supply Source			Remarks
		Nepal	Japan	Third Country	
Vibration Roller	0.8-1.1ton, 3-4ton	○			
Concrete Batcher Plant	30 m^3/hr		○		Procurement Certainty
Concrete Mixer Truck	4.4 m^3		○		Ditto
Concrete Pumping Truck	20 m^3/hr		○		Ditto
Asphalt Plant	60ton/hr		○		Ditto
Asphalt Finisher	2.4-6.0m	○			
Asphalt Distributor	3,000L	○			
Portal Crane	3ton		○		
Erection Girder	PC Girder Length < 35m		○		Procurement Certainty
PC Girder Erection-related Facilities			○		Ditto
Diesel Generator	25,50,100,150, 200kVA	○			
Spraying machine	For Mortar		○		Procurement Certainty
Air Compressor	10.5-11.0 m^3/min		○		Ditto

(3) Transport Plan of Materials and Construction Equipment

Construction materials and equipment procured from Japan will be transported via sea from Kobe or Yokohama Port in Japan to Kolkata Port in India. Customs clearance will be performed at the port. Thereafter, construction materials and equipment will be transported by land from Kolkata to Banepa (construction site) via Birgunj that is located south of Hetauda (reference to **Figure 2.2-24**).

Marine transportation will be used by containership, and the land transportation of approximately 800km will be used by truck, trailer or self‐propel crane depending on the load figure. The transport period from Japan to the construction site is estimated to take 40 days.

Figure 2.2-24 Route Map of Transportation

2.2.4.7 Soft Component (Technical Assistance) Plan

The project does not include any soft component plan, because the operation and maintenance after the completion of the project is able to be carried out by DOR.

2.2.4.8 Implementation Schedule

The project would be carried on with phase 1(detailed design of all sections and construction of section 1-4) and phase 2 (review of detailed design and construction of section 5-10)

(1) Implementation Schedule of Phase 1

Soon after signing the Exchange of Notes (E/N) between the GON and the GOJ regarding the detailed design of the Project, the consultant will carry out the detailed engineering design and preparation of the tender documents for construction works under Japan's Grand Aid Scheme. The consulting services of the detailed design would be completed in 6 months: Firstly one month review survey on the topography and drawings produced in the preparatory survey will be conducted in Nepal. After that the detailed engineering designs, the review of implementation schedule and project cost estimation, and preparation of the tender documents will be carried out as desk work in Japan.

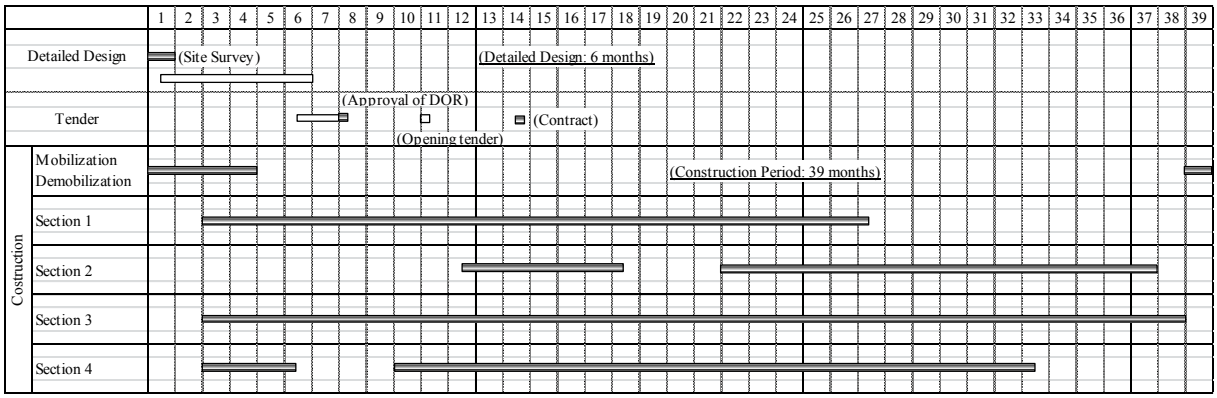
After the approval of DOR on the contents of the detailed design and the tender documents, an E/N will be signed again between the two governments for the construction work and the consulting services for

construction supervision. The tender will be carried out in the following procedure, viz. pre-qualification, tender opening and evaluation, and subsequent negotiation to conclude the contract between DOR and the successful tenderer. After signing the above contract, the signed contract will be verified by the Government of Japan

After receiving the verification of the contract, the consultant is to issue a notice to proceed and then the construction work will be begin. The construction will continue for 39 months till the completion of phase 1of the Project.

The overall time mentioned above is shown in **Table 2.2-40**.

Table 2.2-40 Implementation Schedule of Phase 1

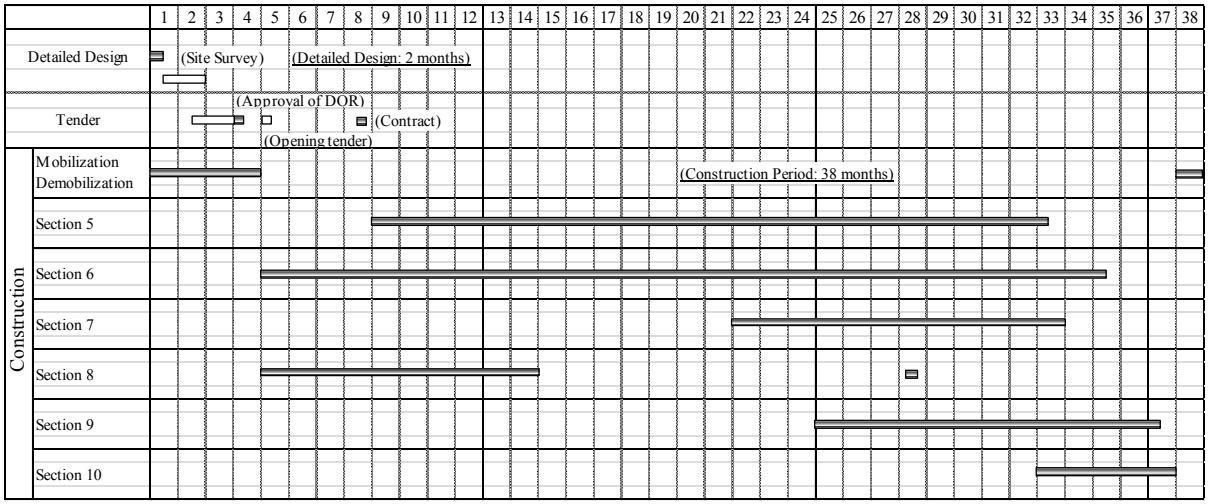


(2) Implementation Schedule of Phase 2

Soon after signing E/N regarding the detailed design and the construction work, the consultant would carry out the detailed engineering design and preparation of the tender documents for construction works. As the detailed design is a review of the design result of phase 1, the consulting services of the detailed design would be completed in 2 months: 2 weeks in Nepal and 1.5 months in Japan. The later process is similar to the phase 1, and the construction will continue for 38 months till the completion of phase 2 of the Project.

The overall time mentioned above is shown in **Table 2.2-41**.

Table 2.2-41 Implementation Schedule of Phase 2



2.3 Obligations of Recipient Country

Obligations of the recipient country required for implementation of the project under the Japan's grant aid and those that are affiliated to the project are summarized below.

2.3.1 Obligations for Implementation under Japan's Grant Aid Assistance

The undertakings required from the GON for the smooth execution of this project are as follows:

- To provide documents, data and information necessary for the execution of this project,
- To acquire land for construction works (road reserve, land necessary for construction, camp yard construction yard etc.) necessary for implementation of the project,
- To secure borrow pits, spoil-banks, and industrial waste disposal areas,
- To open a bank account in Japan on the name of the government of Nepal and issue authorization to payment as well as bear the Advising Commission and Payment Commission,
- To assist in the process for exemption of materials imported for the construction work from taxation and Customs clearance in order to ensure smooth inland transportation,
- To bear the value-added-tax related to the project,
- To assist in the process for exemption of Japanese nationals engaged in the construction work from Customs duties and other fiscal levies on products and services necessary for the execution of the project,
- To ensure proper use and maintenance of the road after its construction,
- To bear all expenses required for the execution of the project, other than those borne by Japan.

2.3.2 Obligations Affiliated to the Project

(1) Prior to Implementation

- Executing resettlement monitoring, restoration of livelihood, detailed property assessment

(negotiation, contract etc.),

- Assessment during completion and post evaluation of resettlement,
- Acquisition of land and relocation of obstacles,
- Acquisition of land/space for construction yard, project office, space for storing materials, construction of temporary roads etc,
- Secure/designate borrow pits, soil dumping and disposal area for construction debris,
- Relocation of public facilities, religious facilities and utilities,
- Felling of tress that affect construction work,
- Removal of traffic signs and billboards
- Implement plans for traffic signals/street lamps and share information with Japan side.

(2) During Implementation

- Informing road users of closures and restrictions during construction by means of effective media,
- Observation, measurement, analysis, inspection and implementation of measures against the issues identified from the results of environment such as air pollution, water contamination,
- Assist in resolving troubles with the local or third parties.

(3) After Implementation

- Planting vegetation on the median and executing inspection and maintenance properly,
- Construction/provision of bus shelters at bus stops constructed under this project,
- Adequate and sustainable maintenance of the existing road at Sanga Pass.

2.4 Project Operation Plan

2.4.1 Implementing Agency

The Department of Roads (DOR), which is the implementing agency of this project, will be the responsible agency for operation and maintenance of the project road beyond completion of the project. The organizational framework (chart) of the DOR for fiscal year 2070/71(equivalent to 2014/2015) is shown in **Figure 2.4-1**. The maintenance works of the project road can be divided periodic inspection, routine maintenance and repair/restoration works. The items included in each of these works are;

(1) Periodic Inspection

- Visual inspection of base course and wearing/surface course
- Inspection of bridges by means of visual inspection and simple measurement (inventory)
- Visual inspection of cut/fill slope condition
- Inspection of drainage facilities by means of visual inspection and simple measurement (inventory)

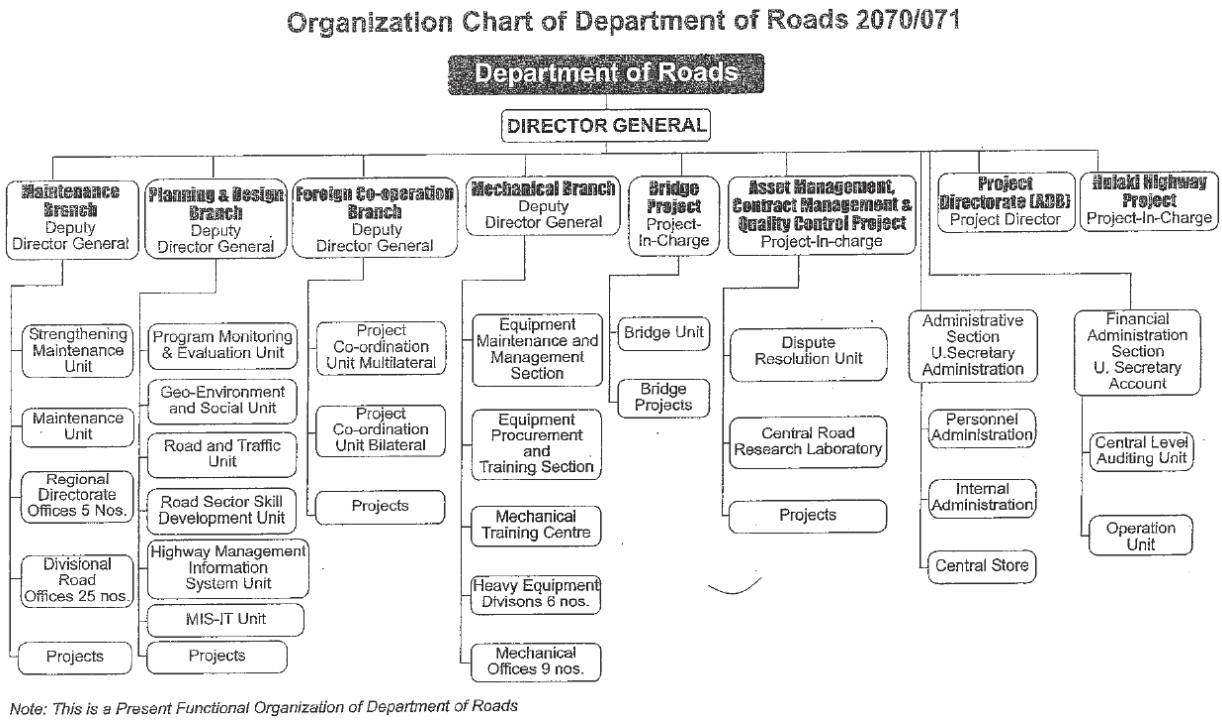
(2) Routine Maintenance

- Trimming of plantations along the central median reserves
- Cleansing of pavement surface and patching of asphalt, necessarily
- Repairing of base course
- Repairing of slopes (earthen and structure)
- Cleaning, clearing clogged material of drainage facilities
- Cleaning of intersection, roads, shoulders, bus laybys, and expansion joints of bridges (including footbridges)

(3) Repair/Restoration

- Repairing of base course
- Overlay of wearing (surface) course
- Repairing of bridge (including footbridges) handrails
- Repairing of slopes (earthen, structure)
- Repairing of road ancillaries

In Nepal, maintenance of arterial roads lies under the jurisdiction of the DOR. The emphasis is higher for strategically important roads. The project road is a National Highway and is designated as Asian Highway, which is an international corridor that links the capital city, Kathmandu with the Chinese border and the eastern plains of Nepal through the recently opened Sindhuli-Bardibas Road. This is believed to attain a high position in the priority list of the DOR for maintenance. The components of this project are considered to have high durability and will not require large scale maintenance for some years. Therefore, maintenance of the project road is not anticipated to have no technical difficulties.



Note: This is a Present Functional Organization of Department of Roads

Figure 2.4-1 Organization Chart of Department of Roads

2.4.2 Budget

The annual budget of MOPIT for the fiscal year 2013/14 is approximately 360 billion NRs. Annual budget of DOR for the same fiscal year is about 280 billion NRs. which is equivalent to about 80% of MOPIT's annual budget. Annual budget of the DOR for the last five years is as shown in **Table 2.4-1**.

Table 2.4-1 Annual Budget of DOR(2009～2013)

(Unit: 1,000 NPR)

Year	Allocated Budget	Actual Expenses				
		Miscellaneous	Construction	Upgrading	Maintenance	Total
2010/11	23,608,850	3,458,409	13,244,109	2,827,793	917,349	20,447,660
2011/12	23,541,835	862,902	8,709,377	8,260,737	1,460,771	19,293,787
2012/13	28,568,359	1,572,467	10,151,487	8,035,647	2,073,363	21,832,964
2013/14	34,517,957	8,518,261	8,497,173	5,025,204	5,920,728	27,961,366
2014/15	37,846,064	5,396,220	32,449,844 (Proposed Budget for Construction)			

2.5 Project Cost Estimation

2.5.1 Estimated Cost of Project

The total initial project cost estimate necessary to implement the project amounts to Japanese Yen 16.039 billion (Phase I: JPY 9.173 billion, Phase II JPY 6.865 billion) which includes both the cost contributions of Japan and Nepal and based on the conditions stated in Item (3) below. However, the total amount does not represent a limit on the amount granted in the Exchange of Notes.

(1) Cost to be borne by Japanese Side

The costs to be borne by the Japanese side are tabulated in **Table 2.5-1**.

Table 2.5-1 Approximate Cost Estimate of Japanese Contribution

Items	Phase Ⅰ (Billion JPY)	Phase Ⅱ (Billion JPY)	Total Cost (Billion JPY)
Construction Cost	8.578	6.585	15.163
Direct cost	5.504	4.301	9.805
Common Temporary Costs	0.679	0.486	1.165
Site Expenses	1.803	1.344	3.147
Head Office Expenses	0.592	0.454	1.046
Detailed Design & Construction Supervision	0.596	0.280	0.876
Total	9.173	6.865	16.039

(2) Cost to be borne by Nepalese Side

The project cost to be borne by the Nepalese side is as shown in **Table 2.5-2**.

Table 2.5-2 Project Cost to be borne by Nepalese Side

Unit: Thousand NRs

Item	Details	Approx. Cost
Acquisition expense of road site	Land acquisition for existing road widening and new road	3,750,200
Acquisition & compensation expense of private houses	Site clearance in ROW	411,250
Relocation expense of religious facilities	Relocation of temples, shrines and monuments from ROW	450
Relocation expense of surface/ overhead public utilities	Relocation of electric poles, electric cables, telephone cables and water fountains to buffer zone	42,256
Relocation expense of underground public utilities	Relocation of drinking pipes and communication cables to buffer zone	86,495
Felling expense of tree	Felling of tree in ROW, grubbing up roots and disposal	1,330
Acquisition expense of disposal area	Land acquisition for disposal of unsuitable soil, asphalt concrete and common concrete	14,538
Land hire charge of preparatory works	Leased land for construction yard and temporary place of surplus soil	24,358
Vegetation construction expense in median strip	Planting of tree and sodding in median strip after construction completion	4,050
Building cost of bus stop customs shed	Building bus stop customs shed after construction completion	300
Bank charge (in connection with AP)		29,640
Total	4,364,867 thousands NRs	

(3) Cost Estimate Conditions

vi) Time of estimate : November 2015

vii) Exchange rate (Nepal Rupee) : NRs 1.00 = 1.16 Japanese Yen

viii) Exchange rate (US Dollar) : US$ 1.00 = 122.20 Japanese Yen

ix) Construction period : 39 months (Phase 1), 38 months (Phase 2)

x) Others :

This plan will be implemented in accordance with Japanese Government's grant aid guidelines. The above estimated project cost will be reviewed by the Japanese government before E / N.

2.5.2 Operation and Maintenance Cost

The normal annual operation and maintenance cost (i.e., cleaning of road facilities surface) in phase 1 and phase 2 would be 5,594 thousand NRs and 6,924 thousand NRs respectively as shown in **Table 2.5-3**. On the other hand, the periodic maintenance/rehabilitation and inspection would be necessary every several years. Therefore, the expense for 20 years about annual maintenance and the periodical maintenance would be 440,339 thousand NRs and 561,394 thousand NRs each in phase 1 and phase 2, and each expense correspond to 0.4% and 0.5% of the DOR's maintenance budget for the fiscal year 2013/2014. Such annual disbursement would be affordable by DOR.

Table 2.5-3 Cost Estimation of Operation and Maintenance

Unit: Thousand NRs

Item	Frequency	Component	Details	Approx. Cost	
				Phase1	Phase2
Cleaning road surface (by manpower)	Once a week	ROW	Clean road surface, shoulder, slope, side ditch	3,125	3,792
Cleaning intersection & bus-stop	Every 2 days	Road surface	Clean sidewalk etc.	927	1,140
Cleaning cross drainage	Once a year	Cross drainage	Clean box culvert & pipe culvert	15	28
Planting in median strip	4 times per year	Median	Planting & trimming	117	149
Maintenance of AC pavement	Ad hoc	Carriageway	Pathing 0.5% pavement area per year	1,410	1,815
Annual Operation & Maintenance Cost				**5,594**	**6,924**
Periodic maintenance of AC pavement	Every 10 years	Carriageway	Overlay of main lane & service road	243,773	316,284
Maintenance of sidewalk	Every 5 years	Sidewalk pavement	Replace damaged interlocking tiles	8,500	10,556

Item	Frequency	Component	Details	Approx. Cost	
				Phase1	Phase2
Maintenance of box culvert for river	Every 10 years	Revetment	Repair of gabions	1,139	3,447
Maintenance of lane marking	Every 3 years	Road surface	Painting of lane marking	59,783	71,932
Maintenance of traffic safety facilities	Every 5 years	Fence in median	Painting of Crossing prevention fence	13,506	18,067
	Every 5 years	Traffic sign board	Cleaning & Replace of traffic sign board	843	1,390
Periodic inspection of Sanga bridge (Subcontract)	Every 5 years	Whole bridge	Check & diagnose condition of bridge member	307	
Periodic inspection of pedestrian crossing bridge (Subcontract)	Every 5 years	Whole bridge	Check & diagnose condition of bridge member	614	1,229
Total Operation & Maintenance Cost for 20 years				**440,339**	**561,394**
(Annual average of 20 years)				**(22,017)**	**(28,070)**

Notes: Operation & maintenance cost is 2014 price.

3. Project Evaluation

3.1 Preconditions

- Right of Way (ROW) for the entire stretch of the project road has been established since long ago. However, the actual acquisition of the ROW has been completed only up to Sanga. ROW for the entire stretch is required to be acquired before the commencement of the construction.
- Given that the ROW is pre-determined, this project fundamentally aims to widen the existing road without changing the existing center line. However, at several locations, improvement of horizontal and vertical alignment to meet with the change of design speed (higher speed applied) necessitates widening beyond the available road reserve (ROW). It is particularly difficult at Sanga Pass due to its steep terrain and fragile geology. Therefore, here a bypass has been planned instead of widening the existing road- thus necessitating acquisition of land prior to procurement of contractors. The site that needs to be acquired is approximately 140,000 m 2 and the market price is approximately 2 billion Yen and it is necessary to allocate sufficient amount for land acquisition on the national budget.
- Procedures and securing of budget (about 600 million yen) for relocation of obstacles such as houses, public facilities, religious facilities, etc., are required to be undertaken by the DOR based on the information provided by the Consultant before procurement of contractor(s).
- Securing construction yards, space for storing material and field offices, roads for construction, lease fees, relocation of electric and communication facilities, water facilities, wells etc. that impede the construction.
- Being a grant aid project, the detailed design and tendering is assumed to be implemented as a tied, meaning limited to Japanese companies. The Nepalese side needs to effectively utilize the results of this survey (drawings, asset survey results, etc.) and appropriately and steadily implement land acquisition and resettlement including relocation, which will also serve as bidding conditions. In particular, it is necessary to cooperate with the related organizations such as DOR and local administrative agencies concerning the implementation of resettlement of residents as below, so that necessary budgetary measures and administrative processing can be carried out.
    - DOR sets compensation unit price after adjusting with CDC (Compensation Determination Committee)
    - Survey affected assets (prepare compensation contract document)
    - Calculate, negotiate, and pay compensation
    - Monitor demolition of the building and handing over of land.

3.2 Necessary Inputs by Recipient Country

The issues that the Nepalese side needs to address to sufficiently attain and sustain the project outcome are as follows;

- As service tracks are not provided along the bypass at Sanga Pass, the existing road will have to bear its function. Therefore, it is necessary to reclassify the existing road section from the current national highway to the service track, and at the same time, it is necessary to properly maintain and manage this section and keep it in sustainable condition.
- Based on lessons learnt from construction of KB Road, service tracks have been planned at sections (built-up sections/areas such as Suryabinayak to Jagati, Sanga Pass, Banepa Bazaar and Dhulikhel) where it is deemed to contribute in attaining the project outcome from the time the road is open to traffics. Service tracks along other sections are desirable to be provided by the Nepalese side accordingly and appropriately.
- Pedestrian bridges are planned to be provided at locations where service tracks are to be provided and its provision is deemed to contribute in attaining project outcome right after the road is open to traffics. Pedestrian bridges along other sections are desirable to be provided by the Nepalese side accordingly and appropriately.
- Bus laybys to be provided along sections where service tracks will not be provided, will have to be relocated when service tracks in these areas are provided by the Nepalese side in future.
- Proper and timely maintenance after completion of construction is utterly important not only to maintain good driving conditions but also to endure service life of pavement and structures. Cleaning of drainage facilities, removal of earth/sand and obstacles, and repair of distress on the pavement. Therefore, it is important to secure the necessary budget (approximately US $ 50,000) for maintenance and repair, and to carry out ongoing maintenance and management. As stated in the operation and maintenance cost of the previous section.
- Provision of street lights and traffic signals are excluded from this project considering the load shedding situation in Kathmandu. Since road lighting is an important facility for traffic safety, installation of road lighting in this project needs to be appropriately and necessarily provided by the Nepalese side. Similarly, it is desirable to install traffic signals at major intersections.
- Improvement of the road contributes in increase of driving speed. In order to enhance traffic safety, it is required to implement 3Es (Education, Engineering and Enforcement) including periodical execution of traffic safety campaigns.

3.3 Important Assumptions

In Nalinchowk, the Arniko Highway Struggle Committee strongly opposed to handover their land. Persuade and reach consensus with the residents including committee

3.4 Project Evaluation

Implementation of this project under the grant assistance of Japan is justifiable both in terms of relevance and effectiveness.

3.4.1 Relevance

The following reasons justify the relevance of this project to be implemented under the grant assistance

of Japan.

- Japan has been since then extending assistance to Nepal consistently and continuously. On road sector, Japan has been providing grant assistance to Nepal for construction of Sindhuli Road since 1996, the last section (section 3) was successfully completed in July 2015. Another project among others that was recently completed (September 2011) is the "Kathmandu-Bhaktapur Road Improvement Project". In addition, "The Project for Operation and Maintenance of Sindhuli Road", a technical cooperation project and "The Project for Urban Transport Improvement for Kathmandu Valley" are on-going. The project road (SD Road) of this project connects on both the start and the end points with roads that were constructed/improved under the grant aid assistance of Japan. The project begins from the end point of KB Road and ends at the beginning point of Sindhuli Road.
- The project road is a part of Mid-hill Highway that is classified as Strategic Road Network in Nepal. Mid-hill highway is an important trunk road that connects the east and the west ends of the country and runs along the middle of the country.
- The project road is a part of Asian Highway (AH42) that connects with another Asian Highway (AH2) and further proceeds to India. AH2 lies in the south of the country and runs from the east end to the west end. It is an important road that burdens the logistics of the country.
- One of the main policies mentioned in the national development plan, "An Approach Paper to the Thirteenth Plan (APTP)", formulated in July 2013, is the expansion of the road network and provide all-season accessible road to all the District Headquarters of the country. Development of Mid-hill Highway including improvement of SD Road has also been given priority in the AOTO. As such, the improvement of SD Road is in line with the national development plan.
- Improvement of SD Road is identified as one of the most important projects in other development plans, "Strategic Road Network Development Plan (2005)" and "Road Program and Priority Investment Plan (2007)".
- Benefits of the project are not limited to residents including the poor along the objective road and extend to the people of Kathmandu and further to the citizens in the southeast Terai region.
- Nepal is capable to manage necessary resources for sustaining operation and maintenance of the infrastructures (Road, bridge and structures) constructed under this project.

3.4.2 Effectiveness

The goals set in this project are improvement of the SD Road and subsequently reduction of travel time. The expected outcome of the project is as mentioned below.

(1) Quantitative Outcome

Indicator, vehicle type and present and target travel time is shown in **Table 3.4-1**. The outcome for the third year after the road is open to traffics is compared with the present required travel time. The reduction in travel time after the implementation of this project is expected to be 17 minutes and 14

minutes for ordinary vehicles and heavy vehicles (trucks) respectively.

Table 3.4-1 Cost Estimation of Operation and Maintenance

Indicator	Vehicle Type	Travel Time (min)		Reduced Time (min.)
		Present (in 2015)	Target Period (3 years after Operation)	
Travel time reduction	Large	38	24	14
(Suryabinayak to Dhulikhel (approx. 15km))	Ordinary	31	14	17

(2) Qualitative Outcome

- Enhancement of driving comfort
- Improvement of socioeconomic activities of residents along the road including improvement of emergency services due to enhancement of traveling performance and reduction in travel time.
- Contribution to reduction of CO2 emissions from vehicles due to improvement of drivability and alleviation of traffic congestion. Especially, provision of bypass at Sanga contributes in significant reduction of CO2 emissions and reduction of noise on the existing road and its vicinity.
- Provision of bypass at Sanga helps enhance reliability as severance due to slope failure can be avoided.