GOVERNMENT OF NEPAL
MINISTRY OF PHYSICAL INFRASTRUCTURE AND TRANSPORT
DEPARTMENT OF ROADS

PREPARATORY SURVEY FOR NAGDHUNGA TUNNEL CONSTRUCTION IN NEPAL

FINAL REPORT

MARCH 2015

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

CTI ENGINEERING INTERNATIONAL CO., LTD
TONICHI ENGINEERING CONSULTANTS, INC.
METROPOLITAN EXPRESSWAY CO., LTD.
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CR (3)
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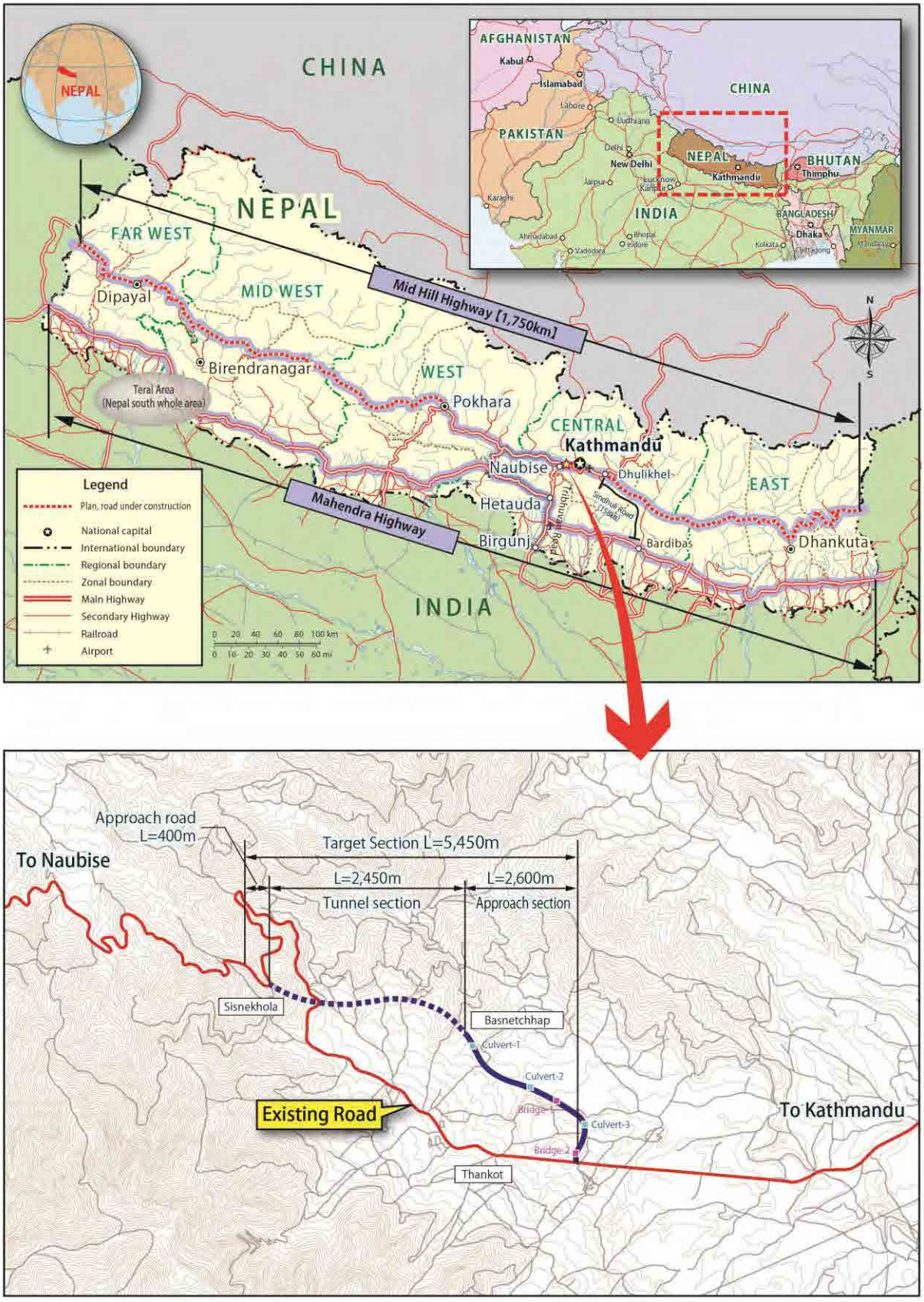
EXCHANGE RATE

September 2014

1NPR= 1.1 Japan Yen

1US$= 97.3 NPR

1US$= 107.1 Japan Yen



LOCATION MAP

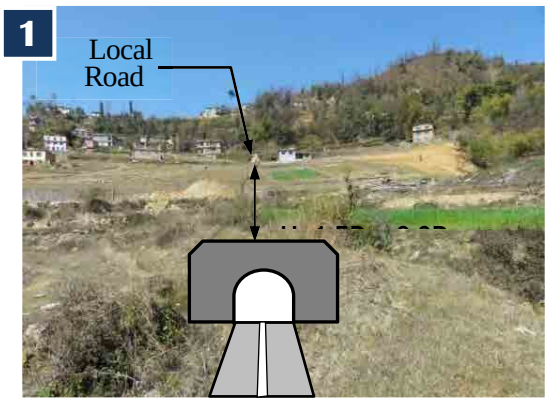
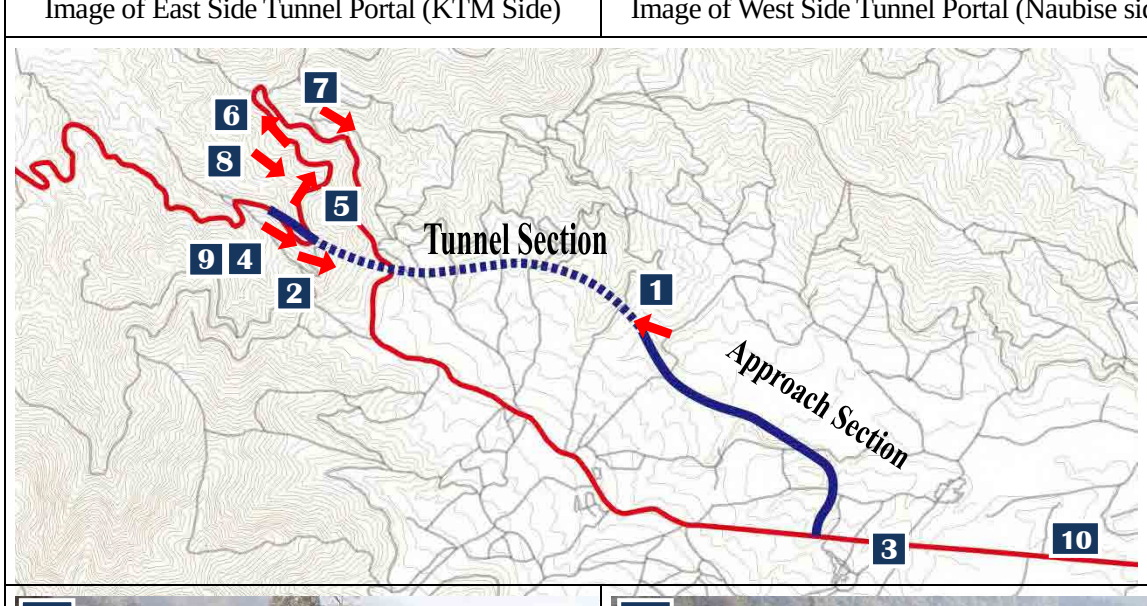


Image of East Side Tunnel Portal (KTM Side)

Image of West Side Tunnel Portal (Naubise side)

Start Point of Project (Houses Alongside)



Traffic congestion due to slow traffic
(Near sisnekhola)

Valley side slope that is deformed and dangerous

Recent slope failure near objective road

Traffic congestion due to stranded vehicles
(Mal-functioning of trucks is frequent)

Traffics (Trucks) are frequently found stuck in open drainage

Traffic congestion is frequent on objective road section (high percentage of heavy vehicles)

East side of the Project section is newly and densly built-up area

ACRONYMS AND ABBREVIATIONS

AADT	Annual Average Daily Traffic
ADB	Asean Development Bank
DDC	District Development Committee
DMG	Department of Mines and Geology
DOLIDAR	Department of Local Infrastructure Development and Agricultural Roads
DOR	Department of Roads
DOS	Department of Survey
DWIDP	Department of Water Induced Disaster Prevention
EIA	Environmental Impact Assessment
EPA	Environmental Protection Act
EPR	Environmental Protection Rule
ESMF	Environmental and Social Management Framework
FY	Fiscal Year
GESU	Geo Environmental and Social Unit
GON	Government of Nepal
IEE	Initial Environmental Examination
JICA	Japan International Cooperation Agency
KMC	Kathmandu Metropolitan City
KTM	Kathmandu
LAA	Land Acquisition Act
LRN	Local Road Network
MLIT	Ministry of Land, Infrastructure, Transport and Tourism (Japan)
MOE	Ministry of Energy
MOFSC	Ministry of Forests and Soil Conservation
MOPIT	Ministry of Physical Infrastructure and Transport
MOSTE	Ministry of Science technology and Environment
NATM	New Austrian Tunneling Method
NEA	Nepal Electricity Authority
NEXCO	Central Nippon Expressway Co., Ltd.
NPC	National Planning Commission
NRS	Nepal Road Standard
NRP	Nepal Rupees
ODA	Official Development Assistance
PPP	Public Private Partnership
PAP	Project affected people/person
RBN	Roads Board Nepal
ROW	Right of Way
RAP	Resettlement Action Plan
TRP	Tribhuvan Rajpath
SRN	Strategic Road Network
VDC	Village Development Committee
WB	World Bank

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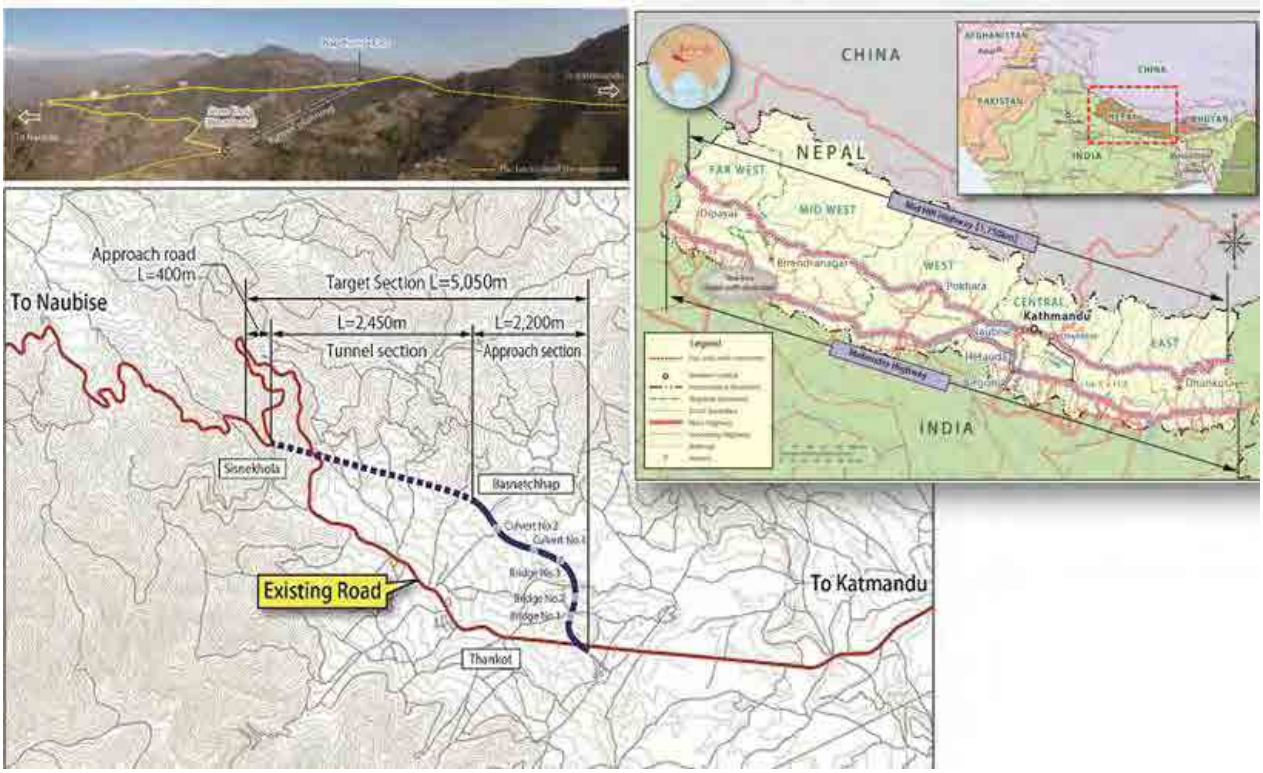
1. BACKGROUND AND OBJECTIVES

1.1 BACKGROUND

- Nepal is a landlocked mountainous country.
- 90% of trade traffic is dependent on roads.
- The Mid-hill Highway (1,750km) East-West Corridor carries 60% of the country's trade transport.
- A section of this highway passes through the steep Nagdhunga Pass with 500m – 1,500m difference in elevations.
- Vertical grades exceeds 10% with consecutive sharp curves causing severe congestion and deadly traffic accidents.
- The section is vulnerable to landslides and water-induced disasters during monsoon.
- In January 2014 Japan International Cooperation Agency (JICA) carried out the "Data Collection Survey on Thankot Area Road Improvement in Nepal" to study improvement measures for the above issues.
- **The Preparatory Survey for the Project is implemented to prepare all necessary data/information which are required for the appraisal of the Project by JICA.**

1.2 PROJECT LOCATION

The location of the Project is as shown below;



1.3 OBJECTIVE OF THE PROJECT

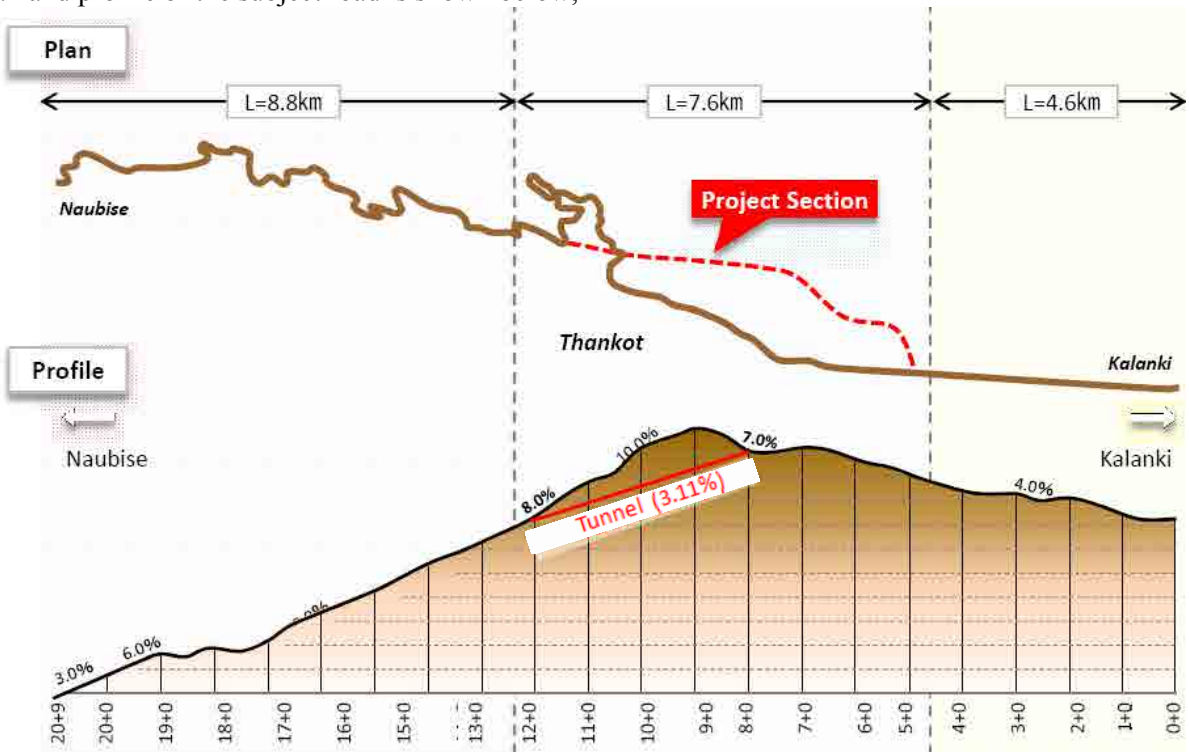
Objective of the project is to to construct a tunnel across Nagdhunga Pass located on the arterial road connecting the capital city of Kathmandu with the rest of the major cities of the country to;

i. improve the alignment of the existing road,
ii. reduce the travel time, and
iii. enhance traffic safety, such that economic activities of Kathmandu and other major cities is stimulated and contribute to the economic development of the country.

2. PRESENT CONDITION OF THE SUBJECT ROAD

2.1 EXISTING ROAD ALIGNMENT

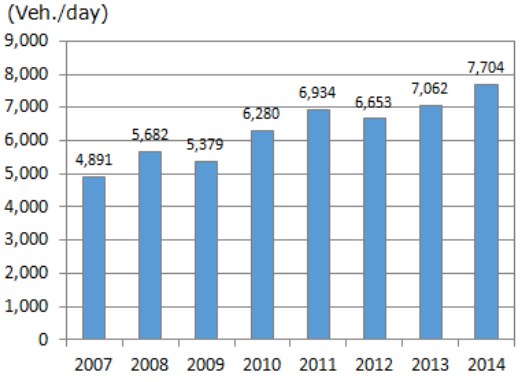
Plan and profile of the subject road is shown below;



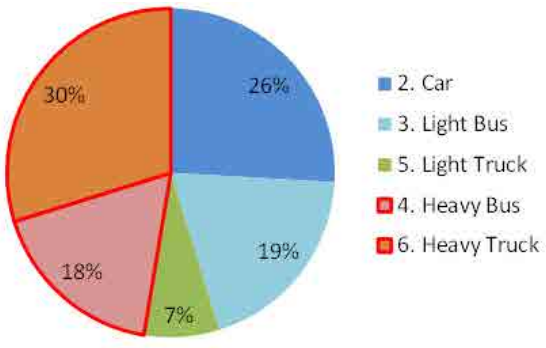
- The existing road **has to go up and down** the Nagdhunga Pass, thus the alignment has **various problems** as follows;
  - Continuous sharp curves and hairpin curves: **19 locations**
  - **Steep gradient**: aggregate 1.6km section exceed a vertical gradient of 7%
- Due to sub-standard alignment, vehicles can travel only with **less than 20km/hour** and traffic congestion is experienced daily.
- There are also **dangerous/unstable slopes** beside the road, thus risks of road closure due to slope failure is high.
- **Solution to avoid above problems is to CONSTRUCT A TUNNEL for a safe, smooth, and less costly travel.**

2.2 TRAFFIC VOLUME AND COMPOSITION

- Traffic volume at Nagdhunga section is increasing every year.
- Share of heavy vehicle shows very high rate accounting to 48% of total traffic



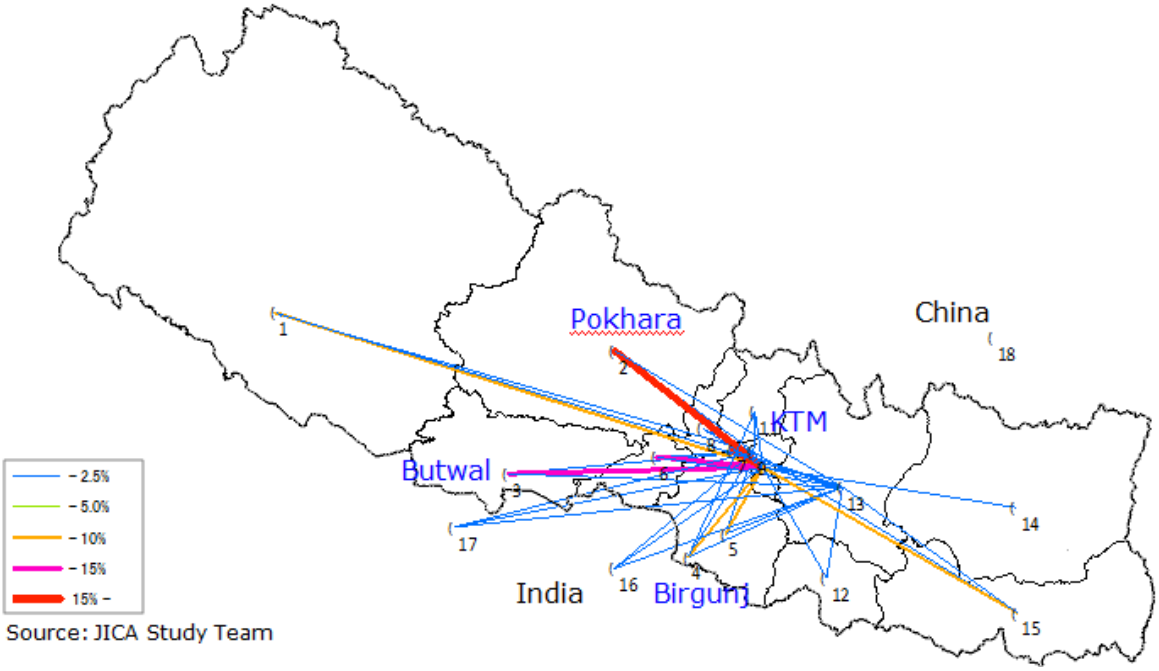
Annual variation of AADT at Nagdhunga



Traffic composition at Nagdhunga
(Without Motor cycle)

2.3 TRAFFIC FLOW PATTERN

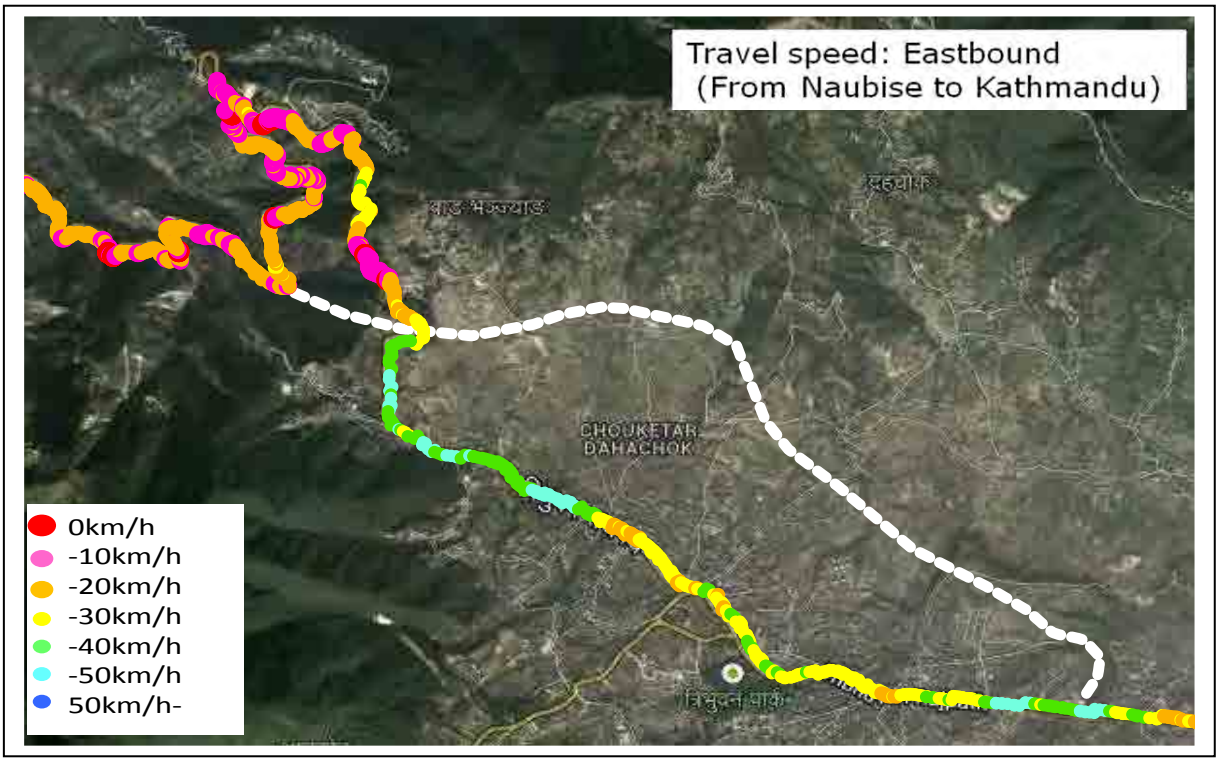
- Result of traffic survey (OD pattern) is shown below. Traffic to/from the western Nepal and India is heavy. Traffic to/from the eastern Nepal is also observed.

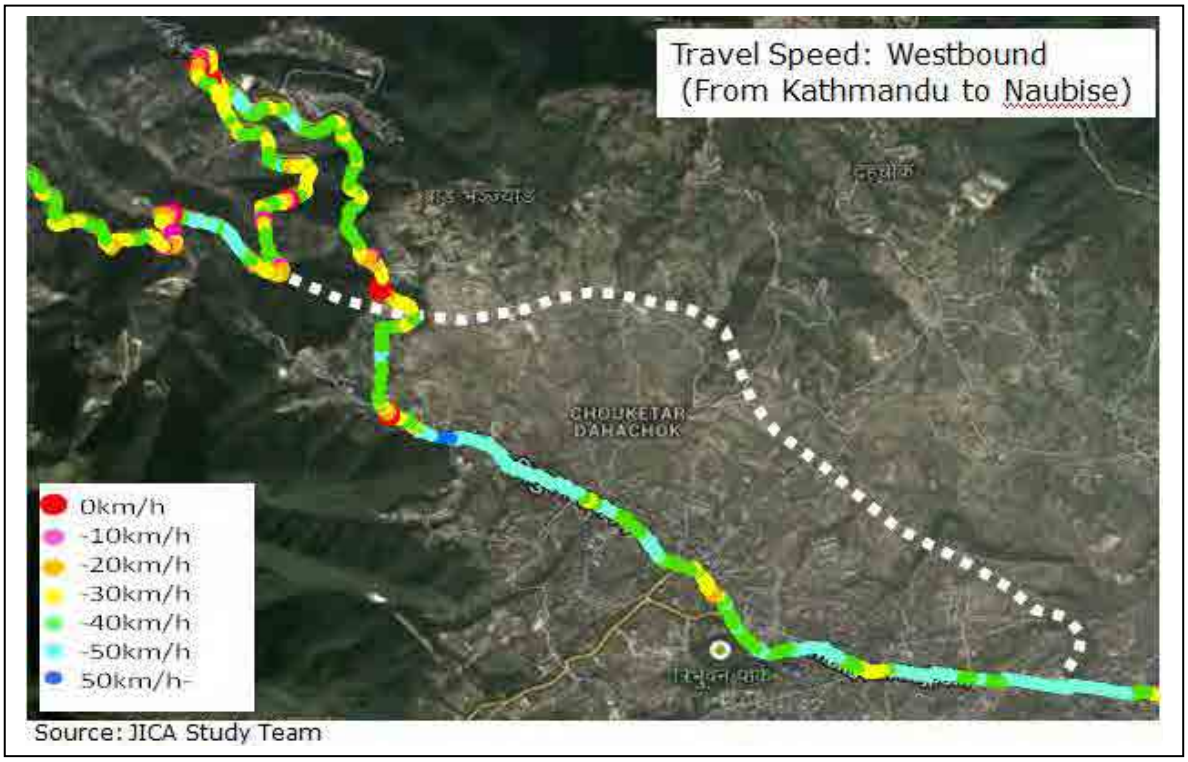


Source: JICA Study Team

2.4 TRAVEL SPEED ON EXISTING ROAD

- The average travel speed of heavy truck on eastbound is less than 16km/hr. Uphill section at morning time is just around 10km/hr. and total travel time for existing road of 8km is 34min.





Source: JICA Study Team

2.5 FUTURE TRAFFIC VOLUME

- Estimate based on growth rate of socio-economic indicator and tunnel utilization factor by direction and by vehicle type.
- Future traffic volume predicted at 7,900(veh./day) in 2020, and 10,000 (veh./day) in 2030.

Future Traffic Volume

	2014			2022			2030			AAGR* (2014-2020)		AAGR* (2020-2030)	
	Eastbound	Westbound	Total	Eastbound	Westbound	Total	Eastbound	Westbound	Total	East	West	East	West
Passenger Car	959	1,036	1,996	1,263	1,365	2,628	1,585	1,712	3,297	3.5%	3.5%	3.0%	3.0%
Micro Bus	389	528	917	512	696	1,208	643	873	1,516	3.5%	3.5%	3.0%	3.0%
Mini Bus	227	344	571	299	453	752	375	568	944	3.5%	3.5%	3.0%	3.0%
Heavy Bus	639	715	1,354	944	1,057	2,001	1,268	1,419	2,686	5.0%	5.0%	4.0%	4.0%
Light Truck	444	127	571	631	181	812	777	223	1,000	4.5%	4.5%	3.0%	3.0%
Heavy truck	939	1,355	2,294	1,335	1,928	3,263	1,643	2,372	4,015	4.5%	4.5%	3.0%	3.0%
Total	3,597	4,107	7,704	4,985	5,679	10,664	6,291	7,167	13,458	4.1%		3.0%	

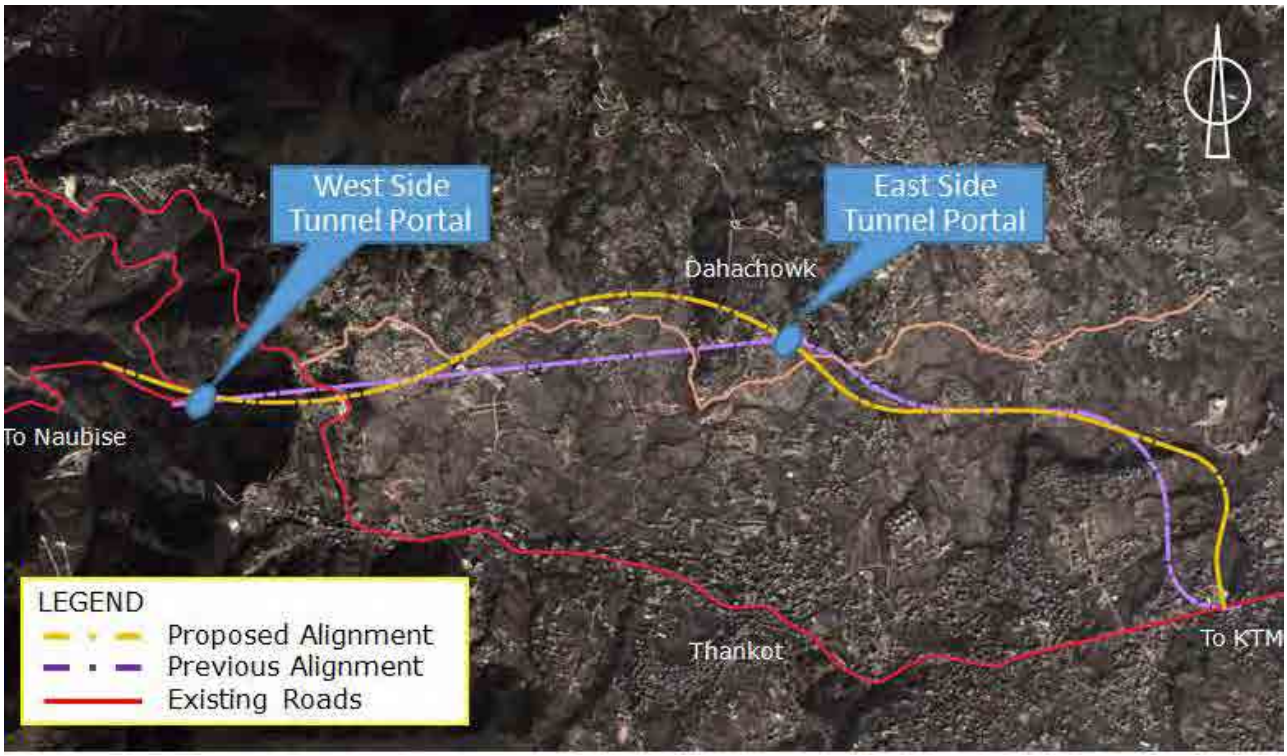
Number of Vehicles on Tunnel Section

	2014			2022			2030			Tunnel utilization ratio (2014-2020)		Tunnel utilization ratio (2020-2030)	
	Eastbound	Westbound	Total	Eastbound	Westbound	Total	Eastbound	Westbound	Total	East	West	East	West
Passenger Car	-	-	-	1,010	955	1,966	1,268	1,199	2,466	80%	70%	80%	70%
Micro Bus	-	-	-	410	487	897	514	611	1,125	80%	70%	80%	70%
Mini Bus	-	-	-	0	0	0	0	0	0	0%	0%	0%	0%
Heavy Bus	-	-	-	850	845	1,695	1,141	1,135	2,276	90%	80%	90%	80%
Light Truck	-	-	-	505	127	632	621	156	777	80%	70%	80%	70%
Heavy truck	-	-	-	1,202	1,542	2,744	1,479	1,898	3,377	90%	80%	90%	80%
Total	-	-	-	3,977	3,957	7,933	5,023	4,998	10,021	74.4%		74.5%	

Source: JICA Study Team

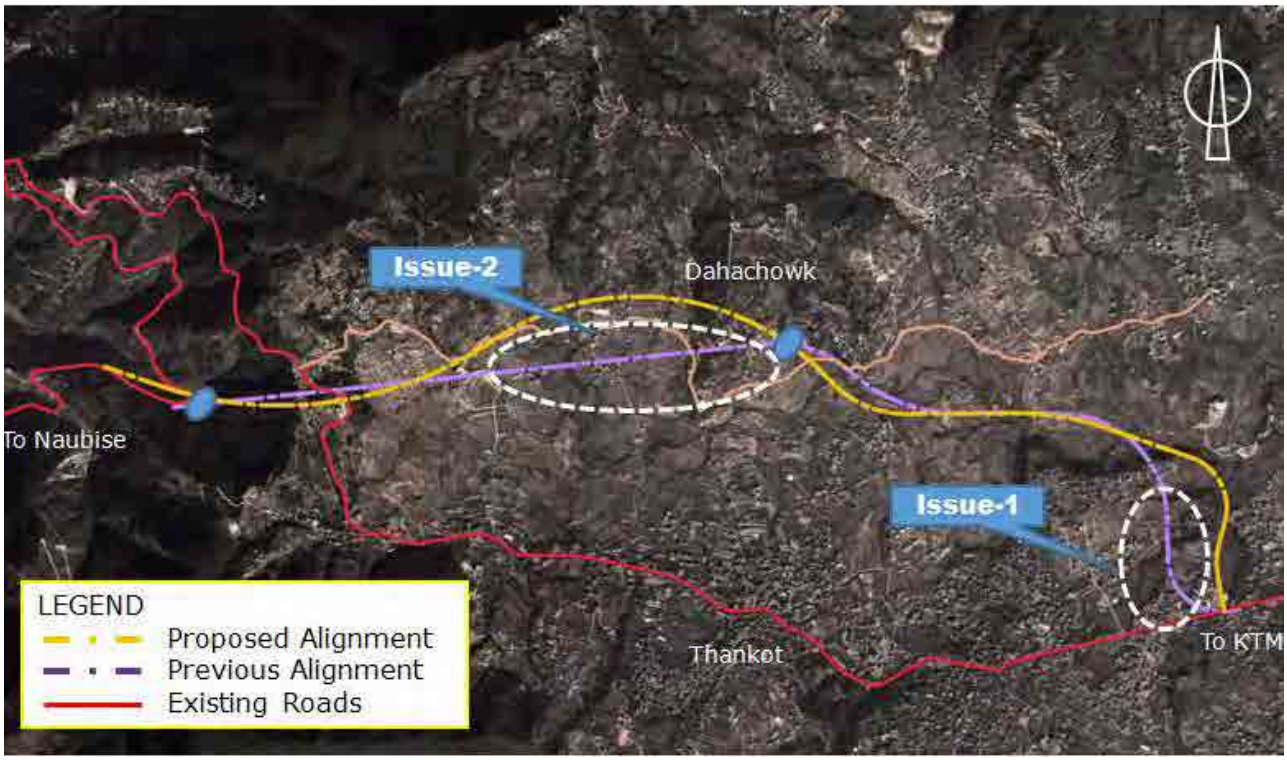
3. ALIGNMENT STUDY

Previous alignment proposed by "Data Collection Survey" and proposed alignments under this survey are shown below;



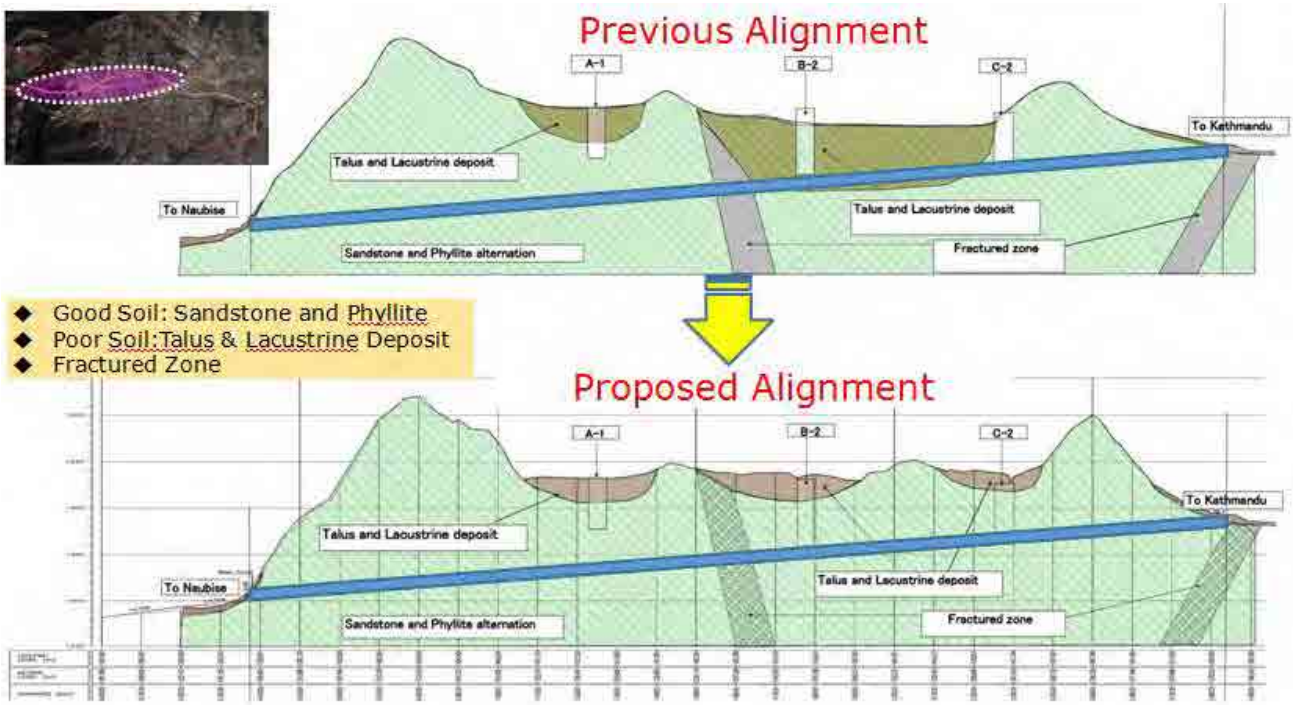
◆ **Issues of Previous Alignment (Where & What?)**

1) Issue-1: Many affected houses (On-going development work)
2) Issue-2: Tunnel section along soft and weathered soil

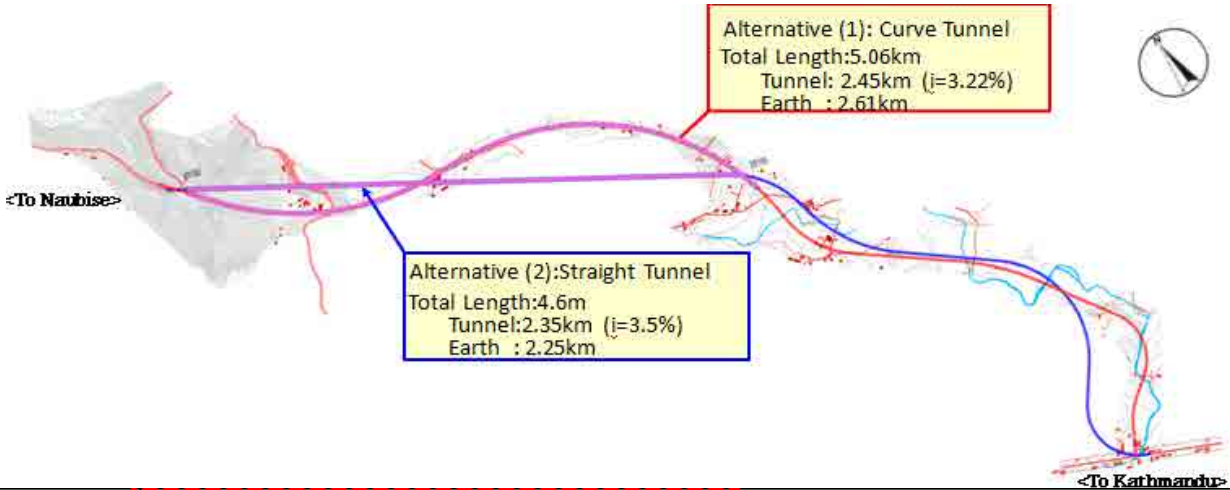


◆ Issue-1: Many houses & on-going development work are affected as shown below.

◆ Issue-2: Tunnel section passes through soft and weathered rock areas



- Comparison of Alignments is shown below and Alternative (1) was recommended.

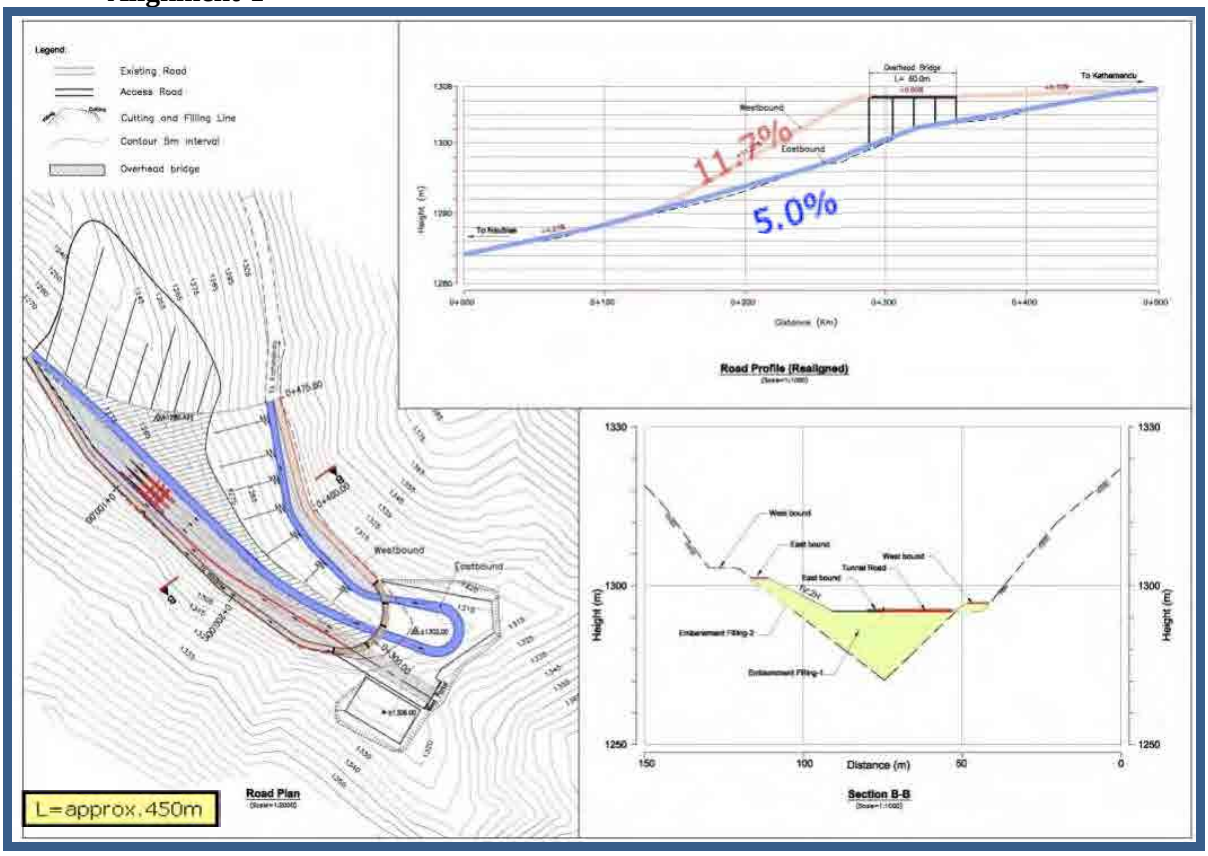


Items	【Alternative(1)】:Proposed Alternative of This Project (Curve Tunnel)		【Alternative(2)】:Alternative of Data Collection Survey(Straight Tunnel)	
Drivability	Tunnel alignment is S-shaped curve.	△	Tunnel alignment is Straight.	○
Vertical Grade	Vertical grade is looser than "alternative (2)".(i=3.2%)	○	Vertical grade is steep. (i=3.5%)	○
Construction Difficulty(Tunnel)	Constructability of tunnel is better than "Alternative (2)" as the tunnel alignment pass through hard rock bed.	○	Construction of tunnel is difficult because the tunnel alignment pass through residual soil layer of basin in east area of tunnel.	△
Affected Houses	Number of relocated house is about half of "Alternative (2)"	○	Maximum number of relocated house is about 27.	△
Cost (Ratio)	1.00	○	1.40	△
Construction Period	42 months	○	59 months	△
Ranking Evaluation	Vertical grade, construction difficulty, affected house, construction cost and period are better than "Alternative (2)". Traffic accident risk is lower than "Alternative (2)".	1	Drivability is better than "Alternative (1)". Traffic accident risk is high.	2

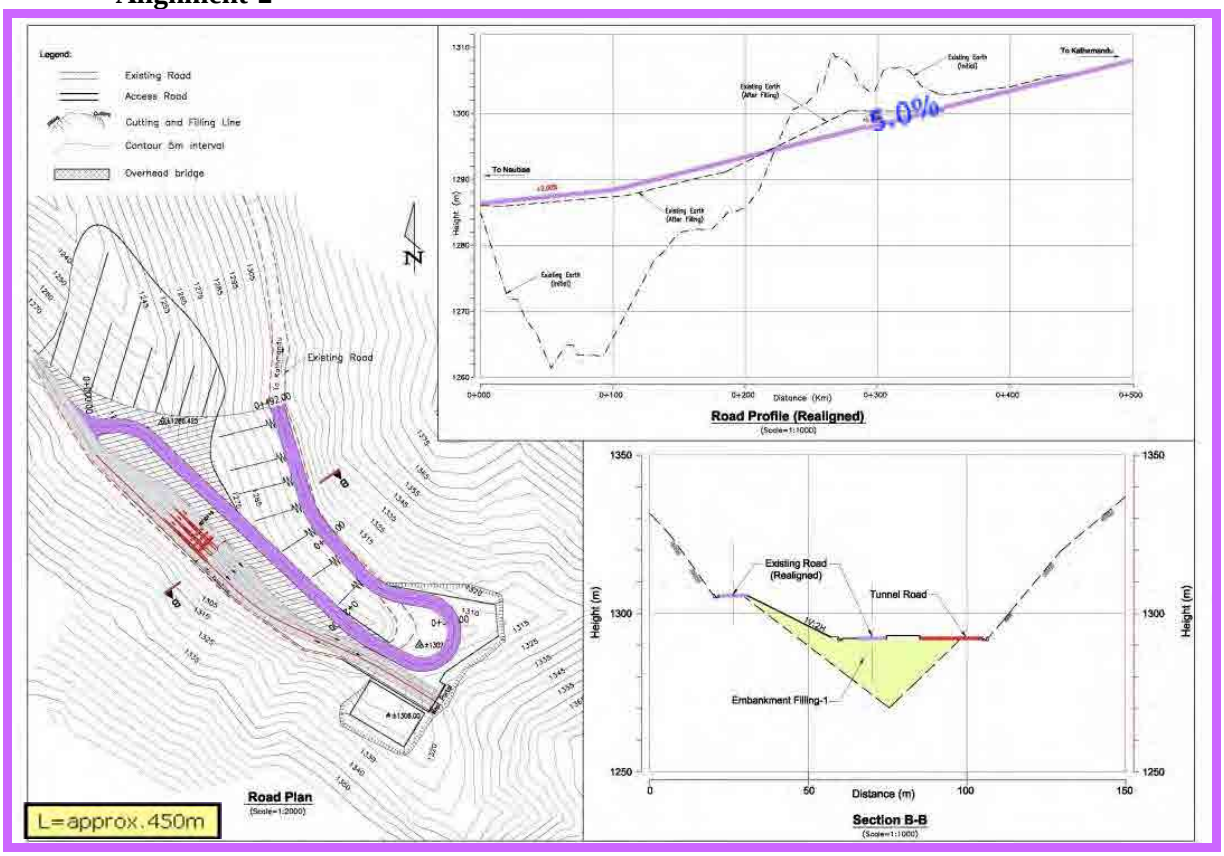
ALIGNMENT STUDY AT WEST SIDE

Due to topographical constraints at the West Portal area, the serious issue was to connect the tunnel alignment with the existing alignment. Two (2) alternatives were studied as shown below:

- **Alignment-1**



- **Alignment-2**



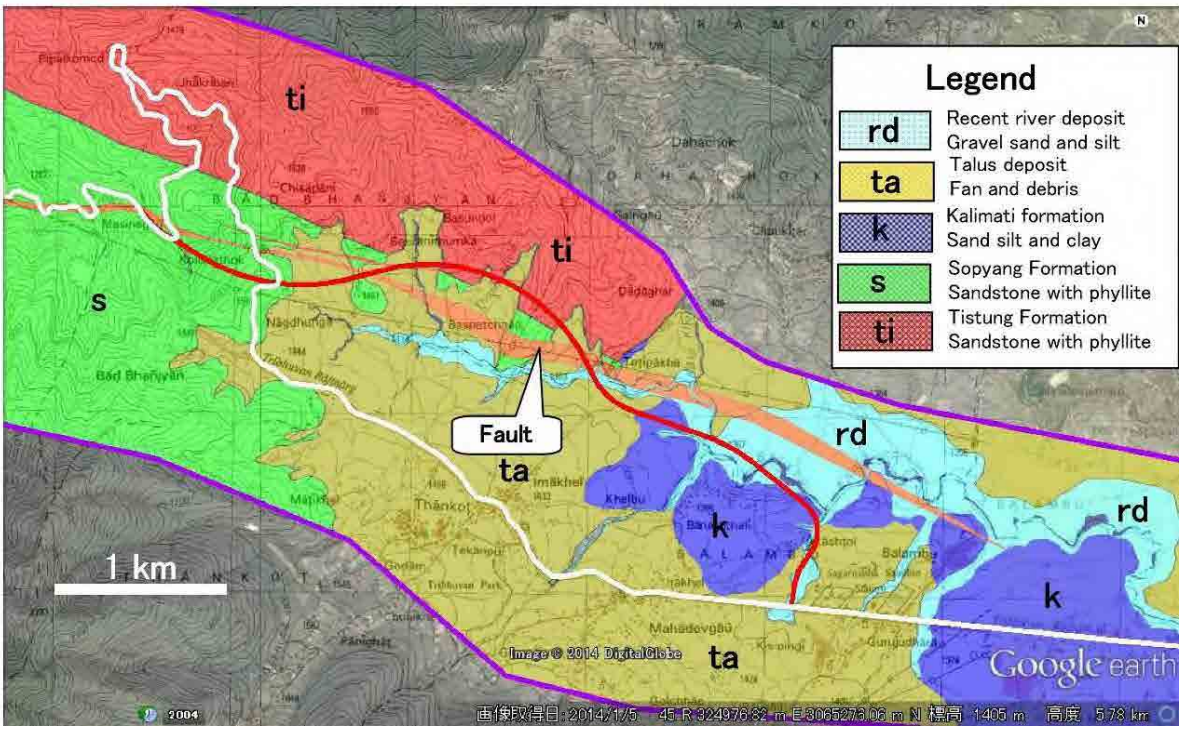
		Alternative-1: Without Intersection		Alternative-2: With Intersection	
Plan					
Concept		Traffic control: Merge/diverge		Traffic control: Signal	
Structures		Metal Bridge L=60m, Walls		Traffic signals	✓
Evaluation factors	Geometry	Min. horizontal radius=15m Max. grade =11.7% (westbound) =5.0 % (eastbound)		Min. horizontal radius: 20m Max. grade= 5% (both direction)	✓
	Safety	Safer than Alt.-2 (Separate route)	✓	Riskier than Alt.-1 (Same route)	
	Drivability (app. road)	Interruption to traffic is low (Approach road priority)	✓	Interruption to traffic could be high (stop at intersection)	
	Constr. Period	5.0 months		1.0 months	✓
	Cost (Ratio)	9.0		1.0	✓
Evaluation				RECOMMENDED	

Alternative-2 was recommended.

4. PRELIMINARY DESIGN OF TUNNEL

4.1 GEOLOGICAL CONDITION

Geological condition of tunnel section and approach section is shown below.



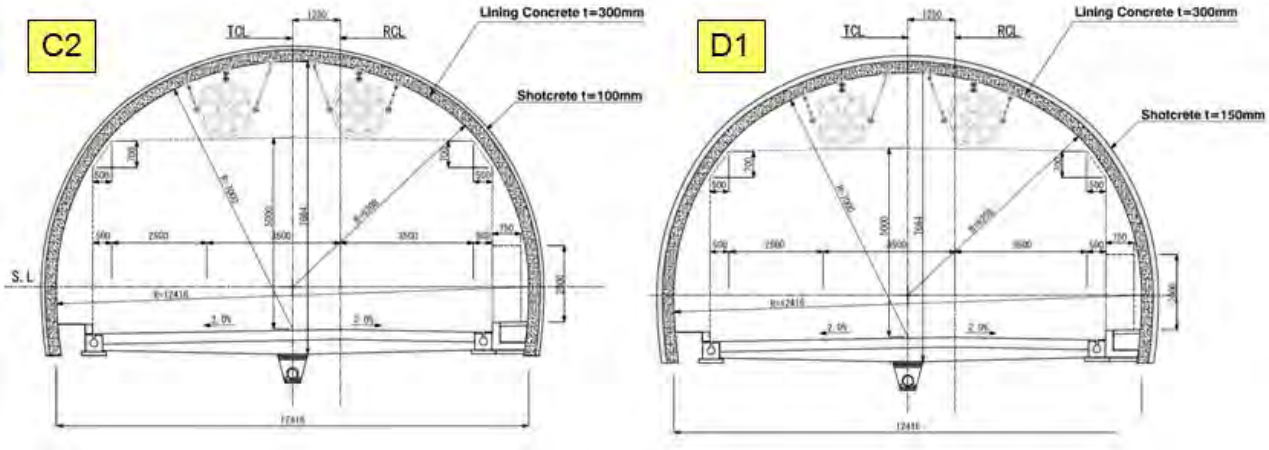
4.2 HORIZONTAL AND VERTICAL ALIGNMENT OF TUNNEL SECTION

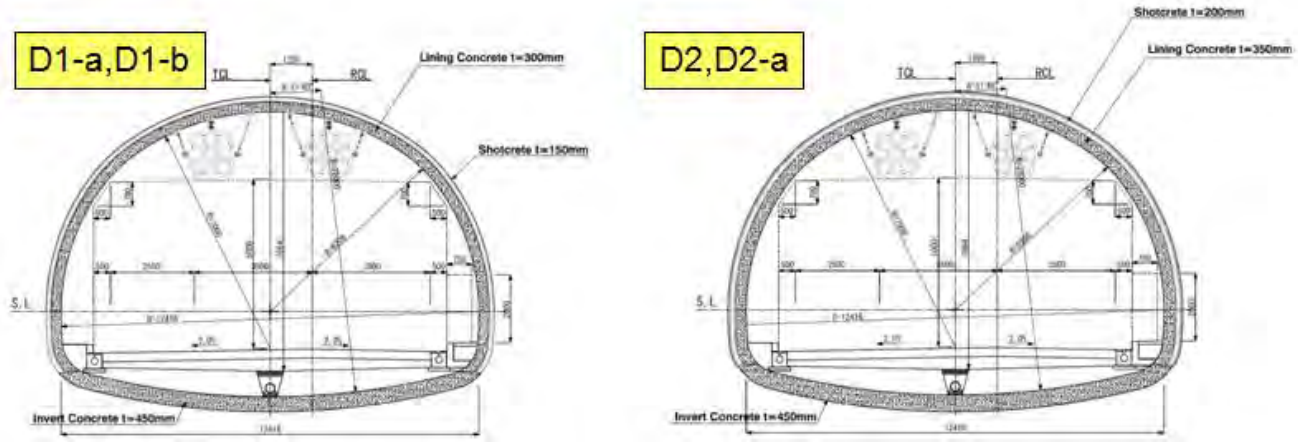
The horizontal and vertical alignments are shown below.

Design Speed	**60 km/hr**
Tunnel Length	**2,450m**
Horizontal Alignment	**S-Shaped Curve (R=1,000m)**
Vertical Alignment	**3.22%**

4.3 TUNNEL CROSS SECTION

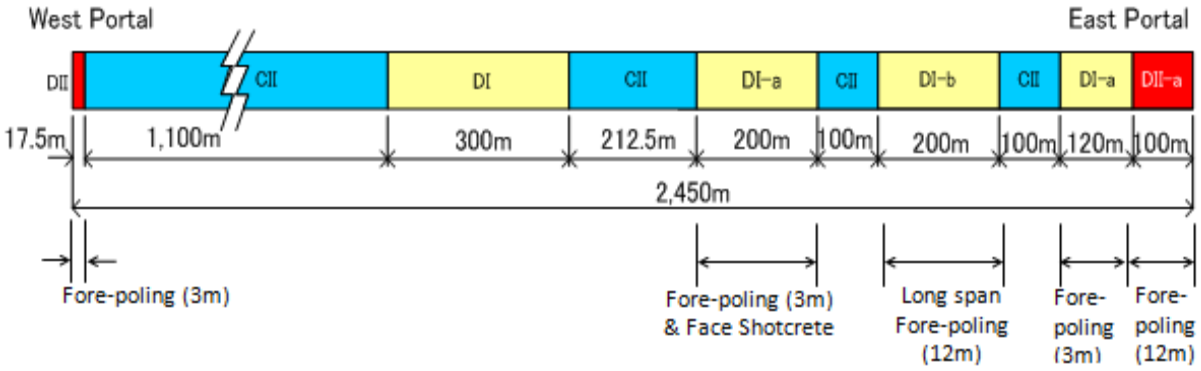
The typical cross section of a tunnel by tunnel excavation pattern is shown below;





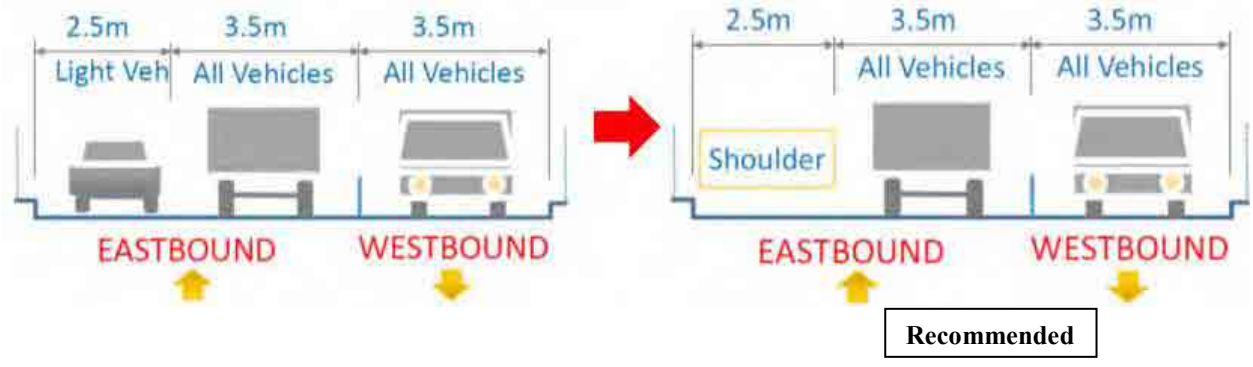
4.4 TUNNEL EXCAVATION PATTERN

Tunnel excavation pattern is shown below;



4.5 TUNNEL LANE OPERATION

The tunnel lane operation will be as shown;



The tunnel lane operation method should be carefully studied during the detailed design stage.

4.6 EXCAVATION METHOD

- There are two methods of tunneling, Drill & Blasting and mechanical excavation.
- Geology of the Nagdhunga Tunnel consists mainly of thin bedded alternation of shale and sandstone with many cracks and is generally classified as poor rock mass. The tunnel shall be excavated mechanically by Road-Header.

Excavation Machine: Road Header

4.7 AUXILIARY METHOD

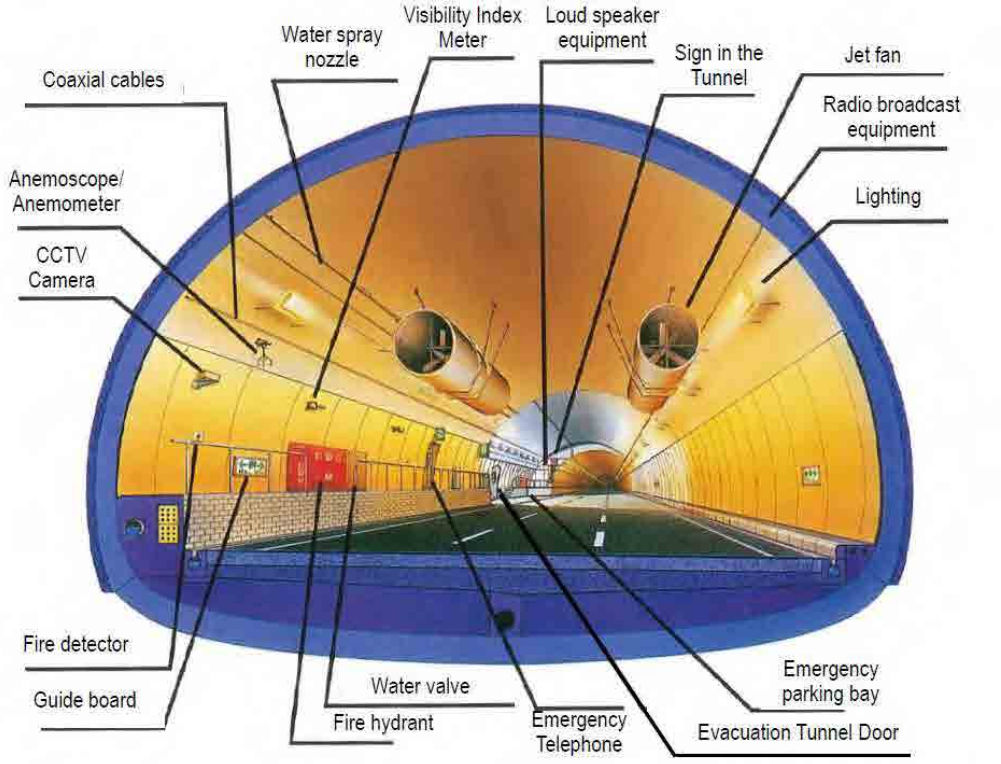
AGF (All Ground Fasten) Method, one of the methods developed by Japan is required at;

When tunneling encounters very poor ground where excavations face is very difficult to self-supporting, shotcreting for the face and rock-bolting for the face are required. When tunneling encounters fault zones extra auxiliary measures such as injection grouting to improve the strength of the poor ground is required.

LONG SPAN FORE-POLING (12m) will be applied at East Portal Portion (100m) and FORE-POLING (3m) will be applied for 337.5m.

4.8 VARIOUS FACILITIES INSIDE A TUNNEL FOR SAFE OPERATION

Various facilities inside a tunnel for safe operation are required as shown below.



Need of Safety Measures

During O&M period of a tunnel, there are following risks;

- Vehicle Breakdown
- Obstacles dropped from vehicles
- Parked or stalled vehicles
- Traffic Accidents
- Fires

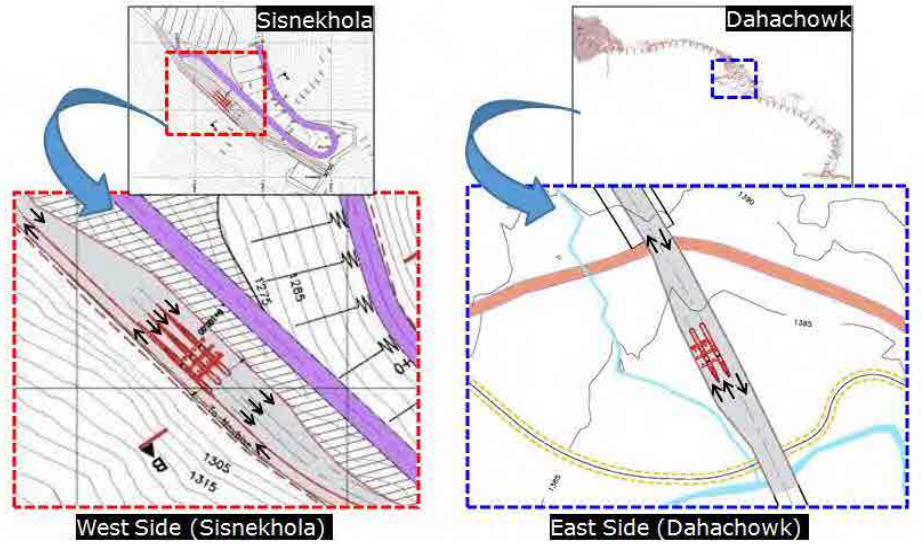
- Within 10 minutes after a fire, smoke will spread inside a tunnel.
- Tunnel users spend about 4 minutes to act
- Thus 6 minutes remain for running away from the location of a fire
- People can run about 1m/sec, thus they can escape for 360m to 400m away from the location of a fire incident
- In order to save peoples' lives, safety measures should be provided at about 400m interval.

The number of jet fans for proper ventilation inside a tunnel shall be twenty-eight (28) units in case of Nagdhunga Tunnel. The number is based on the forecasted traffic volume for year 2030. Jet fan shall be "JFX-1250" and those will be set at a distance of 160 m from the tunnel portal and at intervals of 160 m in the tunnel.

JET FANS INSIDE TUNNEL

4.9 PROPOSED LOCATION OF TOLL BOOTH

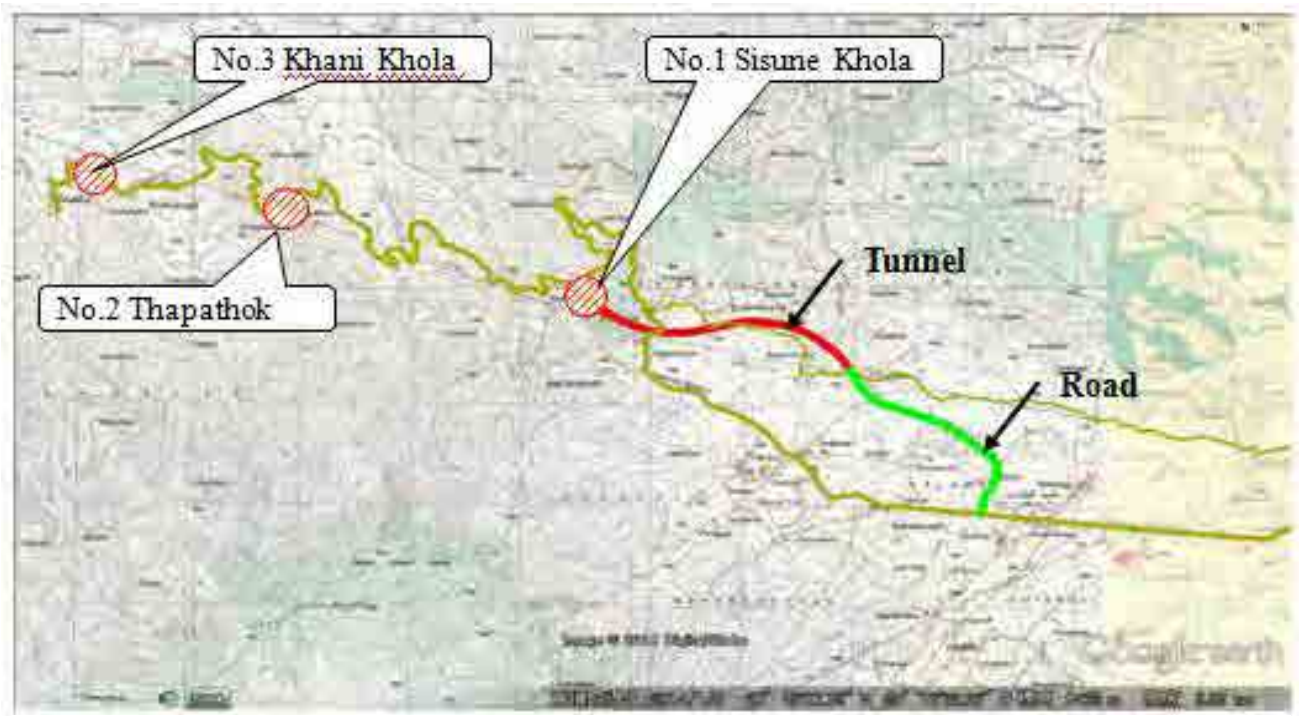
To raise fund for tunnel O&M, a toll fee will be charged to tunnel users. Toll booth will be constructed near the west and east portal areas.



4.10 DISPOSAL AREAS OF EXCAVATED MATERIALS FROM TUNNEL

Due to tunnel excavation, there will be a total of 240,000 m^3 of excavated materials, of which 190,000 m^3 will be disposed of from the West Portal and 50,000 m^3 from the East Portal. Excavated materials from the West Portal are to be disposed at the appropriate disposal area, whereas those from the East Portal are to be used s embankment material for the approach road construction.

Three (3) disposal areas at the West Portal side were studied as shown below. it is recommended that excavated materials are disposed of at No1 disposal area and a Michi0No-Eki be developed utilizing a flat land built by disposing of excavated materials.



No.	Place	Distance	Volume	Feature	Comparison
1	Sisne khoka	100m	300,000	• Close to the tunnel • Secure the land required for the road branch • Installation of tunnel management facility • Effective use of the tunnel drainage	◎
2	Thapathok	5.3km	140,000	• Substantially horizontal land is in secure, • The current road is about 150m can be shortened • Capacity shortage	Δ
3	Khanikhola	8.3km	125,000	• Great Views, agricultural gather near the village, such as Road Station • 5 houses ,Capacity shortage	Δ

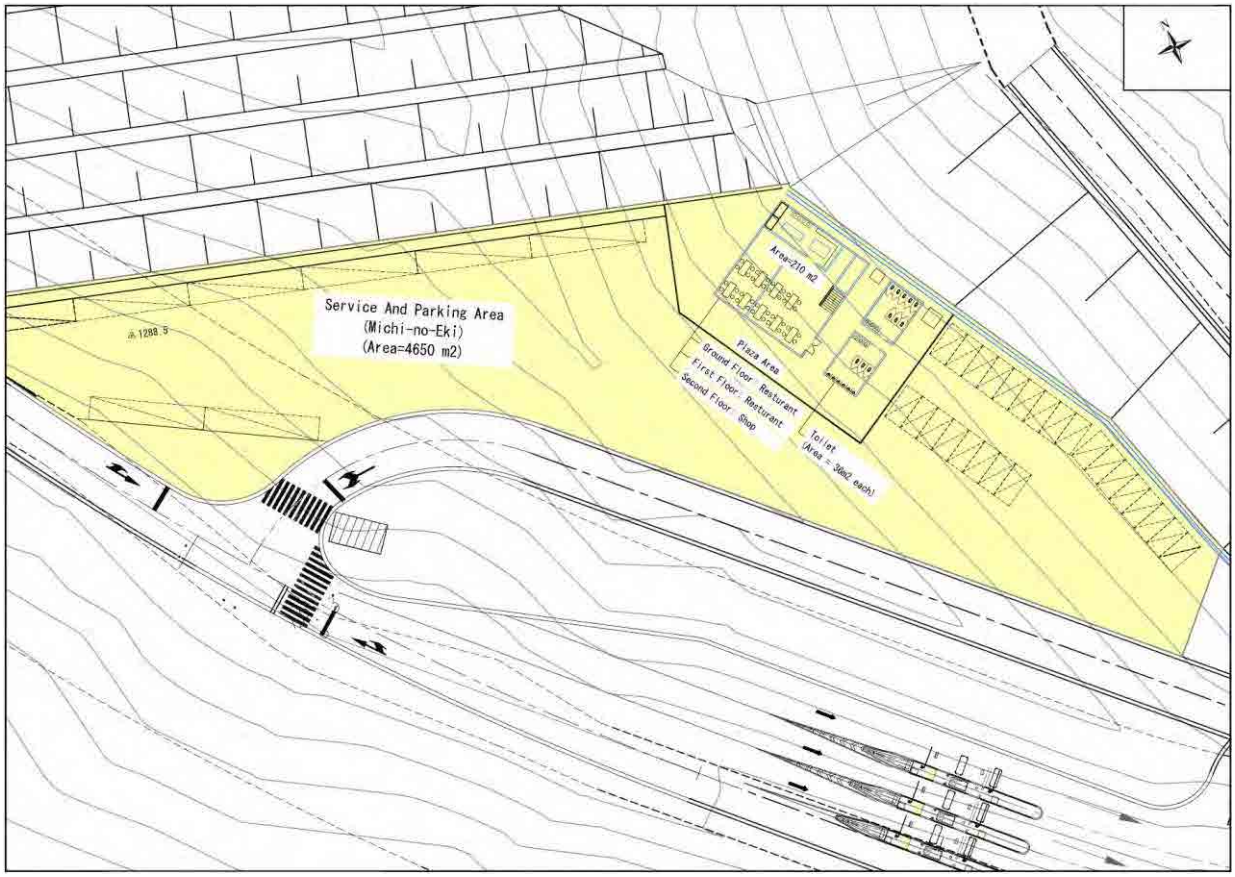
4.11 DISPOSAL AREAS DEVELOPMENT

The West Portal disposal area can be developed utilizing a flat land made by a disposal tunnel excavation materials and a Michi-No-Eki is proposed to be developed.

Michi-No-Eki near West Portal Site
Plaza Area, rest room, restaurant, shops, parking space etc. will be developed.

Facilities to be provided;

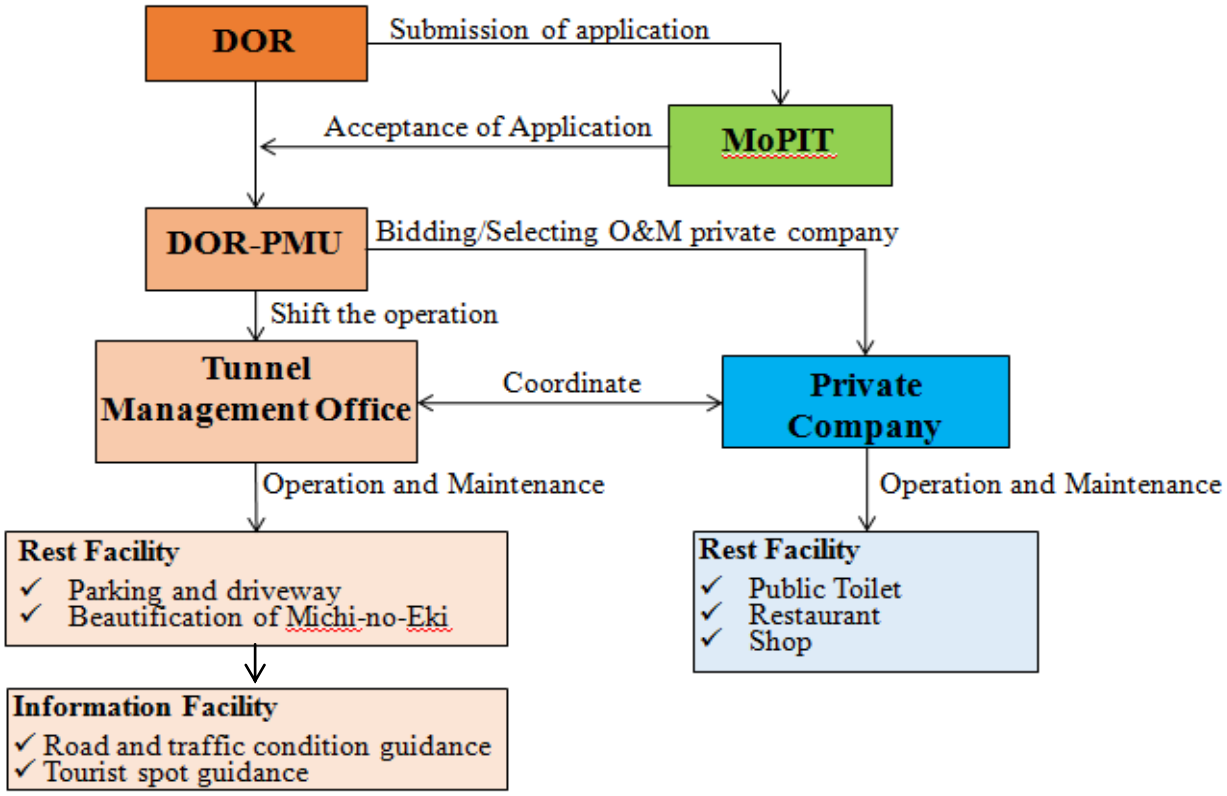
Area:	4,650 sq.m
Parking Space:	8 Heavy Vehicles
	25 Light Vehicles
Fast Food Restaurant (G-Floor):	215 m^2
Shops (1st Floor):	215 m^2
Toilet	
Men:	36 sq.m.
Women:	36 sq.m.



Michi-No-Eki is a facility developed in Japan, literally meaning "road station", provided on National Highways/arterial roads for the purpose to integrate parking area, rest rooms (toilets), information and community facilities provided by local governments.

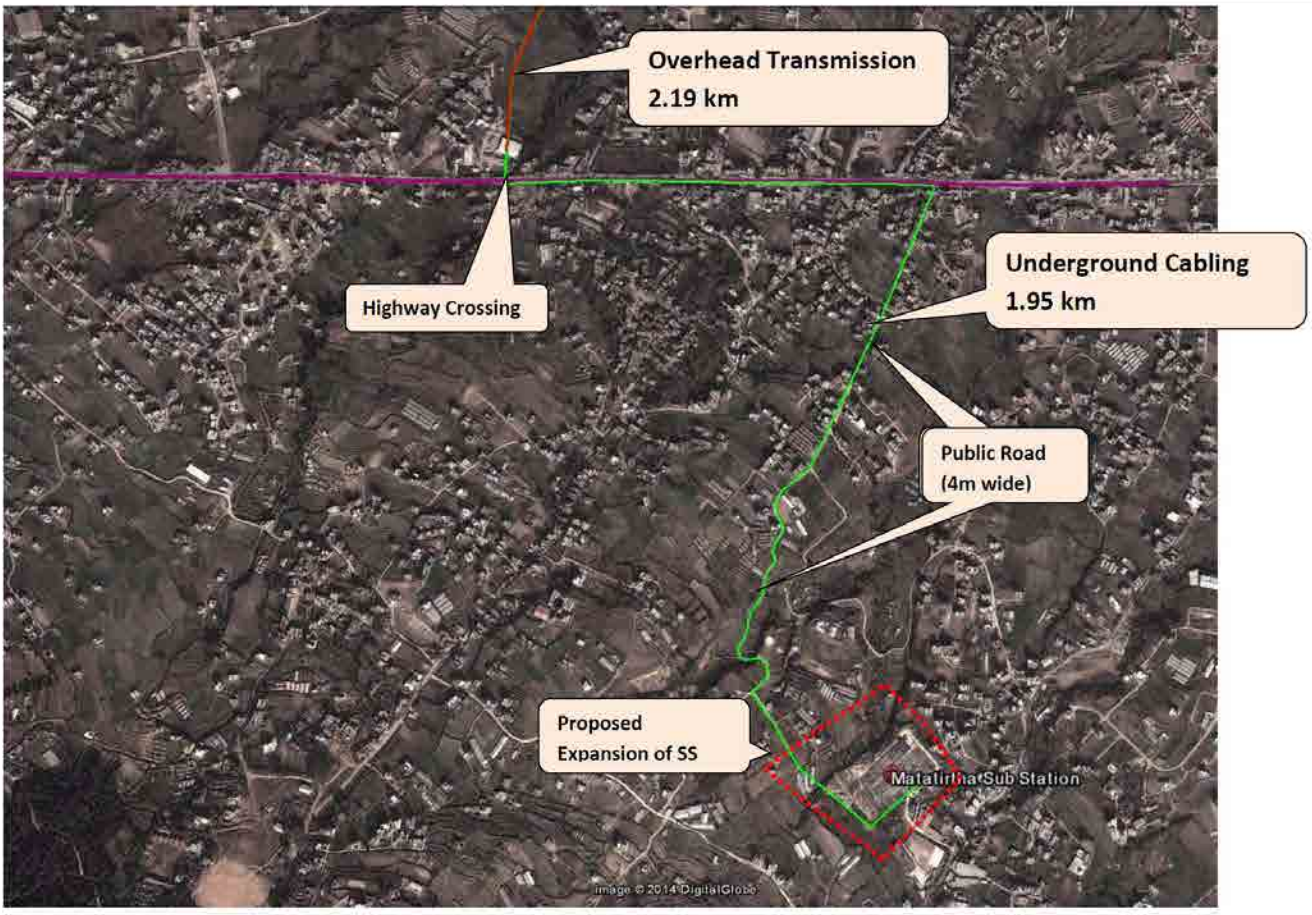
4.12 DISPOSAL AREA DEVELOPMENT ADMINISTRATIVE ORGANIZATION

It is proposed that DOR-PMU manages the Michi-No-Eki and selects a private company who carries out O&M of a restaurant and shops. The O&M of parking space, provision of information, etc., will be implemented by the Tunnel Management Office.



4.13 TRANSMISSION LINE

The uninterrupted power supply for operation of various facilities is quite important for maintaining the safe operation of the tunnel. For the routine operation of a tunnel, stable electricity is critically requird, especially for running of ventilation fan and lighting facilities. An 11 kV Transmission Line is constructed from NEA Matathirtha Sub-station to East Tunnel Portal Site.



For Sub-station and Transmission Line:

- Vacuum Circuit Breaker (VCB) Switch Gear – 2sets – 11KkV
- Adaptation Panel – 2sets
- Power Cable (11kV) for underground cabling – 1.95 km length
- Overhead Transmission Line Cable – 2.19 km length
- H-Poles – 45 nos.
- Civil Works for Cable Laying : RCC Channel Box (Pre-cast)

For East Portal Switch Yard:

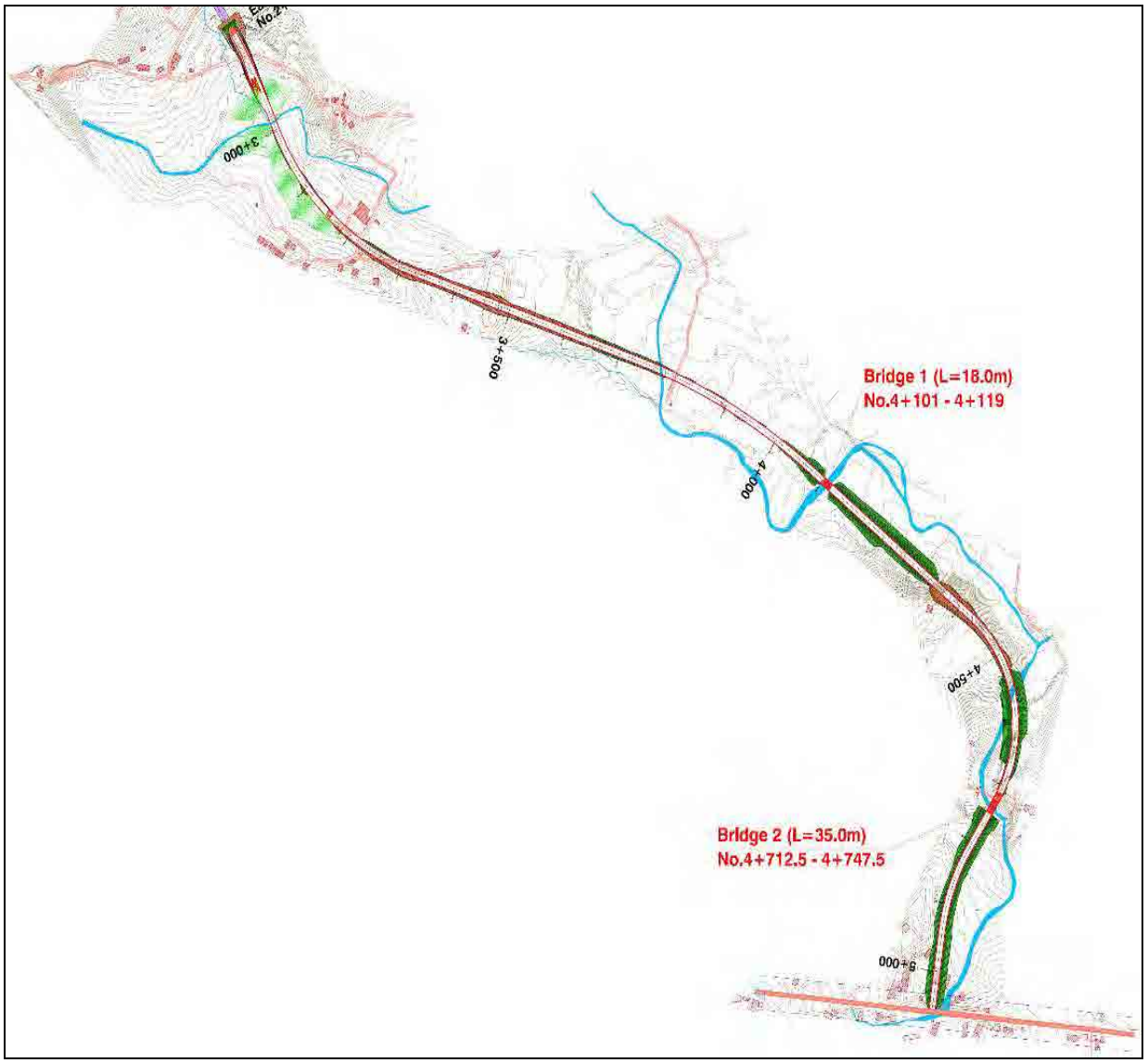
- Transformer (11kV/400V), Dry, Indoor Type, Capacity 750kVA x 2 nos.
- Bus coupler – 2 nos.
- Air Circuit Breaker (ACB) Switch Gear

MOPIT will finalize a consultation with MOE and NEA together with the draft MoU on **Uninterrupted Power Supply and Dedicated Feeder including grid connection for Tunnel**.

5. PRELIMINARY DESIGN OF APPROACH ROAD

5.1 APPROACH ROAD

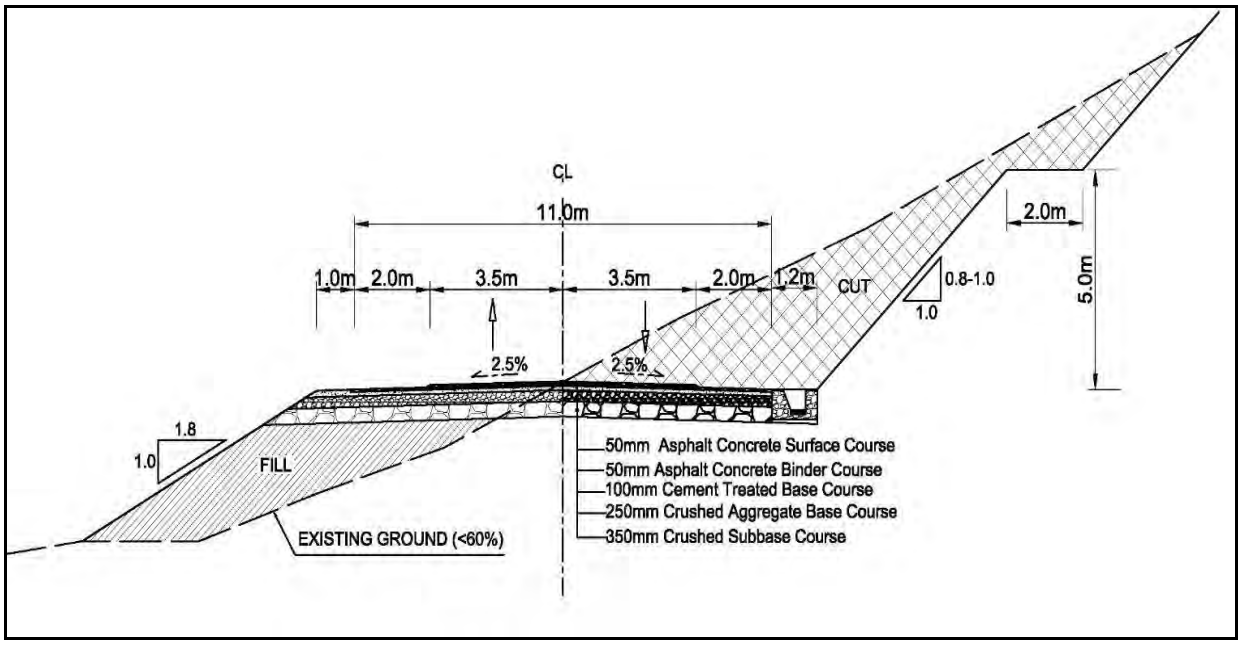
Approach Road consists of 0.4km of West side approach and 2.2km of East side and a total length of 2.60 km. Two (2) bridges and three (3) box culverts are required.



5.2 PROPOSED DESIGN CRITERIA FOR HIGHWAY DESIGN

The proposed design criteria is shown below;

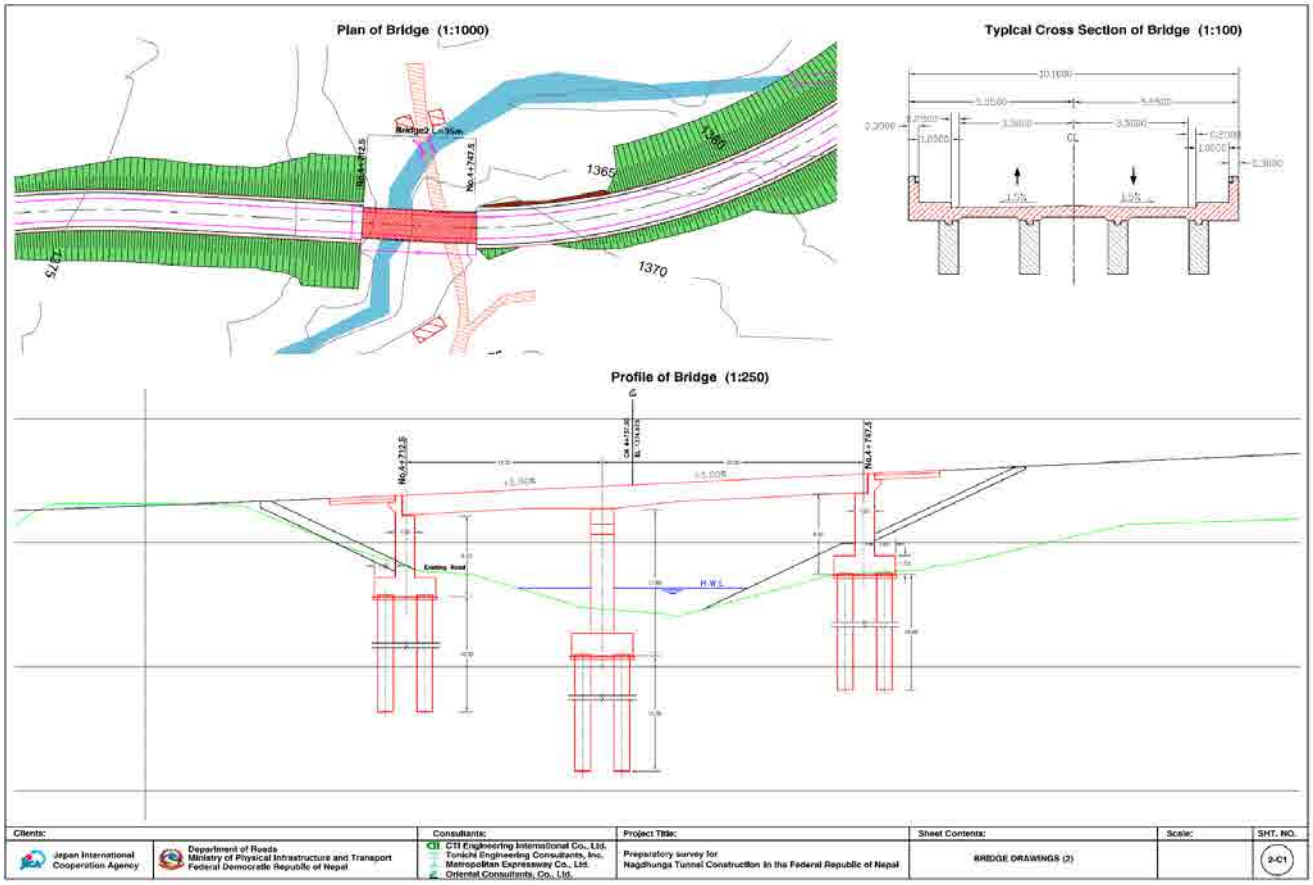
SN	Items		Parameters	Reference	Remarks
1	Highway Classification		National Highway Class II		
2	Design Speed (km/h)		60.0		5000-20000 PCU/day
	Cross section	No of lanes	2.0		
		Formation Width (m)	12.0		
		Lane Width (m)	7.0		
		Hard Shoulder (Paved) (m)	2.0		
		Soft Shoulder (Earthern) (m)	1.0		
		Camber/ Crossfall (%)	2.5		
		Slope of Earthwork			
		Fill	V:H = 1:1.8	JRA	
		Cut	V:H = 1:0.8 to 1.8	JRA	
3	Sight Distance	Stopping Sight Distance (m)	65	NRS	
4	Overtaking	Overtaking Distance (m)	300		
5	Horizontal Alignmen	**Minimum Radius of Horizontal Curve (m)**			
		Desirable Minimum (m)	150		
		Absolute Minimum (m)	100		
		Unavoidable condition (m)	90		
		Maximum superelevation (%)	6		
		Minimum Length of Transitonal Curve (m)	50	JRA	
6	Vertical Alignment	Maximum Average vertical grade (%) section	4	NRS	
		Maximum Average vertical grade (%) in limited length	6	NRS	
		Critical Length of grade (m)			
		For less than equal maximum average	No limit	NRS	
		For greater than maximum average	210	NRS	
		Minimum Radius of Vertical Curve (m)			
		Crest / Summit Curve	1000		
		Sag / Valley Curve (m)	1200		



Typical Road Cross Section

5.3 BRIDGE PLAN, PROFILE AND CROSS SECTION (RC, 2SPAN, 35M)

The plan, profile and cross section of one of the proposed bridges is as shown below;



6. PROJECT COMPONENT

The project components include as shown below;

1. Civil Works Component

- Construction of a Tunnel
- Construction of Approach Road and Bridges
- Disposal Area Development of Excavated Rocks/Soils
- Power Supply Facility for tunnel operation
- Other facilities as required (Michi-no-Eki, Toll facilities)

2. Consulting Services

- Detailed Design
- Preparation of Bid Documents
- Assistance in Bidding
- Construction Supervision

3. ROW and RAP

- Right-of-way Acquisition
- RAP Implementation

4. Capacity Development for Tunnel Operation and Maintenance

- Capacity Development for Tunnel Operation and Maintenance

7. ESTIMATED COST

Based on Preliminary Design, estimated cost is as follows;

1) Civil Work Cost (Base Cost in Year 2014)	
• Tunnel Construction	10.01 Billion NRP
• Toll Facility	0.03 Billion NRP
• Approach Road/Bridges	0.67 Billion NRP
• Power Supply Facilities	0.15 Billion NRP
• Others (Disposal Area, Michi-no-Eki, Control Office)	0.21 Billion NRP
Base Cost Total	**11.07 Billion NRP**
• Contingency (10%)	1.11Billion NRP
Total for Civil Work including Contingency	**12.18 Billion NRP**

2) Consultancy Cost	
• Detailed Design, Tender Assistance and Construction Supervision	0.86 Billion NRP
• Capacity Development for Tunnel O & M	0.10 Billion NRP
Total for Consultancy Cost	**0.96 Billion NRP**

3) ROWA Cost	
• Right-of-Way Acquisition Cost including Disposal Area	1.27 Billion NRP (govt. price) 2.59 Billion NRP (market price)

Note: The above costs are exclusive of VAT

8. ECONOMIC EVALUATION

8.1 QUANTIFIED BENEFITS

Two (2) benefits were quantified; vehicle operating cost savings and travel time cost savings.

Unit price of vehicle operating cost is shown below;

Gradient= 0 NPR/veh-km

Speed (km/hr)	Car	S_Bus	M_Bus	H_Bus	L_Truck	H_Truck
10	26.9	35.8	77.4	135.2	30.7	127.8
20	23.5	29.8	54.8	89.0	26.9	95.1
30	20.2	23.8	32.3	42.7	23.1	62.4
40	19.4	22.6	28.8	36.6	22.2	55.0
50	18.3	21.0	24.3	29.1	20.7	45.0
60	17.5	19.8	21.3	24.3	19.6	38.4

Gradient= 3.2% NPR/veh-km

Speed (km/hr)	Car	S_Bus	M_Bus	H_Bus	L_Truck	H_Truck
10	27.0	36.3	83.9	155.0	32.4	136.7
20	23.7	30.2	59.4	102.0	28.4	101.7
30	20.3	24.1	35.0	48.9	24.4	66.7
40	19.6	23.0	31.2	41.9	23.4	58.9
50	18.5	21.3	26.3	33.3	21.9	48.1
60	17.6	20.0	23.1	27.9	20.7	41.1

Gradient= 7.0% NPR/veh-km

Speed (km/hr)	Car	S_Bus	M_Bus	H_Bus	L_Truck	H_Truck
10	28.0	41.3	105.4	211.5	40.9	182.3
20	24.5	34.4	74.6	139.2	35.9	135.6
30	21.0	27.4	43.9	66.8	30.8	89.0
40	20.3	26.1	39.2	57.3	29.6	78.5
50	19.1	24.2	33.0	45.5	27.6	64.1
60	18.3	22.8	29.0	38.0	26.2	54.8

Source: JICA Study Team

Unit price of Travel Time Cost is shown below;

Classification	NPR/veh.-min
Passenger Car	12.2
Micro-bus	22.1
Mini-bus	18.4
Large Bus	58.8
Light truck	3.3
Heavy truck	7.6

8.2 ECONOMIC EVALUATION COST

Economic evaluation result is as follows;

No.	Indicators	Result
1.	Net Present Value (NPV)	1.2 Billion NPR
2.	Benefit – Cost Ratio (BCR; B/C)	1.13
3.	Economic Internal Rate of Return (EIRR)	13.3%

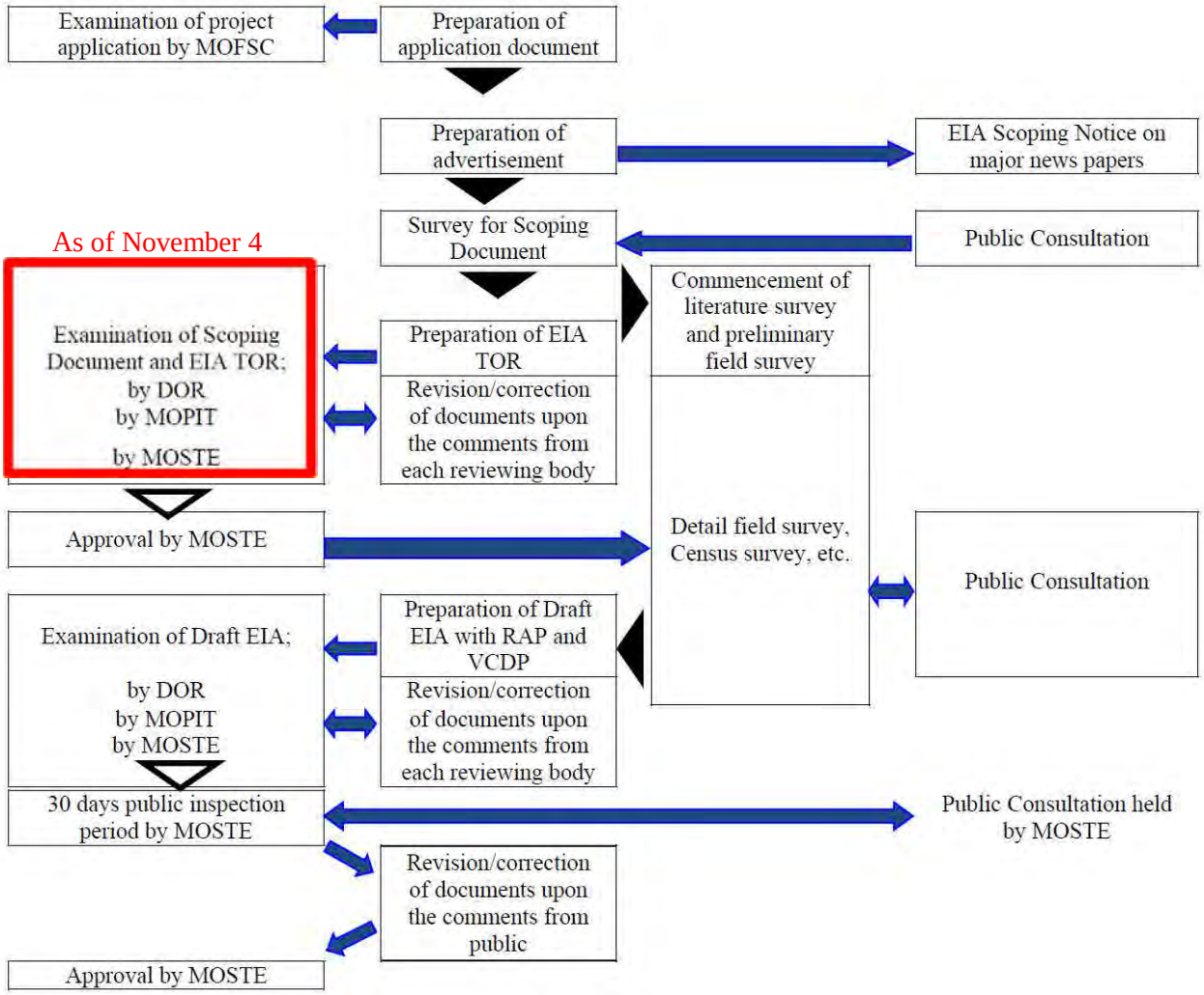
Social discount rate is 12.0%
Source: JICA Study Team

The economic evaluation result shows a positive NPV and EIRR of 13.3% that is higher than the official target rate of 12%. These values indicate that the project is economically viable.

9. ENVIRONMENTAL AND SOCIAL CONSIDERATION STUDY

9.1 STUDY FLOW

Study flow is shown below;

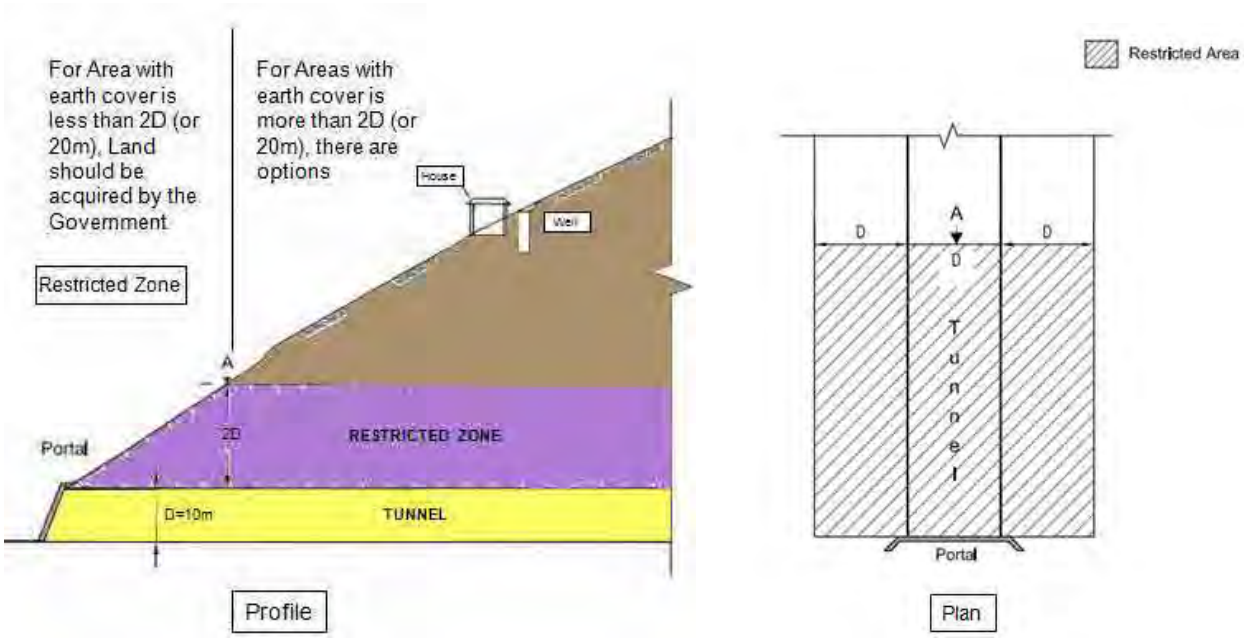


9.2 NECESSITY OF TUNNEL PROTECTION DURING AND AFTER CONSTRUCTION

- In order to keep a tunnel safe throughout its life span, development of land above the tunnel must be prohibited or controlled.
- Non-uniform loads nor excessive additional loads must be restricted.
- Any activities such as digging a well, driving a pile, construction of high story buildings, etc. must be prohibited and/or restricted.
- Critical area for tunnel stability is the area of 2D (D is tunnel width or height and 20m for this project).

9.3 CRITICAL AREA FOR TUNNEL (OR TUNNEL PROTECTION AREA)

The critical area for tunnel or restricted zone is the area with earth cover of less than 2D (or 20m). This area of land should be acquired by the Government.



9.4 UNDERGROUND RIGHT OF SURFACE LAND OWNER

- Is there any law which specifies the underground right of the surface land owner?
- As far as we have checked, there is no law which specifies the underground right of the surface land owner.
- This means that a surface land owner can do any underground development. (They are not penalized whatever they do below the surface.)

9.5 HOW TO PROTECT A TUNNEL

(1) For the Area with Thin Earth Cover of less than 2D (or 20m) above tunnel

For this area, any development above tunnel will affect stability of tunnel, thus it is recommended that the Government acquires a land and a land title shall be transferred to the Government through the usual process.

(2) For the Area with Enough Earth Cover of more than 2D (or 20m) above tunnel

Option No. 1 Total Acquisition

Though this option can be exercised through existing legal provisions, this is a costly affair.

Compensation in respect of the land in this option is determined by legally constituted Compensation Determination Committee.

Option No. 2 Partial Acquisition and Partial Restrictions:

Option No. 3 Full acquisition of the land but possessory rights with landowners

This option may be less costly than that of Option No. 1, but costlier than that of Option No. 2. Secondly entering into agreement with each individual landowner may be cumbersome process.

Option No. 4 No land acquisition by Government but certain activities restricted with the payment of compensation

Mitigation measures:

The enabling legal provisions may be incorporated either through new enactment or through amendment in Land Acquisition Act, 2034. **(Recommended)**

Option No. 5 Long Term Lease (of maybe 100 years)

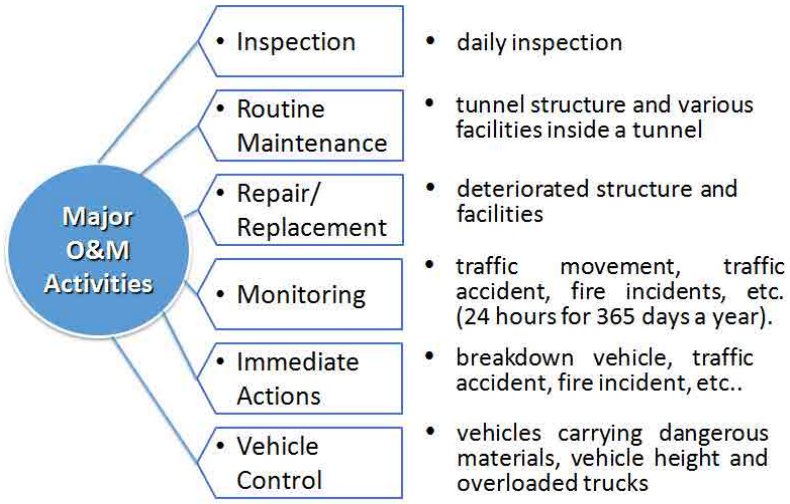
Recommendation:

If any new enactment can be achieved or if some legal provision could be incorporated in existing Land Acquisition Act, 2034 by way of amendment in the Act, in our opinion, the most suitable option shall be **Option No. 4**, wherein government shall not acquire the land and the landowners shall have limited rights and the landowners are paid minimum compensation for their restricted use of land.

10. TUNNEL OPERATION AND MAINTENANCE

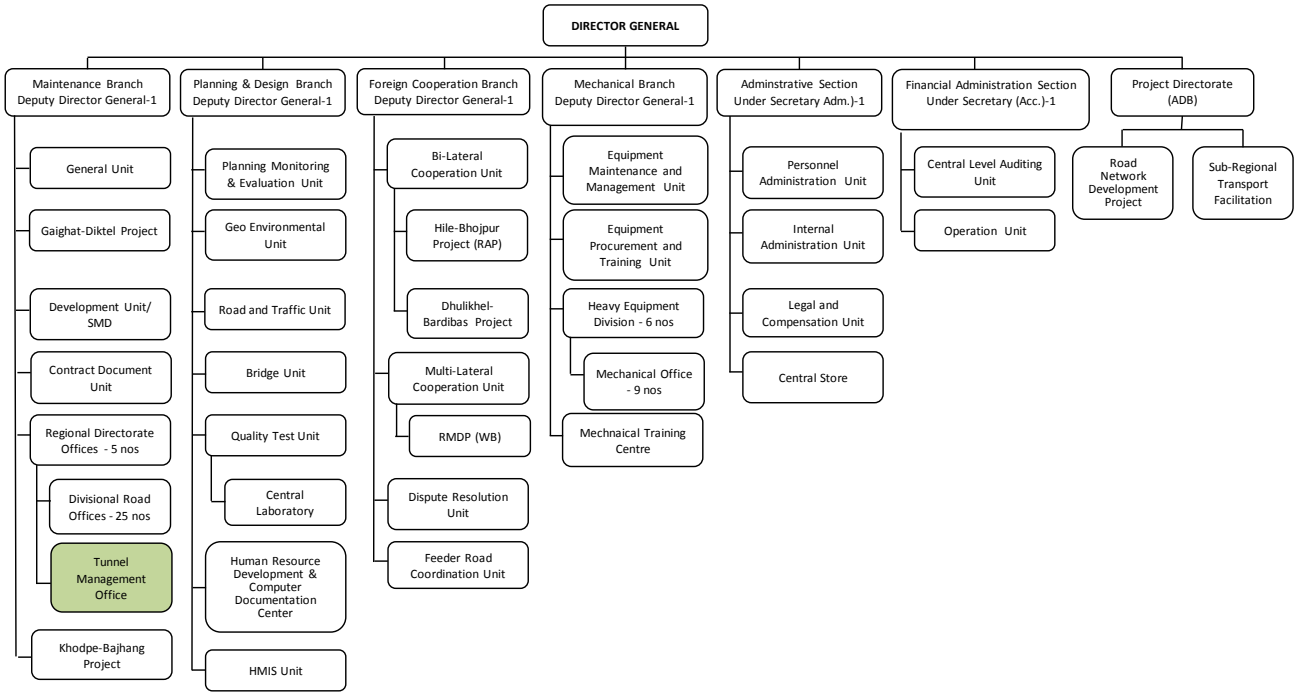
10.1 MAJOR O&M ACTIVITIES

Major O&M activities are the following: Inspection, Routine Maintenance, Repair/Replacement, Monitoring, Immediate Actions and Vehicle Control.



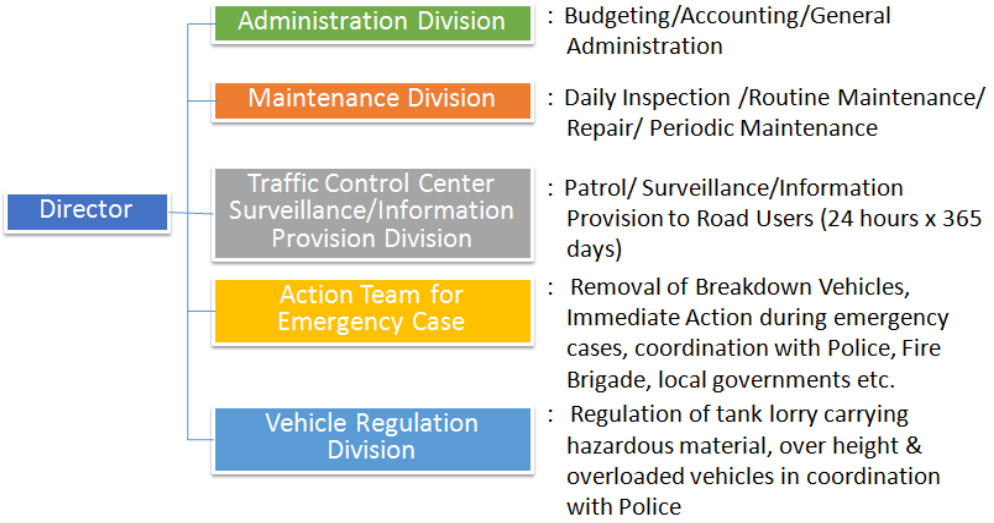
10.2 TUNNEL O&M ORGANIZATION

The tunnel O&M Organization is composed as shown below. The tunnel management office shall be created under Regional Directorate Office of DOR.



DOR Organization

Tunnel Management Office shall be organized as shown below;

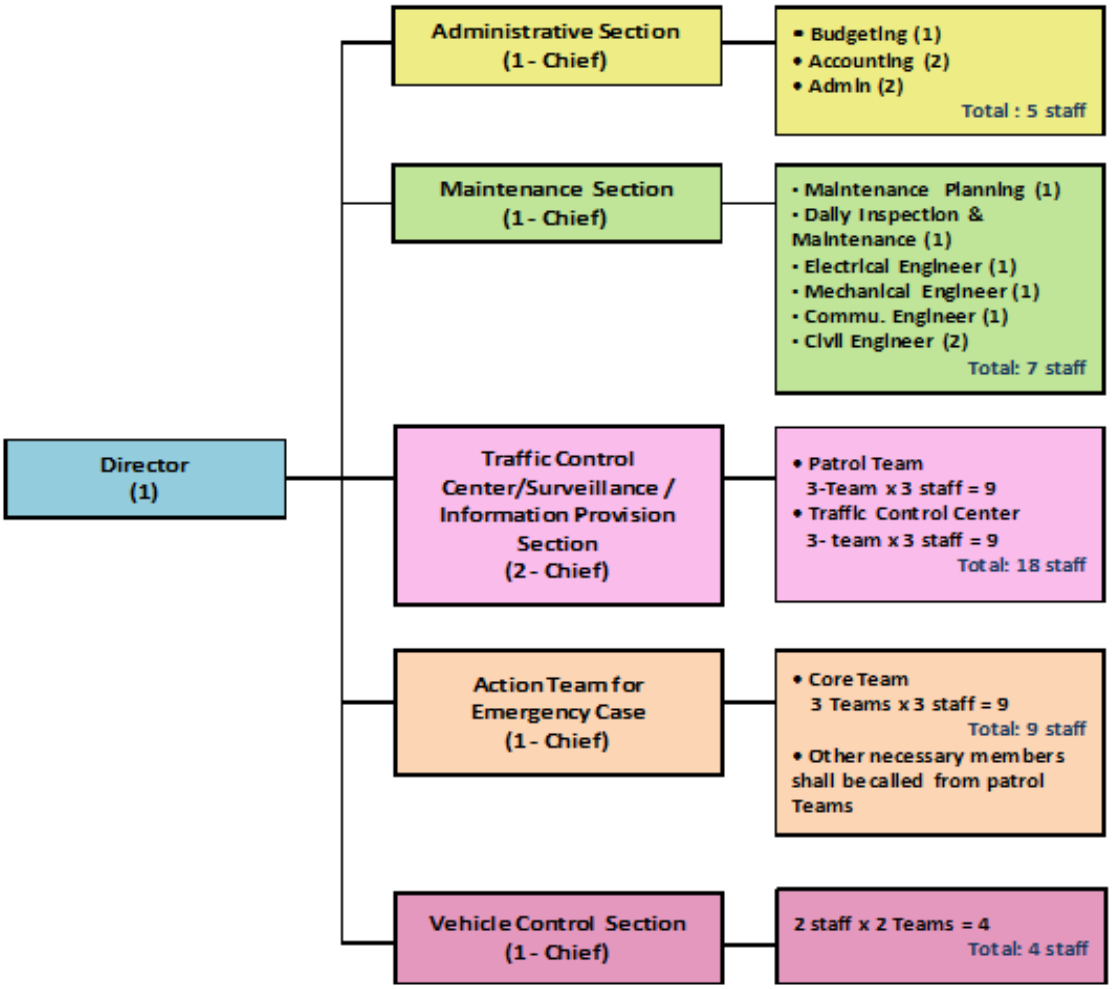


Tunnel Management Office Organization

10.3 STAFFING REQUIREMENT OF TUNNEL MANAGEMENT OFFICE

Tunnel Management Office shall be composed of the following staff.

No. of Staff = 50 Staff
If toll is collected: Additional 20 Staff



10.4 ANNUAL O&M COST REQUIRED

The required total annual O&M cost of tunnel will be 44.1 Million NRP/Year.

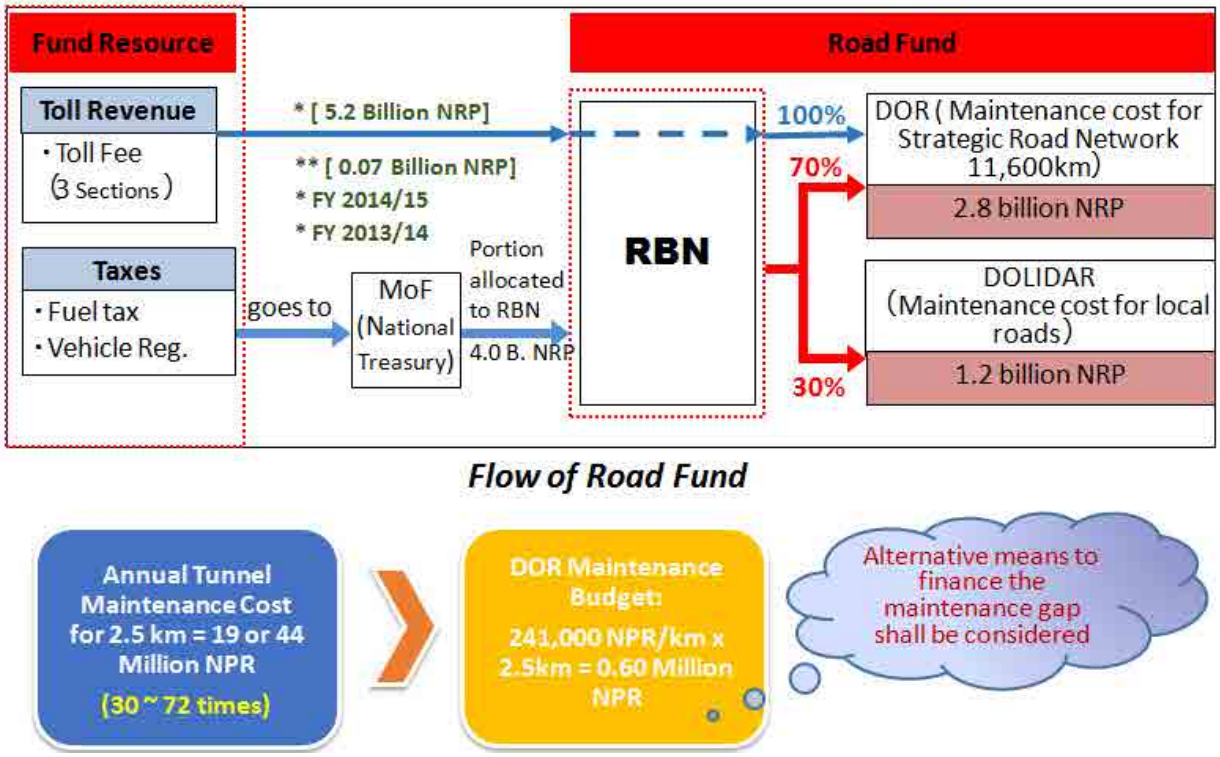
Million NRP/Year

Electricity Cost	25.0	(58%)
Tunnel Management Office Running Cost including Staff Cost	13.1	(28%)
Maintenance Work/Replacement of Parts, etc.	6.0	(14%)
Total	**44.1 Million NRP/year**	

If TOLL fee will be collected, an additional O&M cost of 6.5 Million NRP/Year will be required.

10.5 ROAD FUND FOR ROAD MAINTENANCE

The flow of road fund is as shown below;



Flow of Road Fund

10.6 IF A TOLL IS COLLECTED, HOW MUCH A TOLL WILL BE?

To raise fund for tunnel O & M cost, the following toll rate is required;

Toll Rate for Road Users

Toll Rate per Vehicle	
Light Vehicle	Heavy Vehicle
25 NRP	35 NRP

The interview survey on willingness-to-pay revealed that **about 90%** of passenger car users are willing to pay a toll and a big truck company owner answered that he is willing to pay even if a toll rate is higher than 35 NRP.

It is recommended that a toll should be collected from tunnel users to raise tunnel O&M cost.

10.7 SUMMARY OF ISSUES

Toll Collection by RBN

RBN is the only public entity which is authorized to collect a toll from road users. RBN is currently outsourcing toll collection activities to the private sector. The same system can be applied to this tunnel project.

RBN and DOR should agree on toll collection to raise tunnel O&M fund and toll revenue shall be exclusively used for a tunnel O&M.

Tunnel Management Office Operator

Tunnel Management Office should be operated and managed by DOR. Since this is the first tunnel construction project in Nepal, DOR has no experience for tunnel management. Prior to opening of the tunnel, DOR staff should undergo various capacity development programs. Although there is an option that tunnel O&M be carried out by a private sector, it is not recommended, simply because a private sector still has no experience of public infrastructure management.

Toll Collection Policy

- Toll rate will be 25 NPR for light vehicles and 35NPR for heavy vehicles (at 2014 price).
- Roads Board Nepal (RBN) will collect toll from a road user, while Department of Roads will newly organize "Tunnel Management Office for the Tunnel" and undertake O&M. RBN may outsource toll collection work to a private company.
- Toll raised by RBN shall be turned over to DOR after deducting necessary administrative cost of RBN, and shall be exclusively used for tunnel O&M.
- Toll revenue collected by RBN shall be turned over to DOR every 6 months. O&M cost required for the initial 6 months shall be allocated from Road Fund by RBN to DOR.
- RBN shall undertake periodical monitoring to check if toll revenue is exclusively used for tunnel O&M.

11. IMPLEMENTATION PLAN

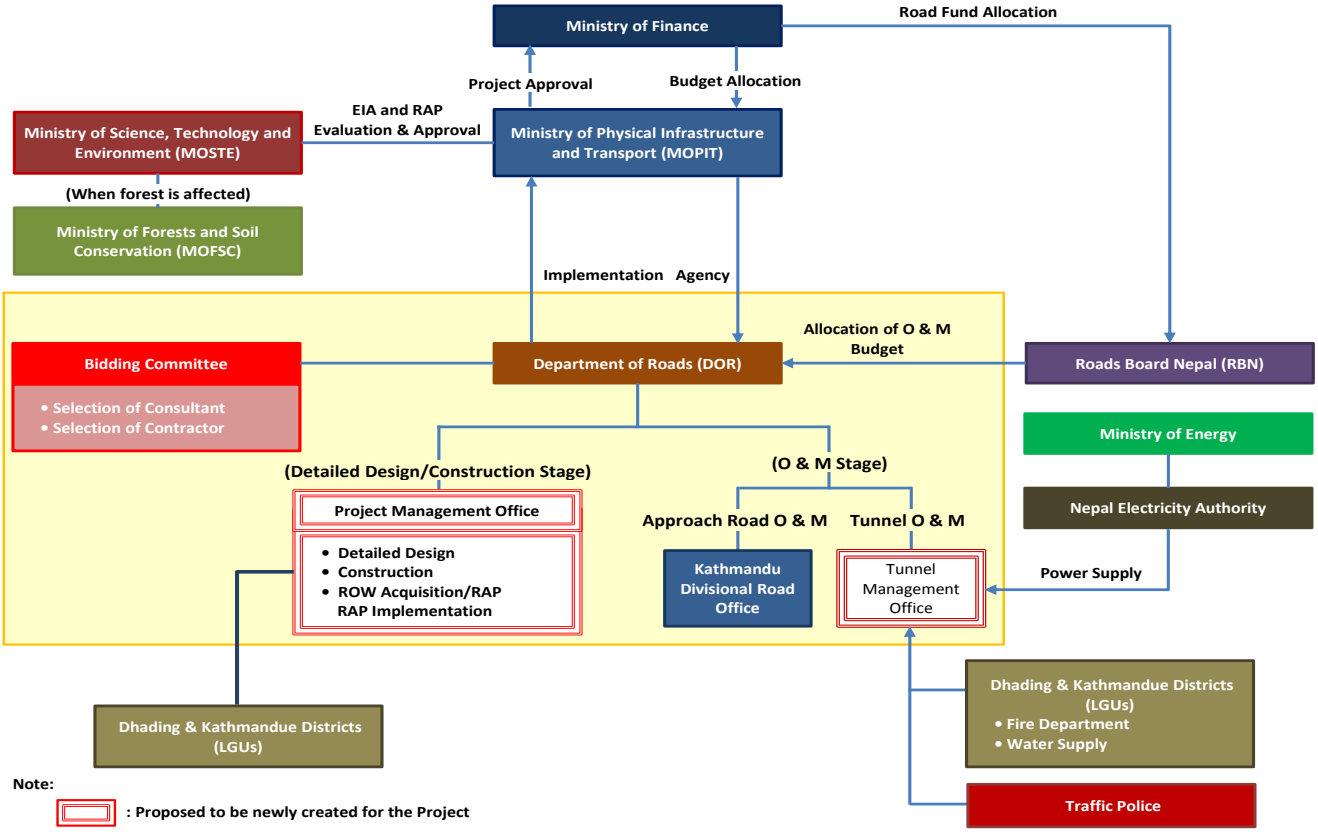
11.1 IMPLEMENTATION AGENCY

a) Implementation Agency during Detailed Design and Construction Stage

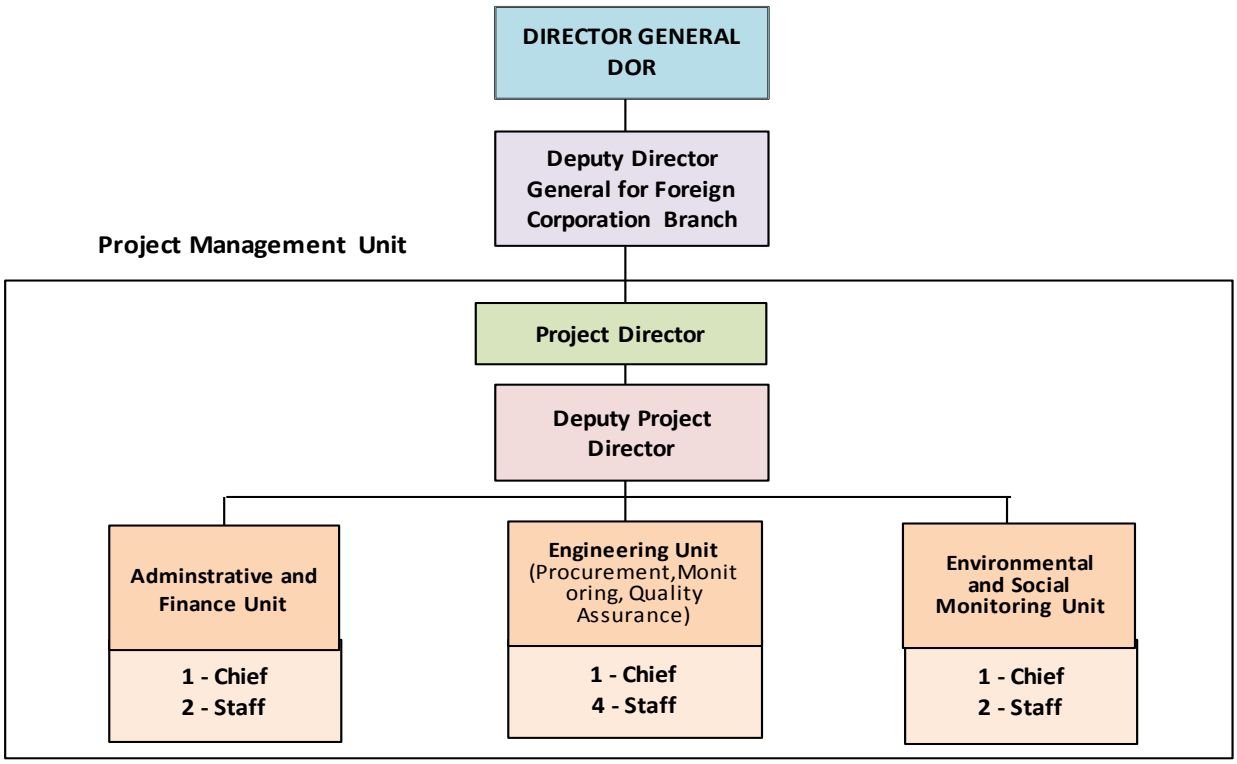
- Department of Roads, Ministry of Physical Infrastructure and Transport
- Project Management Office for the Project will be created.

b) Implementation Agency during Operation and Maintenance Stage

- Department of Roads shall be responsible for tunnel O&M. DOR shall create Tunnel Management Office.
- Road Board Nepal will collect the toll and toll revenue shall be turned over to DOR for tunnel O&M.

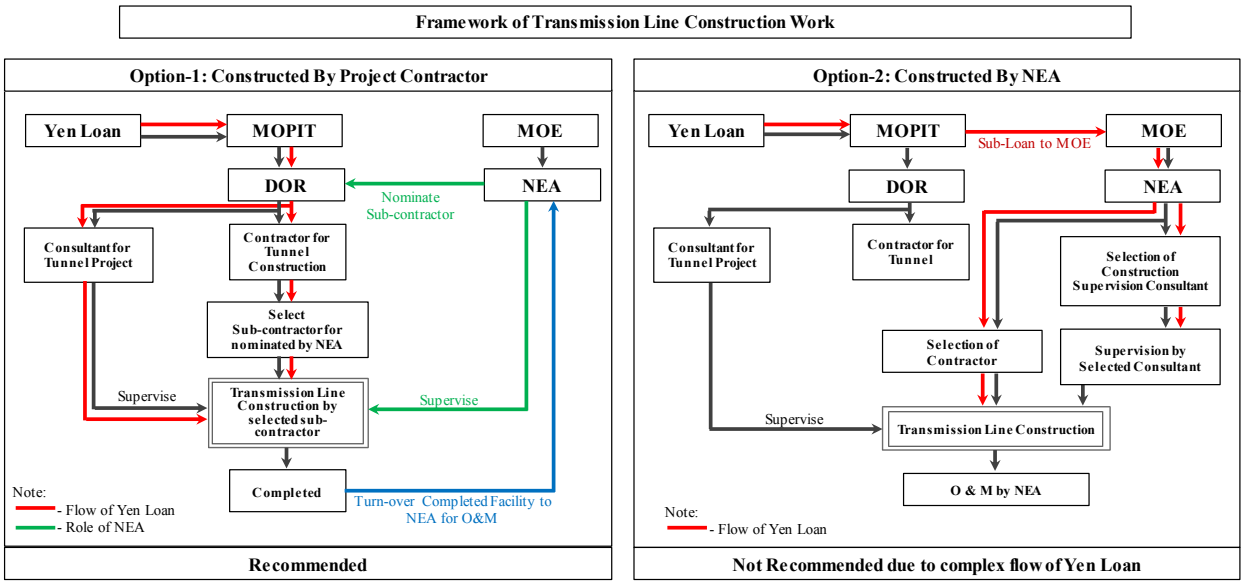


Project Implementation Organization Structure



Proposed Organization of Project Management Office

The framework of transmission line construction work has two options; 1) constructed by Project Contractor or 2) constructed by NEA, as shown below. it is recommended that Option-1 be adopted.



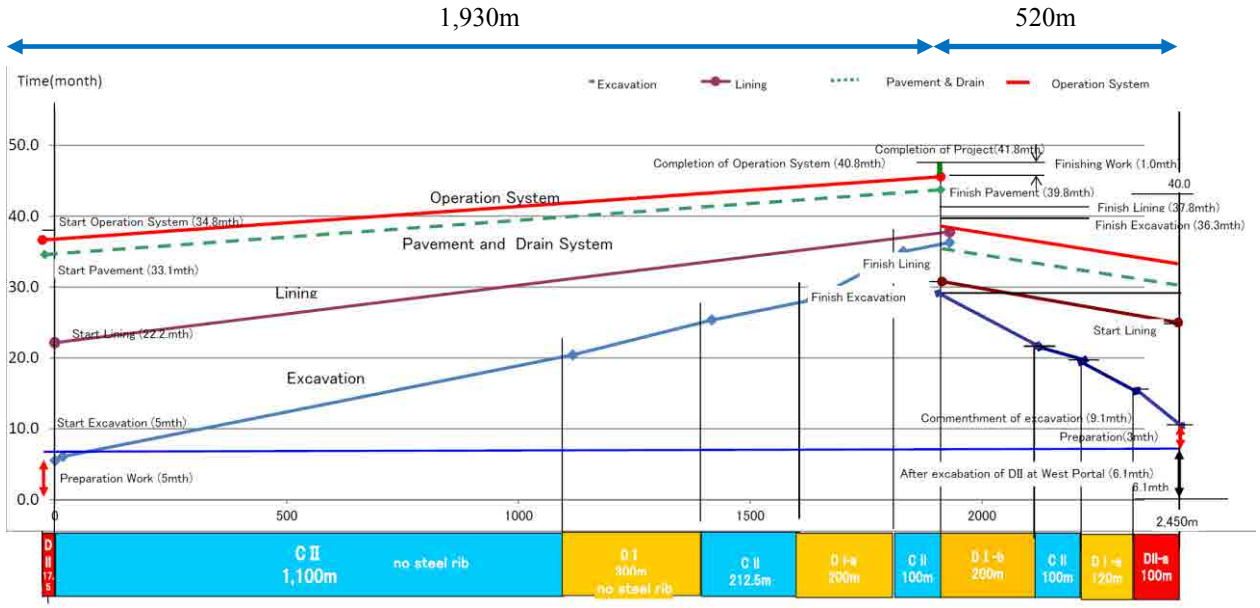
11.2 IMPLEMENTATION SCHEDULE

The implementation schedule is as shown below;

	Period	2014	2015	2016	2017	2018	2019	2020	2021	2022
Project Appraisal	November 2014	●								
Pledge	February 2015		●							
E/N	March 2015		●							
L/A	March 2015		●							
Procurement of Consultant	12 months (2015.3 ~ 2016.2)		3 2 (12months)							
Detailed Engineering Design	12 months (2016.3 ~ 2017.2)			3 2 (12months)						
Procurement of Contractor	14 months (2016.11 ~ 2017.12)				1 2 (14 months)					
Right-of-Way Acquisition	14 months (2016.11 ~ 2017.12)				1 2 (14 months)				(Defect Liability Period)	
Construction	42 months (2018.1 ~ 2021.6)					1 6 (42 months)			6	
Construction Supervision	54 months (2018.1 ~ 2022.6)					1 6 (42 months)			6	
Capacity Development for O & M	12 months (2020.7 ~ 2021.6)							7	6 (12 months)	
Operation and Maintenance	2021.7 ~								7	

11.3 CONSTRUCTION SCHEDULE OF TUNNEL

Construction period of tunnel is 42 months.



11.4 PROCUREMENT OF CONTRACTORS AND CONSULTANTS

The DOR as the executing agency will procure the contractors and consultants.

Executing Agency	Contract Package	Selection Method
DOR	Civil Work for Tunnel, Approach Road, Bridges, Toll Facilities, Control Office, Disposal Area Development and Transmission Line	JUMP/ICB with PQ, 2-envelope 1-stage (JICA Standard Bidding Documents under Japanese ODA Loans (Work), JICA Standard Pre-Qualification Documents under Japanese ODA Loans)
	Consulting Services for Detailed Design, Supervision and Capacity Development of Tunnel O&M	Shortlisting, Quality-Based Selection (JICA Standard Request For Proposals under Japanese ODA Loans (Consultants))

11.5 FLEXIBLE ACTION FOR CHANGE ORDER

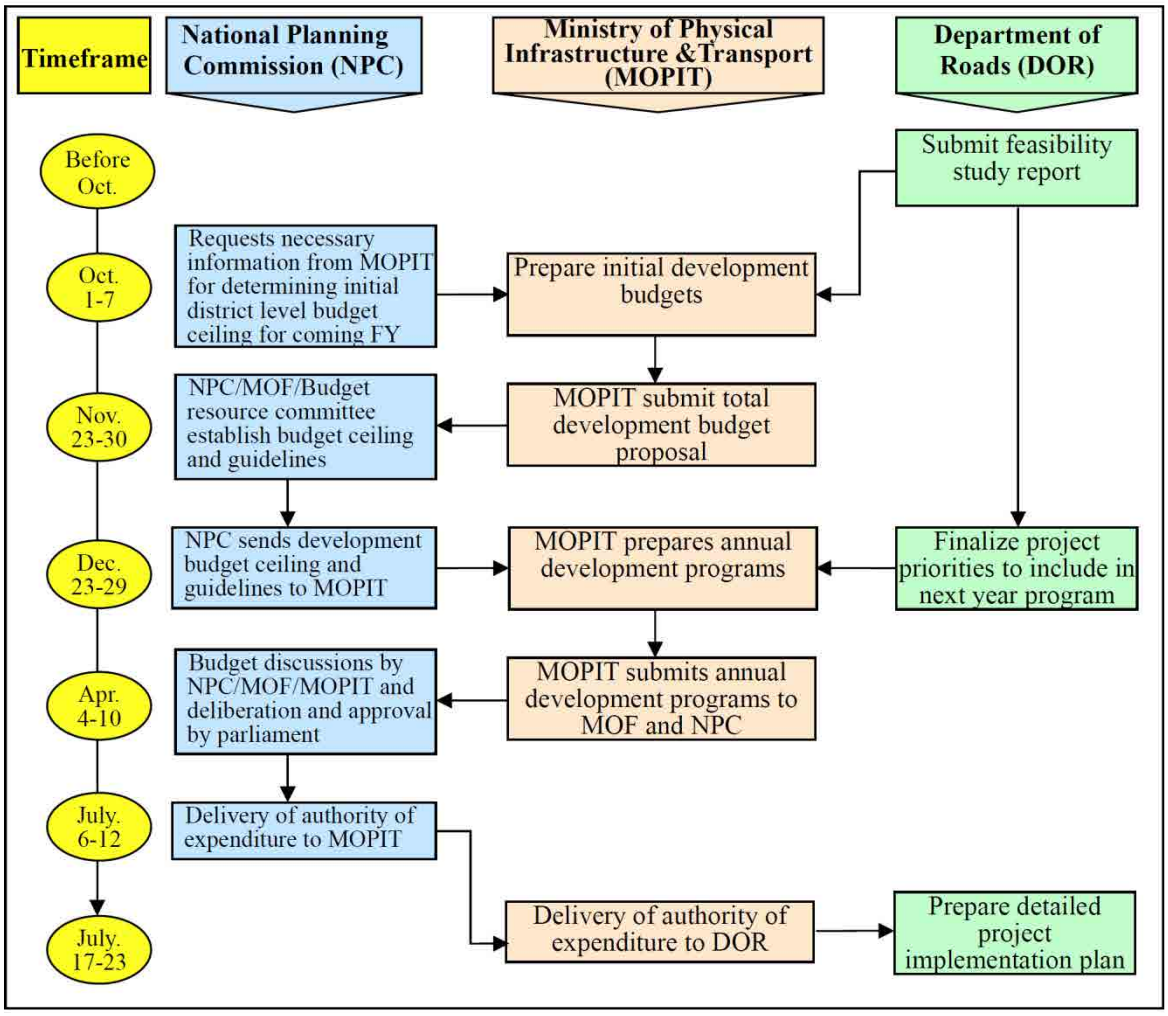
Revealing exact geological condition is not possible even through detailed survey. Therefore, construction of tunnel requires immediate decision for change orders when excavation encounters geological condition differing from the initial assumption. Immediate decision is also necessary as excavation work needs to be continued. Therefore, following considerations are required to be taken;

1. The Government can approve change order under the recommendation of the Consultant (the Consultant should be given adequate power)
2. This condition should be clearly mentioned in the contract documents *(this will allow contractors to bid based on fair price)*
3. DOR will have to secure sufficient budget for the project to be prepared for possible change orders (Price contingency/physical contingency should be included in the annual budget)
4. DOR shall, if necessary, realign the budget to this tunnel project from the budget of other projects to ensure continuity of the project even when unexpected geological condition is encountered.

12. PROJECT APPROVAL AND PROGRAMMING

12.1 PROJECT APPROVAL

All projects need approval from the Parliament. Below shows the flow process;



13. EVALUATION ACTIVITY

JICA will publish the "Ex-Ante Project Evaluation Report" soon after the signing of the L/A for the Project. The report consists of eight major items: 1) project name, 2) necessity and justification of the Japanese ODA Loan, 3) objectives of the Project, 4) project description, 5) operation and effect indicators (performance indicators), 6) risk due to external factors, 7) evaluation results of past similar projects and lessons learned, and 8) evaluation plan.

JICA also should conduct ex-post evaluation 2 years after the Project completion at JICA's expense, so as to assess the Project's effectiveness, impact, and sustainability.

The Government of Nepal shall confirm at the timing of both evaluations, and shall submit necessary evaluation results including Operation and Effect Indicators.

Operation and effect indicators are shown in the table below.

Indicators	Original(Yr 2014)	Target (Yr 2023)
Operation Indicator		
AADT: Annual average daily traffic	7,700 (veh./day)	10,200 (veh./day)
Tunnel Section	-	7,600 (veh./day)
Existing road section	7,700 (veh./day)	2,600 (veh./day)
Effect Indicator		
Reduction of travel time		
Eastbound (To Kathmandu)	30 min	7 min (-23 min reduction)
Westbound (From Kathmandu)	20 min	6 min (-14 min reduction)
Reduction of Travel Time Cost (million NPR/year)		
Eastbound (To Kathmandu)	-	1,725
Westbound (From Kathmandu)	-	800
Reduction of Vehicle Operating Cost (million NPR/year)		
Eastbound (To Kathmandu)	-	770
Westbound (From Kathmandu)	-	610
Increase of average travel speed		
Eastbound (To Kathmandu)	15 km/hr	40 km/hr (25km/h up)
Westbound (From Kathmandu)	25 km/hr	50 km/hr (25km/h up)
Reduction of traffic accident		
Num. of vehicle involved in accidents	240	120 (50% down)
Num. of people involved in accidents	130	65 (50% down)

Main Report

CHAPTER 1

INTRODUCTION

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INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Nepal is a landlocked mountainous country. An estimated 90 percent of Nepal's trade traffic is dependent on roads. The number of vehicle registration has almost doubled in the last 5 years. There is also significant rise in the statistics of freight transport and visitors in the period of 2004 to 2012. On the other hand, the road length with respect to the population is estimated at 0.95km per every thousand person and the road density accounts to about 138.6 km per kilo-square km standing lowest in South Asia. In addition, the ratio of unpaved roads is also high, which is about 46.1%. The slow development of the road, particularly the Mid-hill Highway (1,750km) and the Kathmandu-Birgunj Corridor that starts from Kathmandu and pass across Terai region and ends in Birgunj - a strategically important town for inland trade- located near the border with India. This corridor carries about 60% of country's trade transport.

The target section is located on the major highway that connects Kathmandu with the second largest city Pokhara and the southern Terai region including an important trade center with the neighboring India. The existing road in this section passes through steep Nagdhunga Pass, where the elevation difference is about 500m - 1,500m. The section consists of vertical grades exceeding 10% in combination to small consecutive horizontal curves causing severe traffic congestion and frequent deadly traffic accidents. During monsoon, the section is extremely vulnerable to landslides and other water-induced disasters posing threat of severance of traffic.

Various studies have been conducted before regarding improvement of the existing Tribhuvan Highway from Kalanki to Naubise section. The Feasibility Study conducted by DOR in February, 2013 studied possibility of improvement of the existing Tribhuvan Highway from Nagdhunga to Naubise focusing on improvement through provision of tunnels. The report concludes that the only technically viable stretch is from Imakhel to Sisnekhola. It points out that provision of tunnels in other sections is not feasible as maintaining gentle vertical slope (within the desirable slope of less than four percent) is not possible. Similar study was also conducted by Japan. The Overseas Construction Association of Japan, Inc. (OCAJI) has also conducted a study in 2012 on improvement of the Kalanki to Naubise section. The report also concluded that the most critical section in the above stretch is the Nagdhunga Pass and improvement of this stretch will improve the traffic condition significantly. In the report, it also proposed a tunnel through the Nagdhunga Pass while pointing out other possibilities such as a combination of short tunnel and a spiral bridge and a combination of a short tunnel and land bridge etc. Furthermore, another study, the "Data Collection Survey on Thankot Area Road Improvement in Nepal" was carried out by Japan International Cooperation agency (JICA) in January, 2014 with an aim to collect basic information and conduct analytical work for the section from Kalaki to Naubise. In this survey, the methods recommended in the OCAJI's survey were undertaken and compared. A tunnel from Dahachok to Sisnekhola was considered most appropriate in terms of cost, adverse environmental impacts and operation and maintenance cost.

Subsequently, this Preparatory Survey is carried out to review the results of the Data Collection Survey and conduct further investigations and surveys to identify the necessity of the tunnel in improving the existing road alignment, reducing travel time and enhancing traffic safety so that it will contribute in enhancing smooth flow of trade transport in Kathmandu and other major cities.

1.2 OBJECTIVES OF THE STUDY

The objective of this survey is to conduct a study to prepare and compile all necessary data/information for JICA appraisal of the "Naghdhunga Tunnel Construction Project" under the loan scheme of Japan. The study basically includes the following items;

i) Objectives and outline of the project

ii) Project cost estimate

iii) Implementation schedule and implementation method of the project

iv) Project execution organization, operation and maintenance management system, and

v) Environmental and social consideration

1.3 OBJECTIVE AND SCOPE OF THE PROJECT

The project objective is to construct a tunnel across Nagdhunga Pass located on the arterial road connecting the capital city of Kathmandu with the rest of the major cities of the country to; i) improve the alignment of the existing road, ii) reduce the travel time, and iii) enhance traffic safety, such that economic activities of Kathmandu and other major cities are stimulated and contribute to the economic development of the country.

The scope of the project basically includes;

i) Civil work Component

- Construction of a Tunnel
- Construction of Approach Road including Bridges and culverts
- Disposal Area Development (Michi-no-Eki)
- Power Supply Facility for operation of the tunnel
- Other facilities such as, toll booths, tunnel management office etc.

ii) Consulting Services

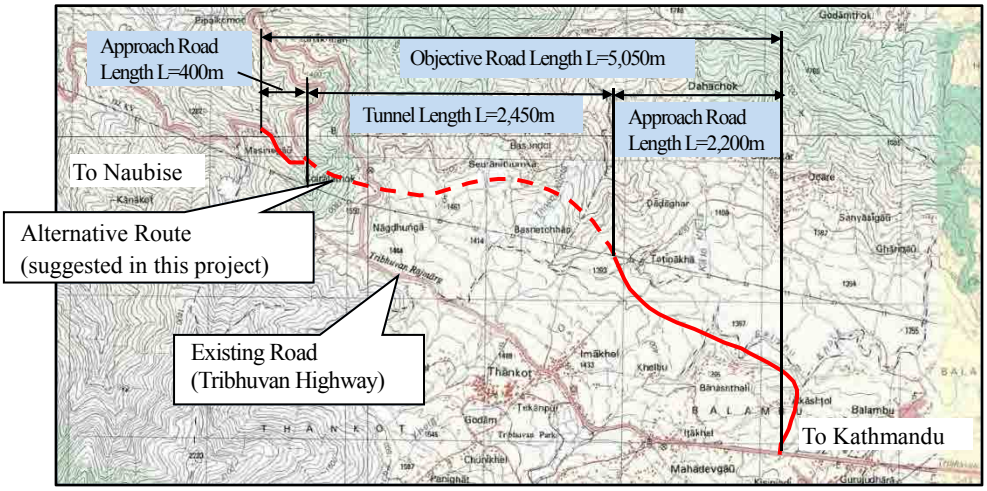
- Detailed Design
- Preparation of Bid Documents
- Assistance in Bidding
- Construction Supervision

iii) Right-of-way (ROW) Acquisition and Resettlement Action Plan (RAP) Implementation

iv) Capacity Development for Tunnel Operation and Maintenance (O & M)

1.4 STUDY AREA

The survey area is located in two districts; Kathmandu, and Dhading. The approximate area is indicated in **Figure 1.4-1**.



Source: JICA Survey Team

FIGURE 1.4-1 STUDY AREA

1.5 SCOPE OF THE STUDY

Scope of the study includes the following items.

(1) Confirmation of the Necessity and Background of the Project

- To confirm the Project background / rationale in consideration with national road policy in Nepal
- To review the legal framework such as laws, regulations, rules, or standards codes of road sector in Nepal
- To review the organizational structure within Department of Roads (DOR) for implementing the Project
- To assess DOR's organizational structure, jurisdiction and their expertise
- To confirm other relevant JICA Official Development Assistance (ODA) loan projects and other donors' relevant projects

(2) Confirmation of the Project Site Situation

- To review existing road condition and ambient environment of the route
- To review present traffic volume and future traffic demand
- To review the proposed alignment of the tunnel and its approach road
- To review the environmental and social situation of the site

(3) Preliminary Design of the Tunnel and its Approach Road, and Implementation Plan of the Project

- To conduct the detailed study on topographical, hydrological, geological or other necessary issues
- To prepare the preliminary design of the tunnel and its approach road including intersections and toll gates (if required) as well as disposal area development plan and facilities for power supply (from the transmission line)
- To estimate the Project cost and construction schedule
- To prepare the implementation plan of the Project, that includes the plans for packaging, design, bidding, procurement, resettlement, utility relocation, etc.
- To prepare the details of consulting services that includes detail design, construction supervisions, tender assistance, etc.

(4) Environmental and Social Consideration

- To review Nepali law and regulations concerning environmental and social consideration and find out necessary procedures for the Project implementation
- To review the environmental and social impacts of the Project and prepare the mitigation measures and monitoring plan in accordance with the requirements of JICA's "Guideline for Environmental and Social Consideration"
- To prepare Resettlement Action Plan (RAP) and Environmental Impact Assessment (EIA) in accordance with the requirements of Nepali law and regulations as well as JICA "Guideline for Environmental and Social Consideration"

(5) Operation and Maintenance Plan after Construction

- To estimate necessary manpower and budget allocation requirements
- To prepare a sustainable operation and maintenance plan with ensuring manpower and

budget

- To prepare the scope of work of the consulting service regarding operation and maintenance management of the tunnel and methods to limit overloaded and hazardous vehicles.

(6) Evaluation of the Project

- To collect baseline data for the operation and effect indicators
- To propose the operation and effect indicators (e.g. traffic volume, travel time reduction, traffic accident reduction) and monitoring plan
- To undertake Economic evaluation of the Project
- To evaluate the qualitative effects of the Project

The survey was scheduled to commence in the middle of June 2014 and end in the middle of December. The items and schedule of the survey are indicated in **Table 1.5-1**.

The survey was carried out by the team organized by JICA. The Team members scheduled to participate in the study in Nepal was composed of the following members:

	MEMBERS	POSITION/INCHARGE OF
1	Mr. KIUCHI Mitsuo	Team Leader/ Highway Planning (1)/ Organization & System
2	Mr. UENO Ryuichi	Deputy Team Leader/Highway Planning (2)
3	Mr. YONEYAMA Hideki	Tunnel Planning (1) Scaffolding and Support Structure
4	Mr. MITANI Satoshi	Tunnel Planning (2) Excavation Method/ Construction Planning
5	Mr. SHRESTHA Robinson	Highway Design
6	Mr.YAJIMA Hiroshi	Structural Design
7	Mr. SAKAGUCHI Takuma	Tunnel Design (1)/ Equipment and Electrical Appliances
8	Mr. SAWADA Kentaro	Tunnel Design (2)
9	Mr. NAKAJIMA Fumiki	Disaster Mitigation and Slope Protection/Geology Assesment
10	Mr. NIII Takashi	Operation and Maintenance Management
11	Ms. IDE Kakiko	Environment Consideration
12	Mr. IIO Tsuyoshi	Social Consideration
13	Mr. UMEDA Norio	Construction Planning/ Cost Estimation
14	Mr. OIKAWA Ryuichi	Traffic Demand Forecast/ Economic/Financial Analysis
15	Mr.HAYASHI Masahiko	Engineering Survey (Natural Condition)
16	Mr. KAIDA Yukishi	Groundwater Analysis
17	Mr. PRADHAN Rajendra Narsingh	Transmission Line Planning
18	Mr. KANEKO Hiroshi	Disposal Area Development Planning (Michi-no-Eki)
19	Mr. OHTAKE Hiroaki	Design Assistance/Project Coordination

The Survey was implemented in close coordination with the DOR and Roads Board Nepal (RBN), the implementing authorities, including other main relevant authorities mentioned below.

- Ministry of Physical Infrastructure and Transport (MOPIT)
- Department of Mines and Geology, Ministry of Geology and Mines (DMG)

- Ministry of Soil and Forest Conservation (MFSC)
- Ministry of Science, Technology and Environment (MOSTE)
- Nepal Electricity Authority (NEA), Ministry of Energy (MOE)

TABLE 1.5-1 SCHEDULE OF THE SURVEY

	Work Items \ Period	2014 6	7	8	9	10	11	12	2015 1
(a)	JICA Mission Schedule	**FF1**			**FF2**		**Appraisal**		
(b)	Official Request from GON to GOJ Expressing the Project will apply JUMP								
(1)	Preparation, Presentation and Discussion of Inception Report								
(2)	Gathering Information on Project Background								
(3)	Review of Previous Alignments								
(4)	Traffic Survey								
(5)	Traffic Demand Forecast								
(6)	Study on Design Principles and Standards								
(7)	Engineering Surveys								
(8)	Project Executing Organization								
(9)	Operation and Maintenance Organization								
(10)	Confirmation of Environmental and Social Considerations								
(11)	Study on Climate Change Mitigation Measures								
(12)	Study on Japan's Technology Utilization								
(13)	Listing of Local Contractors Eligible for Consortium with Japan's Contractors								
(14)	Support for Holding Technical Explanatory Meeeting								
(15)	Invitation of Counterparts to Japan								
(16)	Preliminary Design, Construction Execution Plan, ROW Acquisition Plan and Cost Estimate								
(17)	Operation and Maintenance Plan								
(18)	Project Implementation Schedule								
(19)	Implementation Plan for Consulting Services								
(20)	Project Cost Estimation								
(21)	Comparison with Project Cost with Similar Projects								
(22)	Overall Implementation Schedule								
(23)	Project Evaluation								
(24)	Finalization of Basic Project Plan								
(25)	Assistance for Project Approval Procedure in Nepal								
(26)	Preparation, Presentation and Discussion of Draft Final Report								
(27)	Preparation and Submission of Final Report								
	Others	Submission of Inception report		Submission of Interim report		Submission of Draft Final report		Submission of Final Report	

(From Goverment of Nepal to Government of Japan)

Note : ——— Preparation Period ▬ Field Survey Period ▭ Work in Japan ▭ National Holiday in Nepal △—△ Report Explanation ------- Other Works

1.6 FINAL REPORT ORGANIZATION

1.6.1 Reports Prepared

The following reports over prepared and submitted to DOR, MOPIT.

- Inception Report
- Interim Report
- Draft Final Report

1.6.2 Organization of the Final Report

The Final Report is organized with only Main Text and Drawings for this Project.

CHAPTER 2

NATIONAL DEVELOPMENT PLAN AND TRANSPORT SECTOR DEVELOPMENT PLAN

CHAPTER 2
NATIONAL DEVELOPMENT PLAN AND TRANSPORT SECTOR DEVELOPMENT PLAN

2.1 INTRODUCTION

Planned endeavor of development was initiated with the First Five Year Plan in 1956. 9 five-year plans and 3 three-year plans have already been implemented. In these twelve previous periodic plans that set the goals and priorities of overall national development. All these previous plans have made remarkable contribution to economic and social development of Nepal. However, the problems such as poverty, economic disparity and social exclusion still need to be addressed in the country. The Approach Paper to the Thirteenth Plan (APTP) (FY 2013/14 -2015/16), the latest national strategy plan, is currently being implemented not only to address these issues, but also with the vision to transform the status of the country. Brief overview of the last three year plan including the APTP follows hereunder.

2.1.1 National Development Plan

2.1.1.1 Three Year Plan (TYP) (FY 2010/11 – 2012/13)

(1) Vision

The vision is to transform Nepal from the group of the least developed country to the group of developing countries as a "Prosperous, Peaceful and Just Nepal" within a two-decade period.

(2) Goal

Improve the living standards of all Nepal people, reduce poverty to 21 percent and achieve Millennium Development Goals by 2015 through sustainable economic growth, creating decent and gainful employment opportunities, reducing economic disparities, achieving regional balance, and reducing social exclusion.

(3) Objective

Bring positive changes in people's lives through achieving employment centric, inclusive and equitable economic growth by contributing to poverty alleviation and lasting peace.

(4) Strategies

- To achieve employment centric, pro-poor and broad based economic growth through the joint efforts of government, private and community/cooperative sector.
- To develop physical infrastructure to support future federal structure and contribute to regional economic development.
- To emphasize on inclusive and equitable development for achieving sustainable peace.
- To contribute to socio-economic transformation by improving economic and social services.
- To make development interventions result-oriented by ensuring good governance and effective public service delivery.
- To strengthen economic growth and stability by developing private and community/cooperative sectors and mainstreaming industry, trade and service sector in the national development efforts.

(5) Targets and Achievements of Three Year Plan

Table 2.1-1 shows the major Targets and Achievements of Three-Year Plan**.**

TABLE 2.1-1 TARGETS AND ACHIEVEMENTS OF THREE YEAR PLAN

Statement	Status of 2009/10	Targets of TYP	Achievements of TYP period			
			2010/11	2011/12	2012/13	Average growth
Economic growth rate (%)	4.3	5.5	3.9	4.5	3.6	4.0
Agricultural sector growth rate (%)	2.0	3.9	4.5	5.0	1.3	3.6
Non-agricultural sector growth rate (%)	5.4	6.4	3.6	4.2	5.0	4.2
Population living below the poverty line (%)	25.4	21	25.2	24.4	23.8	-
Employment growth rate (%)	3.0	3.6	2.9	2.9	2.9	2.9

(6) Some Important Achievements

- Significant achievement in revenue mobilization.
- Positive trend in international reserves.
- Maintaining surplus in balance of payments.
- Good progress in social indicators.
- Significant progress in roads, bridges, renewable energy and communication accessibility.
- Peace and governance, expansion of integrated service centers.

(7) Major Problems

1) Low economic growth rate
2) High consumption GDP ratio.
3) High poverty incidence (23.8%).
4) Agriculture Sector: land management, expansion of irrigation facilities, smooth supply of chemical fertilizer and improved seeds, extension of agricultural credits and marketization of agricultural products, commercialization and mechanization of agriculture.
5) Industrial Sector: problem in industrial relation, energy crisis, shortage of human resources.
6) Infrastructure Sector: uninterrupted transportation throughout the year, road connectivity in remote areas, smooth implementation of development projects, obstructions.
7) Trade: decline in the production of exportable commodities, trade deficits due to higher per capita income and changes in consumption- induced imports.
8) Good Governance/Peace: emerging culture of impunity, could not establish Truth and Reconstruction Commission, local bodies without people's representatives.

(8) Relevance to this Project

One of the major strategies of this plan identifies development of infrastructure to support regional economic development. It also accords high priority to nationally important priority projects that will contribute directly to the relief of the people.

Nagdhunga Tunnel Project is recognized by the GON as a nationally important project and has been approved to be listed in the 1st priority (P-1) project. P-1 is identified as the most prioritized project after the national pride projects. Implementation of this project is expected to contribute to vitalize the economic activities of all regions including the capital city, Kathmandu by providing uninterrupted transport along the objective section.

2.1.1.2 Thirteenth Plan (Three Year: FY 2013/14 – 2015/16)

(1) Background

Nepal still remains a least developed country (LDC) and, if required efforts are accelerated on development process along with political commitment, Nepal may be upgraded to the list of developing country from LDC by the next decade. Nepal has already achieved one from among the three essential indicators, and there is a provision that even the attainment of any 2 of the 3 indicators may upgrade the status. Hence, the objective, goals, strategy and priorities of this Plan are oriented towards upgrading Nepal to a developing country from the current status of a LDC.

Moreover, this Plan is also focused on the attainment of MDGs as well as SAARC development goals, sustainable development, human rights and climate change, address to other matters where commitment is shown at the regional and international level and to alleviate poverty through promoting a green economy.

(2) Long Term Vision

To upgrade Nepal into a developing country from the current status of a LDC by 2022.

(3) Objective

To bring a feeling of direct positive change in the living standards of common people by reducing economic and human poverty prevalent in the nation.

(4) Goal

The main goal of the Plan is to bring down the population living below the poverty line to 18 percent. Other goals have been determined as **Table 2.1-2** Targets of the Thirteen Year Plan.

TABLE 2.1-2 TARGETS OF THE THIRTEEN YEAR PLAN

S. No.	Indicators	Status of FY 2012/13	Targets TP
1	Annual average economic growth rate (%)	3.6	6.0
2	Annual average agricultural growth rate (%)	1.3	4.5
3	Annual average non-agricultural sector growth rate (%)	5.0	6.7
4	Annual average growth rate in employment (%)	2.9	3.2
5	Life expectancy at birth (in years)	69.1	71.0
6	Population (in millions)	27.2	28.3
7	Population growth rate (%)	1.35	1.35
8	Maternal mortality rate (per 100,000)	229.0	134.0
9	Population with access to drinking water (%)	85.0	96.25
10	Population with access to sanitation (%)	62.0	90.5
11	Net enrolment rate at the primary level (Grade 1-5) (%)	95.3	100.0
12	Number of district headquarters with road connectivity	73.0	75.0*
13	Density of mobile phones and telephones (per 100)	71.5	100
14	Installed capacity of electricity generation (in MW)	758.0**	1426
15	Population with access to electricity (%)	67.3	87.0
16	Irrigation (in hectares)	13,11,000	14,87,275
17	Forest coverage area (%)	39.6	40.0
18	Total length of road transport (km)	25,133	28,133

Source: Thirteenth Year Plan

* In case of district headquarters of Humla, to be connected from the Chinese autonomous province of Tibet

** A total of 758 MW of electricity is connected to the national transmission line including 705 MW from hydropower and 53 MW from thermal power. 35 MW from alternative energy is not yet linked to the national transmission line.

(5) Strategy

The following strategies have been adopted for the realization of above objective and the goals:

1) Achieve an inclusive, broad-based and sustainable economic growth by enhancing the contribution of private, government and cooperative sectors in development process.
2) Develop physical infrastructure.
3) Enhance the access, use and quality standards in social service sectors.
4) Enhance good governance in public and other sectors.
5) Enhance economic and social empowerment of the targeted groups, sectors and groups.
6) Implement developmental programs in line with climate change adaption.

(6) Priorities

This Plan has laid down the priority areas as follows:

1) Development of hydropower and other energies.
2) Increase in productivity, diversification and commercialization of the agricultural sector.
3) Development of basic education and health, drinking water and sanitation sectors.
4) Promotion of good governance.
5) Development of roads and other physical infrastructure.
6) Development of tourism, industries and trade sector.
7) Protection of natural resources and environment.

The pursuance of above priorities will aid in realization of the Plan's Objective.

(7) Economic Growth Targets

Table 2.1-3 shows the economic growth targets of Three Year Plan**.**

TABLE 2.1-3 ECONOMIC GROWTH TARGETS OF THREE YEAR PLAN

(NRP 10 million)

S.No.	Sectors	Growth Rate	Base Year of 2012/13	2013/14	2014/15	2015/16
1	**Agriculture**	**4.5**	**55,558.5**	**57,947.5**	**60,555.2**	**63,461.8**
1.1	Agriculture, forestry and fisheries	4.5	55,558.5	57,947.5	60,555.2	63,461.8
2	**Non-agriculture**		**104,358.8**	**110,690.5**	**118,120.6**	**126,772.0**
2.1	Industry	6.7	23,870.2	25,031.8	26,364.1	27,932.9
2.1.1	Industry, mining and quarrying	4.7	10,795.9	11,260.1	11,778.1	12,378.8
2.1.2	Electricity, gas and water	8.2	2,028.7	2,184.9	2,361.9	2,572.1
2.1.3	Construction	5.5	11,045.6	11,586.8	12,222.4	12,982.0
2.2	**Services**		**80,488.4**	**85,658.7**	**91,756.3**	**98,839.2**
2.2.1	Wholesale and retail trade	5.6	3,058.4	24,096.0	25,445.4	27,175.7
2.2.2	Hotel and restaurant	8.6	2,914.1	3,156.0	3,430.5	3,735.9
2.2.3	Transport, storage and communication	8.4	14,714.6	15,877.1	17,210.7	18,725.3
2.2.4	Financial intermediaries	6.2	6,720.7	7,103.8	7,537.1	8,042.1
2.2.5	Real estate, rent and business activities	6.7	13,553.0	14,366.2	15,343.1	16,447.8
2.2.6	General administration and defense	5.9	3,029.9	3,196.5	3,385.1	3,595.0
2.2.7	Education	8.2	8,619.5	9,291.8	10,063.0	10,918.4
2.2.8	Health and social works	7.7	2,202.2	2,367.4	2,554.4	2,753.6
2.2.9	Other activities of social, community and personal activities service	9.5	5676.0	6203.9	6787.0	7445.4
3.Gross value added (Including FISIM)		6	159,917.1	168,638.0	178,675.7	190,233.8
4. Financial Intermediation Service (indirectly measured)		8.2	5899.0	6370.9	6899.7	7479.3
5. Gross domestic product (at basic price)		5.9	154,018.1	162,267.1	171,776.0	182,754.5
6. Taxes less subsidies on products		11.1	16,101.2	17,952.8	19,963.6	22,059.7
7. Gross domestic product (at producer's price)		6.4	170,119.3	180,219.9	191,739.6	204,814.2

(8) Relevance to this Project

The long term vision of the Thirteenth Plan including the objectives, goals, strategies and priorities include continuity of the previous three year plan with some different approaches only. One of the major strategies of this plan is to enhance the access, use and quality standards in social service sectors and its policies set construction of Mid-hill Highway and roads supporting important tourism cities and construction of environment-friendly roads in achieving the goals and targets.

Nagdhunga Tunnel is planned to improve the most critical section of the Tribhuvan Highway, which is an integral part of the Mid-hill Highway. It also serves as the only road link between Kathmandu and Pokhara, the most famous tourist city in the country. Therefore, in such aspect construction of Nagdhunga Tunnel is considered to be in line with the development plan and is expected to contribute in enhancing the access, use and quality standards in social service sectors and boost the regional economy.

2.2 ROAD DEVELOPMENT PLAN

2.2.1 Brief Overview of the Three Year Plan (TYP) (FY 2010/11 – 2012/13)

In infrastructure development, the current plan has given high priority to the road sector due to its contribution in socio-economic development of nation, social integration, service delivery and governance functions. Up to the third year of the current Plan, 25,133 km of strategic roads have been constructed. Achievements in the construction of new roads and use of telephone services have been more than the targets of the plan.

The Plan period has also witnessed a low performance in the upgrade of roads, reconstruction and their restoration following low priority attached to the maintenance of older projects and excessive focus on new programs and projects. The Plan targeted access of road transport in the all 75 headquarters districts. However, road transport has reached to 73 districts headquarters only. The major challenges in the road sector are to provide road access to all the district headquarters and remote areas due to exclusive geographical terrain, to operate reliable and safe transport throughout the year, to attract the private investors in road construction, to coordinate among various agencies involved in road construction and to evaluate the possibilities of damage due to natural calamities and apply mitigating measures.

In an overall perspective, during the review period, the expected outcome could not be met due to several reasons such as lack of complete budget in physical infrastructure sector, discrepancy between the annual budget and periodic plan, absence of elected representatives in local bodies, non-inclusion of project progress in the performance appraisal of the employees and absence of a, high level authoritative coordinating agency.

2.2.2 Thirteenth Plan (Three Year: FY 2013/14 – 2015/16)

(1) Background

By TYP (2010-13), remarkable achievements have been made in the expansion of road structure and a total of 25,133 km of strategic roads have been built which includes 7799 km of black topped roads, 6830 km of gravel and 10504 km of dirt roads. By this period 1609 bridges are in operation. Seventy three district headquarters now have road connectivity to strategic roads network. In order to manage and sustain the road sector development, national highways, feeder roads and strategic cities linking roads are classified under the strategic roads network and district, urban and rural roads are grouped under the local roads network. As a road sector program, a Ten Year Primary Investment Plan (2007-2016) is being implemented and accordingly the necessary roads as well as the construction and repairs of bridges overland are underway.

(2) Objective

To expand standard, reliable, affordable and safe transport network to contribute national

integration, socio economic development and regional balance.

(3) Strategy

1) Expand transport access so as to link district headquarters and inter districts.
2) Expand transport by raising access to agriculture, industries, hydropower, tourism, education and health services.
3) Prioritize repair and maintenance by safeguarding roads network and assuring safe and effective travel.

(4) Operating Policy

1) Roads network will be extended to the district headquarters still not being connected. (1)
2) Roads linking district headquarters and other roads network of national significance will be upgraded gradually to make them all weather roads.(1)
3) Postal highway will be upgraded and construction as well as upgrade of north-south roads linking various border trade points and major transit points to the highway will be undertaken. (1)
4) Continuity will be given in the construction of Mid-hill highway and Kathmandu-Tarai fast track. Moreover, the feeder roads and district routes will also be erected, expanded and upgraded. (1)
5) So as to develop commercially important roads, investment as per the public private partnership will be encouraged. (1)
6) Roads assisting in important hydropower, irrigation, tourism and industrial projects and those enhancing access to agriculture, education and health will be upgraded. (2)
7) Roads will be developed and extended as per the vehicular thrust. (2)
8) Considering the pressure of urbanization, roads network will be expanded in a manner contributive to the management of safe, environment friendly, hindrance free mass transportation. (2)
9) Protection, repair, maintenance and management of road assets will be made further effective. (3)
10) While developing and expanding roads structure in urban areas, they will be made pedestrian and disabled friendly. Moreover, cycle lane shall also be arranged for. (3)
11) Gross transport operation cost will be reduced by making the roads repair act effective. (3)
12) The responsibility of operation and maintenance of local roads will be delegated to the local bodies. Likewise, infrastructure on the basis of roads density such as available manpower, machines and equipments, offices, residences will also be transferred to the concerned agencies. (3)
13) The use of local means and resources as well as labour oriented approach will be highlighted in building and repairing rural roads. (3)
14) Ring road expansion works initiated in Kathmandu and other major cities will be intensified. (3)
15) So as to make the road construction sustainable and standard, provision will be made that the builder itself has to repair the roads for a certain period. (3)

Note: Digits given at the end of operating policies (in brackets) indicate the series (order) of strategies.

(5) Expected Outcome

In the Plan period, 3,000 km of new roads will have been built, 2,100 km of roads will have

been upgraded, additional 310 strategic bridges will have been erected and all the district headquarters will have been connected to roads network. The construction of new roads will include the completion of the Mid-Hill Highway including the ongoing Sindhuli-Bardibas Road. Moreover, decrease in road accidents and effectiveness in transport management will have been witnessed.

2.3 RAIL AND OTHER TRANSPORT DEVELOPMENT PLAN

2.3.1 Thirteenth Plan (Three Year: FY 2013/14 – 2015/16)

(1) Background

Other areas besides road and air transport, have been emphasized and programs launched since the Three Year Plan (2010/11-2012/13). The extension work of Janakpur-Jaynagar railway line (26 km.) to Bardibas has been started. Department of Railways has been founded for rail transport development. Studies are being undertaken for the advancement of other transport sectors such as watercourse and rope way.

(2) Objectives

To do necessary works for the development and expansion of safe rail and other alternative transport network.

(3) Strategy

1) Identify, develop and extend rail and other alternative transport network.
2) Identify, develop and extend east-west, north-south rail routes on the basis of need and feasibility and expand light rails transit, monorail in major city hubs.
3) Promote public-private partnership in the development and operation of rails, ropeways, gravity twins, waterways and other transport infrastructure.
4) Develop a sustainable, safe and reliable rail network.

(4) Operating Policy

1) Feasibility study for the development of east-west electric railway will be done and preparation of the Detailed Project Report (DPR) will be initiated. (1)
2) Detailed Project Report (DPR) will be drafted for the operation of metro rail services in Kathmandu valley and investment will be attracted through public-private partnership. (2)
3) Feasibility studies for the advancement of alternative transport systems such as ropeway and cable car will be launched and the feasible projects will be constructed. (3)
4) Investment will be attracted through concepts such as public-private partnership for the development of transport systems such as ropeway, cable car, waterways, etc. in the touristic important places. (3)
5) Operation of the under-construction Biratnagar - Katahari railway and the Jaynagar – Janakpur - Bardibas, which is being upgraded, will be assigned to local bodies or through public-private partnership. (4)
6) Detailed Project Report (DPR) will be drafted of the feasible waterways and construction works will be initiated. (4)

Note: Digits given at the end of operating policies (in brackets) indicate the series (order) of strategies.

(5) Expected Outcome

In the Plan period, the DPR of whole of the Mechi-Mahakali railway (944 Km) would have been completed, construction of Simara-Bardibas segment will have been commenced, Biratnagar-Katahari and Jaynagar-Janakpur-Bardibas railway would have been built, DPR for

the operation of metro rail services in Kathmandu valley will have been prepared, feasibility studies for the operation of cable car services in ten different places of country will have been finished and construction of cable car projects in five places will have been begun.

2.4 AVIATION DEVELOPMENT PLAN

2.4.1 Thirteenth Plan (Three Year: FY 2013/14 – 2015/16)

(1) Background

In order to make the air transport safe, regular, widely available and reliable, necessary infrastructure, development and expansion of the well attended airports, operation and effective regulation of reliable air transport are imperative. So as to enhance and advance national and international air transport, it is required that the air transport be linked with tourism development in participation with the private sector and be made safe, standard, easy and reliable as well as to turn the civil aviation service sustainable, strong and competent.

In order to make air transport services safe, easy, standard and reliable pursuant to the provisions of Air Policy, 2006, initiatives have been taken such as construction and operation of domestic airport, and enhancing the participation of private sector for operation of international flights. As per this strategy, licenses have been granted to private airline companies for operation of international flights. Participation of private companies in domestic flights has also been increasing. A policy has been envisaged to construct airports with physical infrastructure by attracting private sector investment and also with the participation of the community.

(2) Objective

To develop civil aviation industry as a significant contributive economic sector to national development through consolidation of air transport providing quality service and increasing flow and access at the national and international level.

(3) Strategy

1) Establish national and international access by developing the air services reliable, safe, widely available, regular, comfortable and fast and quick means of transportation.

2) Develop and extend essential infrastructure for the advancement of aviation sector with partnership of government, private sector, local bodies and community.

3) Ensure the safety of civil aviation sector through effective monitoring, regulation and using ultra modern technology.

(4) Operating Policy

1) Tourism promotion will be highlighted while making air agreements with various countries. Past agreements will be gradually reviewed in a time relevant manner. (1)

2) Necessary planes will be purchased and services will be improved by strengthening the management of Nepal Airlines Corporation (NAC). (1)

3) Master plan for air transport will be formulated for operating the activities and programs of air services in effective and efficient way. (1)

4) Rebates in flight charges will be given to the flights to hill areas and originating from Janakpur, Ramechhap, Bhairahawa and Dhangadhi airports. (1)

5) A study will be done to develop a separate accounting system considering the contribution of the aviation sector in the national economy. (1)

6) Considering the rising traffic pressure of domestic and international air transport services in Tribhuvan International Airport (TIA), necessary infrastructure will be developed and expanded in a priority basis and the airport will be made operable round the clock. (2)

7) Considering the rising traffic pressure from international air transport services and air

passengers, construction of a second international airport in Nijgadh of Bara district will be initiated. (2)

8) The concept of public private partnership will be forwarded to attract the investment from the private sector to the development of airport infrastructure and its upgrading, technology development and operation of airlines by private sector investor. (2)
9) Airports which are important from touristic perspective will be upgraded in a manner that they could be operated round the year. (2)
10) In order to make the air transport in remote areas including Karnali zone regular and accessible to public, upgrading those airports with ultra modern technology and increasing the number of flights will be continued. (2)
11) Necessary financial resources will be allocated to develop Gautam Buddha airport of Bhairahawa and Pokhara airport as the international airports of regional level. (2)
12) By developing airports of Biratnagar, Janakpur, Bhairahawa, Nepalgunj, Surkhet and Dhangadhi as hub airports, small planes will be encouraged to fly from these airports instead of TIA and thus the pressure of small planes in TIA will be alighted. (2)
13) To make the air services safe, modern aviation aiding equipments will be installed in airports and the flight safety monitoring as well as checking system of all planes will be made compliant to international norms. (3)
14) For making the civil aviation sector safe and reliable, effective monitoring and regulation of this sector will be made through legal and institutional provisions. (3)
15) For guaranteeing aviation security and quality service, the capacity of Civil Aviation Authority of Nepal (CAAN) will be enhanced and structural reforms will be initiated as per the guidelines of International Civil Aviation Organization (ICAO). (3)
16) The unused airports will be upgraded and utilized as infrastructure for tourism development. (3)

Note: Digits given at the end of operating policies (in brackets) indicate the series (order) of strategies.

(5) Expected Outcome

Construction works of second international airport and regional international airports in Bhairahawa and Pokhara will have been started, capacity of TIA will have been enhanced, black topping of runways of 22 domestic airports will have been completed, number of foreign airlines flying to Nepal will have been reached 31 and two way air seats will have been reached 7.5 million per annum and the number of countries with bilateral air agreements will have been reached to 40.

2.5 IDENTIFICATION OF THE NAGDHUNGA TUNNEL CONSTRUCTION PROJECT

2.5.1 Nagdhunga Tunnel Project to be identified in Nepal

Nepal still lags in social infrastructure development especially in areas concerning power supply, road networking, the irrigation system and other public services. Situated at the foothills of the Himalayan with a complex geological location, Nepal is covered with steep terrain. Since 80% of the country is mountain ranges, therefore, road construction and maintenance incur huge costings resulting in very slow progress. The GON had been aware of the importance and the need of tunnels in Nepal since long ago but was not able to implement such projects as it was too early both financially and technically. Now the GON is fully aware and prepared for undertaking such projects as the role of road tunnels is very important in order to secure reliable and efficient road network, it has been taking steps on its own to construct tunnels for this purpose. Being the only trunk road that connects the Capital to the rest of the country, it has identified the need of a tunnel at Nagdhunga Pass to remedy the bottle neck issue and boost the economic activity to realize equitable development of the country. The GON also believes that the construction of a tunnel here could be a model of other tunnel projects to be implemented in

the future.

2.5.2 Nagdhunga Tunnel Project to be identified in Asian Highway Network and in SAARC

Asian Highway No.2 (AH2) is an inter-country highway that was planned to improve the highway systems by developing an international road transport in the region. The roads that lie under this classification basically share the AH design standards. As shown in **Figure 2.5-1** and **Figure 2.5-2**, Asian Highway No.2 passes longitudinally through Nepal connecting the end of eastern Nepal and the end of western Nepal. Moreover, Asian Highway No.42 traverses North and South in Nepal which connects China and Indian borders as shown in **Figure 2.5-3**. As also shown in figure, Nagdhunga Tunnel locates on the Asian Highway No. 42.

Mid-Hill Highway also passes longitudinally through Nepal and it is parallel with East-West Highway as shown in **Figure 2.5-4**. That is to say, Nagdhunga Pass locates along the 2 highways such as Mid-Hill Highway and Asian Highway No.42. Therefore, Nagdhunga Tunnel locates at a very important point in Nepal. Provision of Nagdhunga Tunnel will contribute in eliminating the most critical section of the existing Tribhuvan Highway and ultimately result in the improvement of the AH2.

This existing Tribhuvan Highway is a part of the only corridor linking Kathmandu with its neighboring country, India. Improvement of the corridor will help boost ties with India and also with other SAARC countries and grow momentum for regional cooperation and integration in Asia.

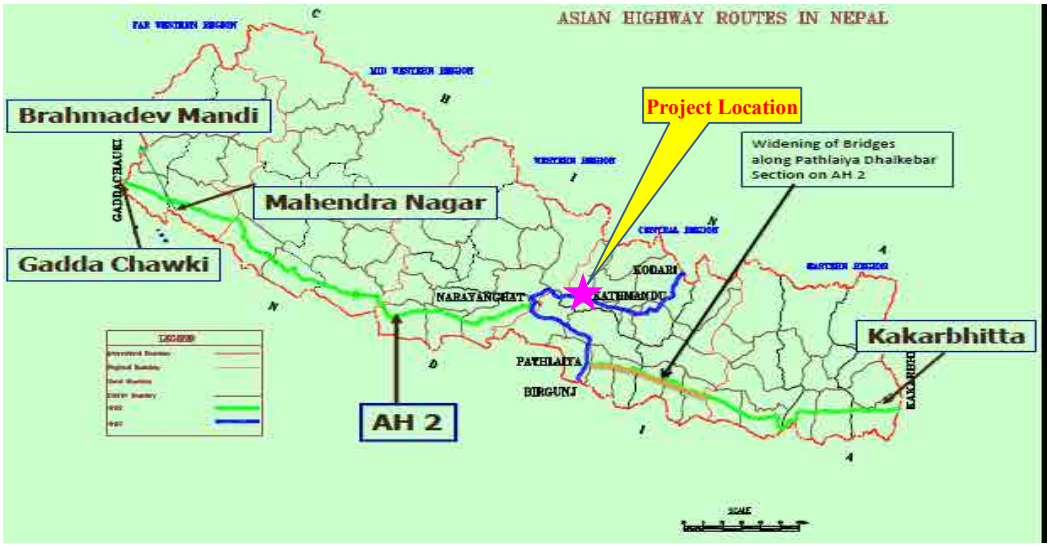
SAARC (South Asian Association for Regional Cooperation) is composed of 8 countries such as India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan, Maldives and Afghanistan. It is to emphasize that SAARC shares the same fundamental values with Japan in democracy, freedom, and the rule of law. Over the years of good relationship between SAARC and Japan, Japan has been always very supportive of SAARC.

The Asian Highway Network brings members of SAARC closer through trade, culture and economy by providing an important connecting road system. As seen **Figure 2.5-2**, **Figure 2.5-3** and **Figure 2.5-4**, by being a member of SAARC, the Asian Highway Netweok is of great significance to Nepal especially since this project at Nagdhunga Pass which is also part of the Mid-Hill Highway is also strategically located in one section of the Asian Highway.

In connection to this, Nepal has highlighted the development of the regional trade in its latest Approach Paper to Thirteenth Plan for promoting regional integration, both domestic and with the neighboring countries. The GON is also working on plans to build a series of highways that will improve north-south connectivity. Nagdhunga Tunnel project is designated as one of such projects that will contribute in strengthening the north and south connectivity.

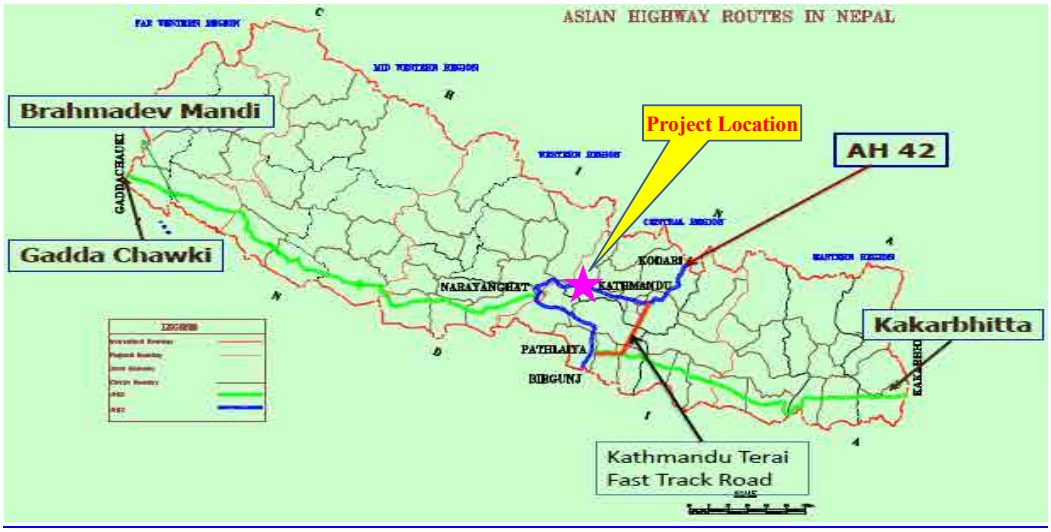
Source: http://horizonspeaks.wordpress.com

FIGURE 2.5-1 ASIAN HIGHWAY NETWORK



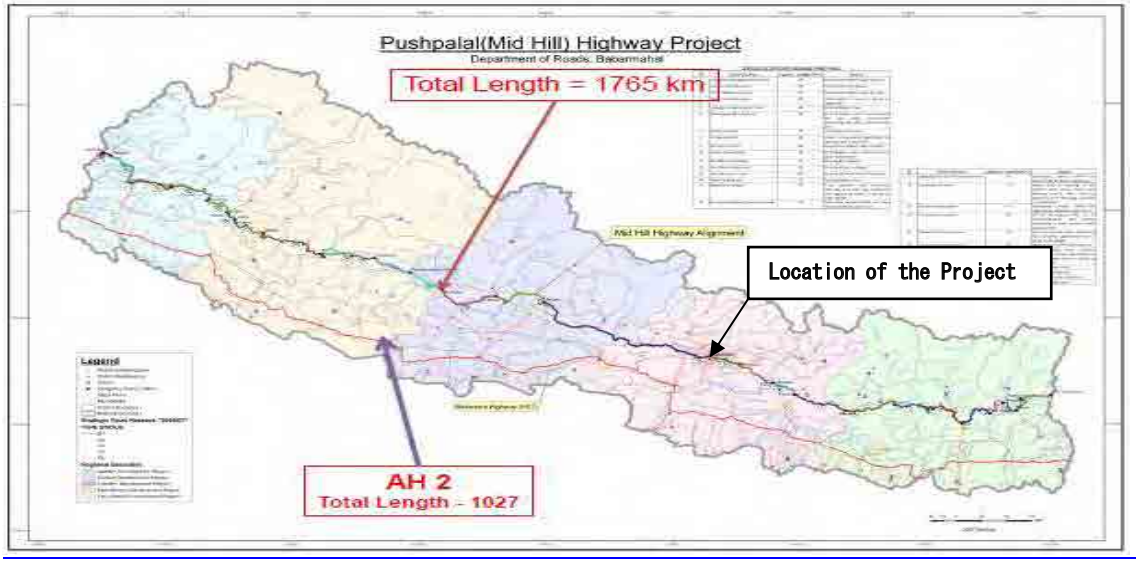
Source: Dinkar Sharma, DOR

FIGURE 2.5-2 ASIAN HIGHWAY NO.2



Source: Dinkar Sharma, DOR

FIGURE 2.5-3 ASIAN HIGHWAY NO.42



Source: Dinkar Sharma, DOR

FIGURE 2.5-4 MID-HILL HIGHWAY AND ASIAN HIGHWAY NO.2

2.5.3 Nagdhunga Tunnel Project to be identified in relation with India

Nepal is located in the same spiritual and cultural sphere with India that is based on the same Hindu religion. There is no visa requirement for travel between the two countries. Both countries share a very deep and close relationship and as can be seen from the **Table 2.5-1**, India is the Nepal's largest trading partner.

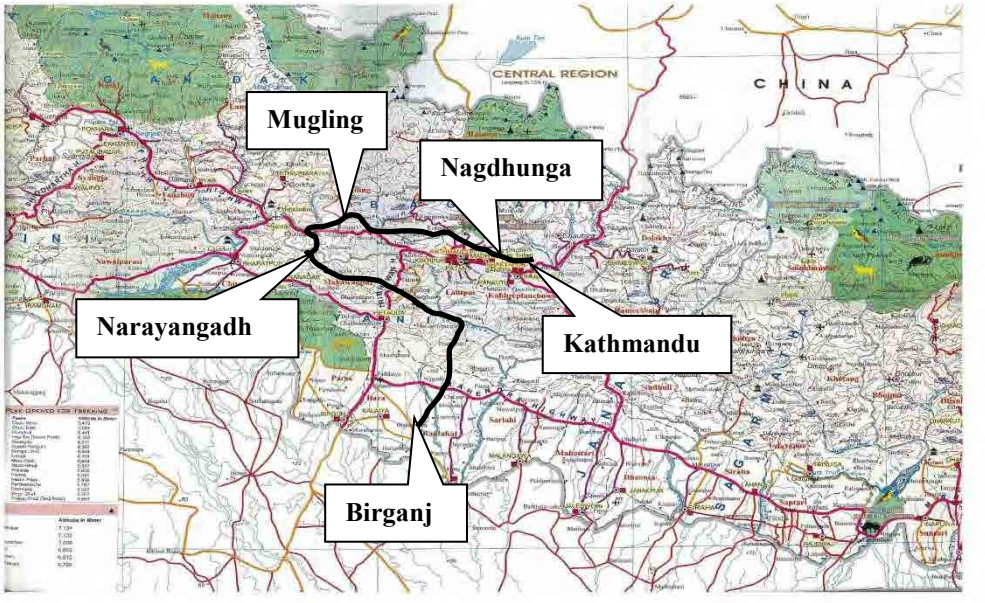
Logistics with India is dependent on the road, which accounts for about 90% of transportation (freight and passenger) in Nepal. Most of the logistics of Kathmandu, as shown in logistics path diagram of **Figure 2.5-5**, Narayangadh, Mugling from Birganj border place great emphasis on the importance on land transportation to Kathmandu beyond the Nagdhunga Pass.

The GON is currently implementing "Nepal- India Regional Trade and Transport Faciliation Project" with an objective to decrease transportation time and logistics cost for bilateral trade between Nepal and India along the Kathmandu-Kolkata corridor by reducing key infrastructure bottlenecks along the corridor. Nagdhunga Pass, which comprise the corridor is one of the most critical bottleneck section and by providing a tunnel here can eliminate the bottleneck.

TABLE 2.5-1 EXPORT AND IMPORT PARTNERS OF NEPAL

Export Partner		Import Partner	
Name of Country	**Share (%)**	**Name of Country**	**Share (%)**
India	68.7	India	64.5
USA	7.5	China	10.6
Bangladesh	3.5	UAE	6.5
Germany	4.0	Thailand	1.6
China	1.3	Indonesia	1.6
England	2.0	Argentina	1.3
France	1.4	Malaysia	1.2
Italy	1.1	Korea	1.1
Canada	1.1	USA	1.0
Japan	1.0	Saudi Arabia	0.9
Other South Asian Countries	1.0	Japan	0.9
Other European Countries	2.9	Ukraine	0.7
Others	4.4	Others	8.1

Source: TEPC: Trade and Export Promotion Center 2011/12



Source: JICA Study Team

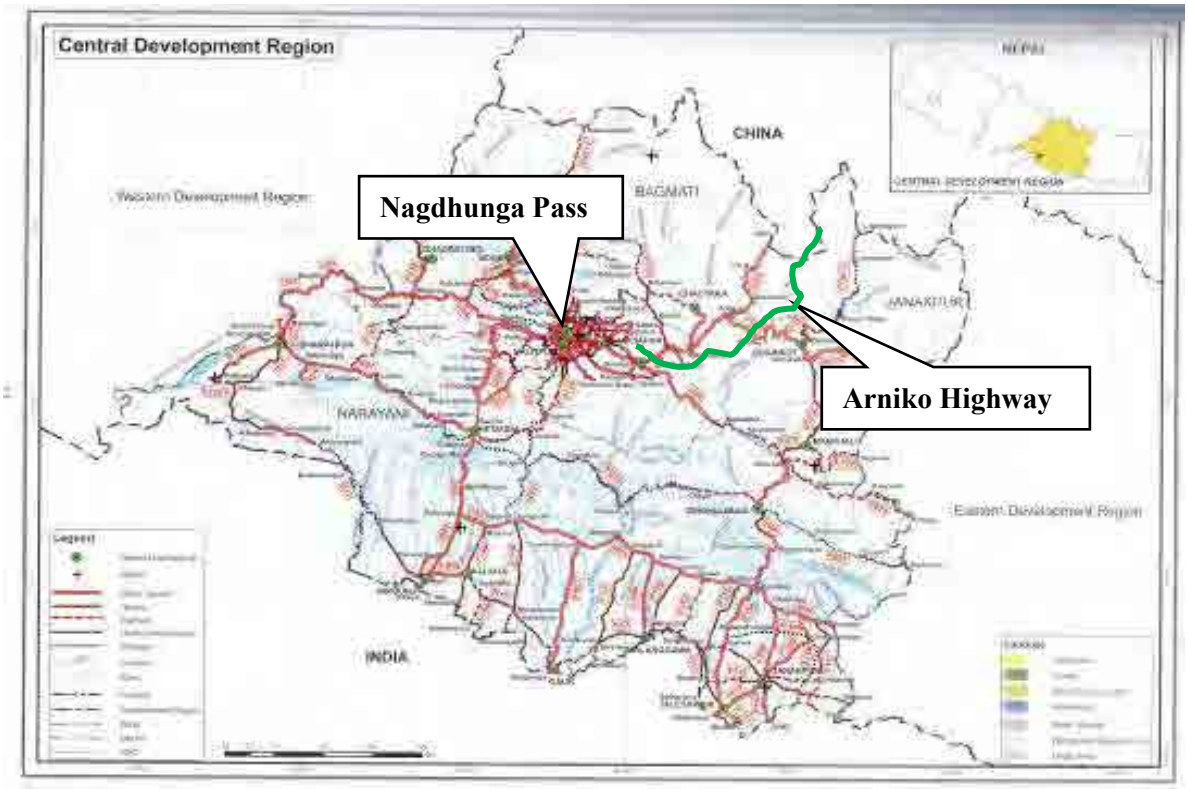
FIGURE 2.5-5 LOGISTICS PATH DIAGRAM WITH INDIA

2.5.4 Nagdhunga Tunnel Project to be identified in relation with China

Nepal shares its border with China in the north and India in the south. China, similar to India is an important trade partner for Nepal. **Table 2.5-1** shows the trade share of Nepal for fiscal year 2010/11. The import and export shares with China were 1.3% and 10.6% respectively. However, recently China is emerging as a major source of import and the figures for this year and following years are believed to see significant rise. On the other hand, Nepal is strategically located between India and China, two of the largest and fastest growing economy. Nepal has a high potential as a transit hub for trade between China and India. However, due to lack of reliable and robust road network, it is only enjoying marginal share of the bilateral trade between the two neighbors.

Currently, the only link with China is through Kodari Bordar, which is served by Arniko Highway. Most of the trade between Nepal and China is carried out through the Arniko

Highway, which is shown in **Figure 2.5-6**. The imported products from China are transported through Arniko Highway to Kathmandu. It is then distributed to different parts of the country and though small, a portion of the imported goods is transported to India through other highways such as Tribhuvan Highway, Prithvi Highway and the East-west Highway. One of the policies set in the Approach Paper is the construction of Mid-hill Highways and improvement of trunk roads to enhance contribution in boosting the social and the economic development of the country as well as strengthen regional integrity. Nagdhunga Tunnel is located on the Tribhuvan Highway.



Source: JICA Study Team

FIGURE 2.5-6 LOGISTICS PATH DIAGRAM WITH CHINA

2.5.5 Nagdhunga Tunnel Project to be identified as a High Priority Project

National Strategy Plan has been prepared as 5 Year National Plan in Nepal. However, after 10th 5 Year National Plan (2002/03 – 2006/07) has been prepared in public, Three Year Interim Plan (2010 - 2011) and Three Year Plan (2010/11 – 2012/13) have been prepared by NPC (National Planning Commission). Thirteenth Plan Approach Paper (2013/14 – 2015/16) is the latest national strategy plan in Nepal at present.

According to Thirteenth Plan Approach Paper, the GON has set a goal to break away from LDC (least developed countries) until 2022. It is positioned as priority 4 sectors such as infrastructure development, agricultural development, human resource development and economic development. In order to achieve the goal, it is necessary to obtain the economic growth rate of 7% per year. At the same time, 4.5% the target growth rate of the agricultural sector and 6.7% growth rate of the non-agriculture sector should be achieved. Additionally, employment growth aims to increase a 3.2% from 2.9% of the current annual rate.

In the plan, emphasis has been given to infrastructure development such as energy, roads and communications are important fields as supporting economic strength. Moreover, agriculture, tourism, industry and human resource development in the agricultural has been urged to improve the capacity of the domestic labor. The above 4 priority sectors will account for 80% to

90% of the development budget over the next three years.

Projects in Nepal are classified into 4 types, in the priority order based on the importance and urgency of the project. They are in priority order; i) Pride Projects, ii) Priority-1 (P-1) Projects, ii) Priority-2 (P-2) Projects, and iv) Priority-3 (P-3) Projects

The GON has approved the Nagdhunga Tunnel Construction Project and has designated it as P-1 Project to be included in the next fiscal year development program.

2.5.6 Nagdhunga Tunnel Project to be identified in Transport Sector Plans

The Thirteenth Plan Approach Paper is the latest and top level plan of Nepal. It describes all kinds of field including roads, railways and airport as a sub-transport sector. In addition, it describes clearly strategies and development goals for the sub-transport sector, with the intention to achieve success during the next 3 years.

As described above, the budget allocation this year was prepared in accordance with the Thirteenth Plan Approach Paper. The budget allocation for this year was specially focused on the infrastructure development. The GON in its 20 year road policy has aimed at constructing the Mid-Hill Highway among others. Under the policy, the GON has started initiating the Mid-Hill Highway project since 2064/65.

The Nagdhunga Tunnel is located on the existing Tribhuvan Highway, which forms a part of the Mid-Hill Highway., which will become one of the backbones of the country. The Tribhuvan Highway also comprises the AH-42 and as such, improvement of Nagdhunga Pass is deemed to contribute in improving the critical section of this important corridor.

CHAPTER 3

TRANSPORT SECTOR OVERVIEW

CHAPTER 3
TRANSPORT SECTOR OVERVIEW

Nepal is a landlocked country with China to the North and India to the South. Because of its mainly mountainous terrain and tough weather conditions, roads and aviation are the major modes of transportation in the country. The presence of railways is negligible, and urban rail transport service is also nothing. The country uses India's eastern port of Kolkata as its gateway to the sea.

3.1 OUTLINE OF TRANSPORT FACILITIES

3.1.1 Road Transport

(1) Road Network in Nepal

The basic road statistics such as the total length and the density of the existing road network including the ratio of pavement and numbers of vehicles registered in each country in the South Asian regions as of 2011(where data for 2011 are not available, the data closest to 2011 have been selected) are tabulated in **Table 3.1-1**. The existing road network in Nepal totals to a length of 19,875 km with a density of 13.8km per 100 square kilometers and ranks second last in the region. In terms of pavement ratio, Nepal having about half the existing roads paved is ranked on top of India, but it is incomparable if it is indicated in terms of length. No. of vehicle registration per km and per 1000 persons are 7.74 and 7.12 respectively ranking 5th and 7th in the list.

Table 3.1-1 ROAD STATISTICS OF SOUTH ASIAN COUNTRIES

Items	Unit	Nepal	India	Pakistan	Bangladesh	Bhutan	Maldives	Sri Lanka	Afghanistan
Road length	1000 km	19.9	4,690.3	262.6	239.2	8.4	0.88	114.1	23.1
Road density	km/100km^2	13.8	143.0	33.0	166.0	21.8	29	173.9	3.5
Pavement Ratio	%	53.9	49.5	65.4	9.5	62.0	100	81.0	29.3
No. of Vehicle registration	Veh./km	7.74	4.63	13.60	1.22	6.15	4.63	8.77	41.58
	Veh./1000 person	7.12	17.55	20.20	3.14	69.64	27.76	48.44	29.29

Source: World Bank

(2) Road Classification and Length with Institutions in Nepal

Road in Nepal is roughly classified into 3 categories; they are SRN (Strategic Road Network) including feeder road, district road (including rural road) and urban roads. SRN including feeder road is belong to DOR (Department of Roads) administration and SRN is developed and improved by DOR as national highway.

On the other hand, district road (including rural road) is developed and improved by DDC (District Development Committee) which is governed under DOLIDAR (Department of Local Infrastructure & Agricultural Roads). In addition, DDC has 75 locations across the country.

Roads within the city are developed and improved by each metropolitan city independently, however, most roads in the city have not been on the roads to withstand vehicle traffic. In addition, throughout the country (Municipality) there are 58 municipalities throughout the country. **Table 3.1-2** shows the extension of the road classification and road administrator.

TABLE 3.1-2 ROAD CLASSIFICATION AND LENGTH WITH INSTITUTIONS IN NEPAL

Road Classification	Strategic Road Network (SRN)* (Highway and Feeder Road)	District Road□□	Urban Road□□	Total (km)
Institutions	DOR	DOLIDAR	Municipality	
Road Length	11,635.58	6,955.46	2,473.17	21,064.21

Source: Mark □ :SSRN 20011/12: Statistics of Strategic Road Network, DOR
Source: Mark □□ :SSRN 2009/10: Statistics of Strategic Road Network, DOR

(3) Strategic Road Network (SRN)

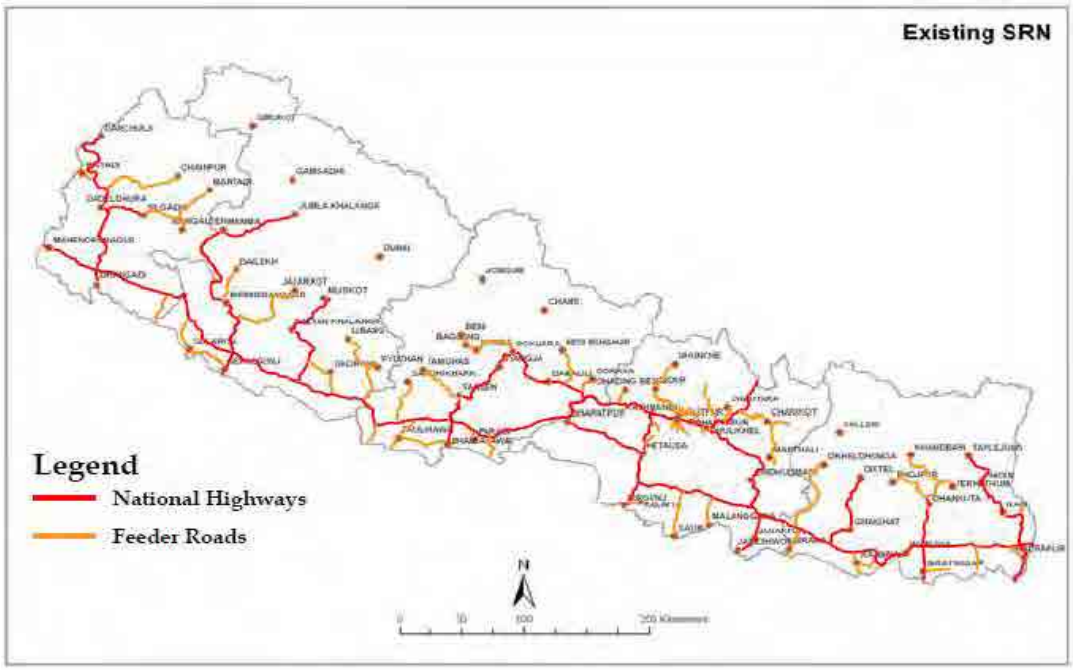
Nepal's total road network and density are low and only 43 percent of the population has access to all-weather roads. More than 60 percent of the network is concentrated in the lowland (Terai) areas of the country. In 2011/12, the strategic road network (SRN) consisted of 11,635 km long of which 5,573m (48%) is built with blacktop surface. The road network expanded by 5%, on an average a year, over the last 3 years with focusing on connecting district headquarters with the national network and improving access between rural areas and market centers.

Table 3.1-3 shows the length of strategic road network (SRN) and **Figure 3.1-1** shows the map of strategic road network in Nepal.

TABLE 3.1-3 LENGTH OF STRATEGIC ROAD NETWORK (SRN)

Year	Road Length (km)			Total (km)	Influenced population (No. per km)	Density (km/100sq.km)
	Blacktop	Graveled Road	Earthen Road			
2011/12	5,573.55	1,888.49	4,173.55	11,635.58	2,287.88	7.91

Source: SSRN 20011/12: Statistics of Strategic Road Network, DOR



Source: SSRN 20011/12, DOR

FIGURE 3.1-1 MAP OF STRATEGIC ROAD NETWORK IN NEPAL

(4) District Road

Based on the 'Local Self Governance Act 1999', district roads including rural and farm roads were developed, improved and maintained by District Development Committee (DDC). However, there is no any road engineer in DDC that Department of Local Infrastructure and Agricultural Roads (DOLIDAR) sends engineers and technical officers to guide DDC to conduct road improvement and maintenance.

Almost of suspension bridges connecting villages in rural roads were built and maintained by DOLIDAR and DDC.

(5) Urban Road

There are 58 municipalities throughout the country. Although main roads and trunk roads in Nepal are belong to DOR, roads located in urban areas are not DOR but belong to municipalities. Therefore, municipalities have to improve and maintain their roads by own budget. However, if there are no any engineers in some municipalities, their roads would be improved and maintained by DOR engineers.

3.1.2 Rail Transport

The country has the total physical railway line of the 57 km. Nepal Railways Corporation Ltd (NRC), a government agency owns the 53-kilometer narrow-gauge rail line, which is composed of two sections (1) 32-kilometer section between Jaynagar in India to Janakpur in Nepal, and (2) a 21-kilometer portion from Janakpur to Bijalpura. Janakpur to Bijalpura network is not operational at present. The Indian Railways manages the 6-kilometer railway line (of which 4-kilometers fall in Nepal) that connects Inland Clearance Deport (ICD) in Birgunj to Raxaul in India.

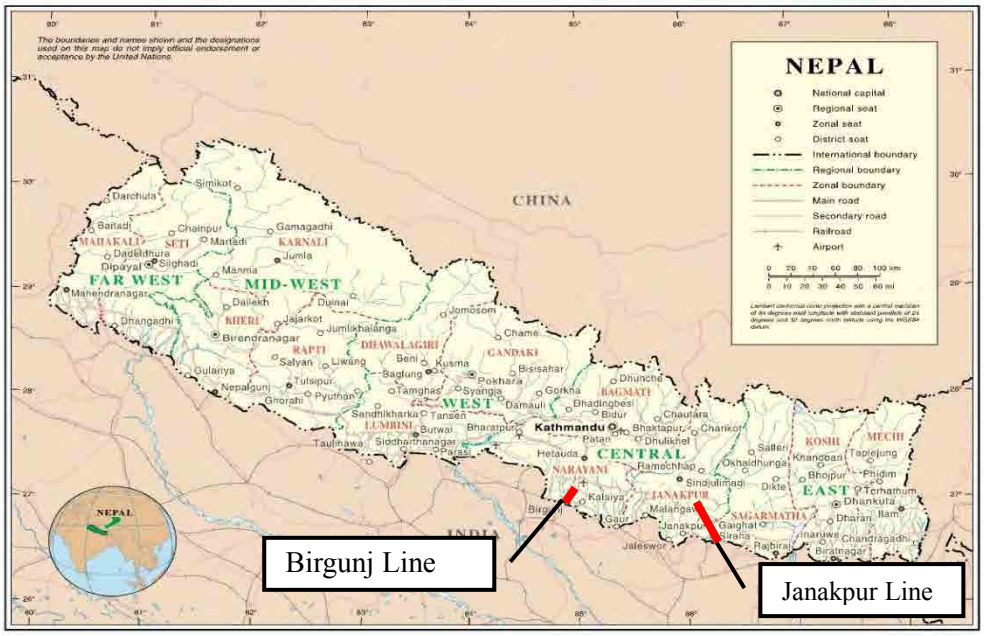
TABLE 3.1-4 RAILWAY LINE IN NEPAL

Items	Janakpur Line	Birgunj Line
Length	(1) Jaynagar (India) - Janakpur 32 km (2) Janakpur – Bizalpura 21 km (Out of Service)	6 km (of which 4 km fall in Nepal (Out of Service)
Gauge	762 mm	1676 mm
Single/double	Single line	Single line
Traction Power	Diesel locomotive	Diesel locomotive
Operation	Nepal Railways Corporation Ltd	Nepal Railways Corporation Ltd

Source: Prepared by JICA Survey Team

As shown the above **Table 3.1-4**, railway of Nepal has been laid near the Indian border two lines, however, narrow gauge line (Janakpur Line) has only been operated with only 29km in Nepal. Moreover, train operation is only 2 times a day for the Janakpur Line.

Figure 3.1-2 shows the location of rail transport and **Figure 3.1-3** shows the location and name of stations along Janakpur Line.



Source: JICA Survey Team

FIGURE 3.1-2 LOCATION OF RAILWAYS IN NEPAL

Source: http://www.aa-net.ne.jp/y-asahi/

FIGURE 3.1-3 STATIONS OF JANAKPUR RAILWAY

3.1.3 Aviation

With 46 domestic and one international airport, civil aviation plays a vital role in linking the hilly and mountainous parts of the country at present. Most of them are green field without modern navigation systems. Domestic Airports are crucial to the growth of trade and tourism in the country as villages in hills and mountains are inaccessible by roads.

Among 46 domestic airports, 4 airports are designated as regional airports for the remote economic activities in eastern, central and western regions. These regional airports are utilized for arrival and departure from neighbor countries as India and China. They are Biratnagar, Pokhara, Bhairahawa and Nepalganj airports as shown **Figure 3.1-4**.

There is only one airport, Tribhuvan International Airport (TIA) has runways over 3,000m and an Airport Surveillance Radar (ASR) instrument in Nepal. Other than TIA, all the airports of Nepal have no ASR that planes have to be operated by a Visual Flight Rules (VFR) system. Moreover, there are only 14 airports are provided with paved runway and the other 33 airports has no paved runway. **Table 3.1-5** shows aviation safety facilities in Nepal.

TIA, which was designed to handle maximum 30 aircraft per hour through a single runway and approach system, is now handling double the number. TIA handed 4.28 million passengers in 2011 while international airlines served 2.70 million and domestic airlines served 1.58 million. On an average, TIA handles 63 international and 217 domestic flights daily in 2012.

TABLE 3.1-5 AVIATION SAFETY FACILITIES PROVIDED BY AIRPORT IN NEPAL

No. of airports in Nepal	47
No. of airports provided with NDB (Non Directional radio Beacon)	15
— 〃 — V/D (Very High Frequency Omnidirectional Radio Range)	7
— 〃 — C/L (Compass Locater)	1
— 〃 — Rader	1
— 〃 — HF (High Frequency)	38
— 〃 — VHF (Very High Frequency)	38
— 〃 — ILS (Instrument Landing System)	0
— 〃 — Paved Runway	14
— 〃 — Unpaved Runway	33

Source: JICA Survey Team

Source: Worldtravels.com

FIGURE 3.1-4 INTERNATIONAL AND REGIONAL AIRPORTS IN NEPAL

3.2 AGENCIES RELATED TO TRANSPORT SECTOR

Names of some organizations of transport sector were changed and some agencies were transferred to other ministry in May 2013. New organizations that have important roles in transport sector is as shown in **Figure 3.2-1.**

The Department of Roads (DOR), Department of Transportation and Management (DOTM) and Department of railways (DORW) are supervised under the Ministry of Physical Infrastructure and

Transport (MOPIT). DOR and the Department of Local Infrastructure & Agricultural Roads (DOLIDAR) share the management responsibilities for the road sector in Nepal.

The DOLIDAR coordinates and executes its programmes through the local government bodies such as the District Technical Office (DTC) and District Development Committees (DDC) and municipalities.

Civil Aviation Agency of Nepal (CAAN) is the implementing agency of airport and aviation safety in Nepal. CAAN and other cultural and tourism agencies are supervised under the Ministry of Culture, Tourism and Civil Aviation (MCTCA).

The detailed responsibilities of the various organisations involved in the road sector are described below.

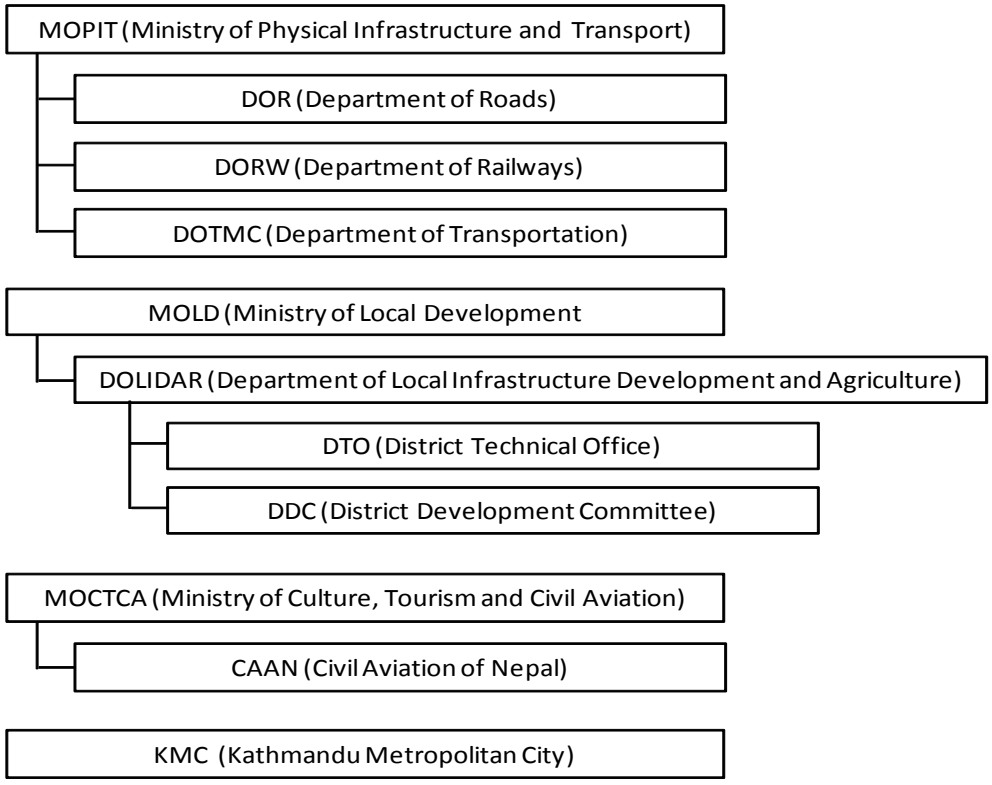


FIGURE 3.2-1 ORGANIZATIONS RELATED TO TRANSPORT SECTOR IN NEPAL

3.2.1 Road Transport

MOPIT and DOR's detailed information are described in Section 3.3 and Section 3.4. This section describes the following agencies;

- DOTM
- DOLIDAR

(1) Department of Transportation Management (DOTM)

DOTM is the responsible agency for managing the surface transport services in Nepal as mandated by the concerned act in Nepal i.e. VTMA (Vehicle & Transport Management Act) 1993. It is presently confined in administrating the vehicle route-permits, driver's

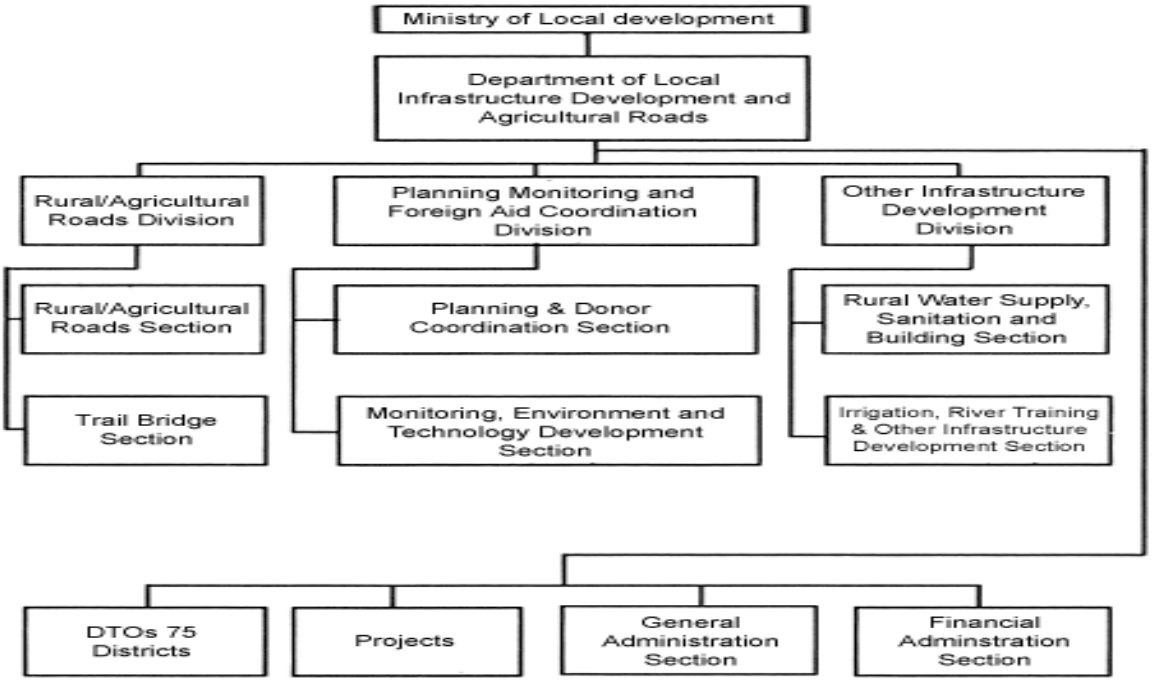
licenses, vehicle emissions and vehicle road-worthiness aspects only. DOTM has therefore delegated its responsibilities for traffic planning and enforcement to the DOR and the Nepal Traffic Police to date as permitted by the VTMA 1993. Number of staff in DOTM is 783.

(2) Department of Local Infrastructure & Agricultural Roads (DOLIDAR)

DOLIDAR is supervised under the Ministry of Local Development (MOLD). DOLIDAR is responsible for the construction, development, improvement and maintenance of the local road networks (LRN) in Nepal. LRN consisted of 6,955km in the country is called as district roads.

DOLIDAR plans local infrastructures through decentralized approach at the local bodies such as the District Development Committees (DDCs) and Village Development Committees (VDCs). The DOLIDAR has been providing technical assistance to the DDCs for some time and will gradually phase out such assistance in the form of District Technical Unit once a fully trained Technical Unit is established within the respective DDC. This department also provides technical assistance to the VDCs as required. Number of staff in DOLIDAR is 1,209.

Figure 3.2-2 shows the organization chart of DOLIDAR.



Source: DOLIDAR

FIGURE 3.2-2 ORGANIZATION CHART OF DOLIDAR

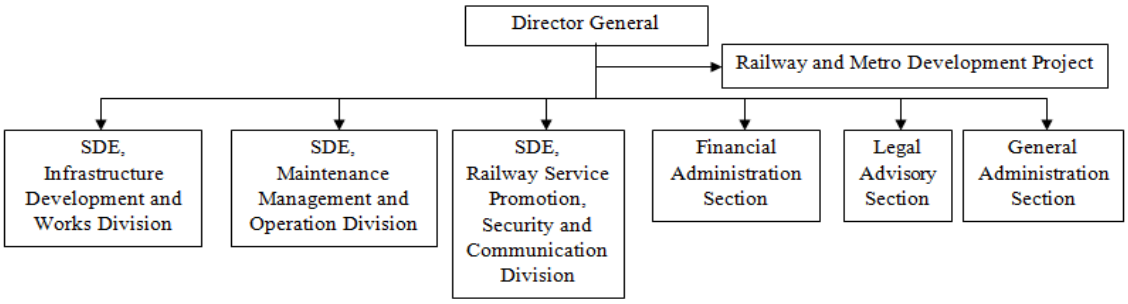
3.2.2 Rail Transport

(1) Department of Railways (DORW)

Department of Railways (DORW) was established in Mar. 2068 as a continuation of Railway construction Project established in FY 065/66 under Construction Division of Ministry of Physical Infrastructure Transport (MOPIT) to enhance and develop rail transportation within country.

(2) Organization of DORW

DORW is presently headed by Director General with three technical divisions headed by Senior Divisional Engineer (SDE); and three Administrative, Financial and Legal divisions. The organizational chart of the Department is shown in the **Figure 3.2-3**. Number of staff in DORW is 29.



Source: DOLIDAR

FIGURE 3.2-3 ORGANIZATION OF DEPARTMENT OF RAILWAYS

(3) Railway Development Programs

i) Border Connections

These projects are under Phase I of the project and estimated to be more than Rs. 11 billion. Both countries have agreed to establish of cross-border railway links at 5 locations on the border.

(1) Jogbani – Biratnagar

(2) Jayanagar – Bardibas

(3) Nautanwa (India) – Bhairahawa (Nepal)

(4) Rupaidiha (India) – Napalgunj (Nepal)

(5) New Jalpaiguri (India)- Kakarbhitta (Nepal).

Railway connections from India, at six different border towns Kakarbhitta, Biratnagar, Janakpur, Birgunj, Bhairahawa and Nepalgunj in Nepal (totaling 184 km) are planned to be constructed. Currently two connection, viz Jaynagar (India)-Janakpur (Nepal)-Bardibas and Jogbani (India)-Biratnagar (Nepal) are under construction.

ii) East-West Railway Network

Construction of an electric railway connecting Mechi to Mahakali (East to West). It is also the part of Trans-Asian Railway Network that falls in Nepal. This is identified and agreed portion of the Trans-Asian Railway network under Nepal's territory needs to be built in order to honor the commitments made with the international communities. The route starts at Kakarbhitta in the east and ends at Gaddachowki in the west. Feasibility study for this section has already been completed. Detailed survey and design of this railway network is being currently undertaken by DoRw. As of now, Detailed Project Report (DPR) of Bardibas-Simara-Birgunj section (136 km) has been completed. DPR of other sections will be commenced soon.

iii) Internal Railway Network

- Kathmandu Mass Rapid Transit

Feasibility study of Mass Rapid Transit (MRT) System in Kathmandu valley has recently been completed.

- Terai – Kathmandu Railway Line

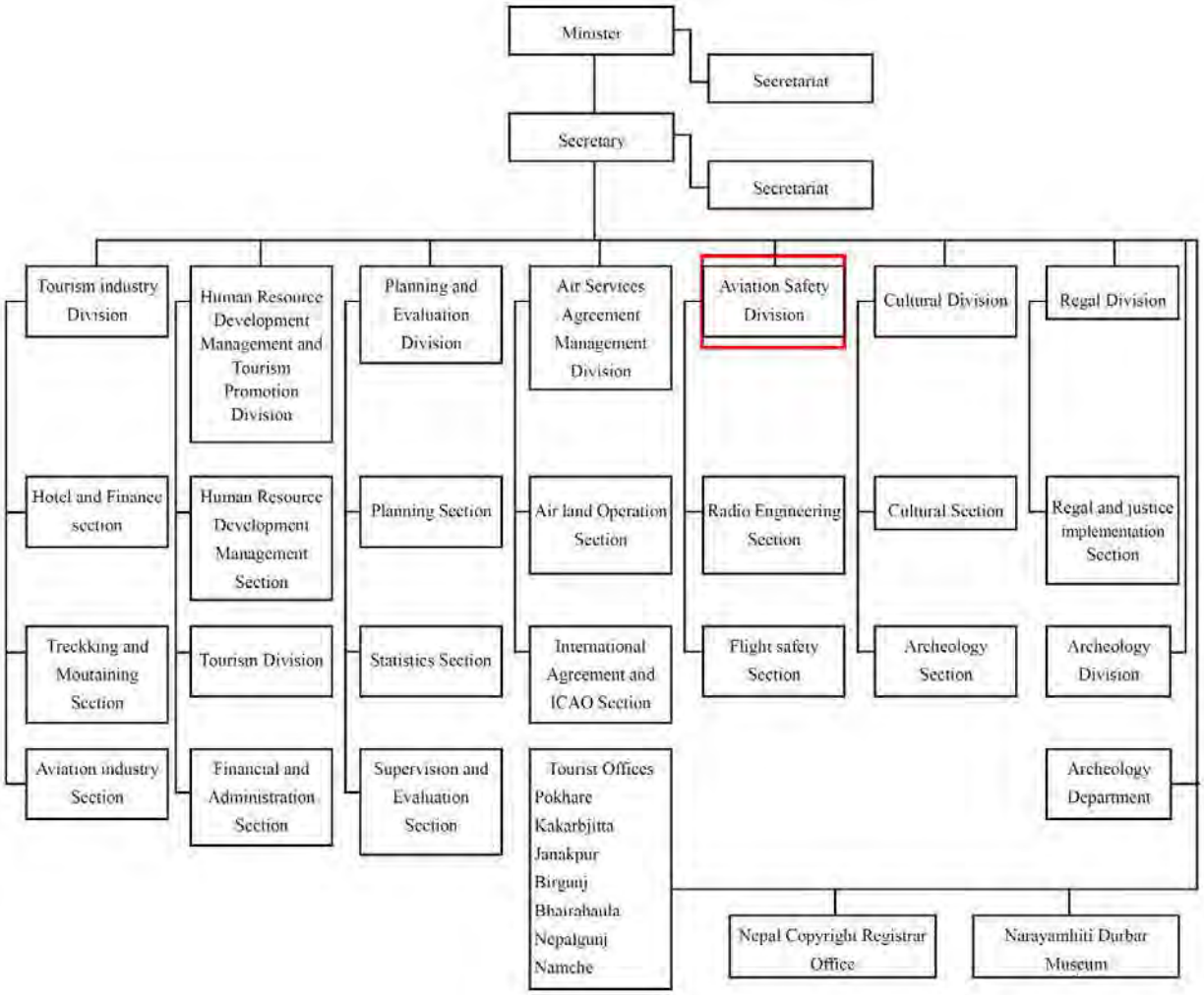
Feasibility study of Tamsariya to Abukhaireni and Kathmandu to Pokhara railway system has been completed.

3.2.3 Aviation

(1) Ministry of Culture, Tourism and Civil Aviation (MCTCA)

Administration of aviation in Nepal is conducted by Civil Aviation Authority of Nepal (CAAN) and CAAN is supervised under the Ministry of Culture, Tourism and Civil Aviation (MCTCA). MCTCA is composed of 7 divisions suca as (1) Tourism Industry Division, (2) Human Resources Management & Tourism Promotion Division, (3) Planning and Evaluation Division, (4) Air Services Agreement Management Division, (5) Aviation Safety Division, (6) Culture Division and (7) Regal Division. Among 7 divisions, CAAN is belonged to Aviation Safety Division.

The organizational chart of the MCTCA is shown in the **Figure 3.2-4**.



Note: ▭ shows the implementing agency of aviation

Source: Home page of MCTCA

FIGURE 3.2-4 ORGANIZATION OF MCTCA

(2) Civil Aviation Authority of Nepal (CAAN)

1) Roles and Function of CAAN

CAAN was established under the umbrella of MCTCA on Dec. 31, 1998. Roles and functions of CAAN are as follows:

- Approval of administration of civil aviation
- Certification of airplane resistance and crew members
- Restriction of civil aviation and airplane movement
- Construction, operation and maintenance of airport
- Installation and maintenance of telecommunication and aviation safety at airport

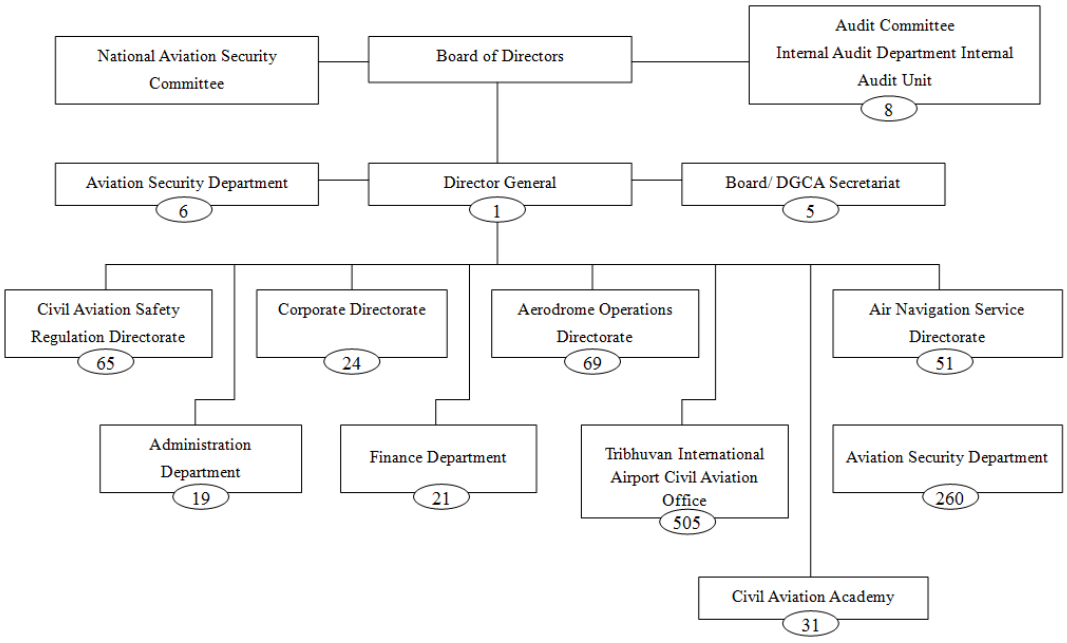
2) Strategies of CAAN

CAAN prepared 'Implementation Plan of CAAN (2069/2070)' in 2013 which shows the civil aviation strategies as follows:

- Aviation safety and implementation of infrastructure development and extension of program
- Implementation of proposals prepared by International Civil Aviation Organization (ICAO) and Universal Safety Oversight Audit Program (USOAP)
- Operation and maintenance by cooperation partnership between public and private
- Mitigation of congestion at TIA (Tribhuvan International Airport) by using the existing resources in CAAN
- Minimization of operation cost
- Improvement of organization management by application of IT infrastructure investment and modernization
- Enhancement of quality and quantity of aviation services by service agencies

3) Organization of CAAN

Number of CAAN staff is 1,065 in 2013 and 242 staff is allocated at headquarters**. Figure 3.2-5** shows organization of CAAN.



Note: ⬭ shows a number of staff.

Source: Report 2013 CAAN

FIGURE 3.2-5 ORGANIZATION OF CAAN

(3) Tribhuvan International Airport (TIA)

There are 46 domestic airports in Nepal and TIA is the only international airport in Nepal. Number of TIA staff is 505 in 2013. Number of takeoff and landing at TIA were 94,197 in 2012. Number of passengers utilized at TIA were 4.5 million peoples in 2012. Weight of freight at TIA was 17,389 tons in 2012. **Table 3.2-1** shows the number of takeoff and landing at TIA from 2007 to 2012.

TABLE 3.2-1 NUMBER OF TAKEOFF AND LANDING AT TIA

	2007	2008	2009	2010	2011	2012
International	11,899	14,276	15,701	19,417	22,792	23,320
Domestic	65,443	69,286	76,191	79,900	79,260	70,877
Total	77,342	83,562	91,892	99,317	102,052	94,033

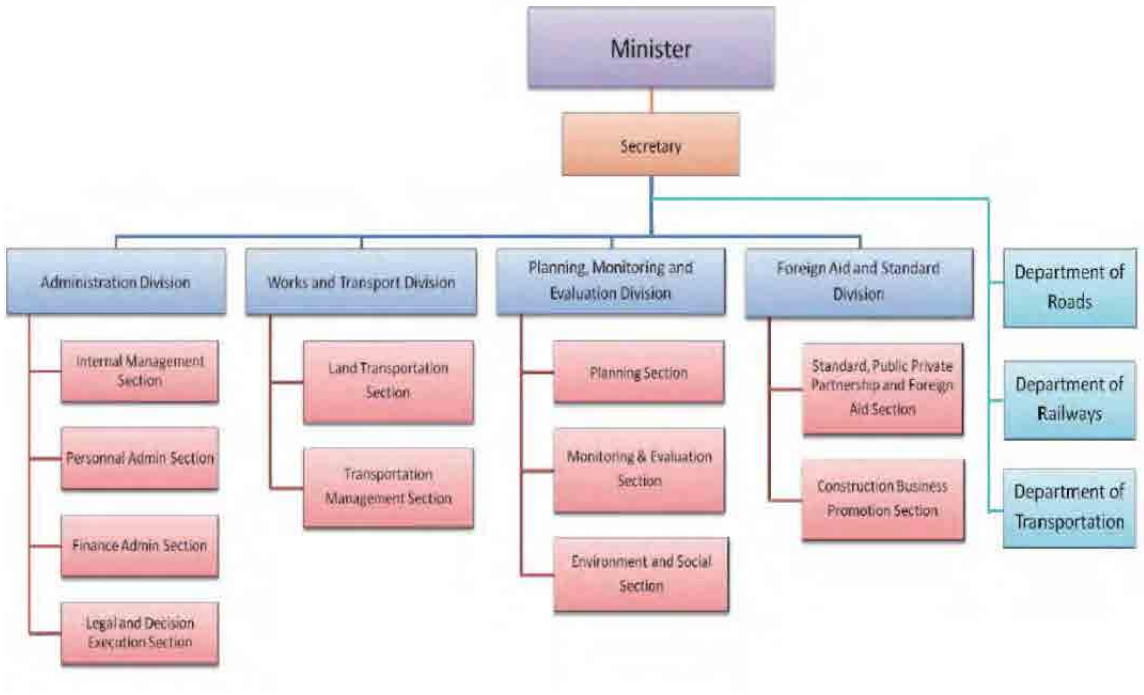
Source: Report 2013 CAAN

3.3 MINISTRY OF PHYSICAL INFRASTRUCTURE AND TRANSPORT (MOPIT)

(1) Organization Chart of MOPIT

Figure 3.3-1 shows the organization chart of MOPIT. Number of staff in MOPIT is 106 including 75 officers and engineers as follows:

Administration Division	25
Works and Transport Division	10
Planning, Monitoring and Evaluation Division	25
Foreign Aid and Standard Division	15
Total	75



Source: MOPIT

FIGURE 3.3-1 ORGANIZATION OF MOPIT

(2) Roles and Functions of MOPIT

The Ministry of Physical Infrastructure and Transport (MOPIT) is established in 2000 and reorganized in 2012 and 2013 during the course of the reorganization Government of Nepal. The main aim of reorganization was to bring important infrastructural development under the umbrella of a single Ministry and to harmonize the policies and bring efficiencies and effectiveness in the provision of infrastructural services.

The roles of MOPIT is to enhance economic activities by linking the villages in the rural areas of the country with the markets by proper development of national transport system, while linking various geographical regions and economic zones with infrastructures of economic development and surface transport, waterways, railways and ropeways and to contribute to various activities and projects related with a number of economic sectors including tourism, agriculture and electricity to be carried out in the country, with a view to support economic and social development of the country.

The functions of MOPIT are as follows:

- To formulate and enforce policies, plans and programs on construction and development of surface, water, railway and ropeway transportation.
- To carry out acts on construction, operation and maintenance of roads (excluding mule tracks) and bridges (excluding suspension bridges).
- To carry out construction works of various surface roads, waterways and ropeways and act as an organization and institution dealing with engineering consultancy.
- To carry out acts pertaining to contact and co-operation with international or regional organizations in the field of housing and physical planning.
- To carry out acts pertaining to contact with international organizations related with construction of highways, waterways and ropeways.

(3) Development Policies and Strategies of Transport Sector

MOPIT is to enhance the country's economical and social development by connecting different geological and economic sectors through the national strategic transport network by developing infrastructures such as roads, railways, waterways and ropeways. The main aim of MOPIT is to link rural sector to the local markets and to support different economic activities and projects functioning in the tourism, agricultural, electrical, industrial, and other sectors of Nepal.

Development policies of transport sector as an executing Ministry are described in 'Vision Paper 2007 (subtitle: New Physical Infrastructure of the New Nepal)' in the followings:

a) State structure, which is Kathmandu centered, will be converted into decentralized model of federal state.

b) Considering the land locked situation of Nepal, additional transit points at Indian and Chinese borders will be opened.

c) Special emphasis will be given for maintaining judicious balance between Himalayan, mountain and Terai region and building a self-reliant physical infrastructure at regional level.

d) Urban development will be guided through industrialization and physical infrastructure will be developed by utilizing the national human capital and expertise.

e) Government role will be made people friendly by promoting public private partnership and mobilizing the national capital to full extent.

f) Physical infrastructure will be developed in an equity basis by ensuring benefits to oppressed class, community, religious and ethnic groups, gender and regions so that national interest,

which will be in line with nationality, democratic republic and federal state structure, is ultimately safeguarded.

g) Policy of planned development will be adopted by identifying provincial capitals and physical infrastructure will be built on the basis of its relevance to federal state structure.

Strategies of transport sector as an executing Ministry are described in 'Vision Paper 2007 (subtitle: New Physical Infrastructure of the New Nepal)' in the followings:

- Constructing the Mid-hill East West Highway in addition to the existing East- West Highway in Terai will reduce the remoteness and inaccessibility of most of the regions of the country.
- Nepal will be developed as a transit route between India and China by opening additional boarder points and constructing a network of North- South roads.
- Under SAARC Multi-modal transport system, priority will be given to four roads and two railway lines. Similarly, upgrading of East- West Highway and Terai- Kathmandu- Kodari Highway which is a part of the Asian Highway will be given due priority.
- Road network will be developed in such a way that the nearest road head will be reached within four hours in the hilly region and two hours in the Terai region.
- Alternative transport routes such as electric railway lines, ropeways and waterways will be developed and linked to the roads network.
- Considering the landlocked situation of Nepal and extrovert model of development, a balanced approach will be adopted in maintaining relationship with India and China through an introvert model of development.
- Fast track will be constructed to connect Kathmandu with Terai.

(4) Annual Budget of MOPIT in the last 5 years

Table 3.3-1 shows the annual budget of MOPIT in the last 5 years. Total national budget in 2013/14 was Rs. 404 billion so that MOPIT budget was 8.7 % of total national budget.

TABLE 3.3-1 ANNUAL BUDGET OF MOPIT IN THE LAST 5 YEARS

(Unit: NRP1,000)

Fiscal Year	Current	Capital	Total
9/10	1,297,272	20,706,998	22,004,270
10/11	2,130,888	35,065,367	37,196,255
11/12	3,829,838	28,077,178	31,907,066
12/13	3,258,061	27,341,548	30,599,609
13/14	5,278,332	29,998,464	35,276,796

(5) List of Major Project of MOPIT

- National Pride Project under MOPIT
  - i) Mid-Hill Highway
  - ii) Postal Highway

iii) North South Koshi Highway

iv) North South Karnali Highway

v) North South Gardaki Highway

vi) Kathmandu Terai Fast Track

vii) East West Electrified Railway Project

- Other Projects under MOPIT

i) Kantilok Path Road Project

ii) Dharan Chatara Gaight Hetauda Road Project

iii) Road Improvement Project

iv) Dhulikhel Sindhli Bardibas Road Project

v) Kathmandu Valley Road Improvement Project

vi) Road Network Development Project

vii) Road Maintenance and Development Project

viii) Road Connectivity Sector Project

ix) Emergency Flood Rehabilitation Project

x) SASEC Road Connectivity Project

(6) Present Condition of Fast Track Project

- **Outline of the project**

Fast Track Project is officially called as Pathlaiya–Nijgadh–Kathmandu Road Project. The Government proposed a first expressway to a four lane standard of 76 km along Nijgadh - Kathmandu Section on a PPP modality. The Concessionaire responsible for getting the Contract also was to build an additional two lane road about 18 km from Pathlaiya to Nijgadh. This route is also likely to serve as a transit route between the two neighboring countries China and India.

- **Proposed Financing Modality**

Estimated cost -Nijgadh to Kathmandu: US$ 818.66 million
Pathlaiya to Nijgadh: US$ 24.86 million

- **Type of Project Proposal**

PPP basis on Built -Operate –Transfer (BOT) modality.

- **Project Technical Specification**

Four lane road of length 76 km from Nijgadh to Kathmandu. There are seven major bridges with overall lengths over 250m, main span lengths of up to 136m, and heights ranging from 50 to 100m. Tunnel of length is 1.35 km. To meet Asian Highway Standard, additional two lane of standard same as AH 2 along Pathlaiya Nijgadh section.

- **Economic and Financial Analyses**

Based on the preliminary costs the Economic Rate of Return (EIRR) of the four lane option is 30.92 percent. The financing plan for the project is not yet decided but, assuming that the project would be fully funded by an international loan (approximating a BOT operation), then

the Financial Rate of Return (FIRR), using the suggested tolls is 14.6 percent pre-tax, about 13.6 percent after normal business taxes, and 12.9 percent if income tax is levied.

- **Expected Timeframe for Implementation**

Concession period of 30 years including construction period of 5 years proposed.

- **Present Status of the Project**

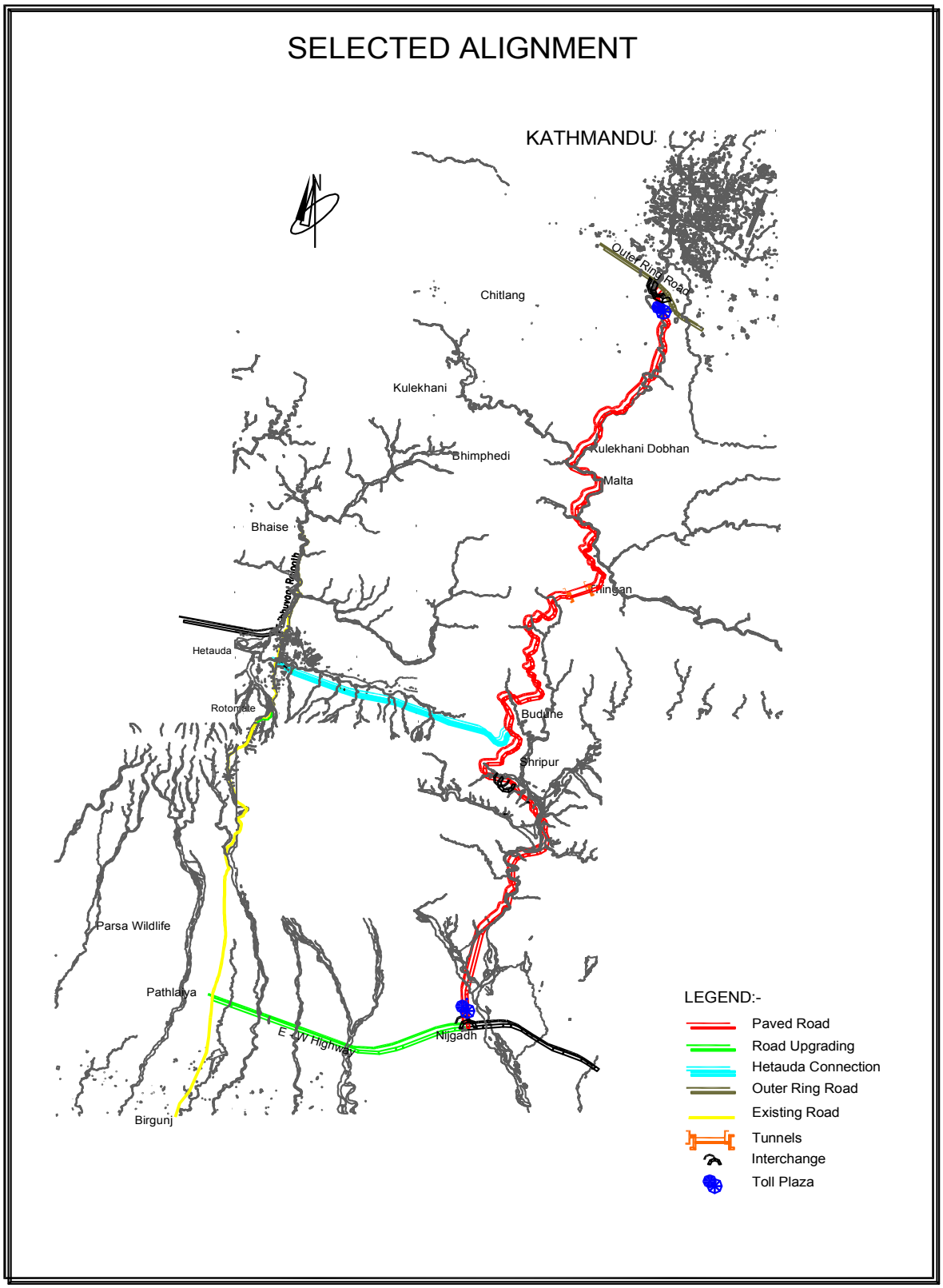
This section of road if implemented will act an as alternate to AH 42 and shorten the road length from 240 km to 120 km. It is likely to act as a backbone for development activities as it will drastically shorten the distance from Birganj (India Border) to Kodari (China Border). RFP had been solicited two times till Oct. 2013, but there was no response from any Companies, although during short listing a number of Companies showed interest and were short listed. The Government is now looking for support from the Donor for implementation of this project.

World Bank is also looking for co-finance international banks for this project implementation in June 2014. According to the new budget (2014/15) on July 2014, the government has set aside 250 million NPR for completing all pre-construction phase works on the Fast Track.

Figure 3.3-2 shows the alignment of Fast Track Project.

(7) National Priority Projects

The Government of Nepal has undertaken 17 projects deemed "projects of national pride" to prioritize development of infrastructures. The construction involved in some of these projects has not move smoothly due to budget delays and land acquisition problems. There is doubt whether or not these projects will be completed in a timely manner. Some progress has been made on Bhairahawa Regional Airport, Melamchi Drinking Water Project, and Upper Tamakoshi Project. **Table 3.3-2** shows the national pride projects.



Source: North –South Fast Track Project, May 2008, ADB

FIGURE 3.3-2 ALIGNMENT OF FAST TRACK PROJECT

TABLE 3.3-2 NATIONAL PRIDE PROJECTS

	National Pride Projects of Nepal	Region	Description	Detail
1	Kathmandu Terai Fast Track	Kathmandu-Nijgadh- Pathlaiya	Four lane highway connecting Kathmandy to Terai (Nijgadh)	83 km
2	East West Electric Railway	Mechinagar - Bhim Datta (Terai region)	The railway line connects Kakarvhitta (Mechi) in the east to Gaddachowki (Mahakali) in the west passing through major ecomonic centres viz. Itahari, Bardibas, Chandaranigapur, Simara, Butwal, Lamahi, Kohalpur, Attariya and Mahendranagar.	945 km
3	Mid Hill Highway (Pushpa Lal Lokmarga)	Chiyobhanjyang - Jhulaghat	It passes through the mid hill region of Nepal	1,776 km
4	Postal Highway	Mechi- Mahakali	run across the Terai in parallel to the East-West Highway	1,444 km
5	North South Koshi Highway	Biratnagar - Shankuwasabha	It connects all 4 districts of Koshi Zone	-
6	North South Gandaki Highway	Gaidakot- Malunga-Mirmi, Beni, Jomsom, Korala	Kaligandaki Corridor Road Project	-
7	North South Karnali Highway	Nepalgunj - Humla	Connects major districts in Mid-Western Region	-
8	Melamchi Drinking Water Project	Kathmandu Valley	The Melamchi project was started in 2000 with an aim to supply 170 million liter of water to the Valley by 2007.	27.5 km Tunnel
9	Gautam Buddha Regional International Airport	Bhairahawa, Rupandehi	the project now is estimated to end by 2016.	-
10	Pokhara Regional International Airport	Pokhara, Kaski	Project on hold due to budget	Runway: 2500 x 50 m
11	Upper Tamakoshi Hydropower Project	Lamabagar, Dolakha	he hydropower company that has aimed to start power generation by mid-March 2016	450 MW
12	Sikta Irrigation Project	Banke District	The Project area comprises 34 Village Development Committees (VDCs) and the municipality of Nepalgunj left of West Rapti	-
13	Rani Jamara Irrigation Project	Kailali	It will serve the left Part of Karnali River	-
14	West Seti Hydropower Project	Doti	The power station would be located approximately 63 kilometres (39 mi) upstream of the Seti River confluence with the Karnali River	750 MW
15	Budi Gandaki Hydropower Project	Gorkha and Dhading	The prefeasibility study of the Project has recommended 600 MW capacity plant with FSL 520 masl.	600 MW
16	Second International Airport	Nijgadh, Bara	15 stands for International carriers, 4 stands for domestic carriers, and 2 stands for cargo flights	Area: 3000 hectares
17	Babai Irrigation Project	Surkhet and Bardiya	The project aiming to provide irrigation and hydro power generation simultaneously is aimed at completing in the next five years.	12 km Tunnel

Source: Gelal Research Group

3.4 DEPARTMENT OF ROADS

The Department of Roads (DOR) is the responsible organization for the overall management, from the design to operation and maintenance of the strategic road networks (SRN) in Nepal. Strategic roads consist of National Highways and Feeder roads, which totals to 12,493.94km in length, as of year 2013/14. These roads accommodate high volume of vehicles and as such play the most important role in the movement of people and goods. The Nagdhunga Tunnel is a part of the existing Tribhuvan Highway. Therefore, all works from the design stage till the operation and maintenance stage of the highway tunnel will be under the responsibility of DOR.

3.4.1 Vision, Overall Goal and Mission

Vision	Managing Roads for National Integration and Socio-Economic Development
Overall Goal	To contribute in achieving sustainable socio-economic development by providing safe, affordable public road infrastructure services through building of a cost-effective, efficient and reliable network system
Mission	To Contribute Towards the Betterment of Living Conditions of the People through Effective, Efficient, Safe and Reliable Road Connectivity
Objective	to develop, expand and strengthen the road network in a sustainable way for enhancing the overall socio-economic development and integration of the country through balanced regional development by providing due consideration for remote areas and deprived communities

3.4.2 Annual Budget of DOR

Table 3.4-1 shows the annual budget of DOR for the last five years. The budget allocated to DOR has seen a constant rise every year which is evident that infrastructure development is being given more attention than before. Total MOPIT budget in 2013/2014 was 35 billion NPR, of which 88% is allocated to DOR.

TABLE 3.4-1 ANNUAL BUDGET OF DOR

Unit: 1,000 NPR

Fiscal year	Allocated Budget	Actual Expenses				
		Miscellaneous	Construction	Upgrading	Maintenance	Total
2010/2011	23,608,850	3,458,409	13,244,109	2,827,793	917,349	20,447,660
2011/2012	23,541,835	862,902	8,709,377	8,260,737	1,460,771	19,293,787
2012/2013	28,568,359	1,572,467	10,151,487	8,035,647	2,073,363	21,832,964
2013/2014	34,517,957	8,518,261	8,497,173	5,025,204	5,920,728	27,961,366
2014/2015	37,846,064	5,396,220	32,449,844 (Proposed Budget for Construction)			

Source: Department of Roads

3.4.3 Organization Chart

Figure 3.4-1 shows the organization chart of DOR. The organization is headed by a Director General (DG), who is responsible for management of five branches and Regional Road Directorate. Each branch is headed by a Deputy Director General (DDG). The RRD is headed by a Regional Director (RD). The total number of staffs in DOR is about 2,611. The number of staffs in terms of classes is mentioned below followed by brief discussion of the role of each unit.

Director General	1
Gazette I Class	18
Gazette II Class	117
Gazette III Class	499
Other Personnel	1,976
Total	**2,611**

(1) Maintenance Branch

The maintenance branch is responsible for maintenance and repairing of SRN. Each year this branch is responsible to formulate the annual road maintenance program. The program is formulated showing which road is to be maintained, when to be maintained and how much the cost will be. The actual maintenance work is conducted based on this program. .The maintenance of the Nagdhnga Tunnel including the approach road will be undertaken by this branch.

(2) Planning and Design Branch

This branch is responsible for planning, design, construction supervision, and appraisal of all development projects related to SRN and financed by the GON. Environmental and social consideration is also looked after this branch through one of its units, the Geo-environmental and Social Unit (GESU). The RAP and EIA of Nagdhunga Tunnel will also be handled by GESU.

(3) Bridge Branch

This branch is responsible for the planning, design, construction supervision, construction and maintenance of bridges on SRN. Recently, this branch has undertaken construction of several bridges on its own.

(4) Foreign Cooperation Branch

This branch is responsible for all road infrastructure projects funded by the international donors. Nagdhunga Tunnel Project will also be looked after by this branch until the construction. It should be noted that the construction work might be entrusted to the Division Office under the Regional Road Directorate.

(5) Mechanical Branch

This branch is responsible for management (from procurement to maintenance) of all construction equipment including vehicles for use or under possession by DOR.

(6) Regional Road Directorate

There are altogether 5 regional offices. East Regional Road Directorate (ERRD), Central Regional Road Directorate (CRRD), West Regional Road Directorate (WRRD), Mid-western Regional Road Directorate (MWRRD), and Far-western Regional Road Directorate (FWRRD).These offices are responsible for controlling the division road offices under its corresponding territory. There are altogether 34 division road offices throughout the country.

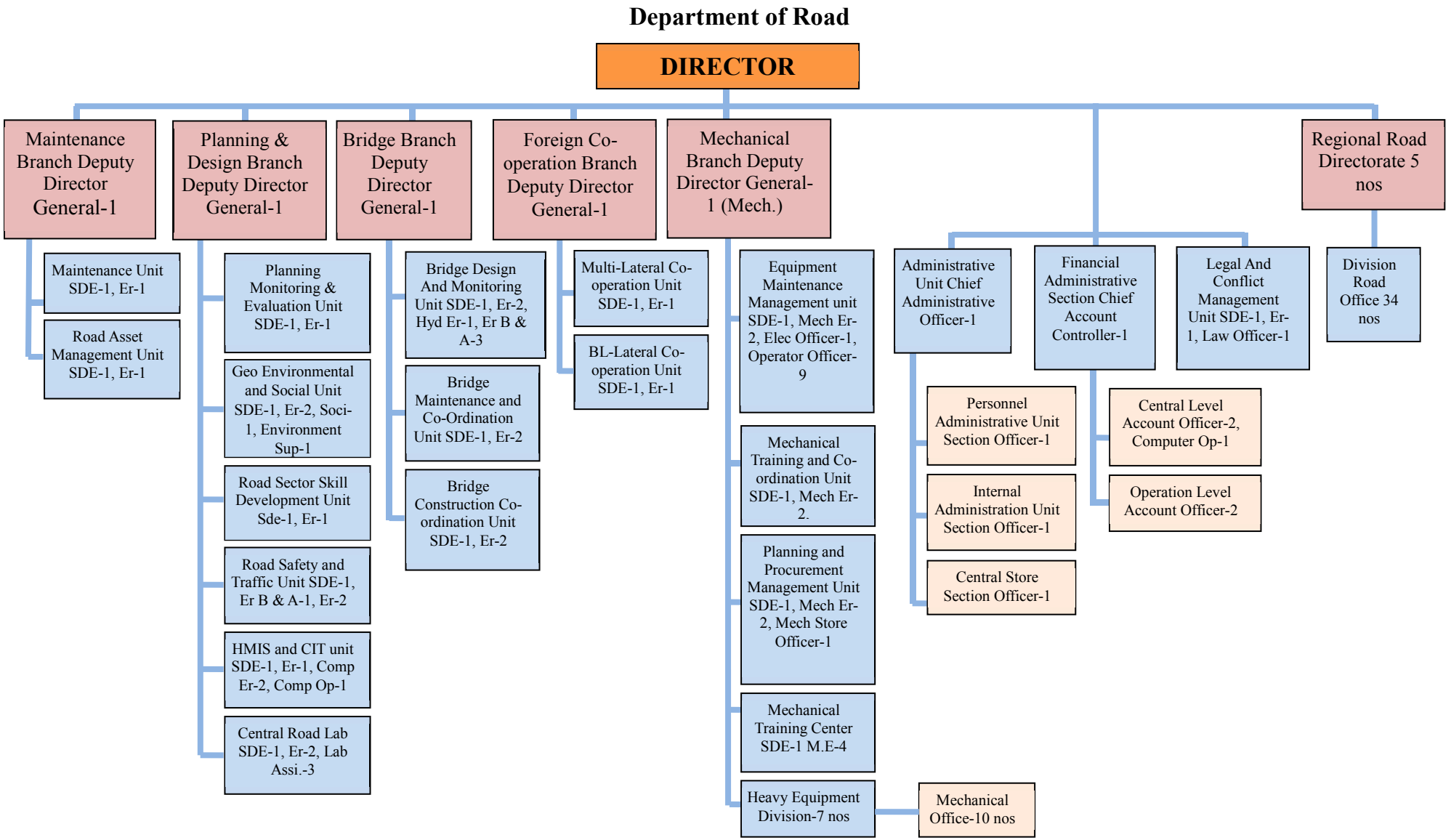


FIGURE 3.4-1 ORGANIZATION OF DOR

3.4.4 Implementing Capacity

The National Budget of Nepal for fiscal year 2013/14 is approx. 404 billion NPR. Approximately 8.57 percent of the national budget, which is equivalent to approx. 35.28 billion NPR, is allocated to MOPIT. From this 35.28 billion NPR, 34.52 billion is allocated to DOR, which amounts to about 88 percent of the budget allocated to MOPIT. The rate of budget utilization of DOR recently is almost three quarters, which in the past – particularly during political turmoil years, was not even about half the allocated budget. The budget that has not been utilized comes from abandonment and incompletion of work by contractor.

There exists a unit under the Planning and Design Branch in the DOR that looks after executing programs for enhancing capacity of DOR staffs. The unit is called Road Sector Skill Development Unit (RSSDU). This unit organizes various trainings each year for the engineers of DOR. It also organizes on-demand programs such as trainings, seminars, workshops etc. under request from a specific branch. In this case, the budget is basically allocated from the corresponding branch. Every year, RSSDU sends DOR officials to National Vigilance Center (NVC) for training on evaluation and appraisal of development projects.

Table 3.4-2 shows some of the major projects recently implemented by DOR under financial assistance from international donors. All but one of these projects has been successfully completed, which in itself reflects the increased performance capacity of the implementing agency. Unlike in the past, when assistance from the international donors was significantly allocated for infrastructure development, the present assistances are forwarded also for enhancing capacity of implementing agencies. For example, one of the components of the RSDP is the institutional strengthening, where capacity development of various units in DOR was targeted. Highway Management Information System (HMIS) was developed by DOR under this component, which it now uses for asset valuation and management. The mid-term review report of this project mentions that DOR has proved to be a pioneer in implementing e-bidding in the country and its effort and achievement was commendable. It also mentions that DOR's performance on social and environmental safeguards were satisfactory.

TABLE 3.4-2 DONOR FUNDED MAJOR PROJECTS IMPLEMENTED BY DOR

Unit: million

Name of Project		Implementation Period	Construction Cost		Remarks
			Foreign Portion	Local Portion	
World Bank	Road Maintenance and Development Project (RMDP)	Feb-2000-June-2007	$49.9	$9.8	Completed
	Road Sector Development project (RSDP)	Apr.2008-Dec. 2013	$34.9	$8.0	Completed
	Road sector Development Project (RSDP)	Feb. 2011-Jun. 2015	$58.5	$50.5	On going (90% completed)
Asian Dev. Bank	Sub-regional Transport Facilitation Project (STFP)	May 2005-Sept. 2010	$15.2	$4.3	completed
	Road Connectivity Section 1 project (RCSP)	Mar.2007-July 2014	$65.2	$14.8	completed

Source: Department of Roads

(1) Operation and Maintenance of Roads

After construction, generally the maintenance responsibilities of a road are handed over to the concerned division office under Maintenance Branch of the DOR. There are thirty four (34) Divisional Road Office in DOR shown in **Figure 3.4-1**. At present, the maintenance responsibilities of the objective section lies under two maintenance division road offices as shown in **Table 3.4-3**

TABLE 3.4-3 DIVISION OFFICES AND RESPONSIBILITIES

No.	Office Name	Responsible Stretch	Office Location (District)	Remarks
1	Kathmandu Division Road Office-2	Kalanki to Peepalmod(Within Kathmandu District)	Minbhawan (Kathmandhu)	Since 2014\2015 Kathmandu division is divided in two division. Kalanki to Peepalmod section lies in Kathmandu division II.
2	Bharatpur Division Road Office	Peepalmod to Naubise (Within Dhading District)	Bharatpur (Chitwan)	

1) Kathmandu Division Office

Role and Function of Division

Kathmandu, being the capital city of Nepal, is the focal point of all national as well as international activities. It is thus very important to provide roads of good serviceability throughout the year. With this goal in mid, Division Road Office, Kathmandu, has been fulfilling its obligations by constructing new road links upgrading as well as maintaining the existing roads to the best of its efforts with limited resources.

A total of 317 km of SRN/SURN roads fall under the Jurisdiction of DRO Kathmandu. Hence the division is responsible for the maintenance of 317km of roads in different standards and under different categories within Kathmandu District.

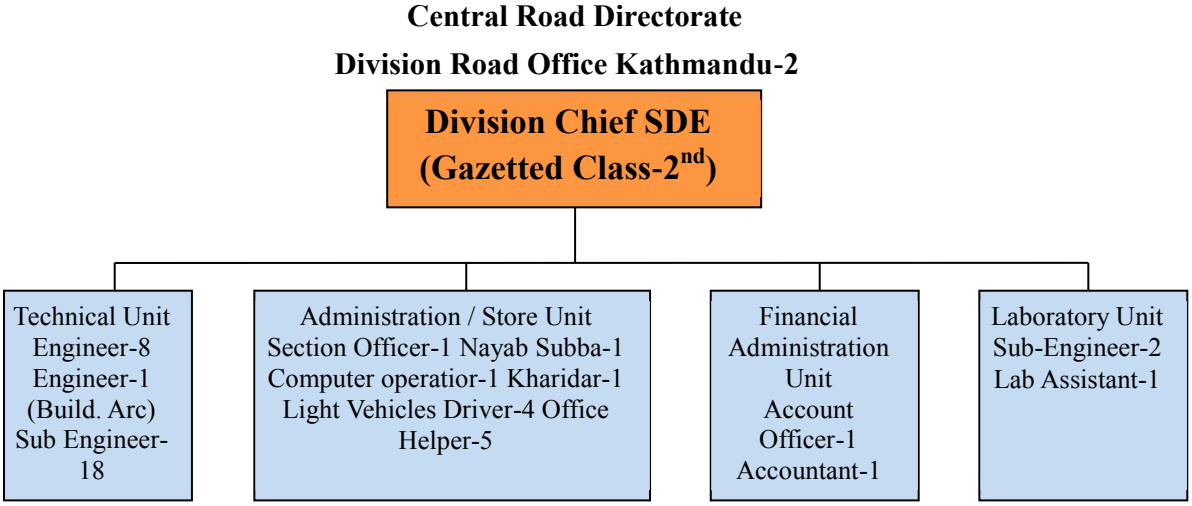


Figure 3.4-2 ORGANIZATIONAL CHART OF DIVISION ROAD OFFICE KATHMANDU II

TABLE 3.4-4 DIVISION ROAD OFFICE KATHMANDU ALLOCATED BUDGET (FY 2013/2014)

Sn	Budget Head	Name of Projects	Allocated Budget in Thousand
1	337107-4	Economic Center and Two District Connecting Roads	39,752
2	337123-4	Regional Roads	24,500
3	337147-4	Kathmandu Valley Roads Construction and Maintenance	260,000
4	337149-4	Kathmandu Valley Road Improvement	985,000
5	337157-4	Bridge Construction	43,300
6	337158-4	Cause Way, Culvert and Bridge Maintenance	7,800
7	337165-3	SRN Roads Routine Maintenance	29,397
8	337165-3	SRN Roads Special and Recurrent Maintenance	23,698
9	337165-3	Periodic Maintenance	123,982
10	337165-3	Rehabilitation Works	20,000
11	337302-4	Tourism Promotion Roads	10,900
12	337305-4	Dhakhin Kali-Chaimalee-Sisnari-Kulekahani-Roads	21,000
13	337133-4	Jor pati-Sanku-Melamchi Roads.	2,500
		Total	1,591,829

Issues of Division

- Lack of sufficient budget
- Budget allocation for non SRN/SURN roads is major problem for Division Roads Office which creates unnecessary pressure from public
- Low budgeted numerous projects are another major issue for the Division
- Lack of coordination of different line agencies
- Leakage of water through water supply pipes/sewer system on the pavement
- Dual ownership regarding ROW, footpath, extension of roads
- Encroachment of roads
- Traffic condition not considered for the allocation of Budget
- Almost all the roads are in the stage of maintenance
- Bridges inside the district are deteriorating

2) Heavy Equipment Division

Heavy Equipment division is managed under Mechanical Branch. There are six heavy equipment division in Nepal. Kathmandu Heavy Equipment Division is the responsible of the SRN in the Central Development Region. This division's information is summarized below.

- No. of Staff = 116
- Budget : 6~7 million NPR
- Major Equipment – Mini Dumper (19) Excavation (3),
  Motor Grader (4), Wheel Loader (5)
  Roller (16), Crane Mounted Truck (2)
  Flat Bed Truck (2), Tipper Truck (10)
  Water Tanker (3), Air Compactor (2)
- Office and Workshop was constructed in forty years ago.
- Major Issues – All equipments were very old. No new equipment.
  – Due to the lack of budget and old vehicle model, it is difficult to procure the spare parts.

	
Workshop and Excavator	Inside Workshop
	
Crane Mounted Truck	Damp Car
	
Wheel Loader	Motor Grader

Source: DOR

PHOTO 3.4-1 KATHMANDU HEAVY EQUIPMENT AND WORKSHOP

3.5 ROAD BOARD NEPAL (RBN)

3.5.1 Brief History, Objectives and Source of Fund

(1) Brief History

Road Board Nepal (RBN) was established in 2002 under the Road Board Act 2058 with the aim of providing sustainable fund for planned maintenance of roads;

- To keep existing maintainable roads in serviceable condition.
- To reduce vehicle operating cost
- To provide more comfort to the road users.

RBN is a self-governing, self-sustaining and organized entity based on Public-Private Partnership (PPP) model.

(2) Major Function

RBN collects, manage and allocate fund for road maintenance to the Road Agencies (RA).

(3) Fund Source

Fund sources are currently as follows;

- Fuel levy on diesel and petrol for vehicles
- Vehicle registration fee
- Road user taxes

Some other possible resources RBN thinks that can be made available in future are:

- Fee for vehicles registered abroad but used in Nepal
- Penalties for non-complier to the rules under this Act
- Subsidies and grant from donors and international agencies, if any

(4) Fund Allocation

Fund allocation is as follows;

a) RBN's administrative cost
b) Allocation to the RAs are made according to the following priority;
   - For routine, recurrent maintenance of roads in Strategic Road Network (SRN), local road network (LRN) and bridges along it.
   - For research and development works related to road maintenance.
   - The collected fund in RBN account is mobilized through Department of Roads (DOR) for maintenance of SNR and through DOLIDAR to concerned Municipalities and District Development Council (DDC) for Urban and District Roads, respectively.
   - The fund release to DOR and DOLIDAR is according to the approved Integrated Annual Plan in trimester basis.
   - Seventy percent (70%) is allocated to the maintenance of the SNR under the responsibility of DOR, and remaining thirty percent (30%) to the maintenance of Local Road Network.
   - RAs have to provide a minimum committed counterpart fund of thirty percent (30%) for Municipalities and twenty percent (20%) for DDCs.

(5) Monitoring and Evaluation

RBN monitors the works carried out by RAs focusing on implementation in line with the objectives, set norms and standards as well as maintaining transparency and quality. The identified shortcomings will be suggested to RAs for the improvements. In case of non-compliance, RBN may withhold the release of fund to concerned RAs.

3.5.2 Resource of Roads Board Nepal

Budget of Roads Board Nepal (RBN) is basically composed of two resources, allocation from MOF and toll revenue collected by itself. Amount allocated to RBN from the road fund together with the toll fee raised by RBN after deduction of its administrative cost is indicated in **Table 3.5-1.** The budget of RBN is used for maintenance purpose for both the SRNs and LRNs and urban roads. However, most of the budget is allocated for the maintenance of SRN.As aforementioned, RBN is the sole authority in Nepal that is entitled to collect toll fee from road users. The actual work to raise the toll fee is done by a private company selected through open bidding. Toll booths are established at six locations, three each in the outbound (going away from Kathmandu) and inbound (going towards Kathmandu) direction. **Table 3.5-2** shows the sections where toll fees are charged including locations where toll booths are installed.

TABLE 3.5-1 RESOURCES OF ROADS BOARD NEPAL

Unit: Million NRP

Fiscal Year	Allocated by MOF from		Raised by RBN from	Total	Allocated Budget to RBN by MOF	Actual Budget Received by RBN from MOF
	Fuel Levy	Vehicle Registration	Toll			
2004/05	199.1	149.5	N/A	348.6	220.0	220.0
2005/06	225.8	151.9	41.0	418.7	362.8	345.7
2006/07	227.5	168.1	39.4	435.0	330.0	330.0
2007/08	247.0	250.5	47.3	545.0	390.0	390.0
2008/09	499.5	444.1	40.2	983.8	760.0	760.0
2009/10	741.1	688.4	50.0	1479.5	664.5	664.5
2010/11	926.6	1,458.6	64.5	2,449.7	1,314.5	1,314.5
2011/12	1,758.8	1,597.6	65.4	3,421.8	2,518.0	2,518.0
2012/13	2,097.9	1,439.8	73.1	3,610.8	2,768.0	2,768.0
2013/14	2,332.7	2,296.6	57.7	4,687.0	2,573.7	2,451.2
2014/15	2,472.7	2,614.8	66.8	5,154.3	4,000.0	4,000.0

Source: RBN

TABLE 3.5-2 TOLLCOLLECTION BY RBN

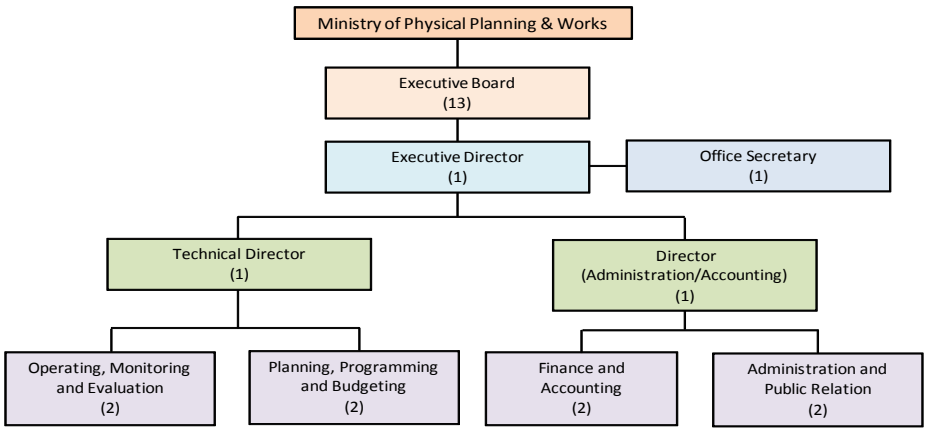
Section		Direction	Location(Station)	Highway
1-2	Kathmandu-Mugling	Outbound	Naubise	Prithvi Highway
		Inbound	Majhimtar	
3-4	Narayanghat-Hetauda	Outbound	Gandryang	Mahendra Highway
		Inbound	Sano Bharyang	
3-5	Narayanghat-Butwal	Outbound	Gaidakot	Mahendra Highway
		Inbound	Ram Nagar	

Note: Outbound : Going away from Kathmandu, Inbound :Going towards Kathmandu

Source: RBN

3.5.3 Organization of RBN

Organization of RBN is shown in **Figure 3.5-1.** The organization is chaired by the Secretary of MOPIT and consists of 18 executive board members. The total number of staffs including the executive director is thirteen. The RBN has two sections, technical section and administration section each headed by a director. There are four staffs in the technical section-two from Operating, Monitoring and Evaluation unit and two from Planning, Programming and Budgeting Unit. These units look after the technical aspects of the maintenance work and monitor the maintenance work of DOR. On the other hand, the Administration Section, which has four staffs, two from Finance and Accounting unit and two from Administration and Public Relation Unit. The financing and accounting unit basically looks after the financial part including auditing of the income and expenditure. The latter unit is responsible for administration works.



Source: RBN

FIGURE 3.5.3-1 ORGANIZATION CHART OF RBN

CHAPTER 4

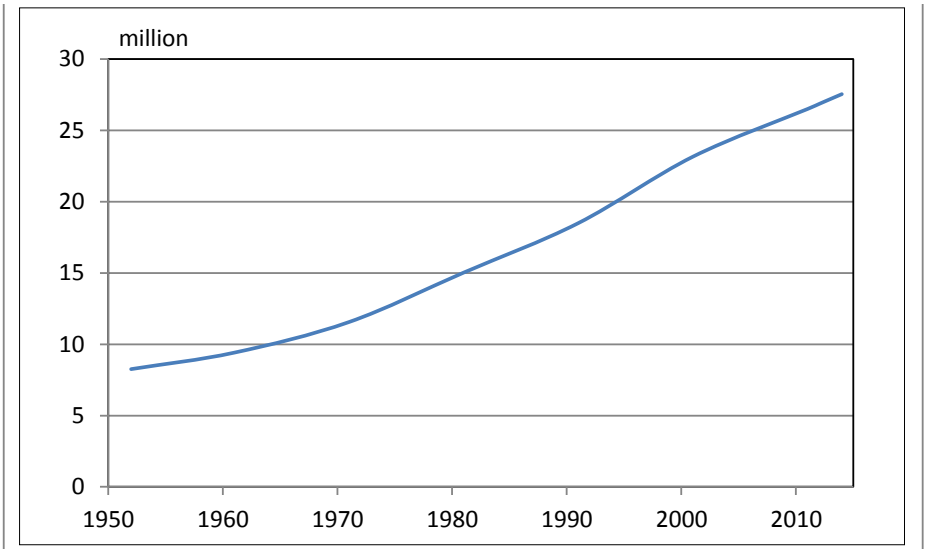
SOCIO-ECONOMIC CONDITION OF THE PROJECT AREA

CHAPTER 4
SOCIO-ECONOMIC CONDITION OF THE PROJECT AREA

4.1 SOCIO-ECONOMIC CONDITION

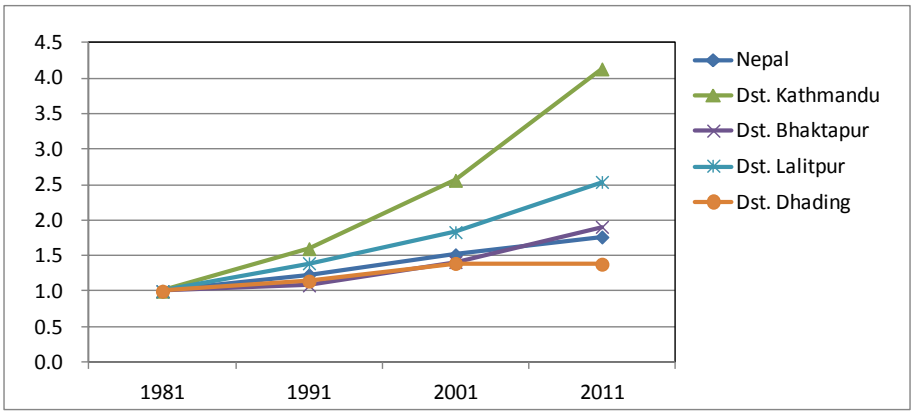
4.1.1 Population

Figure 4.1-1 illustrates the total population of Nepal based on the result of population and housing census. The population of Nepal has reached 26.6 million in 2011. The census showed the population growth rate of Nepal was 1.36 per cent per annum. Nepal's population was 23.2 million according to the last census held in 2001. The population in 2014 can be estimated to reach 27.5 million.



Source: Population census

FIGURE 4.1-1 THE POPULATION CHANGE IN NEPAL



**1981=1.0*

Source: Population census

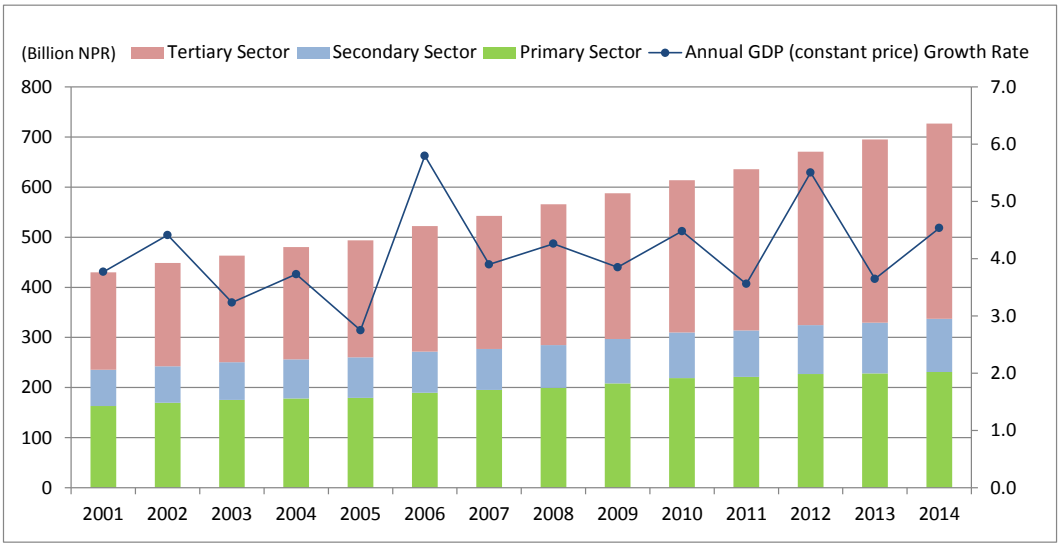
FIGURE 4.1-2 THE POPULATION CHANGE IN PROJECT AREA

4.1.2 Economic and industry

(1) GDP

The Nepalese economy is increasing yearly and GDP growth showed 3.6 % in 2013 fiscal year. In the result, GDP recorded over 700 billion NPR in 2013. The increasing of overseas remittance contributed the growth of tertiary sector that is estimated to account for 20% of GDP. In the context of augmentation of overseas remittance from other countries, the middle-

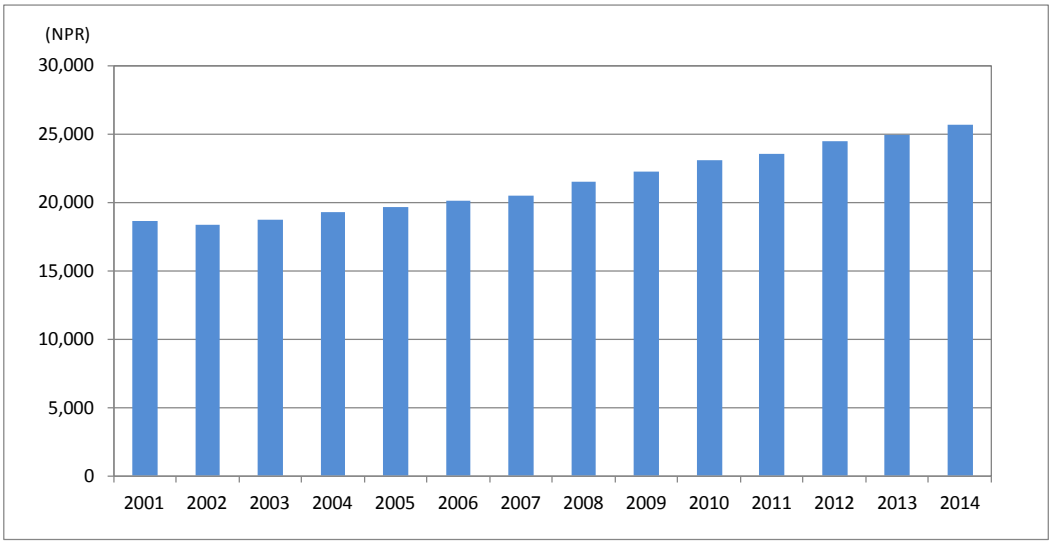
income group in city, mainly in Kathmandu, is increasing. And, this group is affecting to increased consumption. GDP per capita reached 25,000 in 2013.



**2014 is estimation*

Source: Economic census

FIGURE 4.1-3 CHANGE OF GDP AND GROWTH RATE BY SECTOR



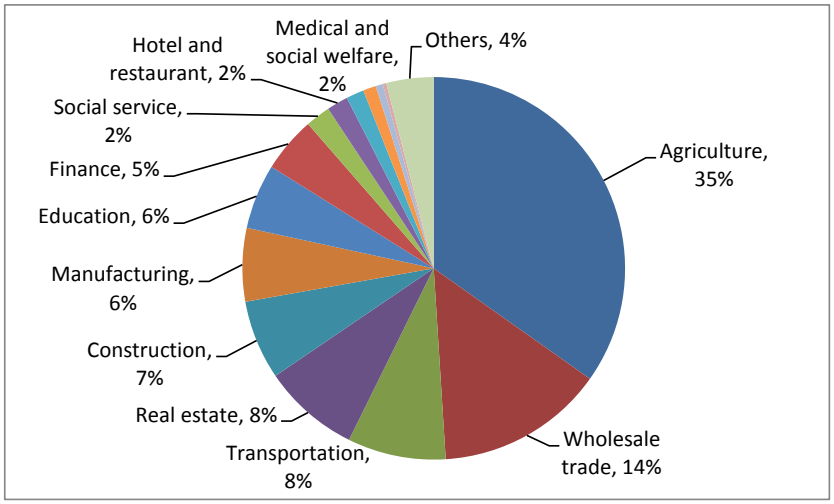
**2014 is estimation*

Source: Economic census

FIGURE 4.1-4 CHANGE OF GDP PER CAPITA

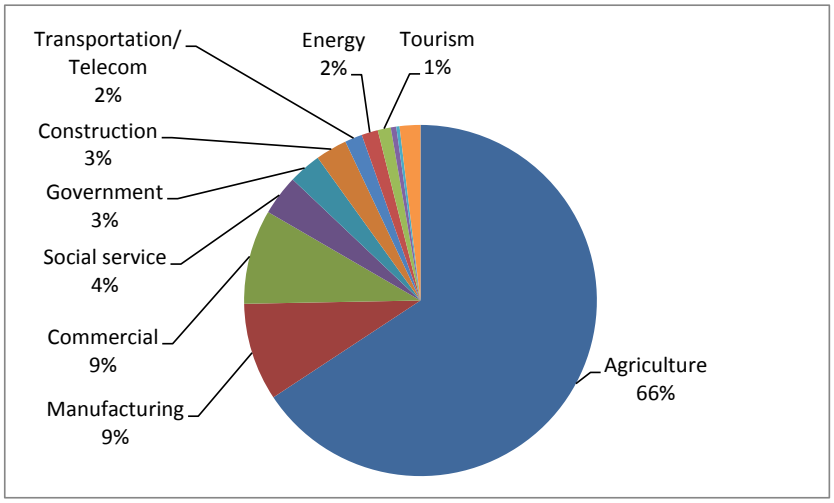
(2) Industry

As regards the industry GDP ratio, the agriculture accounts for 34.8%. Then, the wholesale is 14.2%, transportation industry accounted for 8.3 percent. 66% of the labor population engaged in agriculture. The manufacturing and commercial is 9.0% each.



Source: Economic census

FIGURE 4.1-5 GDP SHARE BY INDUSTRIAL SECTOR



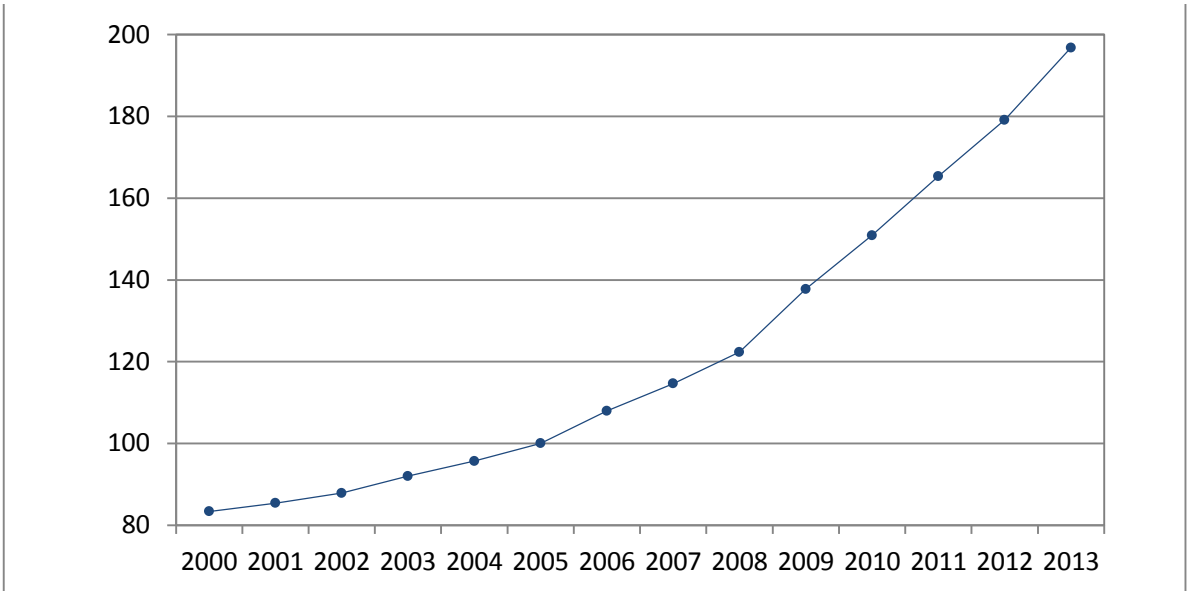
Source: Economic census

FIGURE 4.1-6 EMPLOYMENT SHARE BY INDUSTRIAL SECTOR

(3) Price and Inflation

The consumer price index of base year 2005 is shown in **Figure 4.1-7**. The inflation of the consumer price index is still. In 2000-2013, CPI has increased to 2.4 times. The annual growth rate in this period was around 7%. Recent inflation rate shows more than 9%.

As the factors, outside factors such as price increases in India and high oil prices can be considered.



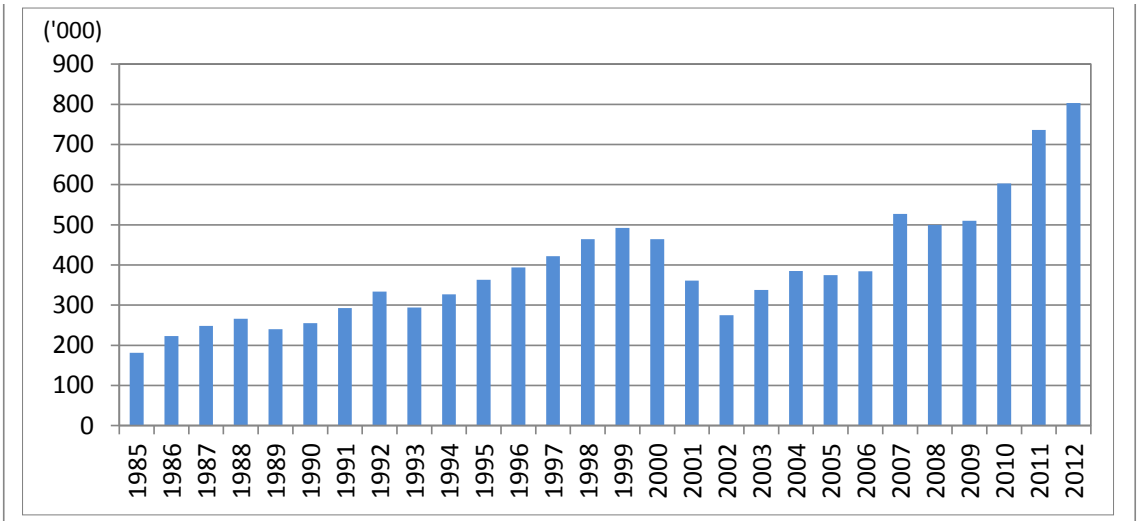
**2005=100*

Source: Quarterly Economic Bulletin

FIGURE 4.1-7 CHANGES IN THE CONSUMER PRICE INDEX INCREASE RATE

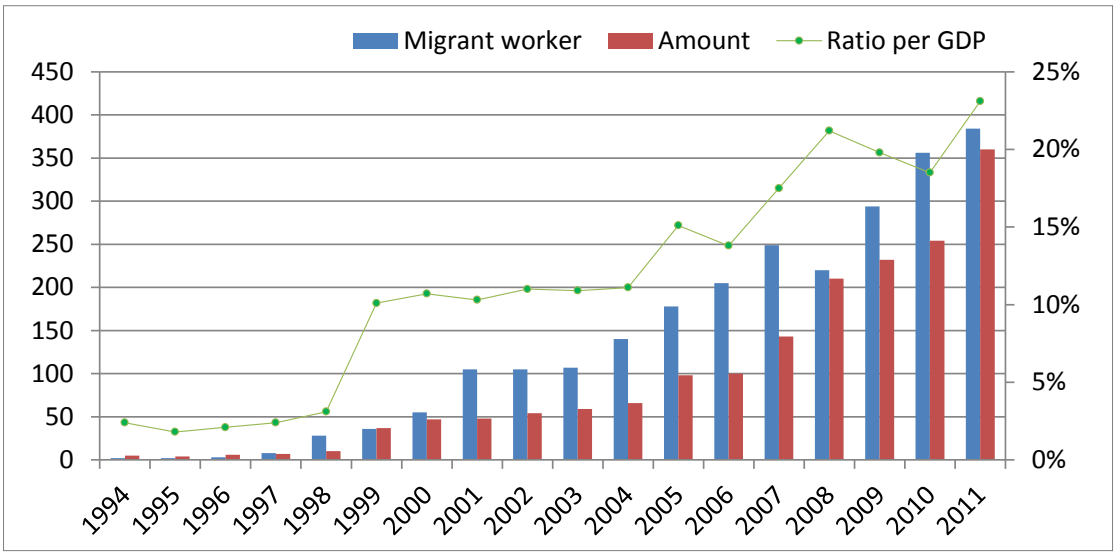
(4) Tourism and migrant workers

The number of tourists has increased with the recovery in the domestic security. Since more than 50 million people for the first time in 2007, it has maintained the milestone of 500,000 people to continue. In 2011, it set a tourist of record over 700,000. The migrant workers from Nepal to other country, which was less than 10,000 in 1998, reached to 384,000 in 2011. Major destination is Middle Eastern countries, Malaysia. The overseas remittance, which is 360 billion NPR, by migrant workers accounts for 23% of GDP in Nepal.



Source: Ministry of Culture, Tourism and Civil Aviation

FIGURE 4.1-8 CHANGES IN NUMBER OF TOURIST

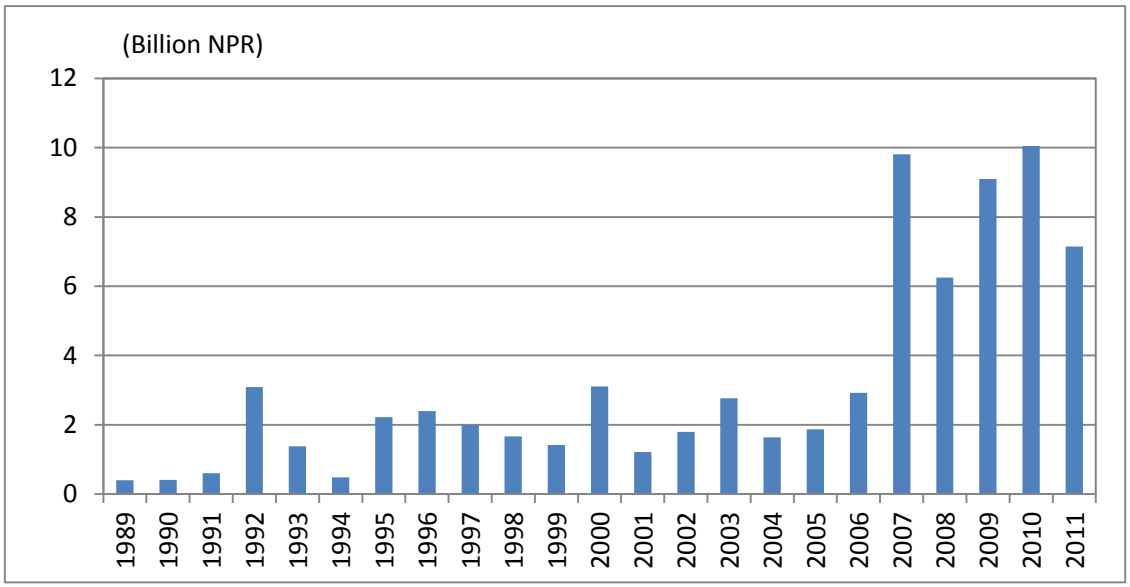


Source: Ministry of Labor & Employment

FIGURE 4.1-9 TREND IN THE MIGRANT WORKERS AND OVERSEAS REMITTANCE

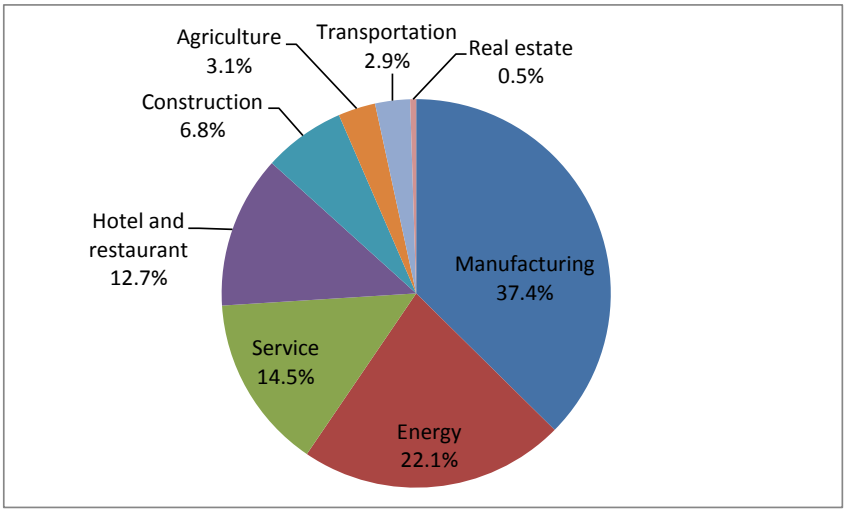
(5) Foreign Direct Investment

FDI to Nepal is increased after 2007. FDI of India accounts for 46.3% of accumulative investment amount by 2012. Regard to sectorial FDI, manufacturing is 37%, energy is 22%, service is 15%, tourism is 13%. FDI to Agriculture as domestic industrial strength is nothing more than 3% of total amount.



Source: Trade and Export Promotion Centre

FIGURE 4.1-10 TRENDS IN FOREIGN DIRECT INVESTMENT



Source: Trade and Export Promotion Centre

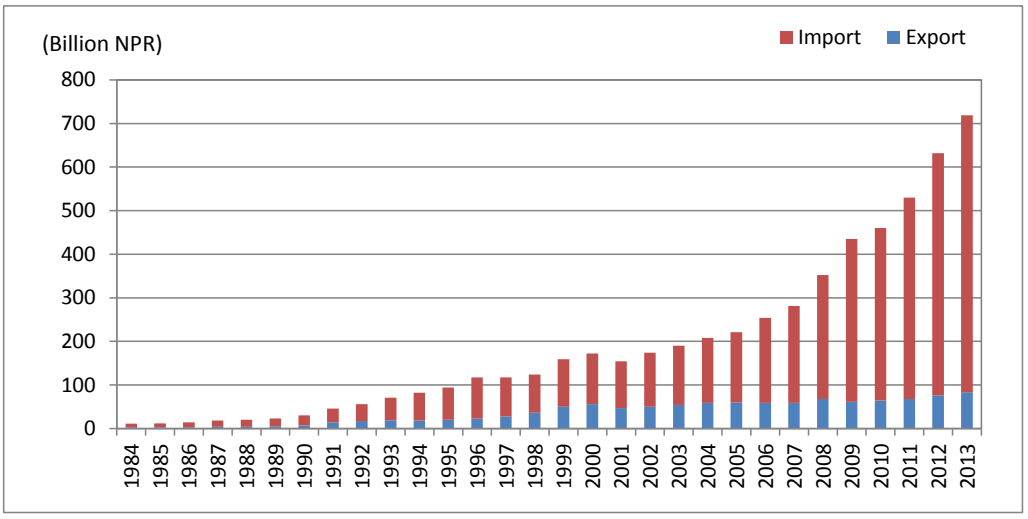
FIGURE 4.1-11 SECTORIAL ACCUMULATIVE INVESTMENT AMOUNT BY 2012

4.1.3 Import and Export

(1) Value of Import and Export

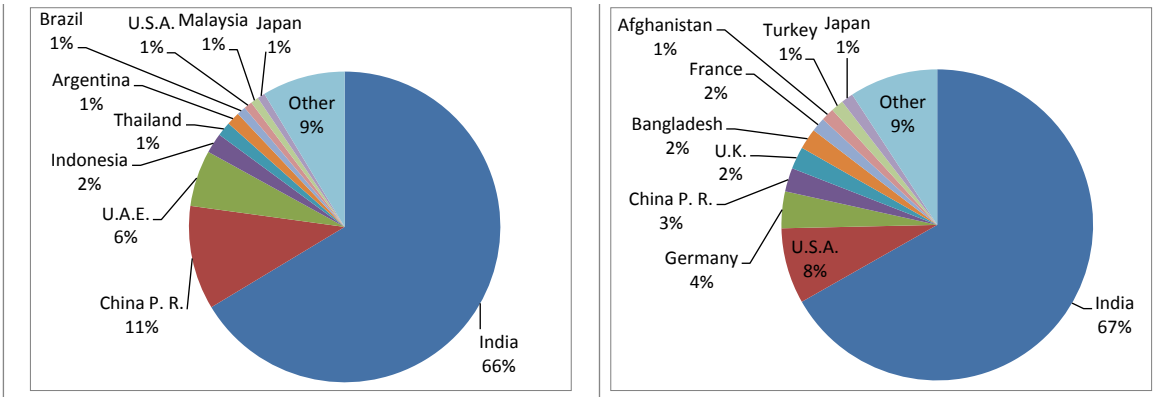
The export value in 2013 is 83 billion NPR which is a 9 % increase over the previous years. The import value in 2013 is 636 billion NPR which is a 14 % increase over the previous years. The value of import that is 7.7 times of import shows a large excess of imports over exports.

Main trade partner is India in both of import and export and the share is over the 65%. Major commodity in import is petroleum which is 31% of total. Industrial product ranks in second that accounts for 19% of total import. In export, Industrial product ranks in top that accounts for 23% of total import. Then, Garments is 11%, Spice and Jute is 9%.



Source: Trade and Export Promotion Centre

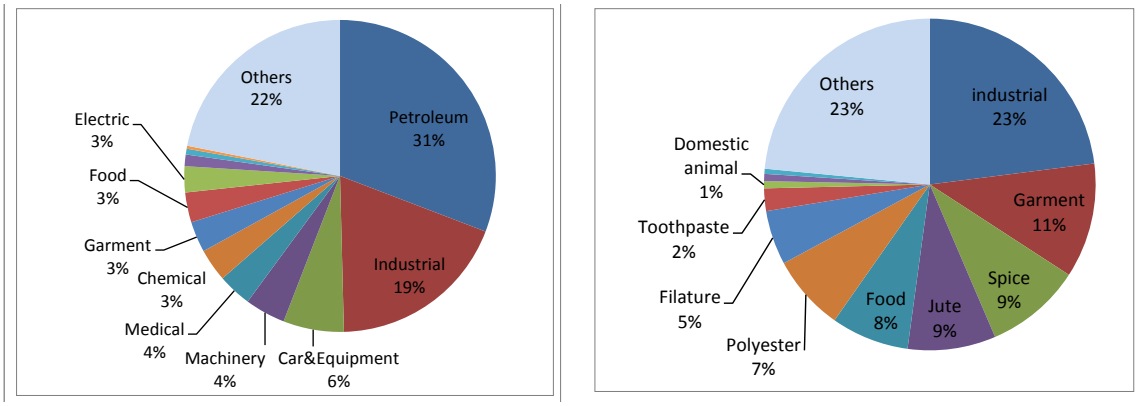
FIGURE 4.1-12 CHANGES OF VOLUME IMPORT AND EXPORT VALUE BASIS



Import Export

Source: Trade and Export Promotion Centre

FIGURE 4.1-13 SHARE OF COUNTRY IN TRADE



Import Export

Source: Trade and Export Promotion Centre

FIGURE 4.1-14 SHARE OF COMMODITY IN TRADE

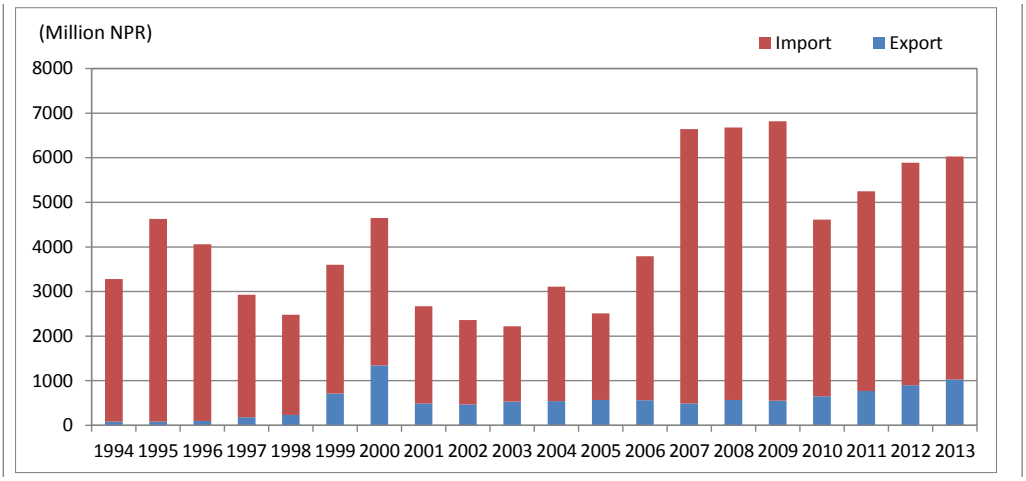
(2) Trade between Japan and Nepal

The import value from Japan is 50 billion in 2013 that is accounted for 28% of steel product, 18% of Machinery, 17% of car. On the other hand, the export is 10 billion. Major commodity exported is garment (39% of total value), textile (18%), millwork (10%), and handicraft (4%). The company in operation by investment of Japan is forty five companies in 2012. And 38 companies are in preparation stage. Visitors from Japan in 2012 are 28,642.

TABLE 4.1-1 COMPANY BY INVESTMENT OF JAPAN

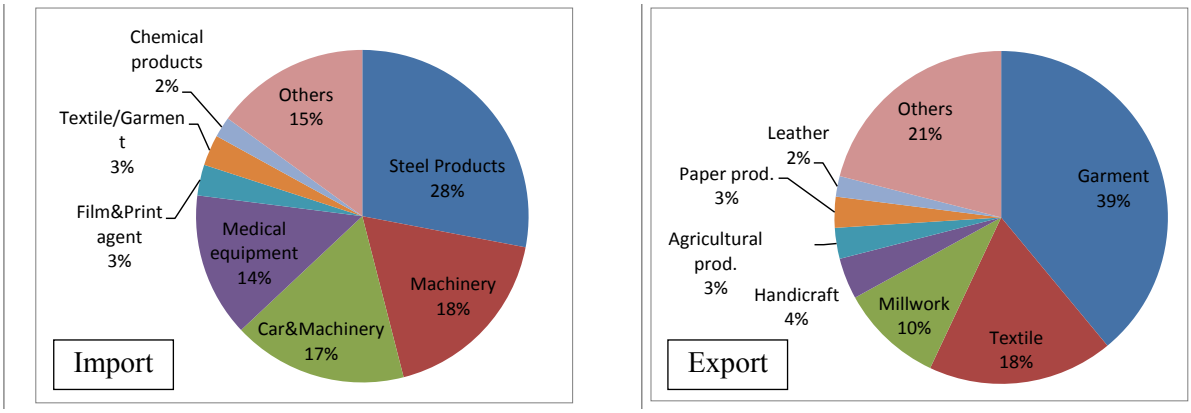
	Operation	Preparation
Software	3	2
Manufacturing	11	11
Construction	4	0
Tourism	21	13
Others	6	12
Total	45	38

Source: Trade and Export Promotion Centre



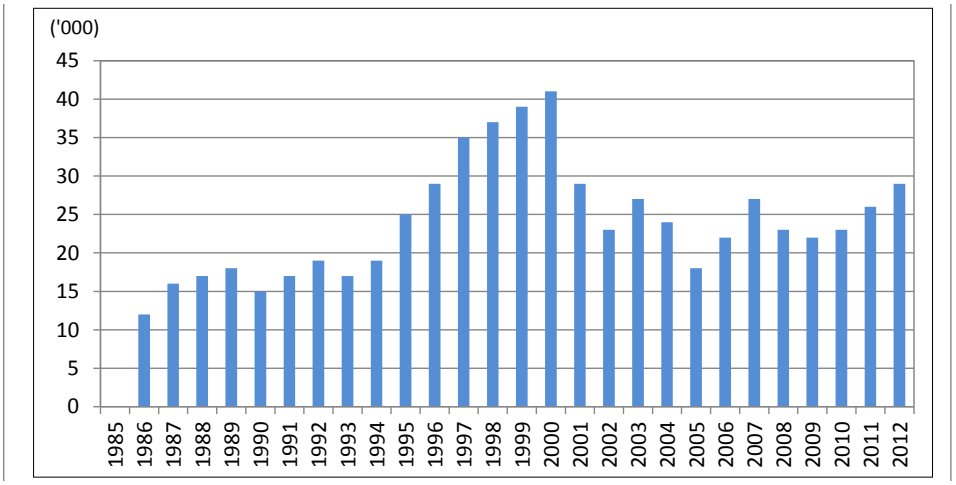
Source: Trade and Export Promotion Centre

FIGURE 4.1-15 TREND IN TRADE VALUE WITH JAPAN



Source: Trade and Export Promotion Centre

FIGURE 4.1-16 TRADE COMMODITY WITH JAPAN BY IMPORT AND EXPORT



Source: Trade and Export Promotion Centre

FIGURE 4.1-17 TREND IN NUMBER OF VISITOR FROM JAPAN

4.1.4 Transportation

(1) Transport Mode for Trade

According customs data by value basis, around 90 percent of Nepal's trade traffic is dependent on land transport by truck. Nepal is a landlocked mountainous country and road network is most important for Nepal economy.

TABLE 4.1-2 TRANSPORT MODE FOR TRADE

Mode	Import (billion NPR)	Export (billion NPR)	Total (billion NPR)	*Share of Mode*
Truck	567	65	633	*88%*
Air cargo	69	17	86	*12%*
Total	636	83	719	*100%*

Source: Customs office data

(2) Number of Vehicle

The number of vehicle registration without motor cycle has almost doubled in the last 5 years. The annual average growth rate of total was over 17.8% in the period of 2008-2013. This growth rate is very high than population or GDP in Nepal.

TABLE 4.1-3 NUMBER OF VEHICLE REGISTERED

year	No. of Vehicle
2008	103,680
2009	136,760
2010	161,493
2011	186,442
2012	219,544
2013	235,138
Growth rate 2008-2013	*17.8%*
2013/2008	*2.3*

**Excluding Motor Cycle*
Source: MOPIT

4.2 PHYSICAL PROFILE (TERRAIN, GEOLOGY, CLIMATE, EARTHQUAKE)

4.2.1 Topography

(1) Regional Topography

Regional topography around the Kathmandu area showed as topographic map and satellite image.

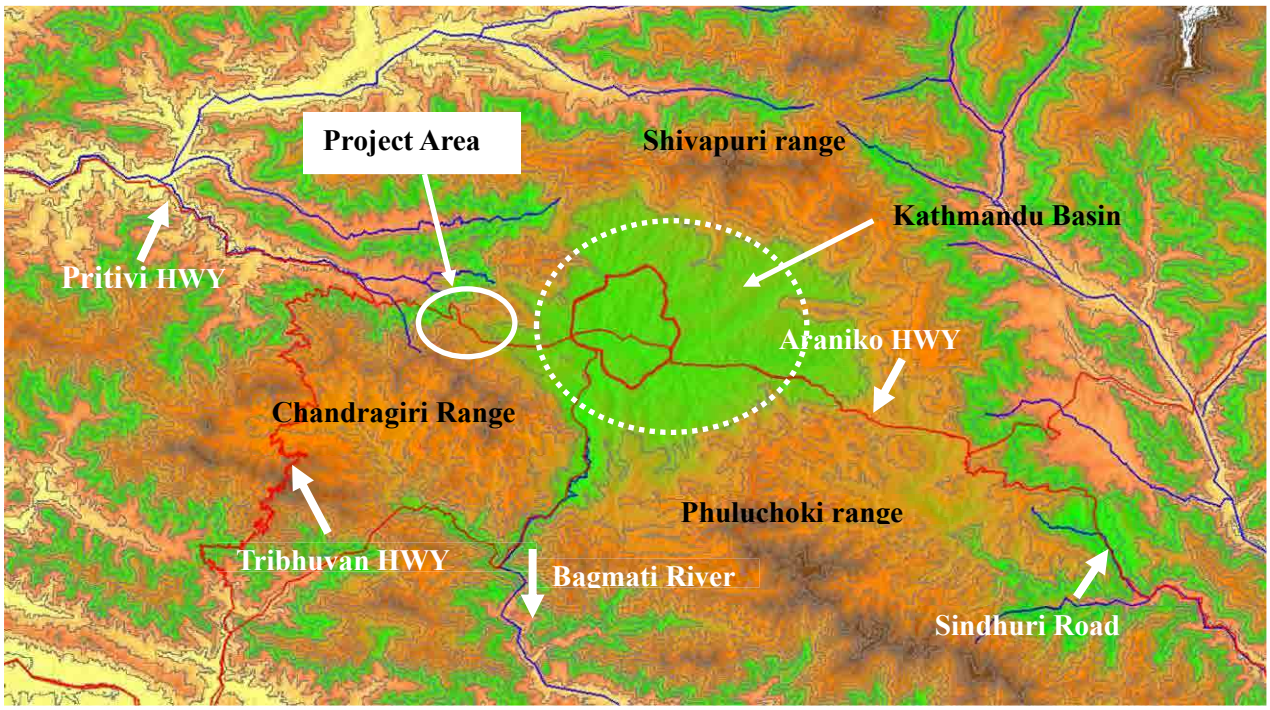


FIGURE 4.2-1 TOPOGRAPHIC FEATURES AROUND KATHMANDU BASIN

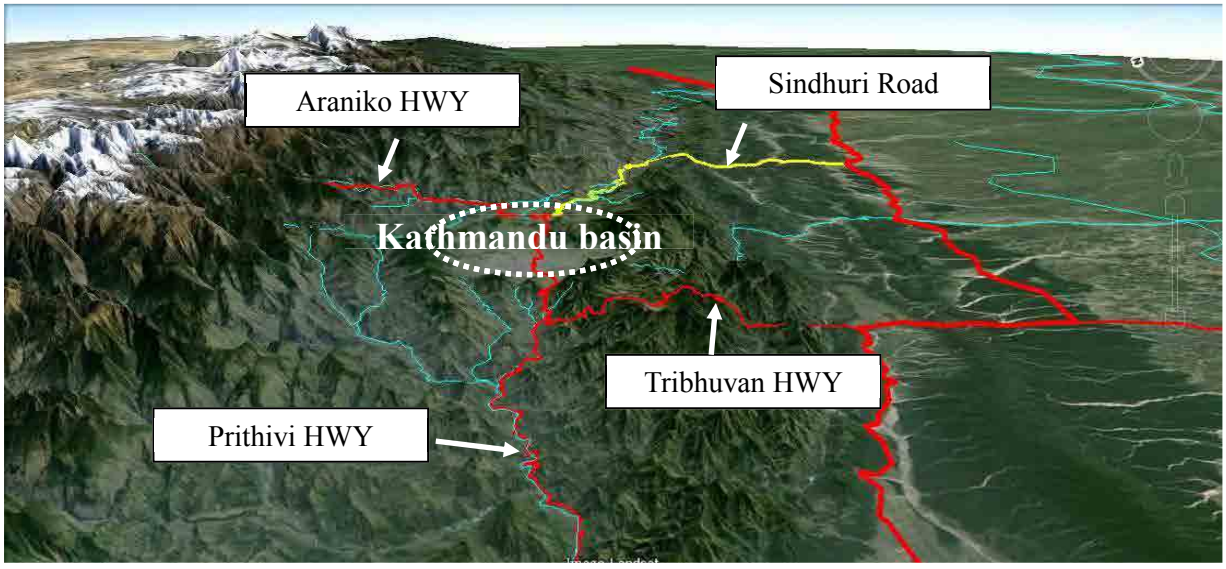


FIGURE 4.2-2 TOPOGRAPHIC IMAGE AROUND KATHMANDU BASIN

According to these figures, the Kathmandu as a capital of Nepal located in the Kathmandu basin.

The Kathmandu basin is surrounded by such as Shivapuri range, Phuluchoki range and Chandragiri range with an altitude of 1500-2500m

The diameter of the basin bottom is an oval of about 15km.Heights of the basin bottom is 1300m, in the past the Kathmandu basin was occupied by a large lake, the last part of which

may have remained until 10,000 years before present.

The basin is therefore filled with lake sediments, deltaic and fluvial deposits as thick as 600 m. The sediments are made up of clay, silt, sand and gravel as lacustrine sediments.

Bagumati river is only the river flow out from Kathmandu basin. In the south part of Kathmandu basin, Bagumati river flow to south which forms a deep canyon. Outside the Kathmandu Basin, large river, such as Trishuri and indrawati rivers are distributed so as to surround the Kathmandu Basin. Erosion by rivers proceed in watershed of these is lower several hundred meters than the Kathmandu Basin altitude.

Main road that can transport supplies to the Kathmandu Basin is only two, to the Chinese border in the Araniko highway from the east side, to reach the border to India by Prithivi highway of the Nagudhunga Pass in from the west side. The slope of Araniko highway is a big collapse in August 2014, it is not possible to pass now.

Major roads in India before entering the connection Kathmandu Basin, Shindhuli road was constructed from Banepa Kathmandu side to Bardibas at Terai side became the three recent.

Because of the characteristics of the terrain of these, to enter into Kathmandu Basin from the outside, it means that climbing the steep slope of several hundred meters, to enter the basin across pass.

(2) Topography of Project Area

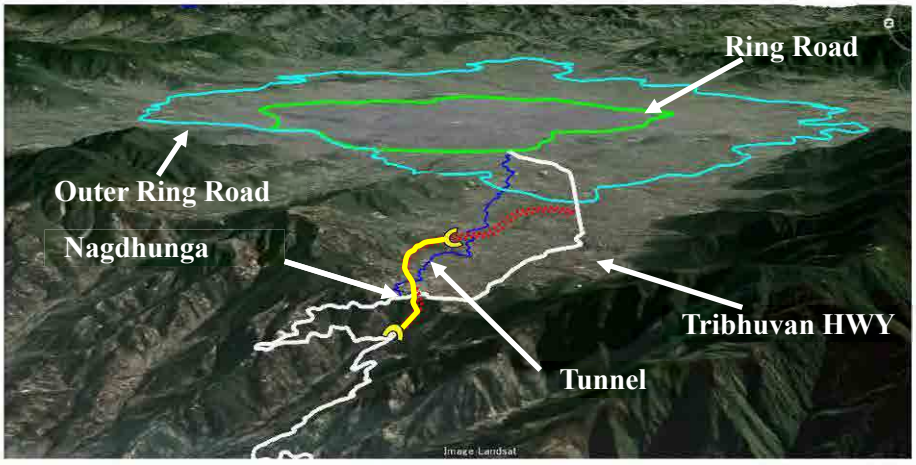


FIGURE 4.2-3 THREE-DIMENSIONAL IMAGE AT PROJECT AREA

1) Topography of Project area divided into two features.

The project area east of the Nagdhunga is characterized by the nearly gentle slope topography of the Kathmandu basin.

But the southernmost part of the project area inside the basin is characterized by the steep to very steep topography of the Chandragiri range.

Similarly, northern part is characterized by moderately steep to steep topography of the Dahachock hill. However, the existing alignment of the Tribhuvan Highway passes from the nearly gentle topography made by the alluvial fans, talus deposits and the lake deposits of the Kathmandu basin creating no threat to the stability of the road except large scale debris flow.

The project area west of the Nagdhunga is characterized by steep topography. The part of the project area between the Baad Bhanjyang in the east and the Sisne Khola in the west is characterized by high gradient of the slope with elevation of 1550 m above msl at a peak near Baad Bhanjyang and nearly 1300 m near Sikre Khola . This steep gradient of the slope together with the geological condition and rainfall makes this zone highly susceptible to more than one type of mass movement activities like landslides and debris flows etc. Traces of landslides and slope collapse can be seen at many locations.

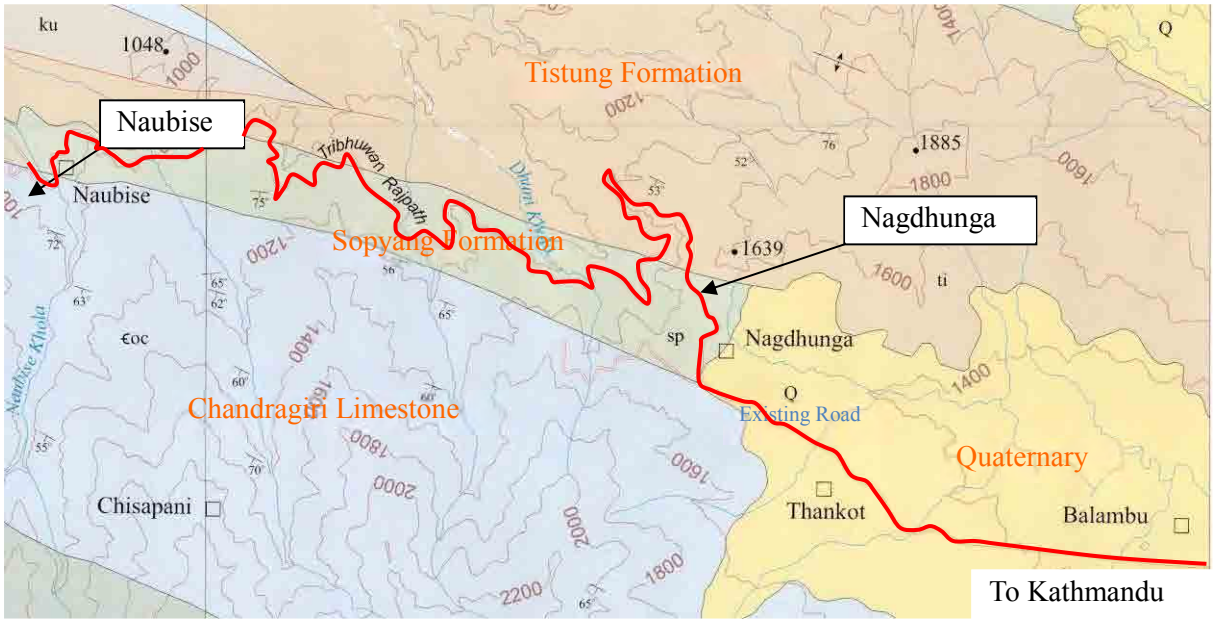
FIGURE 4.2-4 STEEP GRADIENT SLOPE AT WEST SIDE OF PROJECT AREA

FIGURE 4.2-5 GENTILE SLOPE AT EAST SIDE OF PROJECT AREA

4.2.2 Geology

(1) Geological Outline

The outline of the geological condition of the Project Area is mentioned briefly hereunder, based on the results of field survey and the geological maps collected.



After Geological map of part of Dhading, Makawanpur, Kathmandu and Laritpur Districts 2007

FIGURE 4.2-6 REGIONAL GEOLOGICAL MAP OF PROJECT AREA

The characteristics of geology distributed in the project area are as follows:

1) Quaternary – Recent (Q:)

Alluvial, Colluvial and Lacustrine deposits, clay, silt, sandy and gravel and conglomerates.

2) Chandragiri Limestone(eoc:Lower Paleozoic)

Light fine-crystalline, partly siliceous, medium to thick bedded, massive limestone, white quartzite in upper part, top part impure argillaceous, colored, wavy limestone containing Late Ordovician echinoderm.

3) Sopyang formation(sp:Lower Paleozoic)

Sopyang formation consists of alternating layers of thin grey sandstone and psammitic phyllite. The surface is formed of weathered red or gray soil.

4) Tistung formation (ti:Lower Paleozoic)

Tistung formation is distributed on the northern side of Nagdhunga and contains characteristically a layer of massive sandstone. Weathered gray or whitish grey soil is observed at the surface.

The major formations confirmed around the Study Area are compiled in the pictures in **Figure 4.2-7** below.

(2) Geology of the project area

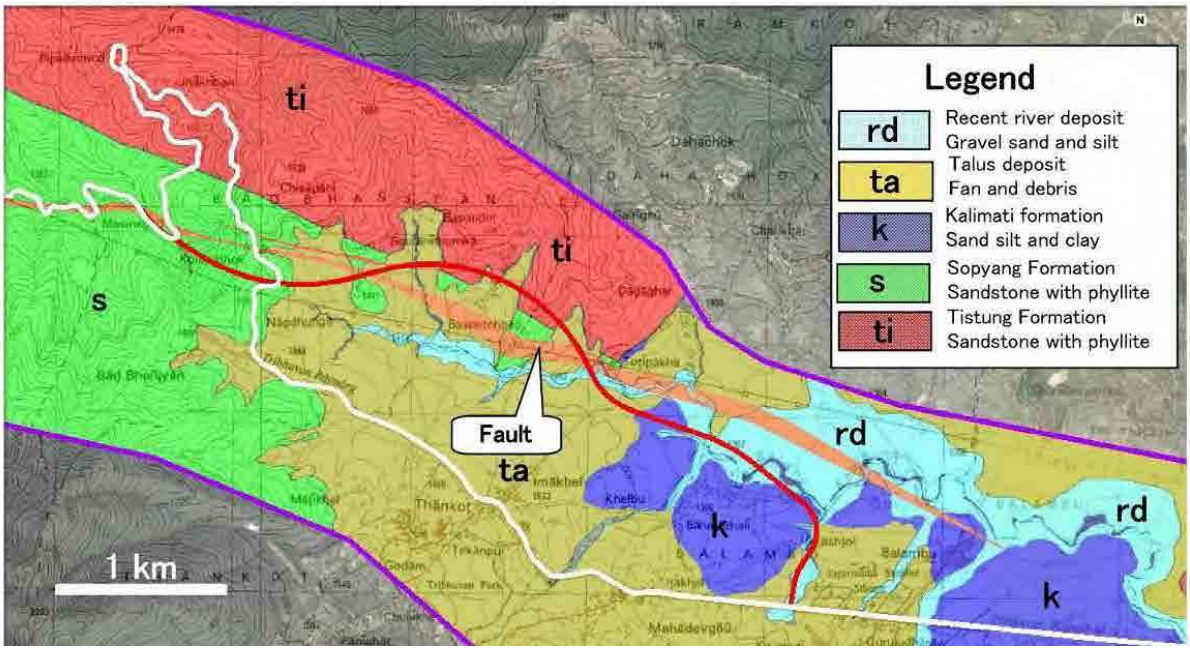


FIGURE 4.2-7 GEOLOGICAL MAP OF PROJECT AREA

Geologically, the basement rock of the project area is mainly composed of the Tistung and the Sopyang Formation as sedimentary rocks. At east side of project area in Kathmandu basin mainly composed of Kalimati formation, Talus deposit and recent river deposit.

The main features of the geology are as follows.

1) Tistung Formation

The rocks of this formation are exposed around the northern part of the project area mainly around Nagdhunga. In this area, this unit is mainly composed psammitic phyllite and phyllitc sandstone. Phyllites are well foliated and moderately to highly

FIGURE 4.2-8 TISTUNG FORMATION

weathered. Rockmass is highly jointed and fractured. The sandstone of this area are thin- to thick-bedded and slightly to moderately weathered. The rock mass is also highly jointed and fractured.

FIGURE 4.2-9 SOPYANG FORMATION

2) Sopyang Formation

This formation is transitional to the underlying Tistung Formation and is well exposed around Badbhanjyang, sisne Khola and basnetchhap area. This unit is mainly composed of well foliated, grey to brown psammitic phyllite, with sandstone.

This unit is also composed of white to brown, medium- to thick- bedded, slightly to moderately weathered sandstone. Some shear zones are also reported from this unit. The rock mass of this unit are also highly jointed and fractured. The rock mass is also highly jointed and fractured.

FIGURE 4.2-10 KALIMATI FORMATION

3) Kalimati Formation

This is one of the important geological units belonging to the quaternary sediments of the Kathmandu basin. The black to brown clay, highly rich in organic matter that was once deposited in the paleo-Kathmandu Lake are now exposed around project area. This unit also consist some intercalations of brown silt and fine sand.

FIGURE 4.2-11 TALUS DEPOSIT

4) Talus Deposit

Talus deposits are found around the Thankot area and include the recent colluvial sediments composed of well graded gravel with dominantly angular fragments of psammitic phyllite and white sandstone derived from the southern as well as northern part of the basin. For mapping purpose, this unit also includes the debris flow and some fan deposits inside the basin. Outside the basin, included within the talus deposits are mainly found around Sikre Khola.

The feature of talus deposit is loose, highly porous and permeable and affects mainly to the stability of the cut slopes made within this unit.

FIGURE 4.2-12 RIVER DEPOSIT

5) River deposit

River deposits (Alluvial deposits) are mainly distributed in the either side of the small to medium sized tributaries and streams

present within the project area. Inside the basin, river deposits are concentrated along the channel and bank of the Balkhu Khola and its tributaries. The alluvial sediment is mainly composed of pebble-cobble and gravel sized particles with rounded phyllites and sandstone. The sizes of the particles vary considerably. Most of the alluvial deposits of the project area are less consolidated, highly porous and permeable.

(3) Geological structure and Fault

According to the geological map of part of Dhading , Makawanpur, Kathmandu and Laritpur District 2007, Tiston formation distributed in the north was overlaped by Sopyang formation distributed in the project area.

Boundary of the formation of these is not clear, but by the site reconnaissance, several meters thick sandstone layers can be seen at Tiston's area. Strata of both is also a interbedded phyllite and sandstone, there is no significant difference in the geotechnical.

Fault of the fractured zone was confirmed in the vicinity of Basnetchhap. This fault is continuous in west-northwest from the east-southeast almost along the proposed tunnel.

Some active faults are reported around Thankot area by different previous researchers. Though these active faults, differently named as Thankot active Fault, Chobhar Active fault, Chandragiri Active Fault etc. by different workers could only be established in the presence of some lineaments in the aerial photograph and google earth images, So It was not confirmed at the surface reconnaissance, but it is presumed that. It is possible that faults some found the construction of the tunnel.

In previous geological survey documents and reference, in the vicinity Thankot of Kathmandu Valley south foothills, northwest - active structure that extends to the southeast direction (active flexure) have been reported.

For this reason, in the route selection of approach road and tunnel, to avoid an active structure zone, in order to avoid the risk of on the tunnel construction, planning on the north side the foothills of the Kathmandu Valley.

FIGURE 4.2-13 FAULT WITH FRACTURED ZONE

4.2.3 Earthquake

Earthquake records in Nepal since 1253 indicate that Nepal was hit by at least 19earthquakes (the last major earthquake was that of 1988) with various digress of damage.

However, the records may not be complete, and the data on loss of life and property may not be very accurate as such data with high reliability are difficult to find.

Out of these, the records of the 1833 (magnitude 7.7) and 1934 (magnitude 8.3) earthquakes

that occurred at an interval of 100 years give better details and show that these earthquakes were highly disastrous. The effects of these earthquakes were particularly severe in the Kathmandu basin. Nepal established its first seismic station in 1978 under the Department of Mines and Geology, Government of Nepal. Today it has 21 telemetric seismic stations covering the whole country with Kathmandu (central Nepal) and Surkhet (mid western Nepal) as base recording stations. Over the years a great amount of data has been collected which have become very useful for earthquake research in the region.

After Seismic Hazard and Mitigation Activities in Nepal - with Emphasis on Kathmandu Valley

SEISMIC HAZARD AND MITIGATION ACTIVITIES IN NEPAL - WITH EMPHASIS ON KATHMANDU VALLEY B.N. Upreti and Masaru Yoshida Vol. 2 No. 1 June 2009 p19

TABLE 4.2-1 SOME HISTORIC EARTHQUAKES IN NEPAL

Year (A.D.)	Deaths	Damages
1255	Estimated magnitude around 7.7 in Ritcher scale. One third of the total population of Kathmandu were killed including Abahya Malla, the King of Kathmandu valley	A lot of damages to residential and temples
1260	Many people died, famine after the earthquake	A lot of damages to residential building and temples
1408	Many people died	A lot of damages to temples, residential buildings, fissures developed in the ground
1681	Many people died	A lot of damages to residential buildings
1767	No record available on deaths	No record available on damage
1810	Many lives were lost particularly in Bhaktapur	A lot damages to building and temples
1823	No record deaths	Some damage to houses
1833	Estimated magnitude 7.7, and 414 people died in the vicinity of the Kathmandu valley	Nearly 4040 houses destroyed in Kathmandu, Bhaktapur, and Patan in the valley and adjoining Benepa and a total of 18,000 buildings damaged in the whole country.
1834	No good record available	Many buildings collapsed
1837	No good record available	No damage in Nepal recorded but greatly affected Patna and other parts of Bihar, India.
1869	No good record available	No good record available
1897	No good record available	No good record available
1917 (1918?)	No record deaths	No record on damage
1934	Estimated magnitude 8.3 (epicenter, eastern Nepal). 8,519 people died out of which 4,296 died in Kathmandu valley alone	Over 200,000 buildings and temples etc. damage out of which nearly 81 thousand completely destroyed in the country. Max. Intensity X. 55,000 building affected in Kathmandu (12,397 completely destroyed).
1936	No good record available	No good record available
1954	No good record available	No good record available
1966	24 people died	1,300 houses collapsed
1980	Magnitude 6.5 (epicenter far western Nepal). 103 people died	12,817 building completely destroyed, 2,500 house collapsed
1988	Magnitude 6.5 (epicenter in SE Nepal). 721 people died	66,382 buildings collapsed or seriously damaged.

Source: UNDP/UNCHS,1993, Pandey and Molnar, 1988, Bilham et al.,1995

To enter Nepal to the capital Kathmandu, it is not in the other passing through the two roads that have been built in the steep mountains.

The huge landslide in Alnico HWY through to China from Kathmandu now, the road has become impassable. If an earthquake occurs, that the mountain road is impassable for a long period of time due to the collapse of many more.

However, the tunnel construction in steep places, the terrain is a method very effective as a bypass road transportation.

4.2.4 Climate

(1) Climate Conditions in Nepal

The temperature and precipitation patterns are highly dependent on the altitude. Although it's a small country, Nepal has five climatic zones.

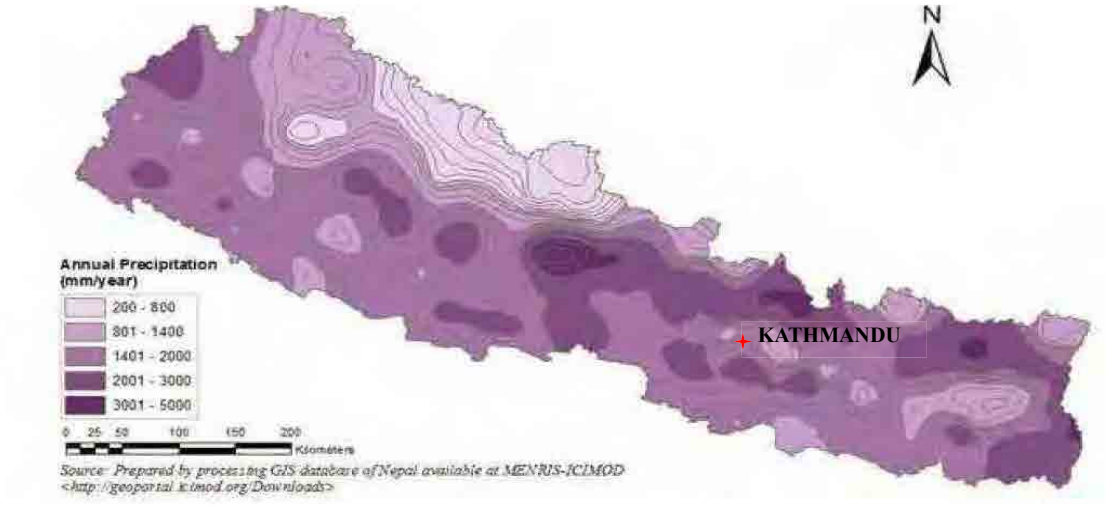
TABLE 4.2-2 THE CLIMATE AT KATHMANDU AIRPORT

Altitude	Climatic Zone
Below 1,200 m	Tropical and subtropical zone
1,200 – 2,400 m	Cool, temperate zone
2,400 – 3,600 m	Cold zone
3,600 – 4,400 m	Sub-arctic zone
Above 4,400 m	Arctic zone

Source: Profile on Environmental and Social Considerations in Nepal, January 2013, Japan International Cooperation Agency

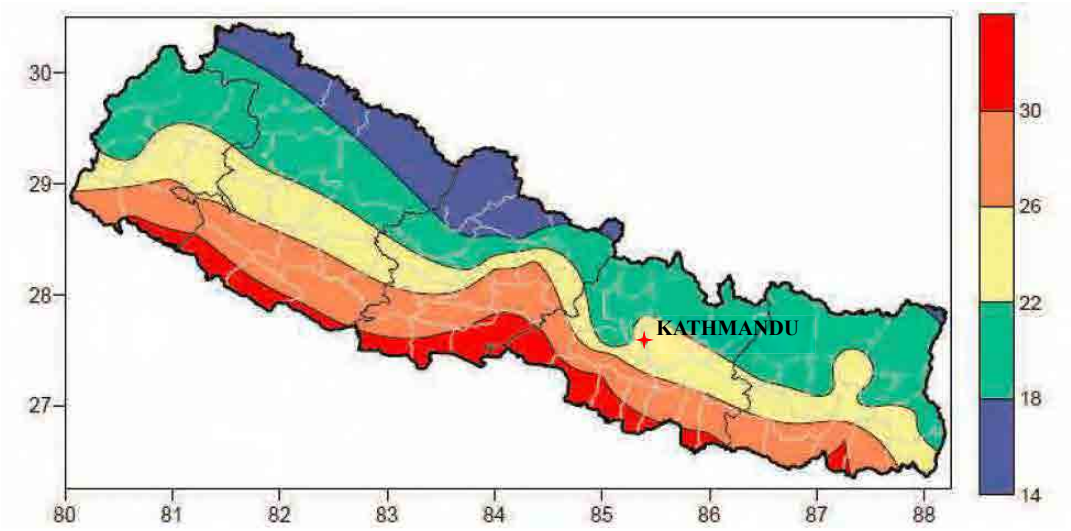
Generally, the temperature in the country decreases from south to north as the altitude increases.

The annual rainfall distribution in Nepal is also influenced by the changes in altitude. In addition to these effects, the amount of rainfall also generally decreases from east to west during the summer monsoon from June to September. Eastern Nepal receives approximately 2,500mm of rainfall annually; the Kathmandu area, about 1,420mm; and western Nepal, only about 1,000mm.



Source: "State of water: Nepal" http://www.wepa-db.net/policies/state/nepal/overview.htm (Accessed on 20 November 2012), cited in Profile on Environmental and Social Considerations in Nepal, January 2013, Japan International Cooperation Agency

FIGURE 4.2-14 ANNUAL PRECIPITATION PATTERN IN NEPAL



Source: Nepal Health Research Council. 2009. "Situation Analysis of Environmental Health in Nepal 2009." http://www.nhrc.org.np/reports/Situation%20Report.pdf (Accessed on 27 December 2012), cited in Profile on Environmental and Social Considerations in Nepal, January 2013, Japan International Cooperation Agency

FIGURE 4.2-15 MEAN ANNUAL TEMPERATURE

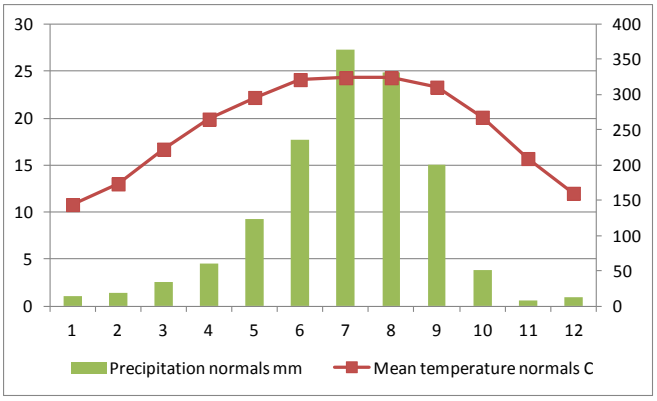
(2) Climate Conditions in the Project Area

The temperature in the Kathmandu area is moderate throughout the year, but its rainfall shows clear dry and wet season. During the wet season between May and September, nearly 90% of the yearly precipitation is observed.

TABLE 4.2-3 MEAN TEMPERATURE AND PRECIPITATION AT KATHMANDU AIRPORT

Month	1	2	3	4	5	6	7	8	9	10	11	12	
Mean temperature normals C	10.8	13	16.7	19.9	22.2	24.1	24.3	24.3	23.3	20.1	15.7	12	Average 18.9
Precipitation normals mm	14.4	18.7	34.2	61.0	123.6	236.3	363.4	330.8	199.8	51.2	8.3	13.2	Total 1,454.9

Source: Department of Hydrology and Meteorology, Climate Normals. http://www.dhm.gov.np/uploads/climatic/880251189NORMAL%20FILE.pdf (Retrieved 2014 March 10)



Source: Department of Hydrology and Meteorology, Climate Normals. http://www.dhm.gov.np/uploads/climatic/880251189NORMAL%20FILE.pdf (Retrieved 2014 March 10)

FIGURE 4.2-16 MEAN TEMPERATURE AND PRECIPITATION AT KATHMANDU AIRPORT