

Comparison of historical rainfall and CCKP output for Nepal (Source: CCKP Portal)

Month	Historical rainfall in mm (1980-2015)	Predicted Rainfall in mm (2020-2099)	Increment
July	326	342	4.9 %
August	279	325	16.5 %
September	202	205	1.5 %

For the design of drainage structures of this road section the design floods have been estimated in safe side considering 16% increase in extreme rainfall in future. Also, for verification purposes floods were estimated by different methods including regional empirical methods which also give reasonable flood estimates. Again, for being in safe side the largest flood value estimated from different methods has been adopted for the design.

15. Design of Bridge, Culvert and Other Strucutre

The bridges are designed following limit state method prescribed by Indian Road Congress (IRC) and Indian Standard (IS) design codes. In some cases, AASHTO guidelines are followed where the Indian standards do not cover the required methodology, particularly for the design of the signature bridges.

Most of the existing bridges in the proposed section of the East-West Highway (EWH) included in the present scope of works are found to be still intact and believed to have considerable number of years of useful life. A condition survey based on visual observation was carried out and recommendations have been made to improve the service level of the existing bridges in separate chapters of the main report. Reviewing the upgrading of previous sections of EWH such as Butwal Narayanghadh and Kamala –Kanchanpur Sections, an understanding was developed not to replace existing major bridges unless they are unfit structurally or functionally. Since then, it has been practiced to add a new bridge at the side of the existing one. There are 43 nos of major,minor bridges and 155Nos culverts.

In the non-urban area bridges, the main carriageway width is kept as 8.0m (7.5m + 0.5m curb-shyness width) as in the previous designs for upgrading of the EWH. Footpath is provided at one side (outer side) with a clear width of 2.75m.

In the urban/semi-urban area bridges, the main carriageway width is kept as 8.0m (7.5m + 0.5m curb-shyness width) as in the previous one. A 5.0m service lane has been provided separated by a double-sided crash barrier. Raised footpath is provided at the side of the service lane with a clear width of 2.2m

16. Social and Resettlement Issues

The social analysis of the project area has identified numerous issues of poor, disadvantaged peoples, gender inequality, accessibility of different facilities and services, status or possibility of HIV/ AIDS and human trafficking. The linkage between poverty and social exclusion and

inadequate or lack of access due to lack of roads or improvement in the transport sector have been widely recognised.

In order to address the above issues like gender inequality, poverty, social risks such as HIV/AIDs and human trafficking, child labour; the mitigation measures should be incorporated in enhancement measures and also livelihood support programs in Resettlement Action Plan under Livelihood Restoration Programs.

17. Resettlement Plan

The Resettlement Plan (RP) is guided by the ADB Safeguard Policy Statement 2009, Land Acquisition Act of Nepal 2034 (1977) and other relevant policies and guidelines.

Through Gazette, Government of Nepal has declared total 50m Right of Way for East West highway. The project road has no land acquisition since the 50m Right of Way is clear throughout the section.

18. Environmental Assessment

As per the statutory legal requirement; Environmental Protection Act (EPA) 2076, and Environmental Protection Rule (EPR) 2020, (2077B.S); Schedule 3, Rule 3, Road sector E (6); Environmental Impact Assessment (EIA) is mandatory for upgrading of national highways or feeder roads of length more than 50 km. However, in accordance with the ADB's Safeguard Policy Statement (SPS), 2009, the project is categorized as category 'B', warranting an initial environmental examination (IEE). The Consultant has been preparing IEE (As upgrading length of road is only 50 km) of the proposed road.

19. Performance Based Maintenance Contract

Performance Based Maintenance of 5 years period will be applied after the Defect Liability period. PBM includes the Road Asset Management (RAM) or road maintenance of the pavement surface in a predefined service level condition including formation width, side drains, bridges and cross drainages, road side structures, road furniture, road marking, traffic sign boards, slope protection and safety elements of the road etc. for at least 5 years time frame.

PBCs need a conducive environment for successful implementation. The most important factors are

- strong commitment and support by key decision makers, especially from the ministry of finance, the ministry in charge of roads, and the road organization;
- a positive attitude from road organization staff;
- client, contractors, and consultants have the capacity to plan and manage this new kind of contract;
- an adequate road asset management system to support the requirements of PBCs;
- long-term funding; and
- a competitive road maintenance market.

20. Cost Estimate

Cost Estimate has been prepared considering District Rate of Rupandehi and Kapilbastu fiscal year 2079/2080. Standard Norms for Rate Analysis of Government of Nepal has also been adopted.

A. Road and Bridge Component

S. No.	Part of BOQ	Description of Works	Amount, NRs.		Total Amount
			590+000-615+000	615+000-640+000	
1	PART 1	General	226,183,242.93	213,503,812.99	439,687,055.92
2	PART 2	Road Works	5,914,528,660.33	4,562,267,645.79	10,476,796,306.12
3	PART 3	Bridge, Overpass and Animal Pass Structures Works	1,738,482,458.08	958,522,967.15	2,697,005,425.23
4	PART 4	Bridge Maintenance Works	28,266,635.44	39,599,769.74	67,866,405.18
5	PART 5	Environmental Mitigation, wildlife friendly, Social and Bioengineering Works	8,359,933.11	22,338,190.41	30,698,123.52
7	PART 6	Performance Based Maintenance Woks and Services	173,160,888.24	169,373,874.64	342,534,762.88
8	PART 7	Schedule of Day Works	58,203,497.00	53,534,560.00	111,738,057.00
9	PART 8	Provisional Sums	275,973,309.89	169,520,935.69	445,494,245.58
A	Total (A)		8,423,158,625.02	6,188,661,756.41	14,611,820,381.43
B	Total without PS (B)		8,147,185,315.13	6,019,140,820.72	14,166,326,135.85
C	Provision for Physical Contingencies @ 10% of (B)		814,718,531.51	601,914,082.07	1,416,632,613.59
D	Provision for Price Escalation @ 10% of (B)		814,718,531.51	601,914,082.07	1,416,632,613.59
E	VAT @ 13% of B+C+D (E)		1,270,960,909.16	938,985,968.03	2,209,946,877.19
H	Grand Total (T) =A+C+D+E		11,323,556,597.21	8,331,475,888.59	19,655,032,485.80

Thus, the total cost of the project including both road and special bridge is:

Total Net Construction Cost (Total of A) : NRs. 14,611,820,381.43

Total of Gross Project Cost (Total of H) : NRs. 19,655,032,485.80

Procurement Works

As implementing authority of this section is DCID-Development Cooperation Implementation Division, DoR, for the proposed road “**Procurement of Works without pre qualification Bidding Process**” based on the Standard Bidding Document of World Bank’s January 2021 has been adopted.

ICB (International Competitive Bid) procedure shall be adopted to enhance the contract administration effectively and to provide opportunity to participate by numbers of professional Contractors to achieve the quality works in stipulated time. It is therefore recommended that ICB procedures to be adopted and contract packaging shall be arranged accordingly for Butwal-

Gorusinghe (Imiliya) Section of East-West Highway. The Road works(50.00 Km) have been divided into two packages.

The proposed contract packages for Butwal-Gorusinghe (Imiliya) Section of East-West Highway are tabulated below:

The Proposed Contract Packages

Road Name	Package	Lots	Chainage		Length (Km)	Contract ID No	Approx. Contract Value (NRs)
			From	To			
Butwal-Gorusinghe (Imiliya) Section of East West Highway	I	1	590+000	615+000	25+000	SHIP/ICB/BG/01	8423.16 mil.
		2	615+000	640+000	25+000	SHIP/ICB/BG/02	6188.66 mil.

21. Economical Analysis

An economic analysis has been carried out to judge the project by comparing the costs to the project with the benefits arising from the project's effect.

The project road has been found to be economically viable because the IRR is higher than the applied discount rate of 9.0% and the NPV value has a positive value. The summary of the economic indicator is tabulated below:

Economic Indicators Summary: (unit: Millions of NRs.)

Alt.	Present Value of total Agency costs	Present Value of Agency Capital costs	Increase in Agency Costs(C)	Decrease in User Costs(B)	Net Present Value (NPV=B-C)	Internal Rate of Return (IRR)
Base	594	481				
Add Lane	8,964	8,574	8,370	32,051	23,681	23.50

**ANNEX XVIII: TOR FOR DETAIL STUDY OF SASEC HIGHWAY
IMPROVEMENT PROJECT**

APPENDIX A- TERMS OF REFERENCE
TERMS OF REFERENCE FOR CONSULTING SERVICES OF
PROJECT PREPARATORY CONSULTANT UNDER
SASEC HIGHWAY IMPROVEMENT PROJECT (SHIP-PPC)

A. Background

The Government of Nepal (the Government) has applied for a loan from the Asian Development Bank (ADB) for the SASEC Highway Improvement Project (the Project) and intends to apply a portion of proceeds to engage a firm of international consultants in association with domestic consultants (the Consultant) to undertake preparatory activities for the processing of a new loan or grant projects for funding by ADB or other bilateral or multilateral development institutions.

B. Objectives of the Assignment

The main objective of the consulting services (the Services) is to carryout feasibility study and detail engineering design of roads and bridges as shown in Table-1 below:

Table 1: List of Project Roads

S.N.	Description	Length	Lanes	Remarks
1	Kakarbhatta-Laukahi	120 Km	4	with both side service lane where required
2	Pathlaiya-Hetauda-Narayanghat	100 Km	4	
3	Butwal-Gorusinghe	50 Km	4	
4	Bridges in the above roads as listed in Annex-1 to TOR		2/4	As per condition survey report
5	Road Safety Improvement and Blackspots elimination of EWH	1027 Km		

1. The overall study consists of:
 - i. appropriate condition surveys;
 - ii. engineering design, specification, bill of quantities, cost estimates;
 - iii. economic analysis;
 - iv. social and environmental assessment in accordance with ADB's Safeguard Policy Statement 2009 (SPS), ADB's Environmental Assessment Guidelines (2003) as well as government regulations and policies;
 - v. Road Safety Improvement and Blackspots elimination in East-West Highway based on identification and recommendation by TA Consultant
 - vi. bidding documents for the improvement works;
 - vii. procurement assistance; and

Other assistance as may be required by ADB Mission for loan processing.

C. Scope of Services

1. General Scope of Services

The consulting service will include, but not necessarily be limited to the following:

- i. Investigate the alignments including bridges, tunnel and other road related structures in terms of socio-economic factors of the influence area, traffic, topography, geology, environmental aspects, soil and other related factors along the alignment with maps, sketches, wherever necessary for the feasibility study
- ii. Inventory of existing road sections including bridges and structures, including geometric features, and type and condition of drainage structures, including an estimate of their load-carrying capacity, pavements, and other major features.
- iii. Carry out engineering surveys as required preparing detailed engineering designs as appropriate to enable construction quantities to be calculated with reasonable accuracy ($\pm 10\%$)
- iv. Prepare designs based on the typical pavement sections, bridges and tunnel sections; applying sound engineering practice and giving due regard to environmental and social safeguards aspects in accordance with the ADB's Safeguard Policy Statement 2009 and Government's related regulations and policies.
- v. Investigate the suitability of local construction materials and, where necessary, locate new quarries and borrow pits and assess the quality and quantity of materials and hauling distance.
- vi. Study the hydrological regime in detail, based on an analysis of rainfall and flood records, supplemented by engineering field investigations, to establish the adequacy of road embankment levels, culverts, and side ditches, and design bed and slope protection for the drainage structures and bridges.
- vii. Assess cross-drainage requirements and proposed new structures (bridges, culverts, and causeways as appropriate) or improvements to structurally unsound structures.
- viii. Conduct detailed geotechnical investigation along the road and potential quarry sites.
- ix. Prepare practical and cost-effective geometric (horizontal, vertical, intersection, etc.) pavement and structural designs on the basis of projected traffic levels; pavement structure studies; axle-load considerations, as determined from activities (i) to (vi) and from previous studies; traffic safety; environmental assessment; and other relevant inputs.
- x. Determine the most cost-effective improvement option for each project road section. Where new pavements are to be provided, they will be designed, using an internationally recognized procedure, for a 20-year life, with provision for overlays during or at the end of that period to extend the life to 25-30 years.
- xi. Prepare engineering technical specifications for each work item, taking into account relevant specifications in use in the country and elsewhere for similar works.
- xii. Inventory of geologically sensitive areas like slip prone areas, areas subject to landslides, rock fall, snow drifts, erosion, avalanche activity etc.
- xiii. Prepare detailed plan for slope stabilization of existing landslide areas and potential landslide areas, with detailed engineering using civil engineering structures and bio-engineering, calculate its costs estimates and include them in bills of quantities.
- xiv. Surface and sub-surface investigation and testing, detail survey and design of slope protection, seismic analysis of Subsurface Investigations.
- xv. Seismic analysis and liquefaction assessment of bridges.

- xvi. Hydrographic survey if needed, utility survey, identification of Underground Structures and Other Obstacles, Structure Preconstruction Survey shall be carried out.
- xvii. Identification of faults in rock strata and impact of faults including geological details of rock strata.
- xviii. Conduct road safety audits with use of ADB's Road Safety Audit for Road Project; An Operational Tool Kit or similar procedures acceptable to ADB. Provisions for managing road safety aspects appropriately during construction will be included in all bidding documents.
- xix. Prepare detailed engineering designs of road, pavement, bridges and structures, and bills of quantities, and calculate engineering costs estimates for civil works.
- xx. Study the possibility of service areas; prepare detailed requirements, design & estimate of service areas including land acquisition.
- xxi. Prepare design and drawings for grade separated intersections at major intersections
- xxii. Prepare detail design for Road Safety Improvements and Blackspots elimination in the western section of East-West Highway (West of Butwal) based on the identification and recommendation made by TA Consultant. The consultant shall prepare comprehensive detail design Road Safety Improvements and Blackspots elimination covering all section of S.N. 1 to 4 of Table-1 of the TOR.
- xxiii. Prepare Bidding Documents (minimum 25 sets for each contract package) for the Procurement of Works, Goods and Services in accordance with the latest ADB standard bidding documents template available on the ADB website.
- xxiv. Prepare contract packages, taking into account (a) the location of the project roads, size of contracts, and other project specific factors; (b) ADB's Procurement Regulations; and (c) the aim of supporting development of strong, competitive domestic private sector capacity in construction industry.
- xxv. Prepare project management report for each contract package with detailed analysis and graphical representation showing critical activities and floats using CPM/PERT and work breakdown structure, which shall justify the project duration of each contract package.
- xxvi. Prepare engineering project implementation schedules for each kilometer using MS Project or equivalent project management software showing anticipated progress of works with required resources breakdown for each contract package. The schedules will reflect seasonal climatic effects at the work sites and take into account typical outputs on earlier ADB-financed road projects.
- xxvii. Prepare engineering drawings as per Client's requirements.
- xxviii. Prepare Quality Assurance and Quality Control (QA & QC) Plans and Safety Manuals prepared to be followed on the respective construction sites so as to enforce adequate QA & QC, and safety of construction workers, engineers and citizens.
- xxix. Prepare traffic management plans with estimation for widening works, replacement of culverts, bridges etc., such that the traffic is not interrupted for more than one hour at any time.
- xxx. Prepare traffic studies, traffic forecasts and carry out Economic Analysis
- xxxi. Preparation of resettlement framework, preparation of resettlement plans for each sub-project as per ADB guidelines and GoN Policy.
- xxxii. Environmental Assessment including EIA or IEE for each sub-project, and climate risk and vulnerability assessment (CRVA) as per ADB guidelines and GoN rules and regulations.

- xxxiii. Provide Knowledge transfer on latest technologies, procedure, methods etc, on road/bridge design & construction and current international practice on contract administration, contract management, disputes and its resolution etc.. Conduct capacity development component.
- xxxiv. Make presentations on the details adopted for design of roads and bridges to the DOR personnel and other relevant personnel before the designs are approved.
- xxxv. Provide On-the-job trainings to 10 fresh civil engineering graduates for minimum of 12 months on surveying, layout, various site investigations, feasibility study, detailed design of pavement, cross drainage, bridges and structures.
- xxxvi. The consultant shall, with consultation with the Client, divide the detail design works in three groups and complete the detail design in phases as mentioned in Table-6: Reports and Submissions.

2. Detailed Survey and Design of Road, Bridge and Other Structures

2.1. Details of Surveys and Studies

2.1.1. Topographical Survey and Mapping

1. The topographical survey shall collect adequate data to show the following details in the subsequent topographical map:
 - i. Topography with details such as: trees, forests, water bodies, existing infrastructures and other land features.
 - ii. Existing road details such as: formation width, paved area, access roads, bus bays, footpath, parking places, traffic signs, islands, signals and ROW limits (Buildings, Taharas, shops etc.)
 - iii. Details of existing cross-drainage structure details such as: length, width and heights of culverts, bridges, details about bridge spans, pier, abutment, railing and vertical clearances, existing access under the bridge, river training works and river bank structure details
 - iv. Existing power line details such as: high-tension poles, low-tension poles, transformers, sub stations, Streetlights poles, underground electrical supply (if any) etc.
 - v. Existing telecommunication details such as: telephone lines, poles, cabinets, towers and underground lines (if any).
 - vi. Existing water supply line details such as: supply mains, distribution lines, valves, valve chambers, underground water storage, fire hydrants, etc.
 - vii. Existing sewer line details such as: trunk sewers, branches, manholes, location/position of septic tank and soak pit of the adjacent building on the both sides of road within the ROW.
 - viii. Existing buildings details such as: religious shrines, governmental building, and residential building, type of foundation and tentative depth of foundation of the building
 - ix. Survey and Production of a map of 100m wide road corridor in 1:500 scale and with 1.0m contour interval and clearly showing the center-line of existing roads.
2. While conducting Survey works, the survey team should be accompanied by a highway engineer. The Consultant shall acquire the reference coordinate points from the Department of Surveys and referencing of all the survey works shall be made on these references. It should

establish inter-visible benchmarks within the ROW at a distance of not more than 200m along the road and on the both sides of the riverbanks in case of bridges.

3. While conducting the topographical survey for bridge design, the survey area should cover a minimum distance of 500m upstream, 500m downstream and 200m from the river banks on either side of the river at the proposed bridge site. In case of the topographical survey of the bridge site, the topographic map should show the following:

- x. Contours at 0.20 m intervals
- xi. Flood lines on either side of the river in the entire area surveyed
- xii. Both banks of the river
- xiii. River cross section at 25 m intervals
- xiv. Details of government and/or public establishments on the river banks, details of existing river training works (if any).
- xv. Traverse lines, benchmarks reference lines and/or points with respect to which the present topo-map is prepared
- xvi. The angle and direction of skew, if the bridge is proposed to be aligned skew
- xvii. The foundation type and zone of influence of the existing foundation of the bridge or any other structures adjacent to the proposed bridge site
- xviii. Other information relevant to design, construction and/or maintenance of the bridge.

2.1.2. Hydrological Survey

1. For determination of all design data the consultant shall carry out a detailed hydrological survey and study of the river and bridge site, which shall include the following:

- i. Catchment area of the river up to bridge site
- ii. Nature, size and quantities of debris carried by the river
- iii. Intensity, duration and distribution of rain in the catchment
- iv. Existing bridge or other hydraulic structures across the river in the vicinity of the proposed bridge site with their details as much as possible.
- v. General slope of the river from the critical point (origin) of the river up to bridge site and general slope of the catchment in both sides of the river.
- vi. Cross sections covering 100m on either side. Beyond flood lines of the river at proposed bridge site, at about 500m. u/s and about 500m d/s. wherein HFL, LWL, LBL, area of the cross section, wetted perimeter and geological profile with silt factor of each strata (at proposed bridge site only) shall be indicated. (Horizontal and vertical scale of the cross section shall be the same.)
- vii. Bed slope of the river which must start from 100m up of the U/S cross section and end at 100 m. down of the d/s. cross section.
- viii. Maximum discharge calculated by established formulas with different return periods and the peak discharge observed over a period of 100 years.
- ix. Velocity and depth of flow at the time of survey.
- x. Shifting of the river in the past at proposed bridge site and in its vicinity.
- xi. Other information required for river control, design, construction and maintenance of the bridge.

2. The hydrological survey shall collect secondary data, preferably from the governmental sources, to determine the following:

- i. Unit hydrograph for the catchment of River for bridge construction
- ii. Size of the opening and location of cross drainage structure
- iii. Minimize modification to the natural drainage pattern

3. After the selection of the proposed bridge site with alternatives and preparation of topographic maps, the Consultant shall discuss the collected hydrological and other data and decide the following points with the client for final decision of the bridge site:

- i. Design discharge
- ii. Scour depth. Maximum Scour depth
- iii. Linear waterway needed to be provided
- iv. Anticipated soil condition for foundation
- v. The most feasible proposed bridge site
- vi. River- training & approach roads
- vii. Type of proposed foundation, substructure and superstructure

4. The consultant shall also carry out a detailed hydrological survey and study along the road alignments and identify catchment, discharge in drain, cross drainage, seepage area etc.

2.1.3. Geotechnical Survey

1. For the pavement design, structures and buildings, the following geotechnical tests should be performed as per site requirement:

- i. Determine the sub-soil condition through pitting (1m x 1m x 1m) and Dynamic Cone Penetration (DCP) tests at 2 locations each 100m of the road alignment.
- ii. Determine the sub-soil condition through 2m deep pitting and DCP test at each 25 m where a retaining wall of height more than 3 m is required.
- iii. Determine the stability of the cut slopes using appropriate stability analysis or through study, field surveys and investigation of materials at site.
- iv. Conduct other tests as required by the geological, geotechnical survey and study.

2. For the design of the bridges, the Consultant should conduct sub surface exploration. The subsurface exploration shall include the following:

a. Test pits and auguring

Test pits and auger-holes in the riverbed to a depth as required by the site condition or scouring criteria of the river shall be made and the required samples shall be taken for lab testing.

b. Bore-holes, field tests and laboratory tests

The properties of the underlying soil are determined by field and laboratory tests of the soil samples obtained from the boreholes drilled to a depth as mentioned in the next paragraph. As far as possible, the locations of the boreholes shall be under each abutment and piers. Generally, the following tests (Table 2) should be conducted for determination of soil properties:

Table 2: Type of tests and sampling frequency

SN	Type of Tests	Sampling Frequency
1	Undisturbed Soil Sampling	at least 2 at each borehole
2	Standard Penetration Test	as required but the interval not less than 1.5 m
3	Grain size analysis	at least 2 at each borehole
4	Hydrometer analysis	at least 2 at each borehole
5	Moisture content	at least 2 at each borehole
6	Bulk and dry density	at least 2 at each borehole
7	Unconfined compression test	at least 2 at each borehole
8	Consolidation test	at least 2 at each borehole
9	Direct shear test	at least 2 at each borehole

c. Depth of soil exploration

The depth of soil exploration from ground level shall be as follows (Table 3):

Table 3: Tentative depths of soil exploration

SN	Type of soil	Governing depth
1	Silty, sandy, clayey soil	3 times the design scour depth, or 1.5 times the least dimension of the foundation footing, or 20 m, whichever is maximum
2	Granular soil (gravels, boulders)	depth of the foundation footing, or 16 m, whichever is maximum
3	Rocks (soft or hard)	Not exceeding 8 m and minimum 5 m

The above-mentioned depths are indicative. The Consultant shall decide the actual required depth of soil investigation according to the field condition and design parameters. If rock is found at the beginning or at mid-depth then the drilling works shall not exceed the depth as mentioned in the table above.

d. Changes in soil strata

During the boring, if there is any change of soil strata, the number of sampling of soils for different tests will be increased and the Consultant shall carry out the entire test required for each layer of soil. No additional payments will be made for such tests.

e. Soil exploration works to be certified

The client, if required, may ask the Consultant to submit the soil/rock samples obtained from the drilling works in core boxes and/or a bore-log certified by the concerned personnel at site. The Consultants shall take site photographs, video or other documentation as appropriate for all site investigation, surveys and studies.

2.1.4. **Seismological Study**

1. The consultants shall collect and refer to the available data regarding the seismic records of the area. The consultant shall conduct seismic vulnerability analysis as well as seismic liquefaction assessment of all structures and incorporate the findings in the design. While considering seismic forces on the bridge design, the Indian Standard Criteria for Earthquake Resistant Design of Structures, IRC: 6 along with other international codes may be followed.

2.1.5. Material Availability Survey

1. The Consultant shall conduct the material availability survey and study. It shall determine the quality and quantity of the materials required for construction. The availability of the necessary material shall be surveyed to determine the following:

- i. Suitable quarry site for boulder, sub-base/base/pavement aggregates, concrete aggregates, sand, fill materials
- ii. Material to be transported from elsewhere
- iii. Material to be imported from outside Nepal, their source and route of transport
- iv. Source of water for construction, location of boring if ground water to be used

2. The Consultant shall conduct study on the availability of construction materials like, sand gravel boulders, timber, etc. with their engineering properties, quantities and lead up to the bridge site. Quarry site of materials with their available quantities should be shown on a sketch plan with reference to bridge/road construction site.

2.1.6. Traffic Study and Analysis, Axle Load Survey

1. For the design purpose the traffic study at the critical points and intersection shall be made. The consultant shall make traffic demand estimates and establish possible traffic growth rates in respect of all categories of vehicles, taking into account the past trends, annual population and real per capita growth rate, elasticity of transport demand in relation to income, estimated annual production increase, socio-economic development plans and the land use patterns of the region having impact on the traffic growth, the projections of vehicle, manufacturing industry in the country, development plans for the other modes of transport, commodity movement behavior should also be taken into account while working out the traffic demand estimates.

2. Axle load surveys in both directions shall be carried out at suitable location(s) in the project road stretch on a random sample basis and deduce the result.

3. While selecting the location(s) of axle load survey station(s), the locations of existing bridges with load restrictions, if any, should be taken into account and such sites should be avoided.

4. The Consultant shall ascertain from local enquiries about the exceptional live loads that have used the highway in the past in order to assess the suitability of existing bridges to carry such loads.

5. Based upon the above-mentioned studies and investigations the consultants shall make the best use of their technical know-how and professional skills to arrive at conclusion and recommend the most sustainable and cost-effective design parameters. The consultant shall discuss in detail all possible options and shall recommend the most appropriate option.

2.1.7. Condition Surveys for Bridges, Culverts and Structures

1. The Consultants shall thoroughly inspect the existing Bridges, Culverts and Structures and shall prepare a report about their condition including all the parameters in the approved format. The condition and structural assessment survey of the bridges / culverts / structures shall be carried out by senior experts of the Consultants for the bridges identified to be in a distressed condition based upon the visual condition survey, supplementary testing. Selection of tests may be made based on the specific requirement of the structure.

G.K.

2.1.8. Inventory survey of Road and Road Side structures

1. The Consultants shall thoroughly survey existing alignment of Roads and prepare a detailed inventory report. The consultant shall prepare detailed drawings of the existing alignments showing plan, profile, drainage, structures, cross-section and other details.

2.1.9. Miscellaneous studies/investigations

1. If not covered by aforesaid, the Consultants shall perform other studies, explorations, tests surveys, calculations, etc. required to produce full and complete set of working drawings, specifications, bills of quantities, requirement of materials and complete cost estimates for the bridge/s including related works based upon which construction activities can be started to complete without further study and/or reference to them.

2.2. Details of Design Works

2.2.1. Design of Road

1. Design of Road shall include the following:
 - i. Design of the vertical and horizontal alignment for a design speeds appropriate as per NRS 2070, and subsequent revision if any, and Asian Highway Standard.
 - ii. Design of highway cross-section at minimum of 1 m interval
 - iii. Design of cut and fill slopes minimum of 1 m interval
 - iv. Structural design of retaining structures (RCC, Plum concrete, reinforced earth, etc.)
 - v. Structural design of all RCC structures (including of bridges, grade separated interchanges and underpasses)
 - vi. Slope protection and Bio-engineering
 - vii. Service lanes along settlement areas and bus bays
 - viii. Identification and design of road crossings for pedestrians and Vehicles from one side of road to another side
 - ix. Identification and design of animal underpass/overpass (if necessary)
 - x. Identification of road side service area and its design
 - xi. Production of design drawings (A1 size) showing plan in 1:500 scale, Longitudinal profile in 500H to 100V scale, cross-sections at 10 m interval in 1:100 scale

Road alignment designed on Digital Terrain Model (DTM) shall be set out at the site with staking the central line and taking levels with verification of design. The consultant may use internationally recognized software for the road and bridge design. However, availing the software for the design purpose and any errors arising thereof during construction shall be the responsibility of the Consultant. All the coordinates in the drawings shall be in reference to the coordinate value acquired from Department of Survey.

2.2.2. Design of Pavement

2. While designing the pavements, the Consultant shall:
 - i. Maximize the use of existing pavement layers (scrapping only in case of strength deficiency)

- ii. Design of sub-grade, sub-base, base and DBST/asphalt layers for each 100 m interval or where the sub-surface condition/traffic volume changes
 - iii. Design for 10.2 T axle load
 - iv. Design shall consider the AADT data which needs to be collected by the consultant at the particular junctions/road sections, direct traffic counting at critical junctions
 - v. Design of pavement on the bridges and approach roads
3. The pavement design task shall also cover working out the maintenance and strengthening requirements and periodicity and timing of such treatments.

2.2.3. Design of Drainage Structures

4. While designing the drainage structures, the Consultant shall use the data collected during the hydrological survey and determine the following:

- i. Type of surface and sub-surface drain
- ii. Type of the cross-drainage structure
- iii. Structural design of slab and box culverts
- iv. Size and location of road-side drainage and cross drainage structures (appropriate side drains and cross drainages such as pipe culverts)
- v. Design of the water conduit/rain water inlets/manholes to take storm water safely to the nearby natural stream
- vi. Maximize the use of the existing structures if possible

2.2.4. Design of Bridges

1. Based on the collected information and results of the condition survey, the consultants shall design the bridges following the standard codes of practice, norms and guidelines. In addition, the designer shall take into considerations of general aesthetics and architectural perspectives of the bridges to be designed. In respect of span arrangement and type of bridge at least three different alternatives (functionally and structurally) with cost benefit analysis considering environmental and social aspect shall be submitted to the client with recommendation of best alternate for each and every bridges.

2. In case of major Bridges with length more than 300m, the consultant shall design long span landmark bridge (suspension, cable stayed, network arch bridge etc.). The consultant shall do a thorough condition survey of existing Bridge and estimate the remaining life of the bridge. The consultant shall also study the possibility of construction of one 4 lane bridge or one/two double lane bridges on either side of the existing bridges with detailed cost benefit analysis and present a report to client for approval.

3. The Consultant shall prepare General Arrangement Drawing (GAD) and Alignment Plan showing the salient features of the bridges and structures proposed to be constructed / reconstructed along the road sections covered under the Study. The width of bridges shall be double lane/4 lane (depending upon the condition of existing bridges) with footpath. The Consultants shall also carry out the design and make suitable recommendations for protection works for Bridges as well as river training works. The design of bridge shall also include design of approach road with proper geometric design to connect with existing road alignment including road safety provision.

4. The Consultant shall perform multi-modal response spectral analysis as well as nonlinear analysis of reinforced concrete column/walls/caisson/pier/abutments/pile etc., of the approved bridge types using internationally recognized computer software.
5. The Consultant shall produce detailed quantity estimate of the bridge and its accessories. They shall collect information on sources of materials and their lead distances and prepare rate schedules and cost estimates based on the standard norms and prevailing district rates.
6. All activities related to field studies, design and documentation shall be done as per the latest guidelines, standard codes of practice (Nepal Bridge Standards) and norms. The Consultants shall work in close coordination with the Bridge Branch of Department of Roads in every step of design of bridges.
7. The design consultant shall submit to DOR design certificates signed by the design consultant's Team Leader and Bridge Design Engineer that itemize all drawings and, if appropriate, bar-bending schedules for all detailed design elements of the Bridges and Approach roads. The certificates shall be in an agreed format and reflect the design consultant's obligations under contract.
8. The design consultant is required to liaise and cooperate in a proactive manner with the checking officers of DOR Bridge Branch and Bridge Design Checking Expert, supplying design information for checking in accordance with an agreed schedule. The checking engineers will be required to provide check certificates as a key deliverable. It is the design consultant's responsibility to resolve all technical issues raised by the checking expert and DOR relating to the design in order to get the approval from DOR.

2.2.5. Traffic Safety Features, Road Furniture and Road Markings

The Consultants shall conduct road safety audit and design suitable traffic safety features and road furniture including traffic signals, signs, markings, overhead sign boards, crash barriers, delineators, service areas etc. The Consultant shall prepare detail design for Road Safety Improvements and Blackspots elimination in the western section of East-West Highway (West of Butwal) based on identification and recommendation by TA Consultant. The consultant shall prepare comprehensive detail design Road Safety Improvements and Blackspots elimination covering all section of S.N. 1 to 4 of Table-I of the TOR. The locations of these features shall be given in the reports and also shown in the drawings.

3. Economic Analysis

2. The consultants will carry out the following tasks but are not limited to:
 - i. Review existing traffic data, conduct traffic counts and origin-destination and axle-load surveys, and forecast traffic for each candidate road sections for 20 and 30 year projections.
 - ii. Prepare an economic analysis of the proposed road improvements using the Highway Development and Management model (HDM, version 4). Calculate the Economic Internal Rate of Return (EIRR), individually and overall.
 - iii. Undertake sensitivity analysis on the risk factor basis for various scenarios such as changes to the cost, generated and diversion traffic, modal shift, construction period, etc.
 - iv. For selected priority road sections with impact on the sub regional transport system, assess the economic impact and outcome/benefits – derived from or attributable to the improved sub regional transport system/network (especially between India and Nepal). This includes (but not necessarily limited to) the following:
 - v. Measurable effect on trade competitiveness through delivery costs, transit times, and supply reliability – identify relevant baseline indicators and predict achievable target outcomes.

- vi. Estimated increase to regional traffic volume and trade volumes generated by the enhanced road network by improving project roads.
- vii. Prepare and submit Economic Assessment Report, presenting the following:
 - (a) Introduction
 - (b) General Considerations
 - (c) Input Data for Vehicle Operating Cost Components and Other Components for Economic Analysis
 - (d) Economic Benefits (including those due to regional implications)
 - (e) Construction and Maintenance Alternatives and Cost Estimates
 - (f) Economic Analysis
 - (g) Sensitivity Analysis
 - (h) Conclusions – summarizing the economic assessment, approach & methodology, findings (EIRRs and sensitivity analysis), and overall economic viability.



Appendices:

- A. Project road details (should be available from main report)
- B. Traffic studies (base year traffic, traffic generation, traffic diversion assessments)
- C. Economic growth trend and traffic forecast (including the basis)

- viii. Develop a project impact monitoring framework and carry out baseline survey for all roads.

4. Social Assessment

- i. The consultants will carry out the following tasks but are not limited to:
 - i. Conduct 20% poverty & social assessment taking into account socioeconomic and poverty status of the project area of influence, including the nature, extent and determinants of poverty in the project area. Identify and estimate the likely socioeconomic and poverty reduction impacts of the project. Assess local demand for the proposed road investments, employment opportunities, child labor, affordability, gender specific capacity to take advantage of the likely socioeconomic opportunities that would result from the project. This will be in accordance with ADB's Guidelines for the Incorporation of Social Dimensions in ADB Operations and its Handbook on Poverty and Social Analysis.
 - ii. Identify project-related interests of key stakeholders, likely barriers to their participation in and benefiting from the project resources, and suggest possible strategies for addressing their concerns.
 - iii. Conduct studies by using participatory approaches. With the participation of stakeholders, identify and analyze the reasons behind the vulnerability of at risk groups, including their exposure to risks. Suggest participatory development strategies for key stakeholders to apply when designing and implementing the project.
 - iv. Prepare a gender analysis. Identify project design elements (policy, investment, or implementation) in which women can participate in and thus benefit from the project.
 - v. Conduct assessment of risks of human trafficking and HIV/AIDS due to the project. Provide suggestions for measures to be incorporated in the project to mitigate possible adverse impacts through human trafficking and HIV/AIDS, and identify possible partners for assisting in implementing such measures.

- vi. Identify any necessary mitigation measures and a strategy for implementing them. Identify potential proactive measures, in terms of additional components and design options, which will make it easy for the poor and vulnerable to benefit from the project.
 - vii. In coordination with the economic analysis, design a time-bound benefit monitoring and evaluation program, including monitoring indicators and baseline data, to assess the project benefits to local communities before and after the construction of project. The program should address not only the economic benefits but also poverty reduction impacts and other social benefits such as stability of the region and integration with other parts of the country.
- Submit a draft final Poverty and Social Analysis (PSA) report to ADB and IDOR for review and comments. Incorporate comments and finalize the PSA accordingly, then re-submit the revised PSA to ADB through DOR. Summarize and submit these PSA findings in the Summary Poverty Reduction and Social Strategy (SPRSS) report format.

5. Resettlement and Indigenous People Assessment

1. The consultants will carry out Resettlement and Indigenous People Planning of the project roads and bridges in accordance with the ADB's Safeguard Policy Statement 2009, Public Communications Policy 2005 as well as Government's acts, regulations and policies. The major tasks include, but are not limited to, the following:

- i. Conduct a preliminary social impact assessment for the project including assessment of possible land acquisition/resettlement impacts for the candidate road alignments in accordance with ADB's Safeguard Policy Statement 2009. Prepare and complete screening and impact categorization form for involuntary resettlement for the candidate road alignments.
- ii. Identify whether the project will be located in, or pass through, areas of significant indigenous people's settlements, and if this is the case propose how to specifically include indigenous peoples in project planning and implementation in accordance with ADB's Safeguard Policy Statement 2009. If relevant, make an overview of population characteristics in the project area and anticipate project impacts. Prepare and complete checklist for indigenous people screening and impact categorization for the candidate road alignments.
- iii. Review existing resettlement policies and plans under ongoing ADB and Government projects and adapt them to the project roads as necessary acceptable to the Government and ADB in compliance with the ADB's Safeguard Policy Statement 2009 and Government related acts and policies.
- iv. Prepare a resettlement plan (RP) and indigenous people plan (IPP) as necessary acceptable to the Government and ADB in compliance with the ADB's Safeguard Policy Statement 2009, and Government related acts and policies. RP and IPP should be based on 100% census which covers a complete enumeration of all Displaced Persons (DPs) and their affected assets.
- v. Assess the Resettlement budget requirement for acquisition of land of different width from footprint of the road to the full Right of Way (ROW) of the road and recommend the best alternative.
- vi. Define categories for impact and eligibility of affected people for compensation and prepare a matrix of entitlements covering compensation and other assistance for all types of impacts to fully replace lost assets, income, and livelihood. Assess whether the

- compensation standards for all types of assets, crops, and trees are based on replacement value and discuss in detail the valuation methodology used.
- vii. Prepare a comprehensive income and livelihood restoration program, supported by adequate budget, to help DPs improve, or at least restore, their incomes and livelihoods. Identify specific measures for the affected poor, ethnic minorities, or other vulnerable households.
 - viii. Ensure that (a) the compensation standards are based on replacement value, and (b) the overall resettlement budget is sufficient to implement the resettlement plan based on the proposed entitlements and rehabilitation plans.
 - ix. Assist Government officials to initiate and expand consultation with the affected communities, local leaders, proponents, and stakeholders who may be opposed to the Project. Prepare a consultation plan for the DOR and a format for documenting consultation with affected people.
 - x. Assess the capacity of the Government in implementing the proposed RP and IPP, recommend improvements and actions required before land acquisition, and proposed necessary training to enable the DOR and the Government to implement the RP and IPP and assess the social and resettlement issues of the follow-on subprojects, if required. Assist the DOR to (i) prepare a resettlement implementation schedule, (ii) recruit NGO/Agency for RP and IPP implementation (if required), and (iii) recruit consultants for external monitoring and evaluation.
 - xi. Assist the DOR to develop a computerized database management system for recording DPs and lost assets. The system should reflect the present impact on DPs and accordingly the entitlements for DPs are planned. The system should be in place from the beginning of the resettlement survey.
 - xii. Develop cadastral mapping of affected plots for construction of the alignments using road inventory map developed under the engineering study. Also, prepare file map and trace map of individual plot of land that needs to be acquired.
 - xiii. While preparing IPPs, conduct (a) social impact assessment, (b) meaningful consultation and (c) ascertain consent of affected IP communities. For items (b) and (c), proper recording and full documentations are required. These documents must be attached to IPPs as annex. These IPPs should also incorporate the findings of the resettlement census.
 - xiv. Prepare a final RP and IPP, and summary RP and IPP based on detailed design, taking into account comments from ADB and the Government, and based on 100% census survey. The RP and IPP should include a record of consultation with affected persons.
 - xv. Conduct a workshop training to provide guidance to the DOR on Project-related social issues and ADB's Safeguard Policy Statement (2009) procedural requirements during Project preparation and implementation. The scope of training should include the differences between the provisions of the ADB policy and the relevant country laws.

6. Environmental Assessment

1. The consultants will carry out Environmental Assessment (EA) of the project roads and bridges in accordance with the ADB's Safeguard Policy Statement 2009, Public Communications Policy 2011 as well as Government's acts, regulations and policies. The EA can require Environmental Impact Assessments (EIA) or Initial Environmental Examination (IEE) as the case may be. The major tasks include, but are not limited to, the following:

- i. In accordance with Government's notification on Environmental Impact Assessment (EIA) and ADB's guidelines, review and confirm the environmental classification of the project, and indicate which sections pass through National Park (NP), Wildlife Sanctuary (WS), other Sanctuary (S), and reserve forest if any. From the review, prepare a summary matrix for environmental classification, showing the length of sections passing through NP, WS, S, or RF areas, necessary environment-related information, and environmental classification;
- ii. If the project is classified as "A", draft terms of reference for the EIA study, to be submitted to the Ministry concerned for approval. After the approval of the TOR for the EIA study, undertake the EIA study and prepare an EIA report. The Consultant will lay special emphasis to induced/cumulative impacts of the projects and estimate and analyze climate change impacts while assessing the environmental sustainability of the proposed project designs;
- iii. If the project is classified as "B", undertake IEE study and prepare an IEE report including an environment management plan (EMP) for each project in accordance with ADB's Safeguard Policy Statement (2009);
- iv. Carry out a climate risk and vulnerability assessment (CRVA) in accordance with ADB's Guidelines on Climate Risk for projects with medium or high climate risk. If the project passes through ecologically sensitive areas, collect necessary primary data on ecology (vegetation analysis, rapid assessment on biodiversity) needs to be used as a basis for predicting the environmental impacts;
- v. Carry out a baseline wildlife study for Pathlalya-Hetauda-Narayanghat road section, to be used as a basis for predicting the wildlife impacts of the project road.
- vi. Ensure that the IEE/EIA study be carried out by taking into account Government's and ADB's EIA guidelines, and that the EIA report and its summary be prepared in accordance with the ADB's Environmental Assessment Guidelines, 2003. The study has to cover project area and affected area, and provide assessment of impacts, analysis of alternatives, environmentally sensitive regions, loss of biodiversity, suitable mitigation measures, adequate consultation with affected people, and a proper management plan;
- vii. Analyze greenhouse gas emission levels in the project cycle, and recommend technically and financially feasible and cost-effective options to reduce or offset project-related greenhouse gas emissions during project design, construction and operation;
- viii. Recommend occupational and community health and safety measures, and proper Grievance Redress Mechanism for the affected people in the course of the project cycle;
- ix. Assess the DOR institutional arrangement and capacity in addressing environmental concerns related to the Project; identify requirements for additional capacity building in project preparatory works; and conduct a seminar/workshop to provide guidance to DOR on procedural requirements and required activities for each stage of project preparation and implementation;
- x. Finalize EIA or IEE report including EMPs and their summaries, as required. Prior to finalization, draft reports should be submitted to DOR and ADB for review.
- xi. Environmental Assessment (EA) report should perform census study while performing biological survey and should mention the details of each tree including: GPS position, name of species, diameter, height and category of timber and should be clearly provided in annex of the report.
- xii. Details of chainage wise information for each community forest/national forest/government forest trees be clearly mentioned and loss from each category should be reported clearly.

- xiii. The consultant shall work in close coordination with respective district forest office during field survey specially in case of tree counting and should submit its proof in the EA report.
- xiv. The location of the project structures/facilities should be clearly mentioned in the EA report showing in colored topographic and google maps with proper scaling.
- xv. There should have coherency in the design report and the EA report.
- xvi. Environmental Management Plan should be precise and applicable as per Nepalese standards/norms.

7. Noise, Air pollution and Water Quality Parameters

1. The Consultant shall perform baseline study for measurement of total suspended particle (TSP), Particulate matter in air, Sulphur oxides, nitrogen oxides, lead, carbon monoxide and benzene as of acceptable standards (WHO/national Ambient air quality standard 2012) and required modelling in the format accepted to ADB. The consultant shall also measure water quality parameters for collecting baseline information in case of surface and ground water contamination as per National water quality standard for drinking water/WHO as accepted by ADB and DoR.

8. Wildlife Survey

1. The Wildlife Expert will coordinate with the TA consultant employed by ADB for wildlife study of project roads specially Pathlaiya-Narayanghat road and incorporate the recommendations from the TA consultant regarding locations, design and numbers of underpasses/overpasses that will be required to be constructed in the design. The Wildlife Expert shall coordinate with the Environmental Specialist and include his/her findings and recommendations in the EMP and EIA Reports.

9. Procurement Assistance

1. Procurement shall be carried out in accordance with ADB's Guidelines on Procurement. The Consultant shall prepare bidding documents and assist with procurement actions, including advertising, issuing bidding documents, responding to queries, receiving and evaluating bids, and preparing bid evaluation reports, and any other appropriate assistance.

10. Capacity Development

1. The consulting services shall include organizing in house, national and overseas training for capacity development of DoR personnel in different disciplines. The consultant shall organize, manage and provide knowledge transfer on current practices and developments on construction techniques, advanced contract management, Dispute resolution, FIDIC etc., to DoR personnel.

D. Team Composition and Qualification Requirement for the Key Expert

The consulting services shall be carried out by an international firm in association with national consultants. Minimum 90 person-months of international experts and 295 person-months of national key experts and 120 person-months of national non-key experts will be required to carry out the assignment. The qualification requirement for evaluation of key experts is set out in Annex 2. The person-month required for assignment is enumerated under Table-4, Staff Input. The Task responsibility of each position is enumerated under Tabel-5, position-based Tasks/Responsibilities.

Table-4: Staff Input**1. International Key Experts**

Position	Quantity	No. of Person-Months	Total Person Months
Team Leader/Senior Highway Engineer	1	24	24
Sr. Bridge Design Engineer-1	1	20	20
Sr. Bridge Design Engineer-2	1	15	15
Sr. Geotechnical Engineer	1	12	12
Sr. Procurement Specialist	1	6	6
Transport Economist	1	5	5
Sr. Road Safety Engineer	1	8	8
Sub-Total			90

2. National Key Experts

Position	Quantity	No. of Person-Months	Total Person Months
Deputy Team Leader /Highway Engineer-1	1	24	24
Highway Engineer-2	1	20	20
Bridge Design Engineer	3	22	66
Structural Engineer	1	10	10
Geotechnical Engineer	2	22	44
Material Engineer	1	6	6
Road Safety/Traffic Engineer	1	12	12
Hydrologist	2	22	44
Transport Economist	1	9	9
Procurement Specialist	1	18	18
Environment Specialist	1	20	20
Social Development/Resettlement Specialist	1	16	16
Wildlife Expert	1	6	6
Sub-Total			295

3. National Non-Key expert

Position	Quantity	No. of Person-Months	Total Person Months
Electrical Engineer	1	2	2
Environmental Engineer	1	20	20
Road Safety Engineer	1	12	12
CAD Operator	2	19	38
Cadastral Surveyor	1	24	24
Social & Resettlement Officer	1	24	24
Sub-Total			120

Table-5: Position Based Tasks/ Responsibilities

S. N.	Position	Task Assignment
1	Team Leader	Shall be over-all responsible for the project inter-alia including but not be limited to: ◆ Overall in-charge of the Project Team, ◆ Overall implementation activities ◆ Coordinate with the Subordinate Team to ensure that the construction process is well controlled as per established Procedures ◆ Interaction with the client ◆ Review of the existing available information, studies and data, inventory survey of priority road section ◆ overall management of the Design activities ◆ Preparation of Quality Assurance Plan ◆ Review of data and documents ◆ Work Program method statements ◆ CPM analysis and planning ◆ Quality Assurance System ◆ Safety Procedures, ◆ geotechnical investigation ◆ working drawings & specifications, ◆ Design works ◆ environmental and social safeguard aspects ◆ proposed construction materials and contingency plan, ◆ Environmental Assessment Works ◆ Project Planning and planning schedule for Construction ◆ Social and Resettlement Planning ◆ Supervise the necessary Test, analyze and recommend for the approval, ◆ Prepare the monthly, quarterly report and other Project Reports as per ToR ◆ Training and Technology Transfer; S/He shall be responsible for guiding/supervising the work of key personnel & support staff to achieve the project objective
2	Senior Highway Engineer	Shall be responsible but not be limited to the following: ◆ Conduct and supervision of all traffic related works ◆ Preliminary and detail design work through practical and cost-efficient approach ◆ Prepare designs based on the typical road sections, applying sound engineering practice and giving due regards to environmental aspects. ◆ Field tests and verifications ◆ Review report Provided by TA Consultant ◆ Identify and locate intersection and grade separated intersection ◆ design, development and production management for the roadway plans, ◆ producing support documentation, including reports, quantities and specifications ◆ Design of Bio Engineering Works and Environmental Protection

		◆ Design of Pavement ◆ Design of Bridges ◆ Training and Technology Transfer
3	Sr. Bridge Design Engineer	Shall be responsible design of Major Bridges including the following:
		◆ Carryout detailed survey and sub-soil investigations of bridge sites ◆ Analysis of Bridge ◆ design the bridge following the standard codes of practice, norms and guidelines Considering general aesthetics and architectural perspectives of the bridges ◆ Discuss with client about span arrangement and type of bridge and foundation type with alternatives and cost-benefit ◆ Modeling and testing of design ◆ Produce detailed quantity estimate of the bridge and its accessories. ◆ Prepare rate schedules and cost estimates based on the standard norms and prevailing district rates. ◆ Training and Technology Transfer
4	Sr. Geotechnical Engineer	Shall be responsible but not be limited to the following:
		◆ Conduct detailed geological mapping at 1:1,000 with contour intervals at 2 m, sub-surface drilling at selected locations for major landslides and collect samples of mechanical properties of soils as necessary; ◆ Stability analysis of slope ◆ Rock Classification of road and tunnel ◆ Assess the requirement for slope protection measures adjacent to the road, and design any necessary remedial works ◆ Detailed Geotechnical investigation of Bridge site, tunnel and road alignment ◆ Potential Quarry site identification and quantification ◆ Training and Technology Transfer
5	Sr. Procurement Specialist	Shall be responsible but not be limited to the following:
		◆ Develop appropriate contract management tools, guidelines and manuals for standardization and knowledge sharing purposes. ◆ Preparing and amending the bidding documents as needed in accordance with ADB's Guidelines and GON Rules ◆ CPM/PERT analysis and reporting ◆ Assist in procurement in accordance with the Procurement Plan and Asian Development Bank Guidelines and preparation of evaluation reports ◆ Preparing the General Procurement Notice (GPN), Specific Procurement Notices (SPNs), Invitation for Bids (IFBs) and other solicitation documents whenever required ◆ Assist in obtaining ADB's "No Objection" on bidding documents, evaluation reports ◆ Monitoring and ensuring timely responses to procurement questions raised by the ADB. ◆ Preparing and updating the Projects' Annual Procurement Plan and Budget detailing contract packages (including estimated cost) for

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		procurement of works & goods and processing times until completion of each procurement activity ♦ Participating in pre-bid meetings, bid opening sessions, bid evaluations and ensuring that the appropriate Guidelines are followed to arrive at the recommendations for award of contracts ♦ Assisting in dealing with claims, bid challenges and litigations relating to procurement
6	Sr. Transport Economist	Shall be responsible but not be limited to the following: ♦ conduct transport research and to identify the economic implications ♦ transport economic analysis, ♦ preparation of economic modeling, investment optimization, economic impact assessments, reducing transport costs, cost recovery, cost apportionment, commercialize projects, feasibility studies, policy analysis ♦ Undertaking economic studies as part of the road design ♦ Conducting HDM-4 analysis ♦ Building capacity for economic analysis related to transport ♦ Training and Technology Transfer
7	Sr. Road Safety Specialist	Shall be responsible but not be limited to the following: ♦ Undertaking analysis of road accident statistics and other related documents including black spots and possible accident-prone locations and assisting in road safety audits when required ♦ Analyzing road designs on issues of road safety ♦ Review report Provided by TA Consultant ♦ Prepare detailed design for Road Safety Improvements and Blackspots elimination ♦ Design and prepare drawings of road safety measures for the particular location in the project. ♦ Check for the latest appropriate road safety measures. ♦ Prepare Road safety audit report ♦ Conduct meetings with stakeholders ♦ Undertake training in road safety measures ♦ Training and technology transfer
8	Deputy Team Leader/ Highway Engineer-I	♦ Shall be responsible but not be limited to the following: ♦ Overall in-charge of the Project Design Team as assistant team leader ♦ Responsible for the overall implementation activities in coordination with team leader ♦ Coordinate with the Subordinate Team to ensure that the construction process is well controlled as per established Procedures. ♦ Interaction with the client ♦ Collection of available data, maps, policy and other related documents. ♦ Preliminary and detail design work through practical and cost-efficient approach ♦ Prepare designs based on the typical road sections, applying sound engineering practice and giving due regards to environmental aspects. ♦ design, development and production management for the roadway plans,

		♦ producing support documentation, including reports, quantities and specifications ♦ Design of Bio Engineering Works and Environmental Protection ♦ CPM analysis and planning ♦ Prepare designs based on the typical pavement sections, applying sound engineering practice and giving due regards to environmental ♦ Establish the thickness and composition of the pavement by trial pits and sampling, and sub-grade strengths by Dynamic Cone Penetration (DPC) testing and/or in-situ California Bearing Ratio (CBR) ♦ Maximize the use of existing pavement layers (scrapping only in case of strength deficiency) ♦ Design of sub-grade, sub-base, base and asphalt layers for each 100 m interval or where the sub-surface condition/traffic volume changes considering the AADT data which needs to be collected by the consultant at the particular junctions/road sections, direct traffic counting at critical junctions ♦ Design of pavement on the bridges and approach roads ♦ Training and technology transfer
9	Highway Engineer-2	♦ Shall be responsible but not be limited to the following: ♦ Coordinate with the Subordinate Team to ensure that the construction process is well controlled as per established Procedures. ♦ Interaction with the client ♦ Collection of available data, maps, policy and other related documents. ♦ Preliminary and detail design work through practical and cost-efficient approach ♦ Prepare designs based on the typical road sections, applying sound engineering practice and giving due regards to environmental aspects. ♦ design, development and production management for the roadway plans, ♦ producing support documentation, including reports, quantities and specifications ♦ Design of Bio Engineering Works and Environmental Protection ♦ CPM analysis and planning ♦ Prepare designs based on the typical pavement sections, applying sound engineering practice and giving due regards to environmental ♦ Establish the thickness and composition of the pavement by trial pits and sampling, and sub-grade strengths by Dynamic Cone Penetration (DPC) testing and/or in-situ California Bearing Ratio (CBR) ♦ Maximize the use of existing pavement layers (scrapping only in case of strength deficiency) ♦ Design of sub-grade, sub-base, base and asphalt layers for each 100 m interval or where the sub-surface condition/traffic volume changes considering the AADT data which needs to be collected by the consultant at the particular junctions/road sections, direct traffic counting at critical junctions ♦ Design of pavement on the bridges and approach roads
10	Bridge Design Engineer	Shall be responsible but not be limited to the following:

		♦ Carryout detailed survey and sub-soil investigations of bridge sites ♦ Analysis of Bridge ♦ design the bridge following the standard codes of practice, norms and guidelines Considering general aesthetics and architectural perspectives of the bridges ♦ Discuss with client about span arrangement and type of bridge and foundation type with alternatives and cost-benefit ♦ Modeling and testing of design ♦ Produce detailed quantity estimate of the bridge and its accessories. ♦ prepare rate schedules and cost estimates based on the standard norms and prevailing district rates.
11	Structural Engineer	Shall be responsible but not be limited to the following:
		♦ Carryout detailed survey and sub-soil investigations of minor bridge sites as required ♦ design the minor bridges following the standard codes of practice, norms and guidelines. ♦ Design of Slab culvert, box culvert, pipe culvert ♦ Design of Masonry, Gabion, plain concrete, RCC structures ♦ Produce detailed quantity estimate of the bridge and its accessories. ♦ Design of other structures required for the roads
12	Geotechnical Engineer	Shall be responsible but not be limited to the following:
		♦ Conduct detailed geological mapping at 1:1,000 with contour intervals at 2 m, sub-surface drilling at selected locations for major landslides and collect samples of mechanical properties of soils as necessary; ♦ Stability analysis of slope ♦ Rock Classification of road and tunnel ♦ Assess the requirement for slope protection measures adjacent to the road, and design any necessary remedial works ♦ Geotechnical investigation of Bridge site and road alignment ♦ Potential Quarry site identification and quantification
13	Material Engineer	Shall be responsible but not be limited to the following:
		♦ Investigate, test, and define sources of construction materials; ♦ Assess the sources of natural construction materials (e.g., quarry sites), carry out suitability tests, ♦ prepare a materials report for the contractors' information
14	Road Safety/Traffic Specialist	Shall be responsible but not be limited to the following:
		♦ Undertaking analysis of road accident statistics and other related documents including black spots and possible accident-prone locations and assisting in road safety audits when required ♦ Analyzing road designs on issues of road safety ♦ Review report Provided by TA Consultant ♦ Prepare detailed design for Road Safety Improvements and Blackspots elimination ♦ Design and prepare drawings of road safety measures for the particular location in the project. ♦ Check for the latest appropriate road safety measures.

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		◆ Prepare Road safety audit report ◆ Conduct meetings with stakeholders ◆ Undertake training in road safety measures
15	Hydrologist	Shall be responsible but not be limited to the following: ◆ Technical assessment of site conditions/suitability and issues, ◆ Surface runoff/run-on analyses, Flood/inundation modeling, Site drainage assessment & design, ◆ Data Collection on existing flow regime and structures, ◆ Drainage/ Hydrological assessment, Estimation of peak Discharge locations and volumes, detailed drainage design, ◆ Hydrological design of culverts/bridges/cross- & toe drains ◆ Study and Analysis of water shed ◆ Determining type of the cross-drainage structure ◆ Structural design of slab and box culverts ◆ Size and location of road-side drainage and cross drainage structures (appropriate side drains and cross drainages such as pipe culverts) ◆ Design of the water conduit/rain water inlets/manholes to take storm water safely to the nearby natural stream ◆ use of the existing structures ◆ Design of Subsurface drains ◆ Technical report preparation
16	Transport Economist	Shall be responsible but not be limited to the following: ◆ conduct transport research and to identify the economic implications ◆ transport economic analysis, ◆ preparation of economic modeling, investment optimization, economic impact assessments, reducing transport costs, cost recovery, cost apportionment, commercialize projects, feasibility studies, policy analysis ◆ Undertaking economic studies as part of the road design ◆ Conducting HDM-4 analysis ◆ Building capacity for economic analysis related to transport ◆ Training and Technology Transfer
17	Procurement Specialist	Shall be responsible but not be limited to the following: ◆ Preparing and amending the bidding documents as needed in accordance with ADB's Guidelines and GON Rules ◆ CPM/PERT analysis and reporting ◆ Assist in procurement in accordance with the Procurement Plan and Asian Development Bank Guidelines and preparation of evaluation reports ◆ Preparing the General Procurement Notice (GPN), Specific Procurement Notices (SPNs), Invitation for Bids (IFBs) and other solicitation documents whenever required ◆ Assist in obtaining ADB's "No Objection" on bidding documents, evaluation reports ◆ Monitoring and ensuring timely responses to procurement questions raised by the ADB. ◆ Preparing and updating the Projects' Annual Procurement Plan and Budget detailing contract packages (including estimated cost) for

		procurement of works & goods and processing times until completion of each procurement activity ♦ Participating in pre-bid meetings, bid opening sessions, bid evaluations and ensuring that the appropriate Guidelines are followed to arrive at the recommendations for award of contracts ♦ Assisting in dealing with claims, bid challenges and litigations relating to procurement.
18	Environmental Specialist	Shall be responsible but not be limited to the following: ♦ Environment Impact Assessment (EIA) and Initial Environment Examination (IEE) of priority road section including summary matrix for Environmental classification. ♦ Design and implementation mitigation and remediation plans ♦ Provide assessment of impacts, analysis of alternatives, suitable mitigation measures, and proper management plan for detail design road sections ♦ Prepare report based on classification of road section, collect the data, accordance with ADB Safeguard Policy Statement ♦ Recommend for the feasible and cost-effective options to reduce or offset project related greenhouse gas emission; ♦ Prepare proper Grievance Redressal Mechanism for the affected people; ♦ Review the DOR institutional arrangement and capacity in addressing environmental issue ♦ Assist and coordinate with the Team Leader the identification and resolution of all environmental problems ♦ Prepare environmental assessment report
		♦ Conduct literature reviews to collect data and information on projected climate changes in the respective project area ♦ Compile or compute projected climate change data in the respective Project area including information on the source of data ♦ Conduct literature review to understand current practices and lessons learnt on climate change adaptation measures in infrastructure projects ♦ Review project concept documents to understand the project scope and potential climate risks ♦ Based on the projected climate data and components of the project identify if there are any medium or high climate change risks that may affect or cause damages to the project infrastructure during its design life ♦ Based on the type of climate risk identified conduct further relevant in-depth studies such as: hydrological analysis and modelling; statistical analysis, GIS based analysis, field data collection and consultation with relevant local authorities and communities etc. ♦ Where relevant, review hydrological studies carried out by the engineering team and provide inputs to integrate future climate data into the study ♦ In consultation with the design engineers of the project identify climate adaptation measures or design modifications for projects to mitigate the key climate risks identified. Where feasible identify innovative measures or best practices being applied successfully in other projects and/or countries ♦ Estimate the incremental costs of adaptation measures or design

		modifications in relation to the total project costs ◆ Prepare a report on the climate risk and vulnerability assessment and adaptation measures incorporated in the project design for projects with medium or high climate change risks.
19	Social Development/Resettlement Specialist	Shall be responsible but not be limited to the following: ◆ Conduct a social impact assessment for the project including assessment of possible land acquisition/resettlement impacts in accordance with ADB's Safeguard Policy Statement 2009. ◆ Prepare a resettlement plan (RP) and indigenous people plan (IPP) as necessary acceptable to the Government and ADB ◆ Prepare a comprehensive income and livelihood restoration program ◆ Identify specific measures for the affected poor, ethnic minorities, or other vulnerable households. ◆ Assist Government officials to initiate and expand consultation with the affected communities, local leaders, proponents, and stakeholders who may be opposed to the Project ◆ Assess the capacity of the Government in implementing the proposed RP and IPP, ◆ prepare a resettlement implementation schedule ◆ Provide supports in recruiting NGO/Agency for RP and IPP implementation and consultants for external monitoring and evaluation. ◆ Prepare a final RP and IPP. ◆ Conduct poverty and social impact assessment ◆ Plan and conduct stakeholder consultative forum ◆ Prepare a gender analysis ◆ Identify mitigation measures and a strategy for implementing ◆ Questionnaire design and approval ◆ Socio economic data analysis ◆ Coordinate and implement activities involving public outreach and communications in conjunction with other key professionals ◆ Identify project-related interests of key stakeholders, likely barriers to their participation in and benefiting from the project resources, and suggest possible strategies for addressing their concerns. ◆ Conduct assessment of risks of human trafficking and HIV/AIDS due to the project and suggest for measures to be incorporated in the project ◆ Identify any necessary mitigation measures and a strategy for implementing them ◆ Prepare the reports on approved format ◆ Conduct a workshop training to provide guidance to the DOR on Project-related social issues
20	Wildlife Expert	Shall be responsible but not be limited to the following:

		- Coordinate with the TA consultant employed by ADB for wildlife study of Pathlalya Narayanghat road. - Prepare the wildlife related mitigation and enhancement measures recommended for the EIA, IEE and EMP and provide updates and revisions and further site-specific recommendations as necessary - Incorporate the recommendations from the TA consultant regarding locations, design and numbers of underpasses/overpasses that will be required to be constructed in the design. - Conduct wildlife study in rest of the road project and propose mitigating measures.
21	Electrical Engineer	Shall be responsible for but not limited to:
		- Design of street lighting, intersection signal etc., - Identification of Electric poles, transformers, wires etc., for relocation with close coordination with related electricity offices - Prepare estimate for relocation requirements.
22	Environmental Engineer	Shall be responsible for but not limited to:
		Assist Environmental Specialist in Data collection, surveys, public hearings, preparation of various reports etc.
23	Road Safety Engineer	Shall be responsible for but not limited to:
		Assist Sr. Road Safety Specialist and Road Safety Specialist in Data collection, surveys, public hearings, preparation of design and reporting etc.
24	CAD Operator	Shall be responsible for but not limited to:
		- Preparation of CAD Drawings - Assist various experts in design works
25	Cadastral Surveyor	Shall be responsible for but not limited to:
		- Conduct cadastral survey - Identify land and structures required to be acquired - Prepare cadastral map of affected plots - Produce cadastral map clearly showing the road
26	Social & Resettlement Officer	Shall be responsible for but not limited to:
		Assist Resettlement and Social Development Experts in Data collection, surveys, focused group discussions, preparation of various reports etc.

E. Reporting Requirement and Time Schedule

- The consulting services shall be implemented over 24 (twenty-four) calendar months from the commencement date.
- The consultant shall submit the reports (10 copies to DOR and 2 copies to ADB) as enumerated in Table-6: Reports and Submissions. The consultant shall initially submit 2 copies of documents/reports as draft in ring/spiral binding form. After approval from the client, the consultant shall submit the remaining 10 copies of each report in book binding form. The consultant shall sign and stamp on all the pages of Design documents, drawings, estimates, rate analysis, investigation report etc., before submitting to the client. All the reports shall also be submitted on electronic copy

compatible with respective program on which they are prepared. All the alignments, including bridges, tunnel alignments shall be tracked on GPS and shall be submitted on compatible format. The consultant shall also produce separate colored posters in A0, A1 and A2 size of each roads and bridge showing detailed plan, profile and other relevant information.

Table-6: Reports and Submissions

No.	Preparatory Outputs	Submission Deadline (no. months after the commencement date)
I	Inception Report	1.0
II	Inventory/Condition Survey Report	2.0
III	Economic Analysis and Feasibility Study Report of all roads and bridges	4.0
IV	Detail Design of Road I	
(i)	Condition Survey Reports	2.0
(ii)	Survey, Hydrological and Soil Investigation Reports	5.0
(iii)	Resettlement and Social Reports	6.0
(iv)	Environmental Assessment, EIA/IEE/EMP, and Categorization	6.0
(v)	Climate Risk and Vulnerability Assessment	6.0
(vi)	Design & Drawing, Specification, and Cost Estimate	7.0
(vii)	CPM Planning and Resources Requirement of each contract package	7.0
(viii)	Draft Bidding Documents	7.0
(ix)	Project Management Report	7.0
(x)	Final Design Reports	8.0
(xi)	Final Bidding Documents (min. 25 sets for each contract package)	8.0
V	Detail Design of Road II	
(i)	Condition Survey Reports	2.0
(ii)	Survey, Hydrological and Soil Investigation Reports	9.0
(iii)	Resettlement and Social Reports	10.0
(iv)	Environmental Assessment, EIA/IEE/EMP, and Categorization	10.0
(v)	Climate Risk and Vulnerability Assessment	10.0
(vi)	Design & Drawing, Specification, and Cost Estimate	11.0
(vii)	CPM Planning and Resources Requirement of each contract package	11.0
(viii)	Draft Bidding Documents	11.0
(ix)	Project Management Report	11.0
(x)	Final Design Reports (min. 25 sets for each contract package)	12.0
(xi)	Final Bidding Documents	12.0
VI	Detail Design of Road III	
(i)	Condition Survey Reports	2.0
(ii)	Survey, Hydrological and Soil Investigation Reports	13.0
(iii)	Resettlement and Social Reports	14.0
(iv)	Environmental Assessment, EIA/IEE/EMP, and Categorization	14.0
(v)	Climate Risk and Vulnerability Assessment	14.0
(vi)	Baseline Wildlife Study Report	14.0
(vii)	Design & Drawing, Specification, and Cost Estimate	15.0
(viii)	CPM Planning and Resources Requirement of each contract package	15.0

No.	Preparatory Outputs	Submission Deadline (no. months after the commencement date)
(ix)	Draft Bidding Documents	15.0
(x)	Project Management Report	15.0
(xi)	Final Design Reports	16.0
(xii)	Final Bidding Documents (min. 25 sets for each contract package)	16.0
VII	Detail Design of Bridges	
A	Design of Minor Bridges	
(i)	Condition Survey Reports	2.0
(ii)	Survey, Hydrological and Soil Investigation Reports	5.0
(iii)	Resettlement and Social Reports	6.0
(iv)	Environmental Assessment, EIA/IEE/EMP, and Categorization	6.0
(v)	Climate Risk and Vulnerability Assessment	6.0
(vi)	Design & Drawing, Specification, and Cost Estimate	7.0
(vii)	CPM Planning and Resources Requirement of each contract package	7.0
(viii)	Draft Bidding Documents	7.0
(ix)	Project Management Report	7.0
(x)	Final Design Reports	8.0
(xi)	Final Bidding Documents (min. 25 sets for each contract package)	8.0
B	Design of Major Bridges	
(i)	Condition Survey Reports	2.0
(ii)	Survey, Hydrological and Soil Investigation Reports	13.0
(iii)	Resettlement and Social Reports	14.0
(iv)	Environmental Assessment, EIA/IEE/EMP, and Categorization	14.0
(v)	Climate Risk and Vulnerability Assessment	14.0
(vi)	Design & Drawing, Specification, and Cost Estimate	15.0
(vii)	CPM Planning and Resources Requirement of each contract package	15.0
(viii)	Draft Bidding Documents	15.0
(ix)	Project Management Report	15.0
(x)	Final Design Reports	18.0
(xi)	Final Bidding Documents (min. 25 sets for each contract package)	18.0
VIII	Design of Road Safety Improvement and Blackspots elimination in Western Part of EWH	
(i)	Review of TA Report and preparation of masterplan	2.0
(ii)	Survey, Hydrological and Soil Investigation Reports	5.0
(iii)	Resettlement and Social Reports	6.0
(iv)	Environmental Assessment, EIA/IEE/EMP, and Categorization	6.0
(v)	Climate Risk and Vulnerability Assessment	6.0
(vi)	Design & Drawing, Specification, and Cost Estimate	7.0
(vii)	CPM Planning and Resources Requirement of each contract package	7.0
(viii)	Draft Bidding Documents	7.0
(ix)	Project Management Report	7.0
(x)	Final Design Reports	8.0
(xi)	Final Bidding Documents (min. 25 sets for each contract package)	8.0

No.	Preparatory Outputs	Submission Deadline (no. months after the commencement date)
IX	Other Deliverables	
(i)	Bid Evaluation Report	As required
(ii)	Documents and Manuals - Contract Administration Manual - Quality Control & assurance Manual	10.0
(iii)	Project Completion Report	22.0
(iv)	Supply of Bidding Documents for all contract packages	During Bidding for the supplying to the bidders in required nos.
(v)	Monthly Report	Within one week of the end of each calendar month
(vi)	Quarterly Report	Within one week of the end of each Quarter
(vii)	Field Report	After the completion of field works
(viii)	Presentations	On each aspect of design of road and bridges

3. The Payment schedule for lump sum contract is provided in Appendix - C

F. Consultants Facilities

- The consultant will need to provide themselves, all the administrative, technical and support staff needed to carry out the services. The inputs provided in part 4 of this TOR is the minimum inputs required. If the consultant thinks that additional inputs are required (Engineers, Technical Support, Administrative Support, specialists etc.), they should propose the additional inputs in their technical proposal and financial proposal. The consultant shall also be responsible for providing all other necessary facilities and logistical support for its staff including accommodation, transportation, office equipment, communications, utilities, office supplies and other miscellaneous requirements that are required to complete all the tasks to fulfill the objective and scope of works, and it shall be included in their financial proposal. The specification of the facilities is set out in annex 3 and 4.

G. Data and Assistance to be Provided by the Client

The client will provide the consultants with all available studies and reports available with the client. Any other studies or report needed shall be obtained by the consultants themselves.



ANNEX 1 BRIDGES

S.N.	Bridge Identification	Chainage	Name of Bridge/Khola	Type of Bridge	Bridge Length (m)	Location		
						District	Latitude	Longitude
1	04/H001/002	1+500	Kali Khola	RCC	26.40	Jhapa	26°38'52.8"	88°08'56.4"
2	04/H001/003	3+440	Pali Khola	RCC	59.00	Jhapa	26°39'00"	88°08'24.0"
3	04/H001/004	5+460	Ninda Khola	RCC	327.00	Jhapa	26°39'36"	88°07'12.0"
4	04/H001/005	6+520	Timai	RCC	74.00	Jhapa	26°39'34.7"	88°05'55.9"
5	04/H001/006	7+840	Nagardubba	RCC	35.20	Jhapa	26°39'22.1"	88°05'59.9"
6	04/H001/007	8+080	Dhukure	RCC	6.90	Jhapa	26°39'18.1"	88°04'48"
7	04/H001/008	8+930	Hadiya	RCC	57.50	Jhapa	26°39'17.1"	88°04'31.7"
8	04/H001/009	90640	Raspandi	RCC	7.10	Jhapa	26°39'12.2"	88°03'51.3"
9	04/H001/010	10+670	Phulbasa	RCC	57.00	Jhapa	26°39'12.9"	88°03'30.9"
10	04/H001/011	13+480	Debniya	RCC	26.30	Jhapa	26°38'59.3"	88°01'51.8"
11	04/H001/012	14+760	Rekha	RCC	35.00	Jhapa	26°38'57.9"	88°01'5.8"
12	04/H001/013	17+720	Aaduwa	RCC	35.00	Jhapa	26°38'33.6"	87°59'23.7"
13	04/H001/014	21+530	Ghagra	RCC	35.00	Jhapa	26°38'27"	87°57'9"
14	04/H001/015	22+950	Biring	RCC	405.50	Jhapa	26°38'25.8"	87°56'17.7"
15	04/H001/016	26+380	Sarunga	RCC	33.40	Jhapa	26°38'37.1"	87°54'15.8"
16	04/H001/017	29+530	Kankai	RCC	702.00	Jhapa	26°39'8.7"	87°52'36.1"
17	04/H001/018	31+130	Hundrunge	Vented Pipe	18.30	Jhapa	26°39'31.5"	87°51'45.9"
18	04/H001/019	22+950	Sukhani-1	Vented Pipe	6.30	Jhapa	26°39'29.6"	87°51'14.1"
19	04/H001/020	32+330	Sukhani-2	Vented Pipe	6.10	Jhapa	26°39'26"	87°51'8"
20	04/H001/021	32+530	Sukhani-3	Vented Pipe	7.20	Jhapa	26°39'20.3"	87°51'1.6"
21	04/H001/022	32+830	Bhalu Khola	Vented Pipe	24.20	Jhapa	26°39'15.1"	87°50'55.5"
22	04/H001/023	34+090	Jharana-1	RCC	33.00	Jhapa	26°39'0.7"	87°50'3.3"
23	04/H001/024	34+470	Jharana-2	RCC	33.00	Jhapa	26°38'57.6"	87°49'50.1"
24	04/H001/025	35+170	Dudhe - 1	Vented Pipe	15.00	Jhapa	26°38'53.3"	87°49'29.3"
25	04/H001/026	35+230	Dudhe - 2	RCC	33.00	Jhapa	26°38'52.0"	87°49'23.6"
26	04/H001/027	36+030	Satasi	RCC	34.40	Jhapa	26°38'44.9"	87°48'55.4"
27	04/H001/028	36+640	Jhiljile	RCC	6.10	Jhapa	26°38'36.5"	87°48'25.7"
28	04/H001/029	39+840	Kamal	RCC	128.00	Jhapa	26°39'1.9"	87°47'6.5"
29	04/H001/030	41+950	Kerakha	RCC	50.00	Jhapa	26°38'55.6"	87°45'56.2"
30	04/H001/031	42+250	Chyangri	RCC	7.10	Jhapa	26°38'58.3"	87°45'43.3"
31	04/H001/032	43+150	Dhangre	Vented Pipe	18.30	Jhapa	26°39'4.7"	87°45'14.1"
32	04/H001/033	45+910	Geuria	Vented Pipe	33.30	Jhapa	26°39'27.4"	87°43'37.8"
33	04/H001/034	47+990	Ratuwa	RCC	585.00	Jhapa	26°39'10.8"	87°42'30"
34	04/H001/035	52+510	Dhardhare	RCC	17.00	Jhapa	26°39'44.2"	87°39'56.3"
35	04/H001/036	52+850	Belani	RCC	33.10	Jhapa	26°39'45.2"	87°39'44.4"
36	04/H001/037	54+150	Bhutre	RCC	7.80	Jhapa	26°39'48.0"	87°38'58.9"
37	04/H001/038	54+750	Mawa	RCC	128.00	Jhapa	26°39'49.6"	87°38'36.1"
38	09/H001/039	55+100	Mawa Branch	RCC	17.00	Morang	26°39'49.8"	87°38'27.1"
39	09/H001/040	57+550	Bakra	RCC	319.00	Morang	26°39'48.1"	87°36'56.7"
40	09/H001/041	58+440	Selli	RCC	84.00	Morang	26°39'54.9"	87°36'26.1"
41	09/H001/042	60+480	Sanjhora	RCC	64.05	Morang	26°39'34.6"	87°35'17.5"
42	09/H001/043	63+630	Pathariya	RCC	17.00	Morang	26°39'40"	87°33'24.2"
43	09/H001/044	64+940	Dans	RCC	95.00	Morang	26°39'38.6"	87°32'36.9"
44	09/H001/045	65+620	Morangi	RCC	28.00	Morang	26°39'38.7"	87°32'12.3"
45	09/H001/046	69+930	Chisang 1	RCC	40.00	Morang	26°39'32"	87°29'37"
46	09/H001/047	70+330	Chisang 2	RCC	130.50	Morang	26°39'31.9"	87°29'22.5"

S.N.	Bridge Identification	Chainage	Name of Bridge/Khula	Type of Bridge	Bridge Length (m)	Location		
						District	Latitude	Longitude
47	09/H001/048	74+530	Chisang Bhangabari	RCC	45.40	Morang	26°39'30"	87°26'51.7"
48	09/H001/049	76+330	Betna	RCC	13.00	Morang	26°39'32"	87°25'47.3"
49	09/H001/050	78+250	Lohendra	RCC	385.20	Morang	26°39'37.5"	87°24'39.1"
50	09/H001/051	79+460	Lalbhuti	RCC	33.08	Morang	26°39'56.8"	87°24'01"
51	09/H001/052	80+570	Sukana Painsi	RCC	21.50	Morang	26°40'6.6"	87°23'23.4"
52	09/H001/053	80+680	Sukana	RCC	64.26	Morang	26°40'7.1"	87°23'19.4"
53	09/H001/054	82+190	Jharana	RCC	20.00	Morang	26°40'9.4"	87°22'25"
54	09/H001/055	84+660	Madhyali	RCC	10.20	Morang	26°39'43.3"	87°21'1.2"
55	09/H001/056	84+960	Mada	RCC	6.80	Morang	26°39'40.6"	87°20'52.2"
56	09/H001/057	86+270	Malati	RCC	8.70	Morang	26°39'30.5"	87°20'5.4"
57	09/H001/058	87+170	Trijuja Ganeshpur	RCC	7.00	Morang	26°39'30.5"	87°19'36.7"
58	09/H001/059	87+920	Gachhiya	RCC	171.20	Morang	26°39'30.9"	87°19'5.9"
59	09/H001/060	91+050	Budhi	RCC	128.40	Morang	26°39'33.9"	87°17'13.6"
60	10/H001/061	91+970	Tengra	RCC	33.60	Sunsari	26°39'43.2"	87°16'43"
61	10/H001/062	93+030	Kheti	RCC	9.70	Sunsari	26°39'52.1"	87°16'6"
62	10/H001/063	95+950	Devi Khola	RCC	6.70	Sunsari	26°40'20"	87°14'32.5"
63	10/H001/064	97+750	Pakali	RCC	15.50	Sunsari	26°40'41.1"	87°13'24.4"
64	10/H001/065	99+740	Charara Canal	RCC	21.60	Sunsari	26°40'19.5"	87°12'19.5"
65	10/H001/066	106+140	Jorti	RCC	12.30	Sunsari	26°37'18.1"	87°10'1.4"
66	10/H001/067	111+050	Sunsari	RCC	85.50	Sunsari	26°36'15.8"	87°7'45.2"
67	10/H001/068	113+400	Sukesena	RCC	7.40	Sunsari	26°36'5.6"	87°6'21.7"
68	10/H001/069	116+760	Khuniya	RCC	20.30	Sunsari	26°36'0.7"	87°04'21.3"
69	10/H001/070	118+200	Jharuwa - 1	RCC	13.50	Sunsari	26°35'57.2"	87°03'29.6"
70	10/H001/071	118+320	Jharuwa - 2	RCC	11.50	Sunsari	26°35'57.2"	87°03'25.1"
71	10/H001/072	120+050	Jantuwa Dhar	RCC	13.50	Sunsari	26°35'53.5"	87°02'23.2"
72	33/H001/215	377+400	Amlekhgunj - 1	RCC T- beam	61.00	Bara	27°17'27.4"	84°59'25.7"
73	33/H001/216	380+380	Amlekhgunj - 2	RCC T- beam	81.40	Bara	27°18'18.6"	84°59'54.6"
74	33/H001/217	382+380	Amlekhgunj - 3	RCC T- beam	60.00	Bara	27°19'7.5"	85°0'16.1"
75	33/H001/218	385+850	Amlekhgunj - 4	PSC	60.00	Bara	27°19'17.3"	85°0'14.1"
76	33/H001/219	387+800	Badahkim	RCC Slab	27.70	Bara	27°20'6.2"	84°59'42.0"
77	33/H001/220	388+980	Grundo	RCC Slab	67.80	Bara	27°20'36.4"	84°59'35.1"
78	31/H001/221	391+780	Churiya	RCC T- beam	60.00	Makwanpur	27°21'42.1"	85°0'17.6"
79	31/H001/222	392+080	Pakkipal	RCC T- beam	18.00	Makwanpur	27°21'50.0"	85°0'21.2"
80	31/H001/223	392+280	Sunsare	RCC	12.58	Makwanpur	27°21'56.1"	85°0'25.4"
81	31/H001/224	392+350	Sayafus	RCC Slab	24.25	Makwanpur	27°22'1.9"	85°0'27.9"
82	31/H001/225	394+850	Karra	PSC	105.00	Makwanpur	27°24'51.3"	85°1'35.2"
83	31/H001/226	397+460	Rapti	PSC	210.00	Makwanpur	27°25'54.5"	85°1'21.8"
84	31/H001/227	425+730	Manahari	PSC	240.00	Makwanpur	27°32'11.6"	84°48'33.8"
85	31/H001/228	437+550	Lothar	PSC	150.00	Makwanpur	27°35'5.8"	84°43'58.8"
86	35/H001/229	438+550	Lothar Branch	RCC Slab	7.20	Chitawan	27°35'13.4"	84°43'11.0"
87	35/H001/230	444+670	Mardar	RCC T- beam	45.00	Chitawan	27°36'5.2"	84°40'10.1"
88	35/H001/231	449+570	Pampha	RCC T- beam	45.00	Chitawan	27°36'17.5"	84°37'15.2"
89	35/H001/232	455+760	Budhi Rapti	RCC T- beam	62.00	Chitawan	27°36'50.5"	84°33'33.7"
90	35/H001/233	458+410	Kair	RCC T- beam	61.60	Chitawan	27°37'4.0"	84°31'58.8"
91	35/H001/234	456+760	Budhi Khola	RCC Slab	15.30	Chitawan	27°37'20.5"	84°30'50.2"
92	35/H001/235	462+940	Khageri - 2	RCC T- beam	66.00	Chitawan	27°37'56.8"	84°29'25.7"
93	35/H001/236	463+060	Khageri - 1	RCC T- beam	39.00	Chitawan	27°37'58.4"	84°29'21.5"

S.N.	Bridge Identification	Chainage	Name of Bridge/Khola	Type of Bridge	Bridge Length (m)	Location		
						District	Latitude	Longitude
94	46-H001-286	586+077	Sub way	RCC Slab	6.7	Rupandehi	27°42'15.6"	83°27'32.9"
95	46-H001-287	586+657	Guhye Khola (Jigadi Khola)	RCC T-Beam	21.35	Rupandehi	27°42'15.6"	83°27'24.1"
96	46-H001-288		Narshing khola(Dry Nala)	RCC T-Beam	16.8	Rupandehi	27°42'15.9"	83°27'18.6"
97	46-H001-289		Dry Nala	RCC Slab	7.2	Rupandehi	27°42'02.6"	83°27'09.2"
98	46-H001-290		Dry Nala	RCC Slab	7.5	Rupandehi	27°42'00.6"	83°27'08.2"
99	46-H001-291		pachapani khola	RCC Slab	10.3	Rupandehi	27°41'54.0"	83°27'05.8"
100	46-H001-292		satgadi no 1	RCC T-Beam	64.5	Rupandehi	27°41'09.8"	83°24'24.2"
101	46-H001-293		satgadi no 2	RCC T-Beam	28.6	Rupandehi	27°41'10.6"	83°24'14.4"
102	46-H001-294		soila river	RCC T-Beam	13.3	Rupandehi	27°41'02.4"	83°23'35.6"
103	46-H001-295		Rajpur khola	RCC T-Beam	26.6	Rupandehi	27°41'01.4"	83°23'23.9"
104	46-H001-296		bamaha khola	RCC T-Beam	32.8	Rupandehi	27°40'56.9"	83°23'07.3"
105	46-H001-297	600+111	Ghamaha khola	RCC T-Beam	51	Rupandehi	27°41'17.7"	83°19'59.2"
106	46-H001-298	600+395	Tulbuliya	RCC T-Beam	42.9	Rupandehi	27°41'18.4"	83°19'52.4"
107	46-H001-299	601+258	Marthurwa khola	RCC T-Beam	16.45	Rupandehi	27°41'18.2"	83°19'19.5"
107	46-H001-300		meghawa khola	RCC T-Beam	21.4	Rupandehi	27°41'17.2"	83°19'08.7"
109	46-H001-301		Inguria nadi	RCC T-Beam	41.25	Rupandehi	27°41'21.2"	83°18'07.2"
110	46-H001-302		Barariha Nadi	RCC T-Beam	39.6	Rupandehi	27°41'19.7"	83°17'50.1"
111	46-H001-303		Dry Nala	RCC T-Beam	11.8	Rupandehi	27°41'28.6"	83°17'31.9"
112	46-H001-304		Pahila Nadi	RCC T-Beam	49.35	Rupandehi	27°42'09.9"	83°15'57.1"
113	46-H001-305		Dry Nala	RCC Slab	10.8	Rupandehi	27°42'09.2"	83°15'54.2"
114	46-H001-306		Kanchan	RCC T-Beam	64.2	Rupandehi	27°42'02.8"	83°15'45.8"
115	47-H001-307		Kothi river	RCC T-Beam	43	Kapilbastu	27°41'37.3"	83°13'43.5"
116	47-H001-308		Gageda khola	RCC T-Beam	8.8	Kapilbastu	27°41'14.3"	83°10'53.2"
117	47-H001-309		Banganga	RCC T-Beam	290	Kapilbastu	27°41'32.1"	83°09'48.5"
118	47-H001-310		Kaila khola	RCC T-Beam	92.7	Kapilbastu	27°40'47.4"	83°07'04.8"
119	47-H001-311		Balhundra khola	RCC T-Beam	20.9	Kapilbastu	27°40'35.4"	83°05'53.2"
120	47-H001-312		Harkon Khola	RCC T-Beam	20.9	Kapilbastu	27°40'23.4"	83°04'38.5"
121	47-H001-313	630+009	Dry Nala	RCC T-Beam	21.3	Kapilbastu	27°40'11.5"	83°03'39.1"
122	47-H001-314	630+362	Kundra Khola	RCC T-Beam	29	Kapilbastu	27°40'03.2"	83°03'29.9"
123	47-H001-315	633+429	Ghorai Nala khola	RCC T-Beam	21.5	Kapilbastu	27°39'31.6"	83°01'47.4"
124	47-H001-316		Dry Nala	RCC T-Beam	13.3	Kapilbastu	27°39'20.6"	82°59'58.2"
125	47-H001-317	636+797	Belwagarwa nadi.	RCC T-Beam	63.5	Kapilbastu	27°39'28.6"	82°59'46.2"

ANNEX 2

PREFERRED QUALIFICATION REQUIREMENTS OF KEY EXPERTS

A. INTERNATIONAL KEY EXPERTS

1.	Team Leader (Experience of the last 20 years will only be considered)	
i.	Educational Qualification	Graduate in Civil Engineering with preferably Master's degree in Transport Engineering/Highway Engineering/ Construction Management
ii.	Experience	
	• Total Experience	20 years
	• Experience in Related Field	15 years in Road and Bridge Works
	• Experience in the Proposed Field of Expertise	10 years' experience as a Team Leader (Design) and experience of 5 highway projects of size approximately US \$ 3.0 million.
		Experience in wide geographic regions.
iii.	Language	Communicate fluently in English Language
2.	Senior Highway Engineer (Experience of the last 20 years will only be considered)	
i.	Educational Qualification	Graduate in Civil Engineering with preferably Master's degree in Transport Engineering/ Highway Engineering
ii.	Experience	
	• Total Experience	20 years
	• Experience in Related Field	15 years in Road Works
	• Experience in the Proposed Field of Expertise	10 years' experience as Highway Design Engineer and experience of 5 projects of similar nature and size (Road projects)
		Experience in wide geographic regions.
iii.	Language	Communicate fluently in English Language
3.	Sr. Bridge Design Engineer (Experience of the last 20 years will only be considered)	
i.	Educational Qualification	Graduate in Civil Engineering with preferably Master's degree in Bridge Engineering/Structural Engineering
ii.	Experience	
	• Total Experience	20 years
	• Experience in Related Field	15 years in Bridge Engineering/Structural Engineering Works
	• Experience in the Proposed Field of Expertise	10 years' experience as a Bridge design Engineer and experience of 5 major bridges of similar nature
		Experience in wide geographic regions.
iii.	Language	Communicate fluently in English Language
4.	Sr. Geotechnical Engineer (Experience of the last 20 years will only be considered)	
i.	Educational Qualification	Graduate in Civil Engineering with preferably Master's degree in Geotechnical Engineering/Engineering Geology
ii.	Experience	
	• Total Experience	20 years
	• Experience in Related Field	15 years in Road and Bridge Works

	• Experience in the Proposed Field of Expertise	10 years' experience as Geotechnical Engineer and experience of 5 projects of similar nature (Road project)
		Experience in wide geographic regions.
iii.	Language	Communicate fluently in English Language

5. Sr. Procurement Specialist (Experience of the last 20 years will only be considered)		
i.	Educational Qualification	
		Graduate in Civil Engineering with preferably Master's degree in Transport Engineering/Highway Engineering/ Contract Management/ Construction Management
ii.	Experience	
	• Total Experience	20 years
	• Experience in Related Field	15 years in Road and Bridge works
	• Experience in the Proposed Field of Expertise	10 years' experience as Procurement Specialist and experience of 5 projects of similar nature (Road Projects) with FIDIC Contracts.
		Experience in wide geographic regions.
iii.	Language	Communicate fluently in English Language

6. Sr. Transport Economist (Experience of the last 20 years will only be considered)		
i.	Educational Qualification	
		Graduate in Civil Engineering/Economics/ Development Economics/Transport Economics with preferably Master's degree in Transport Economics
ii.	Experience	
	• Total Experience	20 years
	• Experience in Related Field	15 years in Bridge and Road Works
	• Experience in the Proposed Field of Expertise	10 years' experience as a Transport Economist and experience of 5 projects of similar nature (Road projects)
		Experience in wide geographic regions.
iii.	Language	Communicate fluently in English Language

7. Sr. Road Safety Specialist (Experience of the last 20 years will only be considered)		
i.	Educational Qualification	
		Graduate in Civil Engineering with preferably Master's degree in Transport Engineering/ Highway Engineering/ Traffic Engineering
ii.	Experience	
	• Total Experience	20 years
	• Experience in Related Field	15 years in Road and Bridge Works
	• Experience in the Proposed Field of Expertise	10 years' experience as Road Safety Specialist and experience of 5 projects of similar nature (Road projects)
		Experience in wide geographic regions.
iii.	Language	Communicate fluently in English Language

B NATIONAL KEY EXPERTS

1. Deputy Team Leader/ Highway Engineer (Experience of the last 15 years will only be considered)	
i. Educational Qualification	Graduate in Civil Engineering with preferably Master's degree in Transport Engineering/ Highway Engineering
ii. Experience	
• Total Experience	15 years
• Experience in Related Field	10 years in Road and Bridge Works
• Experience in the Proposed Field of Expertise	8 years' experience as Highway Design Engineer and experience of 4 projects of similar nature and size (Road projects) with having 3 years' experience as Deputy Team Leader
iii. Language	Experience with International Organization in Infrastructure Projects. Communicate fluently in English Language

2. Highway Engineer (Experience of the last 15 years will only be considered)	
i. Educational Qualification	Graduate in Civil Engineering with preferably Master's degree in Transport Engineering/ Highway Engineering
ii. Experience	
• Total Experience	15 years
• Experience in Related Field	10 years in Road Works
• Experience in the Proposed Field of Expertise	7 years' experience as Highway Design Engineer and experience of 4 projects of similar nature and size
iii. Language	Experience with International Organization in Infrastructure Projects. Communicate fluently in English Language

3. Bridge Design Engineer (Experience of the last 15 years will only be considered)	
i. Educational Qualification	Graduate in Civil Engineering with preferably Master's degree in Bridge Engineering/Structural Engineering
ii. Experience	
• Total Experience	15 years
• Experience in Related Field	10 years in Road and Bridge Works
• Experience in the Proposed Field of Expertise	7 years' experience as a Bridge Design Engineer and experience of design of 4 major bridges
iii. Language	Experience with International Organization in Infrastructure Projects. Communicate fluently in English Language

4. Structural Engineer (Experience of the last 10 years will only be considered)	
i. Educational Qualification	Graduate in Civil Engineering with preferably Master's degree in Bridge Engineering/Structural Engineering
ii. Experience	
• Total Experience	10 years
• Experience in Related Field	7 years in Road and Bridge Works
• Experience in the Proposed Field of Expertise	5 years' experience as a Structural Engineer and experience of 3 projects of similar nature (Road Works)
iii. Language	Experience with International Organization in Infrastructure Projects

iii.	Language	Communicate fluently in English Language
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5.	Geotechnical Engineer (Experience of the last 10 years will only be considered)	
i.	Educational Qualification	
	Graduate in Civil Engineering with preferably Master's degree in Geotechnical Engineering/Engineering Geology	
ii.	Experience	
	• Total Experience	10 years
	• Experience in Related Field	7 years in Road and Bridge Works
	• Experience in the Proposed Field of Expertise	5 years' experience as a Geotechnical Engineer/Engineer Geologist and experience of 3 projects of similar nature (Road projects)
		Experience with International Organization in Infrastructure Projects
iii.	Language	Communicate fluently in English Language

6.	Materials Engineer /Pavement Engineer (Experience of the last 10 years will only be considered)	
i.	Educational Qualification	
	Graduate in Civil Engineering with preferably Master's degree in Highway Engineering/Geotechnical Engineering/Engineering Geology	
ii.	Experience	
	• Total Experience	10 years
	• Experience in Related Field	7 years in Road and Bridge Works
	• Experience in the Proposed Field of Expertise	5 years' experience as a Material Engineer/Pavement Engineer/Geotechnical Engineer/Engineer Geology and experience of 3 projects of similar size and nature (Road projects)
		Experience with International Organization in Infrastructure Projects
iii.	Language	Communicate fluently in English Language

7.	Road Safety/Traffic Specialist (Experience of the last 10 years will only be considered)	
i.	Educational Qualification	
	Graduate in Civil Engineering with preferably Master's degree in Highway /Traffic Engineering	
ii.	Experience	
	• Total Experience	10 years
	• Experience in Related Field	7 years in Road and Bridge Works
	• Experience in the Proposed Field of Expertise	5 years' experience as a Road Safety/Traffic Engineer and experience of 3 projects of similar size and nature (Road projects)
		Experience with International Organization in Infrastructure Projects
iii.	Language	Communicate fluently in English Language

8.	Hydrologist (Experience of the last 10 years will only be considered)	
i.	Educational Qualification	
	Graduate in Hydrology/Engineering Hydrology/Civil Engineering with preferably Master's degree in Hydrology	
ii.	Experience	
	• Total Experience	10 years
	• Experience in Related Field	7 years in Road and Bridge Works
	• Experience in the Proposed Field of Expertise	5 years' experience as a Hydrologist and experience of 3 projects of similar size and nature (Road projects)

	Experience with International Organization in Infrastructure Projects
iii. Language	Communicate fluently in English Language

9. Procurement Specialist (Experience of the last 10 years will only be considered)	
i. Educational Qualification	Graduate in Civil Engineering with preferably Master's degree in Transport Engineering/ Highway Engineering/ Contract Management/ Construction Management
ii. Experience	
• Total Experience	10 years
• Experience in Related Field	7 years in Road and Bridge works
• Experience in the Proposed Field of Expertise	5 years' experience as procurement specialist and experience of 3 projects of similar nature (Road Projects)
	Experience with International Organization in Infrastructure Projects
	Training on Transport Economics for at least 45 hours.
iii. Language	Communicate fluently in English Language

10. Transport Economist (Experience of the last 10 years will only be considered)	
i. Educational Qualification	Graduate in Civil Engineering/Economics/Development Economics/Transport Economics with preferably Master's degree in Transport Economics related field
ii. Experience	
• Total Experience	10 years
• Experience in Related Field	7 years in Road and Bridge Works
• Experience in the Proposed Field of Expertise	5 years' experience Transport Economist and experience of 3 projects of similar nature (Road Projects)
	Experience with International Organization in Infrastructure Projects
iii. Language	Communicate fluently in English Language

11. Environment Specialist (Experience of the last 10 years will only be considered)	
i. Educational Qualification	Graduate in Civil Engineering with preferably Master's degree in Environmental Engineering/Environmental Science
ii. Experience	
• Total Experience	10 years
• Experience in Related Field	7 years in Road and Bridge Works
• Experience in the Proposed Field of Expertise	5 years' experience as an Environmental Specialist and experience of 3 projects of similar nature (Road Projects)
	Experience with International Organization in Infrastructure Projects
iii. Language	Communicate fluently in English Language

12. Social Development/Resettlement Specialist (Experience of the last 10 years will only be considered)	
i. Educational Qualification	Graduate in Social Science with preferably Master's degree in Social Science
ii. Experience	
• Total Experience	10 years
• Experience in Related Field	7 years in Road and Bridge Works

• Experience in the Proposed Field of Expertise	5 years' experience as Social Development Specialist/Resettlement Specialist/Livelihood Specialist and experience of 3 projects of similar nature (Road Projects)
	Experience with International Organization in Infrastructure Projects
iii. Language	Communicate fluently in English Language

12. Wild Life Expert (Experience of the last 10 years will only be considered)	
i. Educational Qualification	Graduate in Bio Diversity Engineering or Environmental related with Preferable Master's Degree in Wildlife Biology or Biodiversity Conservation or related field
ii. Experience	
• Total Experience	10 years
• Experience in Related Field	7 years in Road and Bridge Works
• Experience in the Proposed Field of Expertise	5 years' experience in working on interactions between wildlife and linear infrastructure projects or wildlife conservation activities within large infrastructure projects.
	• Experience with International Organization in Infrastructure Projects
iii. Language	• Communicate fluently in English Language

13. Electrical Engineer	
i. Educational Qualification	Graduate in Electrical Engineering with preferably Master's degree in Electrical Engineering
ii. Experience	
• Total Experience	5 years
• Experience in Related Field	3 years in Road and Bridge Works
• Experience in the Proposed Field of Expertise	2 years' experience as Electrical Engineer
	Experience with International Organization
iii. Language	Communicate fluently in English Language

14. Environmental Engineer	
i. Educational Qualification	Graduate in Civil Engineering with preferably Master's degree in Environmental Engineering/Environmental Science
ii. Experience	
• Total Experience	5 years
• Experience in Related Field	3 years in Road and Bridge Works
• Experience in the Proposed Field of Expertise	2 years' experience as Environmental Engineer
	Experience with International Organization in Infrastructure Projects
iii. Language	Communicate fluently in English Language

15. Road Safety Engineer		
i. Educational Qualification		
	- Graduate in Civil Engineering with preferably Master's degree in Civil Engineering/ Transport Engineering/ Highway Engineering - Obtained Training from SHIP TA Consultant on Road Safety	
ii. Experience		
	Total Experience	5 years
	Experience in Related Field	3 years in Road and Bridge Works
	Experience in the Proposed Field of Expertise	2 years' experience as Road Safety Engineer
		Experience with International Organization
iii. Language	Communicate fluently in English Language	

16. Cadastral Surveyor		
i. Educational Qualification		
	Graduate in Surveying with preferably Master's degree in Surveying or equivalent	
ii. Experience		
	Total Experience	5 years
	Experience in Related Field	3 years in Road and Bridge works
	Experience in the Proposed Field of Expertise	2 years' experience as Cadastral Surveyor for Road works
		Experience with International Organization in Infrastructure Projects
iii. Language	Communicate fluently in English Language	

17. Social & Resettlement Officer		
i. Educational Qualification		
	Graduate in Social field with preferably Master's degree in related field	
ii. Experience		
	Total Experience	5 years
	Experience in Related Field	3 years in Road and Bridge Works
	Experience in the Proposed Field of Expertise	2 years' experience as Social/Resettlement/Gender related field
		Experience with International Organization in Infrastructure Projects
iii. Language	Communicate fluently in English Language	

18. On the Job Trainee Engineer		
i. Educational Qualification		
	- Freshly pass-out Civil Engineers. - Appeared in final exam of BE Civil without any backlogs in previous semester/year's exams	
ii. Language	Communicate fluently in English Language	

Annex 3

OFFICES

A. Provision of Offices and Accommodation for the Consultant

1. General Requirements

1. The consultant shall acquire and provide office space at Kathmandu (within 2 Km radius of PID Office). The consultant shall provide furniture, fittings, equipment and materials in order to provide fully functioning and usable facilities and to provide the consultant's staff with the necessary resources for the administration, detail study and reporting of the works. Offices shall be designated as Office Type-1.
2. The complete office facilities shall include the provision of the land, covered parking facilities for vehicles, renting of the buildings and all other necessary appurtenance such as drainage systems, fences, utilities, etc.
3. After providing the offices and equipment the consultant shall maintain them for the duration of the Service.

2. Services

1. The consultant shall arrange, where possible, for the connection of water mains, drainage and sewerage and mains electricity to all offices and shall be functional all time. In circumstances where location of offices makes such connections impracticable, the consultant shall provide and operate generators to supply adequate power, pumps to supply water from wells or storage tanks with regular deliveries of potable water and sewage disposal facilities which conform in full to the requirements for sewage disposal facilities. A standby generator with fuel of appropriate capacity shall be provided to office to use during load shedding and power failure.
2. Telephone services including at least two direct lines and three mobile phones shall be provided for Office Type-1.

3. Rented Premises

1. Before rented accommodation is approved, the employer must be satisfied that the location is suitable, that the property proposed shall be available for the required duration and that the layout of the property is functionally equivalent to the requirements.



4. Office and Accommodation Buildings

1. The office buildings shall have the rooms described in Table 1.1 below as a minimum.

Table 1.1 Office Room Requirements

S.N.	Room Requirements	Office Type I	
		No. of Rooms	Area
1	Sr. Highway Engineer/Team Leader	1	Total floor area shall not be less than 500sqm
2	Intermittent Professionals (International)	3	
3	Highway Engineer/ Traffic Engineer	2	
4	Bridge/ Structural Engineer	1	
5	Geotechnical Engineer/Tunnel Engineer	1	
6	Materials Engineer/ Pavement Engineer	1	
7	Hydrologist/ Drainage Engineer	1	
8	Procurement Specialist	1	
9	Other Professionals (National)	2	
10	Office Manager/Accountant	1	
11	Office Secretary/Administrator	1	
12	Conference Room	1	
13	Toilet	3	
14	Store Room	1	
15	Kitchen	1	
16	Covered Parking Space / Vehicles	8 Vehicles	

2. Each room, the conference room and the kitchen shall be provided with at least 3 x 15 amp power outlets. Each office room and kitchen shall be fitted with adequate light fittings. Additionally, table lamps/desk lights shall be provided as required. External lighting shall be provided to give adequate illumination of the whole area surrounding the building and covered parking spaces. Each toilet shall be fitted with a wash basin with running water.

5. Furnishings and Equipment

1. The consultant shall provide sufficient fittings, furnishings and equipment for the smooth running of the office. The Provision of fittings, furnishings and equipment shall be such that, there is no difficulty or obstruction in fulfilling all the requirements of the TOR.

2. In the event the Consultant fails to deliver the outputs as mentioned in the TOR in a timely manner, the payment for that period shall be deducted.

B. Maintain and run Office, Accommodation and Provision of Supplies

1. General Requirements

3. The Consultant shall maintain in good decorative and working order all the buildings and the contents thereof installed under the Service. The Consultant shall be responsible for supplying all power, water and telephone services to all the offices. A standby generator or equivalent equipment of appropriate capacity is required on each office to have continuous supply of power during load shedding and power failure.

4. The Maintenance of the Consultant's offices shall include daily cleaning and provision of toilet materials.
5. The Consultant shall provide adequate security to guard and secure the buildings on a 24 hours per day basis.
6. A wireless internet facility shall be provided at every office in order to facilitate the transmission of project data and information.

C. Furniture and Office Equipment for the Consultant

7. Each room shall be fitted with adequate light fittings, ceiling fans with regulators, and two electric 5A outlets with ground connection. The kitchens shall have at least two 5A and one 15A electric outlets.
8. The office shall have two outside telephone lines; one shall be provided for the exclusive use of the Chief Officer in charge of the office, and the other line will be provided with necessary extensions for use in the various offices.
9. The Consultant shall arrange for the offices to be connected with each other by an intercommunications telephone system in order to facilitate communications between the Consultant's staff.
10. The consultant shall provide sufficient number of computers, laptops, printers, scanners and all other required equipment of sufficient specifications to complete all the tasks mentioned in the TOR. The consultant shall also supply six All-in-one computers (Intel i7, RAM ≥16 GB, Storage ≥1 TB, Display Size ≥ 27" 4K, genuine windows 10 OS, keyboard, mouse and other required accessories)
11. The Consultant shall supply and keep replenished all consumable items.

D. Furniture and Office Equipment for the Consultant's Staff

12. The furniture and equipment to be supplied and installed in the offices shall be new, and of acceptable quality.
13. The furniture may be steel, aluminium, wood or combination of these. The Consultant should forward details of the items he intends to supply and obtain prior approval from the Employer.



ANNEX 4 **VEHICLES**

A. Vehicles for the Consultant

1. The type of vehicles the Consultant required to provide for their use shall be as shown below:

S.No.	Vehicle Type	Nos. to be supplied	Description of Specification
1	Type 1	3	New, or nearly new, five or six door Station Wagon (including one/two rear doors) with a diesel engine of at least 2.5 litre capacity, four-wheel drive, high and low ratio gear box with differential lock, a minimum ground clearance (unladen) of 200 mm, Air bags, Air Conditioner, cloth seats, seat belts, locking fuel cap, spare wheel, tool kit, tow rope, jump leads, fire extinguisher and first aid kit.
2	Type 2	5	New, or nearly new, "Double Cab" Pick-Up with a diesel engine of at least 2.2 litre capacity, four-wheel drive, high and low ratio gear box with differential lock, a minimum ground clearance (unladen) of 200 mm, Air bags, Air Conditioner, cloth seats, seat belts, locking fuel cap, spare wheel, tool kit, tow rope, jump leads, fire extinguisher and first aid kit.
3	Type 3	3	New "Off Road" motor cycle with a 4-stroke engine of at least 150 c.c. equipped with panniers and spare tool kit. Included shall be a motor cycle safety helmet meeting the Nepal Road Safety specifications.

2. The consultant may propose for additional vehicles if necessary, in their financial proposal.
3. "Nearly new" means less than 1-year old and with less than 20,000 km travelled and in general good condition.
4. All vehicles shall be fully insured throughout the project period.
5. Payment shall be made only to those vehicles which conform the specification.
6. Additional Type 1 vehicle along with driver, fuel and operational maintenance to be supplied to the Department of Roads, Project Directorate (ADB), Bishalnagar
7. All vehicles shall have full insurance coverage.



Site

LOAN NUMBER 3722-NEP(COL)

LOAN AGREEMENT
(Ordinary Operations [Concessional])

(South Asia Subregional Economic Cooperation Highway Improvement Project)

between

NEPAL

and

ASIAN DEVELOPMENT BANK

DATED 20 November 2018

NEP 52007

LOAN AGREEMENT
(Ordinary Operations [Concessional])

LOAN AGREEMENT dated 20 November 2018 between Nepal ("Borrower")
and ASIAN DEVELOPMENT BANK ("ADB").

WHEREAS

(A) the Borrower has applied to ADB for a loan for the purposes of the Project described in Schedule 1 to this Loan Agreement; and

(B) ADB has agreed to make a concessional loan to the Borrower from ADB's ordinary capital resources upon the terms and conditions set forth herein;

NOW THEREFORE the parties agree as follows:

ARTICLE I

Loan Regulations; Definitions

Section 1.01. All provisions of ADB's Ordinary Operations (Concessional) Loan Regulations, dated 1 January 2017 ("Loan Regulations"), are hereby made applicable to this Loan Agreement with the same force and effect as if they were fully set forth herein.

Section 1.02. Wherever used in this Loan Agreement, the several terms defined in the Loan Regulations have the respective meanings therein set forth unless modified herein or the context otherwise requires. Additional terms used in this Loan Agreement have the following meanings:

- (a) "Consulting Services" means consulting services as described in the Procurement Regulations and set out in the Procurement Plan, and to be financed out of the proceeds of the Loan;
- (b) "DOR" means the Department of Roads of MOPIT, and any successor thereto;
- (c) "Environmental Management Plan" or "EMP" means the environmental management plan for the Project, including any update thereto, incorporated in the IEE;
- (d) "Environmental Safeguards" means the principles and requirements set forth in Chapter V, Appendix 1, and Appendix 4 (as applicable) of the SPS;

**ANNEX XIX: NEPAL GUZZATE MENTIONING
ROW OF THE EXISTING HIGHWAY
25 METER BOTH SIDE**

भौतिक
मंगल सरकार
प्रसारण तथा वातावरण मंत्रालय
सिंदूरघर, काठमाडौं



உதவி 4.



ANNEX XX: LABOR CAMP MANAGEMENT STANDARD

The Labour camp is the core facility for labors/staffs involved in project which will be managed through providing following facilities.

1. The labor camp is located at out of settlement
2. The living quarters have room with minimum space 28 sq ft space for a person with adequate natural lighting and ventilation (mechanical if natural is not possible) at project sites.
3. The living quarters have the facility for Bedding including mosquito net or coil, Fan etc. for each room
4. The Labour camp have toilets and urinal maintaining following requirements.
 - ❖ Toilets are connected to temporary septic tank or soak pit.
 - ❖ Separate toilets for male and female labors if female labors are employed (at least 1 toilet and 1 urinal for every 25 labors).
 - ❖ The toilets have proper doors and fastenings, water supply in drums or piped.
 - ❖ Where both sexes are employed, displays the notice in understanding language “For Women Only”, or “For Men Only”
5. The Labour camp have provided with clean and safe drinking water from the sources such as hand pump, tube well, spring, pond or Jar.
6. The Labour camp have provided with separate and adequate bathing facilities for the use of male and female worker (if both are employed).
7. The Labour camp have provided with basic requirement such as utensils, LP gas etc for cooking.
8. Waste management including drainage system Bins, waste segregation.
9. The labour camp is properly (barricaded by CGI/Bamboo) secured from the possible community threats.
10. The labour camp is equipped with fire extinguisher and first aid box
11. The Labour camp has provided with the register for each worker with their detail

ANNEX XXI: GUIDELINE FOR PUBLIC UTILITIES SHIFTING

Public utilities shifting is an essential aspect of BG road projects to ensure the smooth execution of construction activities and the uninterrupted functioning of various utility. Identify the utilities (such as water supply pipe, water tank, electricity poles, telecommunications poles and cable, irrigation canal, etc.) that may be affected by the road project.

Initial Assessment:

Verify all **public utilities** during pre-construction stage also which are identified during IEE such as water supply pipe, water tank, electricity poles, telecommunications poles and cable, irrigation canal, etc. that may be affected by the BG road project.

Determine the extent of their presence along the project site and assess the potential impact on the project timeline.

Create comprehensive utility maps or drawings indicating the precise location of utilities in relation to the road project.

Collaboration and Coordination:

Establish communication channels with relevant government agencies and stakeholders.

Schedule regular meetings and discussions to share project plans, timelines, and requirements.

Collaborate with relevant government agencies and stakeholders to obtain accurate information regarding the location of underground or overhead utilities.

Utility Relocation Planning

Develop a utility relocation plan that outlines the sequence, methods, and timeline for shifting each utility.

Consider the impact on utility services, surrounding infrastructure, and public safety during the relocation process.

Collaborate with concern stakeholders to design and implement new utility routes or alignments, ensuring they meet the required standards.

Permitting and Approvals:

Obtain the necessary permits and approvals from local authorities and concern stakeholders for the utility relocation work.

Comply with any regulations or guidelines related to safety, environmental protection, and public inconvenience during the relocation process.

Execution and Monitoring:

Continuously monitor the performance of the relocated utilities and address any post-relocation issues that may arise.

ANNEX XXII: BRIEF IEE IN NEPALI

बुटवल- गोरुसिंगे (५० कि.मी) सडक स्तरोन्नतिको

प्रारम्भिक वातावरणीय परिक्षण, संक्षीप्त प्रतिवेदन

रुपन्देही र कपिलवस्तु जिल्ला, लुम्बिनी प्रदेश, नेपाल



प्रतिवेदन पेश गरिएको निकाय:

भौतिक पूर्वाधार तथा यातायात मन्त्रालय

सिंहदरबार, काठमाण्डौ, नेपाल

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प्रस्तावक:

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टेलिफोन नं: :०१-४४३७४९२, ४४३७४९३, ४४१४२३९

फ्याक्स नं: ४४३७४८८

इमेल: pdadb@dor.gov.np

असार, २०८०

संक्षिप्त शब्दावली

उ.म.पा.	उप-महानगरपालिका
गा.पा.	गाउँपालिका
घन.मी	घन मिटर
न.पा.	नगरपालिका
कि मि	किलोमिटर
मि	मिटर
हे	हेक्टर

AASHTO	American Association of State Highway and Transportation Officials
ACCESS	Accelerating Transport and Trade Connectivity in Eastern South Asia
ADB	Asian Development Bank
DLP	Defect Liability Period
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environment Protection Act
EPR	Environment Protection Rules
IEE	Initial Environmental Examination
IRC	Indian Road Congress
PBM	Performance Based Monitoring
PIU	Project Implementing Unit
SC	Supervision Consultant

विषय सूची

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परिच्छेद १: प्रतिबेदन तयार गर्ने संस्थाको नाम र ठेगाना

प्रस्तावित बुटवल-गोरुसिंगे सडकखण्ड स्तरोन्नतिको प्रस्तावक आयोजना निर्देशनालय (ADB), सडक विभाग, भौतिक पूर्वाधार तथा यातायात मन्त्रालय रहेका छन्।

१.१. प्रस्तावकको नाम र ठेगाना

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१.२. परामर्शदाताको नाम र ठेगाना

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यस आयोजनाको कार्यसूची भौतिक पूर्वाधार तथा यातायात मन्त्रालयबाट मिति २०७८/०८/२३ मा स्वीकृत भैसकेको छ। यस आयोजनामा संलग्न विज्ञहरुको सूची तालिका १ मा प्रस्तुत गरिएको छ।

तालिका १: आयोजनामा संलग्न विज्ञहरुको सूची

क्र.स.	विज्ञहरुको नाम	पद/विशेषज्ञता	योग्यता र अनुभव
१	राजन कुमार श्रेष्ठ	टोली नेता/ वातावरण विज्ञ	स्नातकोत्तर, वातावरण र प्रकृति संरक्षण; १३ वटा भन्दा बढी IEE तथा EIA को अनुभव
२	अभिषेक बी.सि.	वातावरण इन्जिनियर	स्नातक, वातावरण इन्जिनियर; १० वटा भन्दा बढी IEE तथा EIA को अनुभव
३	प्रनिल प्रधान	वातावरणविद्	स्नातकोत्तर, वातावरण विज्ञान; वातावरण प्रभाव मूल्यांकनमा ५ वर्ष भन्दा बढी अनुभव
४	रबिन ढकाल	समाजशास्त्री	स्नातकोत्तर, समाजशास्त्र; १२ वटा भन्दा बढी IEE

क्रस.	विज्ञहरुको नाम	पद/विशेषज्ञता	योग्यता र अनुभव
			तथा EIA को अनुभव
५	प्रयाग राज ताम्राकार	वन्यजन्तु विज्ञ	स्नातकोत्तर, वन विज्ञान, ३ वटा भन्दा बढी IEE तथा EIA को अनुभव
६	अनन्त प्रशाद गजुरेल	इन्जिनियर जियोलेजिस्ट	स्नातकोत्तर, जियोलेजी, ५ वटा भन्दा बढी IEE तथा EIA को अनुभव
७	सुरेश बाबु श्रेष्ठ	हाइवे इन्जिनियर	स्नातकोत्तर, ट्रान्सपोर्ट एंड रोड, ४ वटा भन्दा बढी IEE तथा EIA अनुभव
८	संजय अधिकारी	हाइड्रोलोजिस्ट	स्नातकोत्तर, हाइड्रोलोजी र ड्रेनेज ,वातावरण प्रभाव मूल्यांकनमा १० वर्ष भन्दा बढी अनुभव
९	सरोज भट्टराई	पूल विज्ञ	स्नातकोत्तर, ट्रान्सपोर्ट एंड रोड , वातावरण प्रभाव मूल्यांकनमा १० वर्ष भन्दा बढी अनुभव
१०	नेमी भट्टराई	जी.एस.आई. विज्ञ	इन्जिनियर, वातावरण प्रभाव मूल्यांकनमा ५ वर्ष भन्दा बढी अनुभव
११	भरत रेग्मी	फरेस्टर	स्नातक, वन विज्ञान, २ वर्ष भन्दा बढी अनुभव

परिच्छेद २: प्रस्तावको परिचय

२.१. भूमिका

पूर्व-पश्चिम राजमार्गको बुटवल-गोरूसिंगे (५० किमी) सडकखण्ड लुम्बिनी प्रदेशको रुपन्देही र कपिलवस्तु जिल्लामा अवस्थित छ। यस सडकखण्ड रुपन्देही जिल्लाको बुटवल उपमहानगरपालिका, सैनामैना नगरपालिका र कन्चन गाउँपालिका र कपिलवस्तु जिल्लाको बाँडगङ्गा नगरपालिका र बुद्धभुमि नगरपालिका भएर गएको छ। यो आयोजना बुटवलको तिनाउ पुलबाट ३०० मिटर पश्चिम (चेनेज ५९०+०००) देखि सुरु भएर इमिलिया नजिक (चेनेज ६४०+०००) मा पुगेर टुङ्गिन्छ। यस सडकखण्डको स्तरोन्नतिका लागि ACCESS-नेपाल फेज १ आयोजना अन्तर्गत विस्तृत डिजाइनको लागि एसियाली विकास बैंक र आयोजना कार्यान्वयनका लागि विश्व बैंकले आर्थिक सहयोग गरेको छ। यस सडकखण्डको लम्बाई ५० कि मी रहेको छ जस मध्ये २५.६ कि मी रुपन्देही जिल्लामा र बाँकी २४.४ किमी कपिलवस्तु जिल्लामा पर्दछ।

बुटवल-गोरूसिंगे सडकखण्डको विद्यमान औसत चौडाई ८ मि रहेको छ जस मध्ये ६ मि क्यारिजवे र सडकको दुबै तर्फ १ मिटर चौडा पेटी छ। यस सडक पहाडको फेदी हुँदै तराईको समथर भूभाग भएर गएको छ। यस सडकमा पर्ने मुख्य चोकहरुमा जितगदी (चेनेज ५९२+३००), चार नम्बर चोक (चेनेज ६२०+४००), बंगाई (चेनेज ६२६+७००), तामनगर (चेनेज ५९७+१००), मुर्गिया (चेनेज ६०२+९००), सालझन्डी (चेनेज ६११+४००), गोरूसिंगे सन्दीखर्क चोक (चेनेज ६३४+९५०), र बुढी (चेनेज ६३९+०००) रहेको छ।

२.२. प्रस्तावको सान्दर्भिकता

यस सडकको विद्यमान अवस्था खराब रहेको छ र अधिकांश पुलहरू ४० वर्ष भन्दा पुराना रहेका छन्। राष्ट्रिय जनसंख्या वृद्धि संगै यस सडकमा गुड्ने सवारी साधनको संख्या र यात्राको दर पनि बढेको छ। तसर्थ, सडक विभागले स्थानीय स्तरमा र विश्व बैंक र एसियाली विकास बैंक जस्ता अन्तराष्ट्रिय वित्तीय संस्थाहरुको आर्थिक सहयोगमा चरणबद्ध रुपमा पूर्व पश्चिम राजमार्ग चार लेनको सडकमा स्तरोन्नति गर्न प्रस्ताव गरेको छ। बुटवल-गोरूसिंगे सडकखण्ड एसियन राजमार्ग २ को पनि खण्ड रहेकोले भारत, भुटान र बङ्गलादेशसँग सडक सञ्जालमा आबद्ध गर्नुका साथै यस आयोजनाले एसियाली राजमार्गको प्रभावकारीता पनि बढाउने छ।

२.३. आयोजनाको उद्देश्य

बुटवल-गोरूसिंगे (५० कि.मि) सडकखण्ड २ लेनको रहेको छ र यस आयोजनाको उद्देश्य ३० वटा पुलहरू सहित बुटवल-गोरूसिंगे सडकखण्डलाई ४ लेनमा स्तरोन्नति गर्नु रहेको छ। यस सडकको चौडाई शहरी क्षेत्रमा ५० मिटर, अर्धशहरी क्षेत्रमा ३७.४ मिटर र गैर शहरी तथा वन क्षेत्रमा २४ मिटर डिजाइन गरिएको छ। ४ लेनको सडकको मापदण्ड परिपूर्ति गर्न सडकको समानान्तर रूपमा फुटपाथ सहितको थप पुलहरू निर्माण गरिनेछ। सडक स्तरोन्नतीका अवयवहरू अन्तर्गत ५० किलोमिटर सडक २ लेनबाट ४ लेनमा स्तरोन्नति गर्ने, पेभमेन्ट स्तरोन्नति, ज्यामितिय सुधार, चोक सुधार, शहरी क्षेत्रमा सडकको दुवै किनारमा साइकल लेन र फुटपाथ, पैदल यात्री क्रसिङ (ओभरहेड ब्रिज/अन्डरपास), वन्यजन्तु क्रसिंग, नयाँ पुलहरूको निर्माण, नाला सुधार, टेवा पर्खालहरू निर्माण; भू-क्षय नियन्त्रण र स्थिरीकरण, बस स्टपहरू साथै अन्य सडक सुरक्षणका उपायहरू आदिको निर्माण गरिने छ।

२.४. प्रारम्भिक वातावरणीय परिक्षणको कानुनी औचित्यता

यो आयोजना अन्तर्गत ३० वटा पुलहरू सहित ५० कि.मी सडकखण्डको स्तरोन्नति गरिनेछ। वातावरण संरक्षण ऐन, २०७६ र वातावरण संरक्षण नियमावली, २०७७ को अनुसूची ३३ नियम ड (द) को व्यवस्था अनुसार, १० देखि ५० कि.मी लम्बाइको राष्ट्रिय राजमार्गको स्तरोन्नति, पुनर्स्थापना वा पुनर्निर्माण गर्न प्रारम्भिक वातावरणीय परीक्षण अनिवार्य रहेको छ। यो सडक कुनै पनि संरक्षित क्षेत्रहरू (राष्ट्रिय निकुञ्ज, संरक्षण क्षेत्र, वन्यजन्तु आरक्षण, शिकार आरक्षण) भएर जाँदैन। यो आयोजनाको डिजाइन र कार्यान्वयनका लागि एसियाली विकास बैंक र विश्व बैंकको आर्थिक सहयोग रहेको छ। तसर्थ, वातावरण संरक्षण नियमावली, २०७७ दफा २, नियम ७, उपनियम ८ बमोजिम प्रारम्भिक वातावरणीय परीक्षण प्रतिवेदन अङ्ग्रेजी भाषामा तयार गरिएको छ।

२.५. प्रारम्भिक वातावरणीय परिक्षणको उद्देश्य

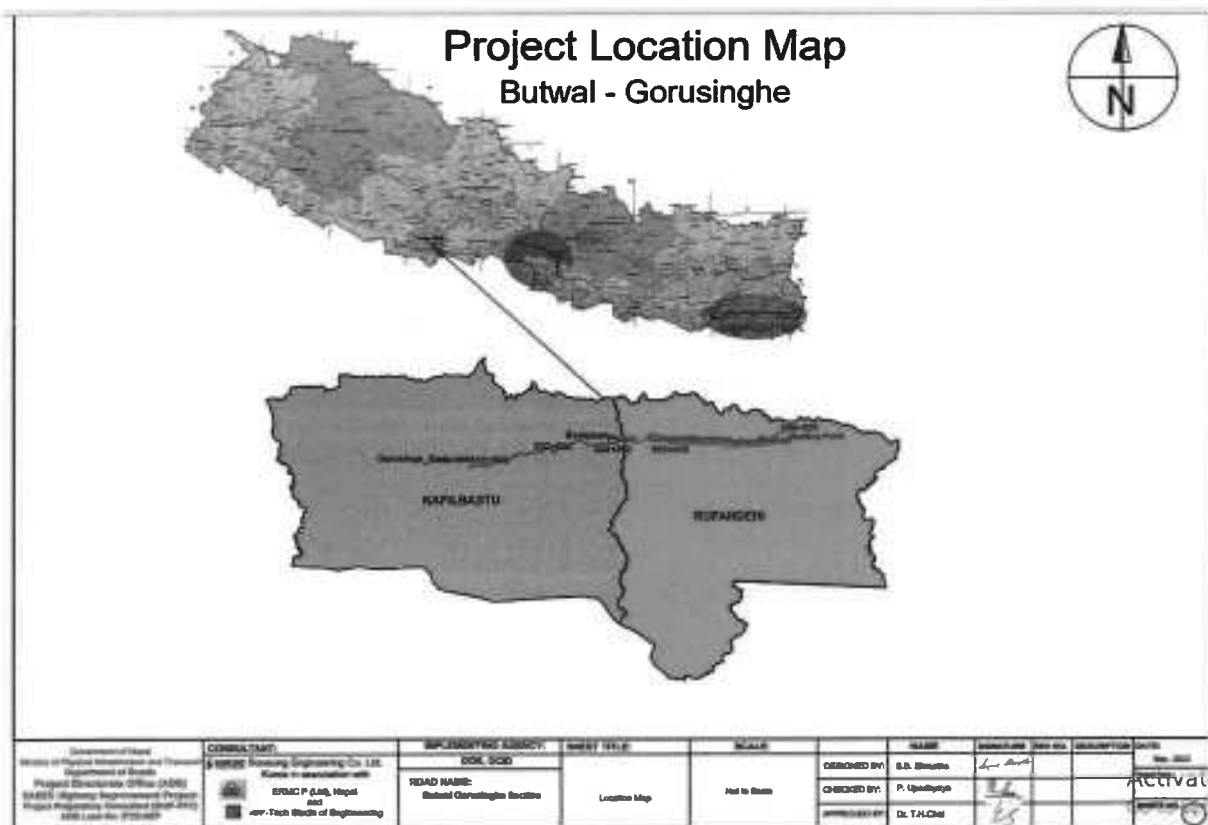
प्रारम्भिक वातावरणीय परिक्षणको प्रमुख उद्देश्य प्रस्ताव निर्माण तथा कार्यान्वयनको चरणमा वातावरणमा कमसेकम असर नपर्ने गरि योजना सुझाउनु हो, यसका विस्तृत उद्देश्यहरू निम्नानुसार रहेको छन्।

- आयोजना प्रभावित क्षेत्रको विद्यमान भौतिक, जैविक, सामाजिक- आर्थिक र सांस्कृतिक वातावरणीय अवस्थाको तथ्यांक सङ्कलन गर्ने,

- आयोजनाको कारणले भौतिक, जैविक, सामाजिक-आर्थिक र सांस्कृतिक वातावरणमा पर्न सक्ने प्रभावहरूको पहिचान, आँकलन तथा मूल्यांकन गर्ने,
- सकारात्मक प्रभावको बढोत्तरी तथा नकारात्मक प्रभावको न्यूनीकरणका उपायहरू पहिचान गरि कार्यन्वयनका लागि प्रस्ताव गर्ने,
- वातावरणीय अनुगमन योजना तथा वातावरणीय व्यवस्थापन योजना तयार गर्ने,
- प्रस्तावित आयोजनाको वातावरणीय प्रभावको बारेमा सम्बन्धित सरोकारवालाहरूलाई जानकारी प्रदान गर्ने,

२.६..आयोजना क्षेत्र र पहुँच

आयोजना क्षेत्र $२७^{\circ}४२'१४.८''$ उत्तरी अक्षांश र $८३^{\circ}२७'३६.८७''$ पूर्वी देशान्तर देखि $२७^{\circ}३९'१८.८५''$ उत्तरी अक्षांश र $८३^{\circ}०२'७९''$ पूर्वी देशान्तर को बीचमा अवस्थित छ। प्रस्तावित बुटवल-गोरुसिंगे सडक लुम्बिनी प्रदेशको रुपन्देही र कपिलवस्तु जिल्लामा अवस्थित छ।



चित्र १: आयोजना क्षेत्रको नक्सा



चित्र २: रणनीतिक सडक संजाल नक्सा

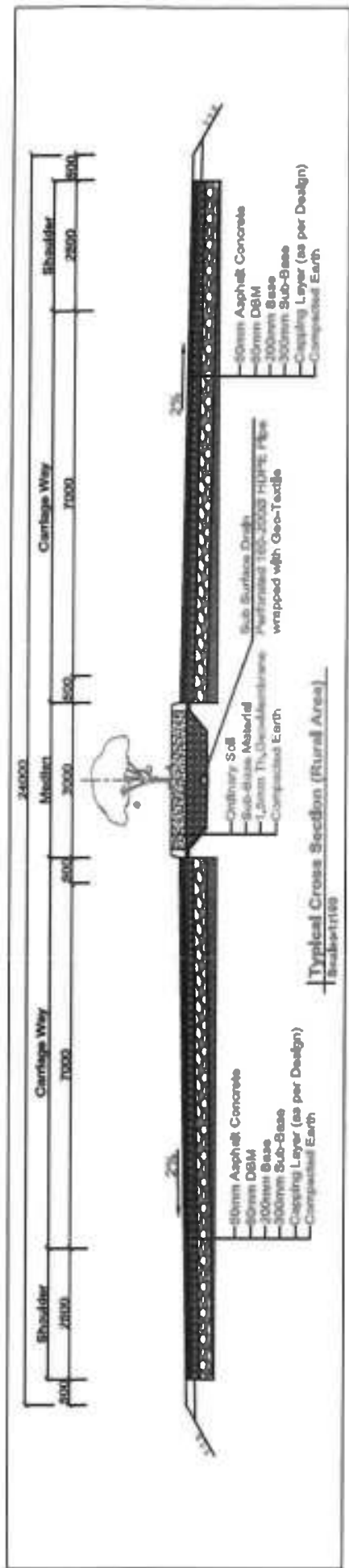
२.७. आयोजनाको विशेषता

तालिका २: प्रस्तावित आयोजनाको मुख्य विशेषताहरू

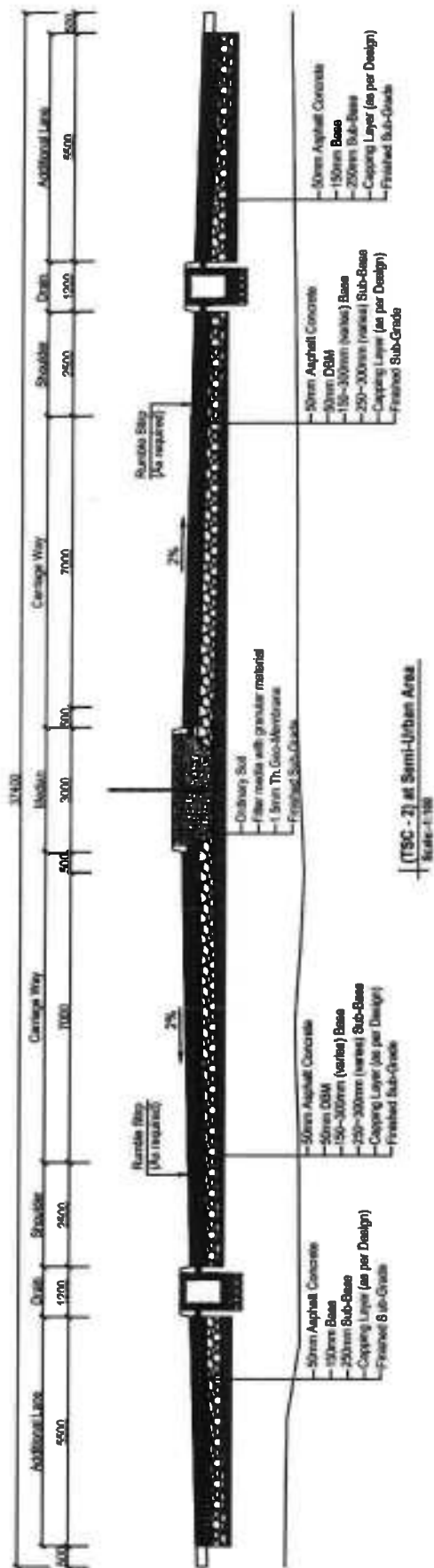
विशेषताहरू	विवरण
आयोजनाको नाम	बुटवल-गोरूसिंगे ५० किलोमिटर सडकखण्ड स्तरोन्नति
आयोजना स्थल	
प्रदेश	लुम्बिनी प्रदेश
जिल्लाहरू	रूपन्देही र कपिलवस्तु
स्थानीय तह	बुटवल उ.म.पा, सैनामैना न.पा, बाणगंगा न.पा, बुद्धभूमि न.पा, कन्चन गा.पा,
सुरुको बिन्दु	चेनेज ५९०+००० (तिनाउ पुल देखि ३०० मि पश्चिम) २७°४२'१४.८" उत्तरी अक्षांश र ८३°२७'३६.८७" पूर्वी देशान्तर; समुद्री सतह देखि १४९ मि उचाइमा
अन्तिम बिन्दु	चेनेज ६४०+००० (इमलिया चोक नजिक) २७°३९'१८.८५" उत्तरी अक्षांश र ८३°०'२.७९"; समुद्री सतह देखि ११७ मि उचाइमा
सडकको लम्बाई	५० कि मी
वर्गीकरण	एसियन राजमार्ग मापदण्ड, वर्ग - ख
सतह	अस्फाल्ट कंक्रीट

विशेषताहरू	विवरण
भौगर्भिक क्षेत्र	समथर तराई
मौसम/जलवायु	उष्ण
सामुन्द्रि सतह बाट उचाई	११७ मी देखि १५८ मी सम्म
सडकको मापदण्ड	राष्ट्रिय राजमार्ग, वर्ग- II
क्रश सेक्सन	
सडकको क्षेत्राधिकार	५० मी (सडकको केन्द्रबाट २५ मी दायाँ र बाँया)
कुल सडकको चौडाई	शहरी क्षेत्रमा: ५० मी चौडाईको पेभ्ड सोल्जर र दुबै साइडमा सर्भिस लेन सहित ४ लेन अर्ध-शहरी क्षेत्रमा: ३७.४ मी चौडाईको पेभ्ड सोल्जर र दुबै साइडमा थप लेन सहित ४ लेन गैर शहरी तथा वन क्षेत्रमा: २४ मी चौडाईको पेभ्ड सोल्जर सहित ४ लेन
यातायात गुड्ने चौडाई	२*७.५ मी एक तर्फी र २*७.५ मी अर्को तर्फी
सडक पेटी चौडाई	२*२.५ मी
बीचको पेटी	३ मी
डिजाइन गति	समथर भूभागमा १०० किमी/घण्टा र घुमाउरो भूभागमा ८० किमी/घण्टा
आयोजनाको किसिम	स्तरोन्नति
जम्मा पुलहरू	ठुलो र सानो गरि जम्मा ३० वटा; ५ वटा ५० मि भन्दा लामो पुलहरू
कल्भर्ट (प्लने र स्ल्याब)	१५५ वटा
निर्माण अवधि	निर्माण अवधि ३ वर्ष र DLP सहित PBM कार्यका लागि थप ५ वर्ष
निर्माण लागत	ने. रु. २१,९३०,४२९,६८९.०० भ्याट बिना

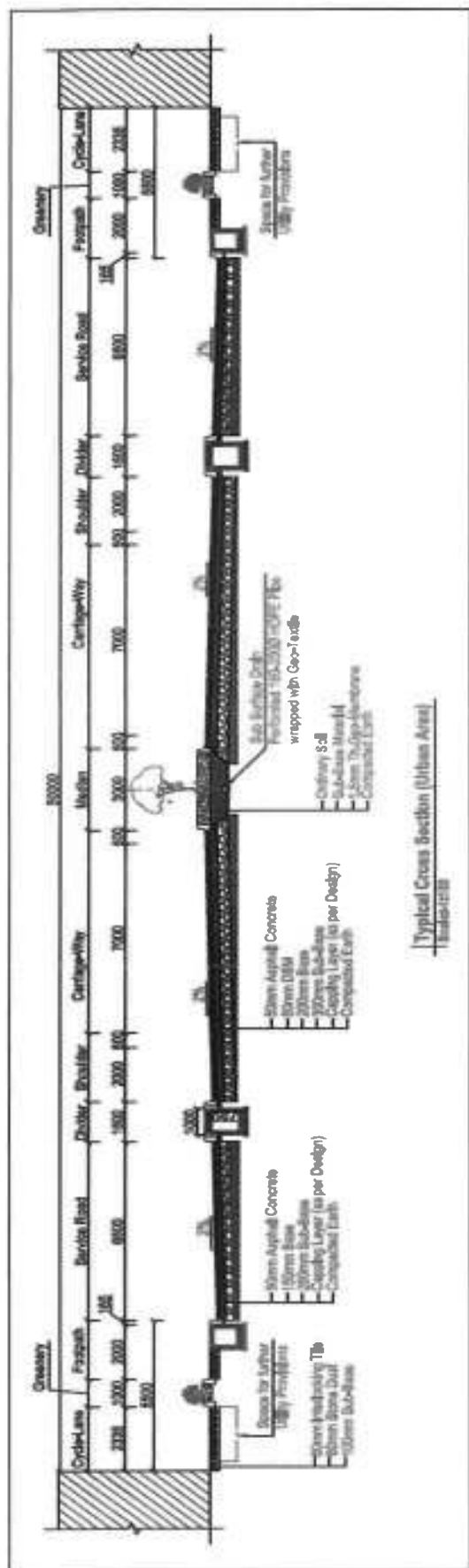
श्रोत: बुटवल-गोरूसिंगे सडकको विस्तृत आयोजना प्रतिवेदन, २०२२



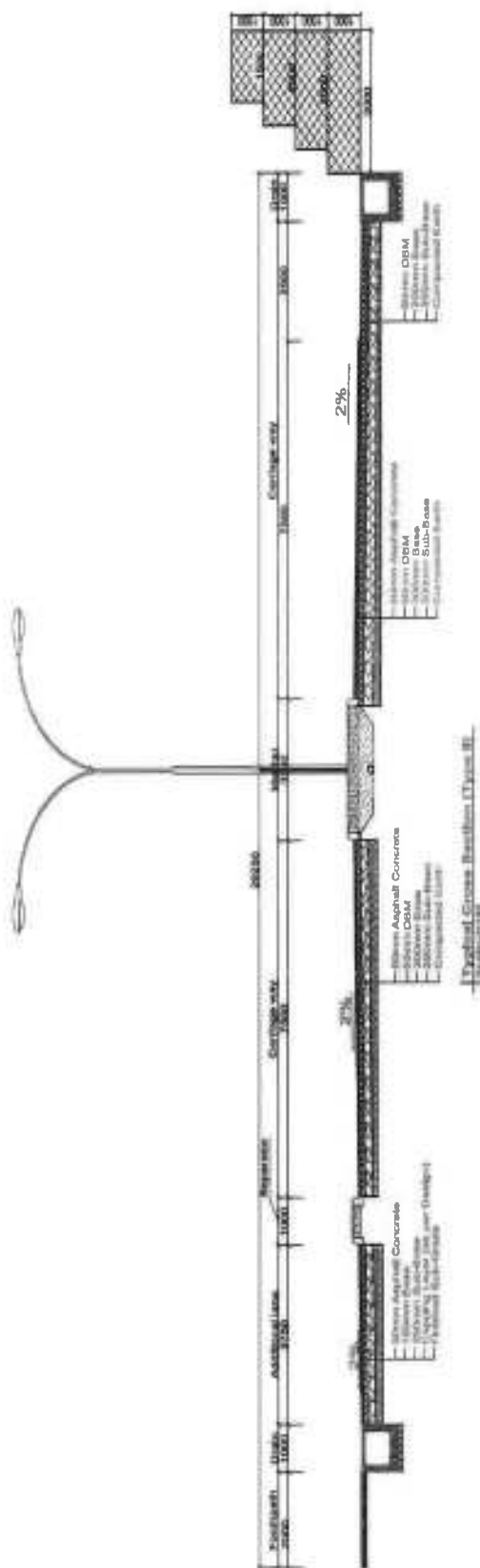
चित्र 3: गैर शहरी क्षेत्रको सडकको डिजाइन



चित्र 4: अर्ध शहरी क्षेत्रको सडकको डिजाइन



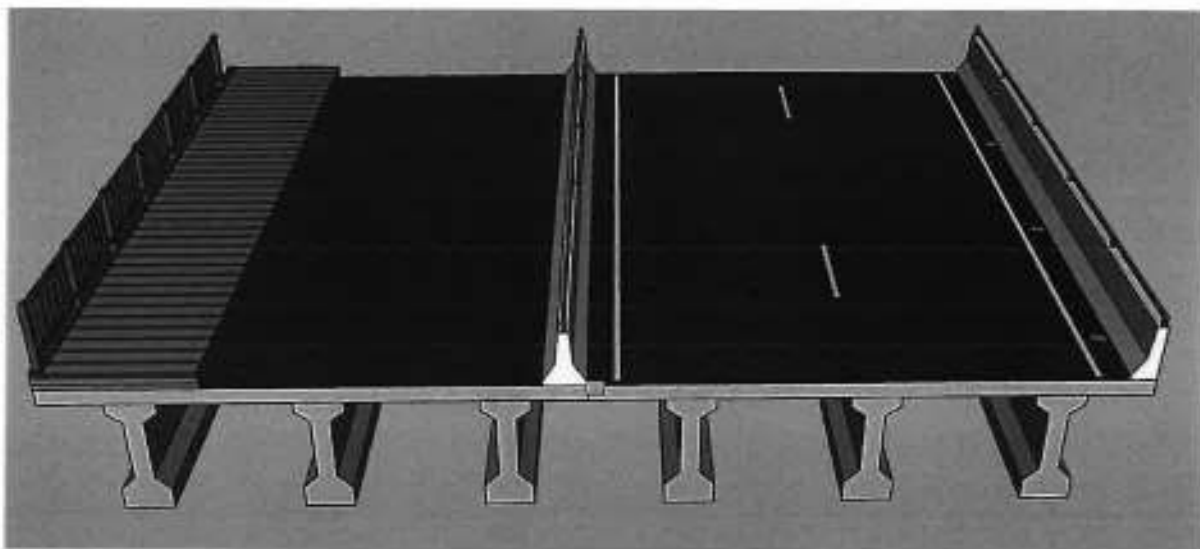
चित्र 5: शहरी क्षेत्रको सडकको डिजाइन



चित्र 6: पहिरो गएको स्थानमा प्रस्ताव गरिएको सडकको डिजाइन

पूल

यस आयोजना अन्तर्गत ३० पुलहरू रहेको छ र ५ वटा ५० मिटर भन्दा लामा पुलहरू सहित सबै पुलहरू नयाँ निर्माण गरिनेछ। प्रस्तावित पुलहरू २ लेनको आर.सी.सि प्रकारको रहेको आर.सी.सि टि बिम, पी.एस.सि बिम, आइ.पी.सि. बिम, पी.एस.सि बक्स बिम जस्ता विभिन्न डिजाइन प्रस्ताव गरिएको छ। सबै पुलहरूमा पानीको निकासको लागि १०० वर्षको अवधि डिजाइन गरिएको छ। सबै पुलहरू IRC loadings वा AASHTO loadings अनुसार डिजाइन गरिएको छ।



चित्र ७: पुलको डिजाइन

पुलेशा/Culvert

हाल संचालनमा रहेका सबै १५५ वटा पुलेशाहरूको क्षमता अभिवृद्धिका लागि परिक्षण गरिनेछ र कमजोर/कमसल पुलेशालाई परिमार्जन गरिनेछ। नयाँ पुलेशाहरू ५० वर्षको अवधिको लागि डिजाइन गरिएको छ। हाल संचालनमा रहेका सबै पुलेशाहरू र १० मि भन्दा कम स्पान भएको पुलहरूलाई नयाँ आर.सि.सि. बक्स कल्भर्ट र पुलहरूले प्रतिस्थापन गरिनेछ।

सडक नाली

२५ वर्षको अवधिको आधारमा सडक नालीको प्रकार र आकार निर्धारण गरिएको छ। आयोजना अन्तर्गत थप ३२,६२० मिटर सडक नालीको निर्माण गरिनेछ।

टेवा पर्खालहरू

विभिन्न प्रकारको टेवा पर्खालहरू जस्तै ग्याबियन टेवा पर्खाल, स्टोन म्यासिनारी टेवा पर्खाल, आर.सी.सि. टेवा पर्खाल, जियोग्रिड टेवा पर्खाल आदि को डिजाइन र प्रस्ताव गरिएको छ।

स्लोप स्थिरिकरण

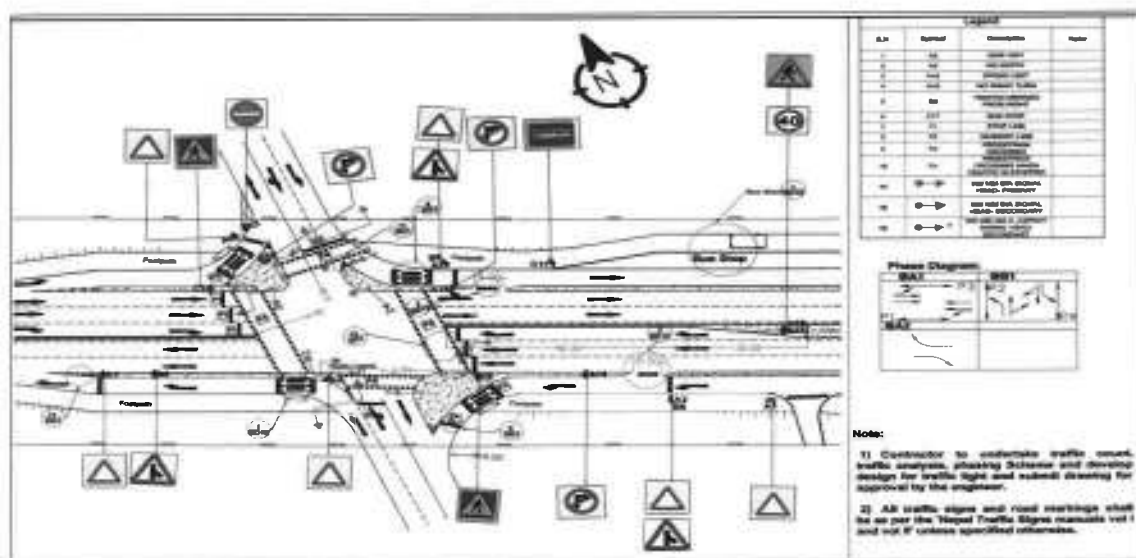
स्लोप स्थिरिकरण कार्य ५० वर्ष अवधिको लागि निर्माण गरिनेछ। स्लोप स्थिरिकरणका लागि १२,११२ घन मी टेवा पर्खालहरू, नदि किनारमा २४,४५८,११२ घन मी टेवा पर्खाल र ६,२५५ घन मी स्टोन म्यासोनरी आवश्यक पर्नेछ।

जलवायु परिवर्तन अनुकुलनका उपायहरू

प्रस्तावित पुलहरू १०० वर्षको अवधिको आधारमा, पुलेशाहरू ५० वर्षको अवधिको आधारमा र सडक नाली २५ वर्षको अवधिको आधारमा डिजाइन गरिएको छ। जलवायु परिवर्तन अनुकुलनका रूपमा थप १०% वर्षा थप गरि जल प्रवाहको गणना गरिएको छ।

चोक सुधार

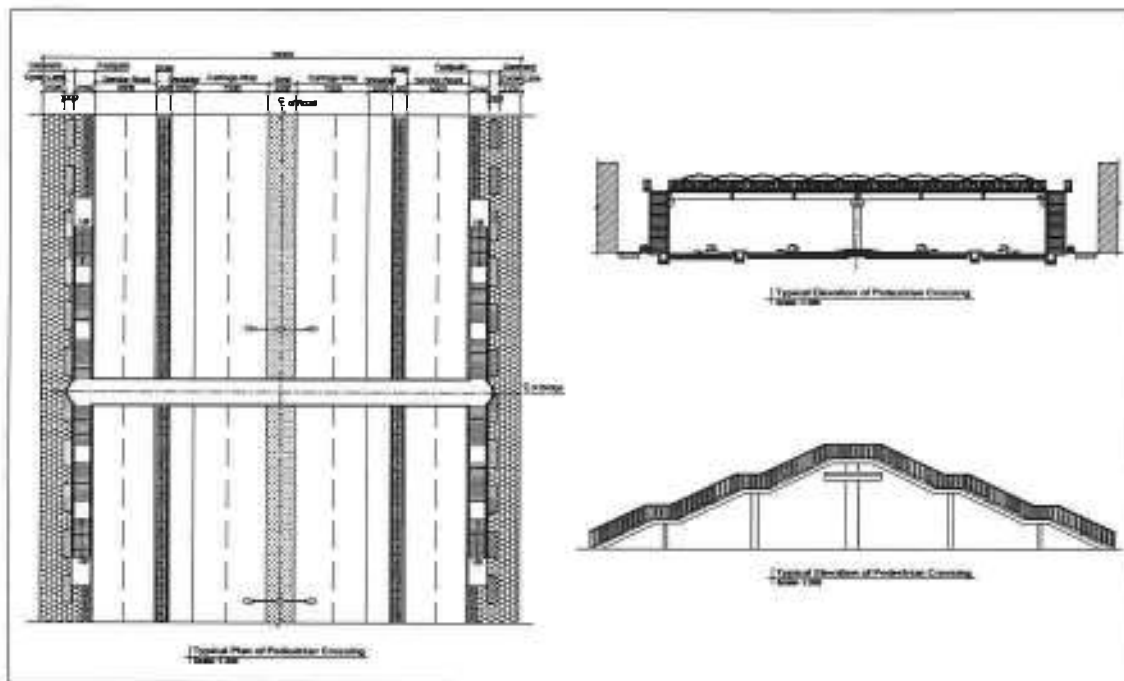
उच्च गतिका सवारी साधनको प्रवाह गर्न र ४ लेनको यातायात संचालन हुने क्षेत्रमा विभिन्न सुविधाहरूको पहुँचको लागि सबै चोकहरूको सुधार गरिनेछ। सुधारका लागि विभिन्न प्रकारका इन्टरसेक्सनहरूको डिजाइन र प्रस्ताव गरिएको छ।



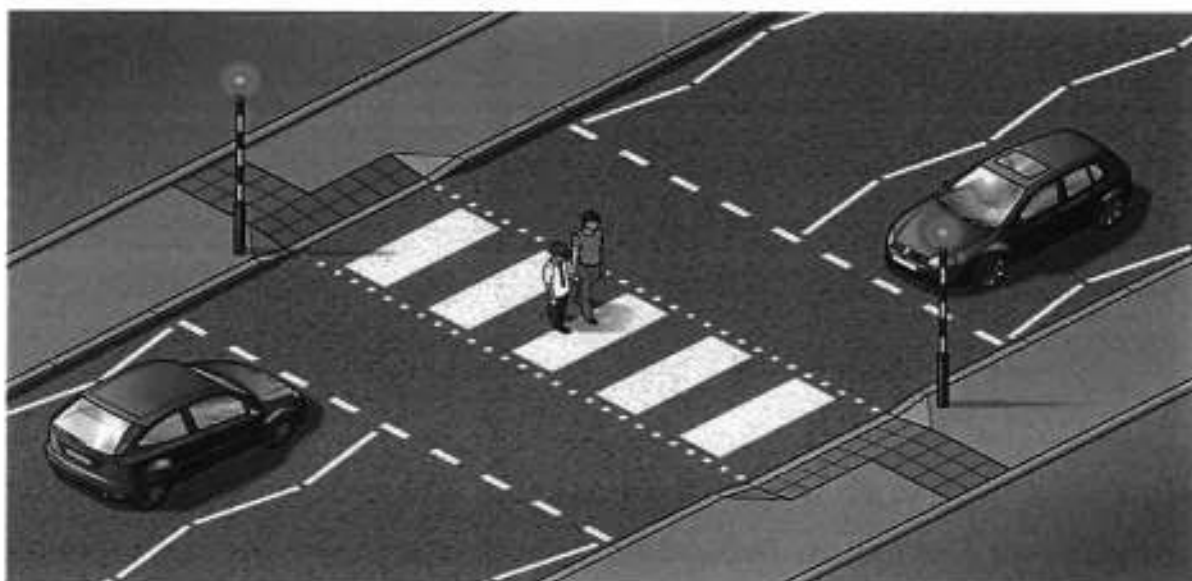
चित्र ८: चोक सुधारको डिजाइन

सडक सुरक्षाका उपायहरु

यस आयोजनामा शहरी क्षेत्रमा फुटपाथ र साइकल लेन, सबै चोकहरुमा ट्राफिक बत्ति, जेब्रा क्रसिंग, ब्यारियर र सडक मार्किंग, ट्राफिक चिन्ह आदि समावेश हुनेछन। पैदल यात्रुको क्रसिंगको लागि ११ स्थानमा आकाशे पुल र १२ स्थानमा अन्डर पास निर्माण गरिनेछ।



चित्र ९: आकाशे पुलको डिजाइन



चित्र १०: अपांग मैत्री जेब्रा क्रसिंग

२.८. जमिनको आवश्यकता

सडकको ५० मिटर क्षेत्राधिकार भौतिक पूर्वाधार तथा यातायात मन्त्रालय, नेपाल सरकारको स्वामित्वमा रहेको छ र यस आयोजनाको लागि क्षेत्राधिकार भन्दा बाहिर थप जमिनको आवश्यकता छैन। यद्यपी अस्थायी कार्यहरू जस्तै शिविर क्षेत्र, निर्माण सामग्री भण्डार, ब्याचिंग प्लान्ट, क्रसर प्लान्ट, एसपाल्ट प्लान्टको स्थापना र संचालको लागि निजी तथा सार्वजनिक जग्गा करिब ६.६ हे. अस्थायी जमिन आवश्यक पर्नेछ।

२.९. मानव श्रोतको आवश्यकता

सडक र पुलको निर्माणबाट करिब ९००,००० व्यक्ति-दिन अदक्ष र करिब ११०,००० व्यक्ति-दिन दक्ष कामदारको आवश्यकता पर्नेछ। निर्माण अवधिभर दक्ष र अदक्ष दुवै गरेर लगभग ५०० कामदारको आवश्यकता पर्नेछ।

२.१०. बिग्रन व्यवस्थापन

करिब २७२,८८३ घन.मी बिग्रन उत्पन्न हुनेछ। उत्खनन् गरिएको बिग्रन निर्माणको क्रममा भरण सामग्रीको रूपमा प्रयोग गर्न सकिन्छ। सबै बिग्रन बेस र सब-बेस सामग्रीको रूपमा प्रयोग गरिने भएकाले बिग्रन व्यवस्थापन स्थलको आवश्यक छैन यद्यपी बिग्रन व्यवस्थापनका लागि २ सम्भावित स्थलहरू पहिचान गरिएको छ।

२.११. कामदार शिविर र भण्डारण क्षेत्र

कामदार शिविरका लागि ४ वटा र निर्माण सामग्रीको भण्डारणका लागि ५ वटा सम्भावित स्थानहरू पहिचान गरिएको छ। निर्माणको चरणमा आवश्यक स्थलहरू थप पहिचान गरिनेछ। निर्माण क्षेत्रमा सवारी साधनको आवतजावतमा असर नपर्ने गरि निर्माण सामग्री भण्डारण गरिने छ। नजिकैका वस्तीहरूमा कामदारहरूको सानो समूहको लागि निर्माण व्यवसायीले कोठा भाडामा लिन सक्नेछ।

२.१२. निर्माण सामग्री

आयोजनाको लागि ६१,१६० घन मी बालुवा, २८४,४०० घन.मी एग्रिगेट, ६८,३२० घन.मी ढुङ्गा, ४०२,५०० घन.मी सब-बेस, र २५९,५०० घन.मी बेस सामग्री आवश्यक पर्नेछ। आयोजना क्षेत्र वरिपरी निर्माण सामग्रीहरूका सम्भावित ११ श्रोत पहिचान गरिएको छ। आयोजना स्थल नजिकै ढुङ्गा, बालुवा जस्ता निर्माण सामग्री पर्याप्त मात्रामा उपलब्ध छन्। पहिचान गरिएका

निर्माण सामग्रीको स्रोत सरोकारवाला निकायबाट स्वीकृत प्राप्त छन् र सडकको क्षेत्राधिकार भन्दा बाहिर पर्छैन।

२.१३. इन्धनको आवश्यकता

निर्माण कार्यका लागि मुख्यतया मट्टितेल, डिजेल र पेट्रोल आवश्यक पर्नेछ। निर्माण कार्यको लागि मुख्यतया डिजेल र पेट्रोल प्रयोग गरिन्छ साथै डिजेल सामग्रीको ढुवानीको लागि सवारी साधनले प्रयोग गर्नेछ। बिटुमिन तताउनका लागि मट्टितेल पनि प्रयोग गरिनेछ।

२.१४. आयोजना कार्यान्वयन तालिका

प्रस्तावित सडक तथा पुलहरूको निर्माण २०२३ को सेप्टेम्बरबाट सुरु हुनेछ र यसको निर्माण अवधि ३ वर्षको रहने छ। साथै DLP सहित PBM को लागि थप ५ वर्ष अवधी रहनेछ।

कार्य विवरण	पहिलो वर्ष				दोश्रो वर्ष				तेस्रो वर्ष				चौथो वर्ष देखि आठौ वर्ष			
	अवधि (Quarters)															
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4				
निर्माण चरण र निर्माण कार्यहरू																
साइट क्लियरेन्स																
उत्खनन् कार्य																
पुलेसा संरचनाहरू निर्माण																
पुलहरू निर्माण																
टेबा पर्खाल																
सडक नाली संरचना																
सडक सतह निर्माण																
बायो-इन्जिनियरिंग																
वातावरणीय कार्य																
ट्राफिक सुरक्षा र पेंटिंग																
DLP र PBM कार्य																

श्रोत: बुटवल-गोरसिंगे सडकको विस्तृत डिजाइन प्रतिवेदन, २०२३

परिच्छेद ३: अध्ययन विधि

अध्ययन विधि अन्तर्गत सन्दर्भ सामाग्रीको पुनरावलोकन, स्थलगत सर्वेक्षण, अन्तरक्रिया गरिएको थियो र प्रभाव मूल्यांकन म्याट्रिक्सको प्रयोग गरि प्रभाव पहिचान गरिएको थियो। आयोजनाको सम्भाव्यता अध्ययन प्रतिवेदन, यस्तै प्रकृतिका आयोजनाहरूको वातावरणीय मूल्यांकन प्रतिवेदनहरू र अन्य सन्दर्भ सामाग्रीहरूको अध्ययन गरिएको थियो। आयोजना प्रभावित नगरपालिका र वडाहरूको जनसांख्यिकीय जानकारीका लागि राष्ट्रिय तथ्यांक कार्यालयद्वारा प्रकाशित प्रतिवेदनहरूको पुनरावलोकन, लक्षित समूह छलफल र स्थानीय नेता, वडा तथा अन्य सरोकारका पदाधिकारी, प्रतिनिधि लगायतसँग छलफल गरिएको थियो। आयोजना प्रभावित घरधुरीमा घरधुरी प्रभावली सर्वेक्षण (सन् २०२१ को डिसेम्बरदेखि सन् २०२२ मार्चसम्म), आयोजना क्षेत्रका प्रमुख सरोकारवालाहरूसँग २७ वटा परामर्श बैठकहरू सञ्चालन गरी उनीहरूबाट राय र सुझावहरू लिइएको र विभिन्न नगरपालिका, स्थानीय वासिन्दाहरू, लाभग्राहीहरू, जिल्ला वन कार्यालय, सामुदायिक वन समूहमा १९ वटा अनौपचारिक बैठक र लक्षित समूह छलफल गरिएको थियो। कुल १२० घरधुरीमा प्रभावली सर्वेक्षण गरिएको छ।

प्रचलित नीति, ऐन, नियम, नियमावली, निर्देशिका आदिको पुनरावलोकन गरिएको थियो।

स्थलगत अध्ययन गरि भौतिक वातावरणीय प्रभावहरू पहिचान र मूल्यांकन, खानेपानीको गुणस्तर र नदीको पानीको गुणस्तरका लागि पानीको नमूना परिक्षण गरि विश्लेषण, र पोर्टेबल उपकरण प्रयोग गरेर ९ स्थानहरूमा वायुको गुणस्तर र ध्वनि मापन गरिएको थियो। स्थलगत भ्रमणका आधारमा पहिरो, स्लोप अस्थिरताको तथ्याङ्क संकलन गरि विश्लेषण, भूगर्भीय र भू-संरचना तथ्याङ्क विस्तृत सर्वेक्षण आधारमा विश्लेषण गरिएको थियो।

आयोजना क्षेत्रको रूख बिरुवाहरूको कुल गणना गरि तथ्यांक विश्लेषण, जैविक विविधता र वन्यजन्तुका लागि स्थलगत सर्वेक्षण अवलोकन र विभिन्न सन्दर्भ सामाग्रीको समीक्षा गरि जानकारी सङ्कलन गरिएको थियो र वन्यजन्तुको जैविक विविधता अध्ययनको क्रममा सार्वजनिक परामर्श र वन्यजन्तुको उपस्थितिलाई ड्रोपिंग/प्यालेट, अवशेष (छाला, प्वाँख, हड्डी र लास), गुँड आदिको पहिचान गरेर रेकर्ड गरिएको थियो।

सामाजिक-आर्थिक र सांस्कृतिक वातावरणको लागि जनसांख्यिकीय तथ्यांक, बसोबासको अवस्था लगायत अन्य सामाजिक विशेषताहरू जस्तै प्रभावित घरधुरीको सामाजिक आर्थिक अवस्था,

जातजातीहरू, खानेपानी तथा शौचालयको अवस्था, धार्मिक तथा संस्कृति क्षेत्रहरू, प्रभावित निजि तथा सामुदायिक संरचना र अन्य सार्वजनिक सेवा सम्बन्धि तथ्यांकहरू संकलन गरिएको थियो।

३.१. परामर्श बैठक

आयोजना क्षेत्रका सरोकारवालाहरूसँग २७ वटा परामर्श बैठक गरी राय सुझाव संकलन गरिएको थियो। स्थानीय निकायका पदाधिकारी, वन अधिकारीहरू, वन उपभोक्ता समूहहरू, र स्थानीय जनताहरू सहित विभिन्न प्रमुख संस्थागत र सामुदायिक निकायका सरोकारवालाहरूसँग परामर्श गरिएको थियो। परामर्श मार्फत आयोजनाको अवधारणा र उद्देश्यबारे सुसुचित गरि आयोजनालाई थप प्रभावकारी बनाउन स्थानीय सरोकारवालाहरूबाट राय सुझावहरू प्राप्त गरिएको थियो।

३.२. सार्वजनिक सुनुवाई

वातावरण संरक्षण नियमावली २०७७ को नियम ६ बमोजिम सार्वजनिक सुनुवाईका लागि २०७९ असार १ गते बुटवल टुडे राष्ट्रिय दैनिकमा सार्वजनिक सूचना प्रकाशित गरिएको थियो। सबै प्रभावित नगरपालिका, प्रभावित वडा कार्यालय, सामुदायिक वन कार्यालय, स्वास्थ्य चौकी तथा अन्य सार्वजनिक स्थलको सूचना पाटीमा सार्वजनिक सूचना टाँस गरी सो को मुचुल्का सङ्कलन गरिएको थियो। आयोजना प्रभावित सबै ५ स्थानीय तहमा मिति २०७९/०३/१२ देखि २०७९/०३/१६ सम्म प्रभावित नगरपालिकाका अध्यक्ष र उपाध्यक्षको उपस्थितिमा औपचारिक रूपमा सार्वजनिक सुनुवाई संचालन गरिएको थियो। विज्ञको टोलीले राजनीतिक प्रतिनिधि, वडाका कर्मचारी, वन उपभोक्ता समूह, सङ्घसंस्थाका प्रतिनिधि, पत्रकार, प्रभावित स्थानीय जनता र अन्य सरोकारवाला निकायको उपस्थितिमा सूचना प्रवाह, प्रस्तुतिकारण र छलफल गरेको थियो। सरोकारवालाहरूको प्रतिक्रिया र सुझावहरू टिपोट गरि माइन्सुट गरिएको थियो।

तालिका ३: सार्वजनिक सुनुवाईमा सङ्कलित मुख्य राय सुझावहरू

क्र.स.	राय/सुझावहरू	प्रतिक्रिया
१	नदीबाट निर्माण सामाग्री उत्खनन गर्दा स्थानीय निकाय सँग समन्वय गर्नुपर्ने	नदीबाट निर्माण सामाग्री उत्खनन गर्दा स्थानीय निकाय/सरोकारवालाबाट स्वीकृत प्राप्त गरिनेछ
२	चोकको सुधार गर्नुपर्ने	१२ वटा मुख्य चोकहरू र अन्य साना चोकहरूको सुधार डिजाइनमा समावेश गरिएको छ

क्रस.	राय/सुझावहरु	प्रतिक्रिया
३	सडकको क्षेत्राधिकार भित्र पर्ने भौतिक संरचनाको व्यवस्थापन गर्नुपर्ने	स्थानीय निकाय र अन्य सरोकारवालाहरूसँग आवश्यक समन्वय गरिनेछ
४	आयोजना प्रभावितहरुलाई क्षतिपूर्ति दिए पश्चात निर्माण कार्य शुरु गर्नुपर्ने	क्षेत्राधिकार भित्र पर्ने सम्पूर्ण संरचना स्थानान्तरण पछि मात्र निर्माण कार्य शुरु गरिनेछ ।
५	आयोजनाले वन्यजन्तुको सुरक्षाको लागि अन्डर पास र ओभर पासको डिजाइन र निर्माण गर्नुपर्ने	वन क्षेत्रमा वन्यजन्तुको क्रसिंगको लागि अन्डर पासको डिजाइन गरिएकोछ ।

३.३. सिफारिस पत्र संकलन

वातावरण संरक्षण नियमावली २०७७ को नियम ७(२) बमोजिम आयोजना प्रभावित स्थानीय तह तथा प्रभावित वडाका वडा कार्यालय, विद्यालय, स्वास्थ्य चौकी तथा अन्य सार्वजनिक स्थलको सूचना पाटीमा सुझावसहितको सिफारिस पत्र सम्बन्धी सूचना टाँस गरिएको थियो। सूचना टाँसिएपछि वातावरण संरक्षण नियमावली २०७७ को नियम ७(२) बमोजिम बुटवल टुडे राष्ट्रिय दैनिकमा ७ दिने सार्वजनिक सूचना प्रकाशित गरिएको थियो। सो पश्चात सम्पूर्ण प्रभावित नगरपालिका, डिभिजन वन कार्यालय र अन्य सरोकारवाला निकायबाट सुझावसहितको सिफारिस पत्र सङ्कलन गरिएको थियो।

परिच्छेद ४: विद्यमान वातावरणीय अवस्था

४.१. भौतिक वातावरण

बुटवल-गोरुसिंगे सडक माथिल्लो तराई क्षेत्रमा, समुद्री सतहभन्दा माथि ११७ मिटर देखि १५८ मिटरको उचाइमा पर्दछ र यस क्षेत्रको प्रमुख भू-उपयोगमा मानव बस्ती, कृषि योग्य जमिन, वन क्षेत्र र जलाधार/नदीनाला रहेको छ। यस सडकको क्षेत्राधिकार ५० मि (केन्द्रबाट दुवैतर्फ २५ मिटर) रहेको र सडकको चौडाई गैर शहरी क्षेत्रमा ७ मि र शहरी क्षेत्रमा १२ मि रहेको छ। यस सडकको क्षेत्राधिकार भौतिक पूर्वाधार तथा यातायात मन्त्रालय/नेपाल सरकारको स्वामित्वमा रहेको छ। आयोजना क्षेत्र उष्ण हावापानी क्षेत्रमा अवस्थित हुनुका साथै आयोजना क्षेत्र भएर गएका अधिकांश नदिहरू शिवालिक र महाभारत पर्वत क्षेत्रबाट उत्तपति भएको छन्। केहि नदीनालाहरू वर्षायाममा आकस्मिक बाढी आउने प्रकृतिका र बाँकी समय सुख्खा रहन्छन्। बाणगंगा नदि यस सडकखण्डमा पर्ने सबैभन्दा ठुलो नदि हो। चेनेज ५९०+००० देखि चेनेज ५९१+००० सम्म पहिरो तथा भू-क्षय देखिएको साथै चेनेज ५९६+३६४, चेनेज ६०४+९७५, चेनेज ६११+४००, चेनेज ६२७+१०० र चेनेज ६३९+७०० मा भू-क्षय र नदी कटानका समस्याहरू देखिएको थियो। नौ स्थानहरूमा वायुको गुणस्तर मापन गर्दा पीएम २.५ वन क्षेत्र बाहेक अन्य स्थानमा राष्ट्रिय परिवेश वायु गुणस्तर मानक भन्दा बढी पाइएको थियो। सोहि ९ स्थानमा औषत २४ घण्टामा ध्वनिको स्तर ३०.१ डीबी (ए) देखि १२९.१ डीबी (ए) सम्म मापन गरिएको थियो जुन बुटवलमा सबैभन्दा उच्च र वन क्षेत्रमा सबैभन्दा न्यून मापन गरिएको थियो। बुटवल क्षेत्रमा ध्वनिको स्तर राष्ट्रिय ध्वनि गुणस्तर मापदण्ड र विश्व बैंकको ई.एच.एस मापदण्ड भन्दा उच्च रहेको पाइयो साथै खानेपानीका सबै अवयवहरू राष्ट्रिय खानेपानी गुणस्तर मापदण्ड भित्र रहेको थियो।

४.२. जैविक वातावरण

यस आयोजना उष्ण हावापानी क्षेत्रमा अवस्थित छ। यो सडक कुनै पनि राष्ट्रिय निकुञ्ज, संरक्षण क्षेत्र, वन्यजन्तु आरक्षण, शिकार आरक्षण भएर जाँदैन। यस सडकखण्डको करिब १५.४ कि.मी क्षेत्र सालझण्डी-पिपरा वन खण्ड (चेनेज ६११+८००-चेनेज ६१७+९००), गोरुसिङ्गे वन खण्ड (चेनेज ६२७+०००-चेनेज ६३५+६००) र बडहरे/बुढी वन खण्ड (चेनेज ६३७+७००-चेनेज ६३९+०००) जस्ता मुख्य वन क्षेत्र भएर गएको छ। आयोजना क्षेत्रमा मुख्यतया सालका रुखहरू र खोला बगर क्षेत्रमा खयर-सिसौका रुखहरू र गैर काष्ठ वन पैदावार अन्तर्गत जामुन, बर्रो, हर्रो,

साज, बोटधएरो, टाटरी, आदि रहेको छ। साल र बिजयसाल यस क्षेत्रमा पाइने संरक्षित वनस्पति हुन्। सडकको क्षेत्राधिकारसँग राष्ट्रिय वन, सामुदायिक वन र साझेदारी वन जोडिएको छ ।

स्थलगत अध्ययनका क्रममा २४ प्रजातिका स्तनधारी, ९३ प्रजातिका चराचुरुङ्गी, ४७ प्रजातिका उभयचर तथा सरीसृप र १४ प्रजातिका माछा रेकर्ड गरिएको थियो। रतुवा, मलाहा बिरालो, चितुवा, बाँदर, जंगली बँदेल आदि लाई स्थलगत अध्ययनका क्रममा प्रत्यक्ष/अप्रत्यक्ष रूपमा पहिचान गरिएको थियो। चराचुरुङ्गीका प्रजातिहरू मध्ये २६ प्रजाति पूर्ण माइग्रेन्ट, ८ प्रजाति एल्टीट्युडीनल माइग्रेन्ट, ३ प्रजाति नोर्माडिक र अन्य ५५ स्थानीय प्रजाति पहिचान गरिएको थियो भने सुँग्राका विभिन्न प्रजातिहरू सबैभन्दा बढी अवलोकन गरिएको थियो। स्तनधारी वन्यजन्तुहरूले उत्तर दक्षिण आवागमनका लागि मुख्यतया सालझण्डी-पिपरा वन खण्ड र गोरुसिङ्गे वन खण्डलाई कोरिडोरको रूपमा प्रयोग गर्ने गरेको पाइएको थियो।

४.३. सामाजिक-आर्थिक र सांस्कृतिक वातावरण

आयोजना क्षेत्र रुपन्देही र कपिलवस्तु जिल्ला रहेको छ र यो आयोजना बुटवल उप-महानगरपालिका, सैनामैना, वाणगङ्गा र बुद्धभूमि नगरपालिका र कञ्चन गाउँपालिका भएर गएको छ। आयोजना प्रभावित क्षेत्रको कुल जनसंख्या १,४०,०५६ रहेको छ जसमा पुरुषको जनसंख्या ६६,१२९ र महिलाको ७३,९२७ रहेको छ। यस क्षेत्रमा ब्राह्मण, क्षेत्री, थारु, दलित, मुस्लिम र मदेशी जातजातिको बसोबास रहेको पाइन्छ। यस सडक आयोजना क्षेत्रमा पर्ने संस्कृतिका सम्पदाहरू भएर जादैन यद्यपि सडकको क्षेत्राधिकार भित्र धार्मिक महत्वका वर/पिपल जस्ता रुखहरू भएको विश्राम स्थलहरू रहेका छन्। यस आयोजनाबाट कुल १२० घरधुरीको १२२ निजी संरचना र अन्य संस्थाको ५ वटा गरि १२७ निजी संरचनाहरू प्रभावित हुनेछन् साथै २०६ सामुदायिक संरचना र २,३५८ सार्वजनिक उपयोजिताहरू पनि प्रभावित हुनेछन्। यस आयोजना कार्यान्वयनको चरणमा, चेनेज ४९+८०० मा पर्ने प्रशिद्ध धार्मिक स्थल झुन्दुला माई मन्दिर सहित सडकको क्षेत्राधिकार भित्र पर्ने १३ मन्दिरहरू प्रभावित हुनेछन्।

परिच्छेद ५: प्रस्तावसँग सम्बन्धित नीति, कानून तथा मापदण्ड

प्रस्तावित बुटवल-गोरुसिंगे सडक आयोजनाले नेपाल सरकारका देहायका नीति, कानून, निर्देशिका, नियमावली र मापदण्डलाई समेटेको छ। नेपाल सरकारको नीति, कानून, निर्देशिका र मापदण्डका अतिरिक्त यस आयोजनाले नेपालले हस्ताक्षर गरेको अन्तर्राष्ट्रिय महासन्धि सम्झौतालाई पनि आकर्षित गर्नेछ।

५.१. नेपालको संविधान

संविधानको धारा ३० को उपधारा (१) ले 'प्रत्येक व्यक्तिलाई स्वच्छ र स्वस्थ वातावरणमा बाँच्न पाउने हक हुनेछ' भन्ने व्यवस्था गरेको छ। पीडितलाई वातावरणीय प्रदूषण वा हासबाट हुने कुनै पनि हानी नोक्सानीको लागि कानून बमोजिम क्षतिपूर्ति प्राप्त गर्ने अधिकार हुनेछ। संविधानको धारा ५१ मा सन्तुलित, वातावरणमैत्री, गुणस्तरीय र दिगो भौतिक पूर्वाधार विकास गर्ने नीति अवलम्बन गर्ने उल्लेख छ भने विकासको दृष्टिकोणले पछाडि परेका क्षेत्रलाई प्राथमिकता दिइएको छ।

५.२. नीति तथा योजनाहरू

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- श्रम ऐन, २०७४
- मुलुकी अपराध संहिता, २०७४
- फोहोरमैला व्यवस्थापन ऐन, २०६८
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- सवारी तथा यातायात व्यवस्थापन ऐन, २०४९
- खानी तथा खनिज पदार्थ ऐन, २०४२
- भू तथा जलाधार संरक्षण ऐन, २०३९
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५.७. वातावरणीय मापदण्ड

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- वायुको गुणस्तर सम्बन्धी मापदण्ड, २०६९
- राष्ट्रिय ध्वनी स्तर सम्बन्धि मापदण्ड, २०६९
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परिच्छेद ६: विकल्पहरूको विश्लेषण

वैकल्पिक विश्लेषण अन्तर्गत डिजाइनको विकल्प र प्रविधि, कार्यान्वयन प्रक्रिया, समय तालिका र वन विनास कम गर्ने विकल्पहरू अध्ययन गरिएको छ। हाल यो सडक संचालनको अवस्थामा रहेको र स्तरोन्नतीका लागि प्रस्ताव गरिएकोले वैकल्पिक सडकको विकल्प विश्लेषण गरिएको छैन साथै अन्य विकल्पहरू जस्तै डिजाइन, वैकल्पिक प्रविधि, समय तालिका र संचालन प्रक्रिया, कम वन विकल्पहरू विधिवत विश्लेषण गरिएको छ। ग्रेड तथा एलिभेटेड चोक, फुटपाथ सामाग्री, लेनको चौडाई र संख्या, नालाहरूको मर्मत सम्भार जस्ता डिजाइनहरू विश्लेषण गरिएको छ र यी संयोजनहरू वित्तीय, आर्थिक र प्राविधिक हिसाबले उपयुक्त रहेको छ। निर्माण कार्य खण्डगत रूपमा संचालन गरिने र रुखहरूको कटान न्यूनीकरण गर्न वन क्षेत्रमा सडकको चौडाई घटाएर २४ मि कायम गरिएको छ। यसका साथै यस आयोजनामा अपनाईएका विकल्पहरू वातावरणीय दृष्टिकोणले उपयुक्त रहेकोछन्।

परिच्छेद ७: वातावरणीय प्रभाव पहिचान र मूल्यांकन

प्रस्तावित आयोजनाको विद्यमान वातावरणीय अवस्थाको आधारमा सम्भावित प्रभावहरूको पहिचान र मूल्यांकन गरिएको छ। यस आयोजनाले स्थानीय वातावरणमा सकारात्मक र प्रतिकूल दुवै प्रकारको प्रभाव पार्ने देखिन्छ जुन बुँदागत रूपमा तल प्रस्तुत गरिएको छ।

७.१. सकारात्मक प्रभावहरू

१. निर्माणको चरण

- रोजगारीका अवसरहरू सिर्जना,
- स्थानीय वासीको आयआर्जनमा वृद्धि,
- स्थानीयको प्राविधिक सीप र क्षमता अभिवृद्धि,

२. संचालनको चरण

- व्यापारमा सुधार,
- महिला सशक्तिकरण,
- यात्राको समय, लागत र सडक दुर्घटना घट्ने,
- हरित गृह ग्यासको उत्सर्जनमा न्यूनीकरण,
- सार्वजनिक सुविधाहरूमा अभिवृद्धि,
- पर्यटन विकास,

७.२. नकारात्मक प्रभाव

१. निर्माण पूर्वको चरण

- खानी तथा उत्खनन् स्थल, क्रसर प्लान्ट, ब्यचिग प्लान्ट, आस्पल्ट प्लान्ट, कामदार शिविर र भण्डारण स्थलको स्थापना र संचालनको लागि स्वीकृती,
- रुखहरूको कटान,
- अस्थायी जमिन प्राप्ति,
- निजी संरचनाहरू स्थानान्तरण,
- सामुदायिक संरचना र सार्वजनिक उपयोगीताहरूमा प्रभाव,
- अस्थायी ट्राफिक डाइभर्सन,

२. निर्माणको चरण

भौतिक वातावरण

- भू-उपयोगमा परिवर्तन
- माथिल्लो भागको माटो गुम्ने
- अस्थिर स्लोप
- खानी तथा उत्खनन् स्थलको संचालन
- कामदार शिवीर र निर्माण सामाग्री भण्डारण स्थलको संचालन
- क्रसर प्लान्ट, ब्यचिग प्लान्ट, आस्पल्ट प्लान्टको संचालन
- बिग्रिन उत्पन्न तथा व्यवस्थापन
- फोहोर मैलाको उत्पादन
- पुल तथा पुलेसको निर्माण
- वायु, र ध्वनी प्रदुषण तथा कम्पन
- पानीको गुणस्तरमा हास

रासायनिक वातावरण

- इन्धन र रसायनको चुहावटबाट पर्ने प्रभाव
- बिटुमिनको प्रयोग

जैविक वातावरण

- वनस्पति तथा वन क्षेत्रमा पर्ने प्रभाव
- निर्माण कामदारद्वारा वन पैदावरमा पर्ने प्रभाव
- संरक्षित प्रजातीमा पर्ने प्रभाव
- वन्यजन्तु तथा वन्यजन्तुको आवतजावत पर्ने प्रभाव
- पन्छीवर्ग र जलीय जिवहरूमा पर्ने असर
- वन डढेलो
- वन्यजन्तुको अवैध व्यापार र चोरी शिकारी

सामाजिक-आर्थिक तथा साँस्कृत वातावरण

- निजी संरचनामा पर्ने असर
- सामुदायिक संरचना र सार्वजनिक उपयोगीताहरूमा प्रभाव
- कामदारहरूको आवागमनबाट पर्ने प्रभाव

- पेशागत स्वास्थ्य र सुरक्षा
- सामुदायिक स्वास्थ्य र सुरक्षा
- लैङ्गिक हिंसा
- धार्मिक स्थलमा पर्ने प्रभाव
- कृषियोग्य जमिनमा पर्ने असर

३. संचालनको चरण

भौतिक वातावरण

- पहिरो र माटो खस्ने
- वायु, र ध्वनी प्रदुषण
- जल प्रदुषण
- पुलेशा तथा नदि प्रणालीमा पर्ने प्रभाव

जैविक वातावरण

- वन्यजन्तु तथा वनस्पतिमा पर्ने प्रभाव
- वन क्षेत्रको अतिक्रमण
- वन्यजन्तुको आवागमनमा पर्ने असर

सामाजिक-आर्थिक तथा संस्कृतिक वातावरण

- सडकको क्षेत्राधिकार अतिक्रमण
- सडक सुरक्षा
- सामुदायिक स्वास्थ्य र सुरक्षा
- कामदारको स्वास्थ्य र सुरक्षा

परिच्छेद ८: सकारात्मक प्रभाव अभिवृद्धि तथा नकारात्मक प्रभाव न्युनिकरणका उपायहरू

प्रस्तावित आयोजनाको विद्यमान भौतिक, जैविक र सामाजिक-आर्थिक तथा सांस्कृतिक वातावरणको आधारमा सम्भावित प्रभावहरू पहिचान गरिएको छ। यस आयोजनाले स्थानीय वातावरणमा लाभदायी र नकारात्मक दुवै प्रकारको प्रभावहरू पार्ने देखिन्छ।

८.१. सकारात्मक प्रभाव र अभिवृद्धिका उपायहरू

वातावरणीय प्रभावहरू	अभिवृद्धिका उपायहरू
रोजगारीका अवसर सृजना	आयोजना निर्माणको चरणमा लगभग ९००,००० व्याक्ति-दिनको अदक्ष र ११०,००० व्याक्ति-दिनको दक्ष कामदार आवश्यक पर्नेछ। आयोजनाले निर्माण कार्यका लागि स्थानीय वासीलाई प्रोत्साहन गर्नुका साथै रोजगारीमा प्राथमिकता दिनेछ।
स्थानीय वासीको आयआर्जनमा वृद्धि	निर्माण कार्यले स्थानीयको आम्दानीको स्रोत बढाउनुका साथै थप व्यवसायहरू जस्तै खाद्यान्न तथा चिया पसल र किराना पसलको स्थापनाको अवसर सिर्जना गर्नेछ। साथै आयोजना क्षेत्रमा निर्माण कामदारको आगमनसँगै स्थानीय चिया पसल तथा अन्य पसलले पनि आफ्नो व्यवसायलाई बढावा दिनेछन्।
स्थानीयको प्राविधिक सीप र क्षमता अभिवृद्धि	आयोजनाले प्रभावित परिवारका सदस्यहरूलाई विभिन्न प्रकारका सीपमूलक तालिमहरू जस्तै खेलौना तथा कुशन बनाउने, होटल संचालन, साना/हलुका सवारी चलाउने, ब्युटी पार्लर संचालन, मोबाइल फोन मर्मत सम्बन्धि तालिम प्रदान गर्नेछ। निर्माण सम्बन्धि सीप र प्राविधिक ज्ञान हासिल गर्न आयोजनाले स्थानीय जनतालाई अवसर प्रदान गर्नेछ। कामदारहरूले आफुलाई म्यासीनरी, ग्याबियन तार बुन्ने, पर्खाल निर्माणका कार्य, बार बाइन्डिङ, बायो इन्जिनियरिंग जस्ता भू-क्षय स्थिरिकरणका कार्यहरूमा पूर्ण रूपमा दक्ष बनाउनेछन्।
व्यापारमा सुधार	प्रस्तावित आयोजनाले पूर्व-पश्चिम राजमार्गको सडक सञ्जाल र छिमेकी मुलुकसँगको व्यापारमा सुधार ल्याउनेछ। यो सडक भारतको बेलहिभा र कृष्णनगर नाका नजिकै रहेको यस सडकले भारत हुँदै अन्य देशसँग पनि जोडेको छ। ४ लेनको सडक निर्माणपछि भारतबाट आयोजना क्षेत्र र देशका अन्य भागमा वस्तु तथा सेवाको ढुवानी सस्तो, सहज र छिटो हुनेछ।

वातावरणीय प्रभावहरू	अभिवृद्धिका उपायहरू
महिला सशक्तिकरण	आयोजनाले प्रभावित घरधुरीका महिलालाई विभिन्न प्रकारका सीपमूलक तालिम (जस्तै खेलौना तथा कुशन बनाउने, होटल संचालन, साना/हलुका सवारी चलाउने, ब्युटी पार्लर संचालन, मोबाइल फोन मर्मत) सम्बन्धि तालिम प्रदान गर्नेछ। सडक सञ्जालका कारण महिलाहरूको रोजगारी र तालिममा पहुँच पुग्नाले क्षमता विकास हुनेछ। महिला विकास तालिम संस्थाहरूमा, विभिन्न प्रशासनिक निकायमा र अन्य कार्यालयहरूमा पनि महिलाको राम्रो पहुँच हुनेछ।
यात्राको समय, लागत र सडक दुर्घटना घटाउने	प्रस्तावित चार लेनको अस्पल्ट कंक्रीट सडकले विद्यमान ट्राफिक व्यवस्थापनको समस्या समाधान गर्दै सडक दुर्घटनाहरू न्यूनीकरण गर्नेछ साथै यात्रा सजिलो, छिटो, सुरक्षित र आरामदायक हुनेछ। भारतबाट आयोजना क्षेत्र लगायत देशका अन्य भागहरूमा वस्तु तथा सेवाको ढुवानी छिटो र सस्तो हुनेछ। २ लेनबाट ४ लेनमा सडक स्तरोन्नति हुँदा पुग्ने महत्वपूर्ण फाइदाहरू अन्तर्गत बलयाक स्पोट हटाउने, पुलेशाहरू, सडक नाला, बस स्टप, ट्राफिक संकेतहरू, सडक बत्ती, पैदल यात्री क्रसिंग, ओभरपास, क्रैश ब्यारियर, चोक सुधार आदि रहेको छ जसले गर्दा यात्रा समय करिब ३० मिनेट र सडक दुर्घटना, सवारी मर्मत खर्च र सामानको ढुवानी लागत कम हुनेछ। पैदल यात्रुको सुरक्षाको लागि जम्मा ११ स्थानमा ओभरपास क्रसिंग प्रस्ताव गरिएको छ (बेलबास (चेनेज ५९२+९८०), बमहा बजार (चेनेज ५९८+५००), रानी बनगाई चोक (चेनेज ५९९+९२०), मुर्गिया बजार (चेनेज ६०६+४१०), पहीला बजार (चेनेज ६१०+०६०), सालझण्डी (चेनेज ६११+२२०), पिपरा (चेनेज ६१८+०५०), बुद्धनगर चोक (चेनेज ६१८+७८०), चार नम्बर चोक (चेनेज ६२६+६६०), विश्रमा स्थल (चेनेज ६२७+८६०), गोरुसिंगे (चेनेज ६३६+०२०))।
सुधारिएको सडक पूर्वाधार र हरित गृह ग्यास उत्सर्जनमा कमि	सुधारिएको सडकका कारण सवारी साधनको पार्टपुर्जाहरू टुक्रिन र खिइन कमि हुनेछ जसले गर्दा पार्टपुर्जाहरूको लागि लाग्ने लागतमा कमि आउनेछ तथा ईन्धन खपत कम हुने र कार्बन उत्सर्जन न्यूनीकरण हुनेछ।

वातावरणीय प्रभावहरू	अभिवृद्धिका उपायहरू
सार्वजनिक सुविधाहरूमा अभिवृद्धि	आयोजनाले पिपरा बजार (चेनेज ६१८+०००) मा स्थायी छहारी, ढल निकासको व्यवस्था तथा खानेपानीको सुविधा सहित बजारको विस्तार गर्नेछ। गोरुसिंगे चोक देखि सन्धिखर्क तर्फ जाने बाटो (चेनेज ६३४+९५०) मा रहेको सार्वजनिक शौचालयलाई सबैको पहुँच हुने गरि स्तरोन्नति गरिनेछ। यस सार्वजनिक शौचालयको स्तरोन्नतिबाट यात्रु तथा स्थानीय वासीहरू लाभान्वित हुनेछन्। सार्वजनिक शौचालयको निर्माणमा यस आयोजनाले सहयोग गर्नेछ भने यसको व्यवस्थापन बुद्धभूमि नगरपालिकाले गर्नेछ।
पर्यटन विकास	सुधारिएको सडकले आयोजना क्षेत्रमा सौन्दर्यता थप्दछ र स्थानीय पर्यटकलाई आकर्षित गर्नुका साथै यस क्षेत्रको स्थानीय पर्यटन विकासमा टेवा पुर्‍याउनेछ। यस सडकको निर्माण सम्पन्न पश्चात लुम्बिनी, सिद्धबाबा मन्दिर, देवदह, गजेडी ताल, मुकुन्दसेन पार्क, जन्दुला माई जस्ता प्रसिद्ध पर्यटकीय स्थलहरूमा सहज पहुँच हुनेछ।

८.२. नकारात्मक प्रभाव र न्यूनीकरणका उपायहरू

वातावरणीय प्रभावहरू	न्यूनीकरणका उपायहरू
भौतिक वातावरण	
निर्माण चरण	
भू उपयोगमा परिवर्तन	यस सडकको चौडाई वन क्षेत्र तथा गैर सहरी क्षेत्रमा २४ मिटर, अर्धशहरी क्षेत्रमा ३७.४ मिटर र शहरी क्षेत्रमा ५० मिटर कायम गरिएको छ। सडकको क्षेत्राधिकारको स्वामित्व नेपाल सरकारको भौतिक पूर्वाधार तथा यातायात मन्त्रालयसँग रहेको छ। सडकको विद्यमान यातायात गुड्ने चौडाई ८ देखि १२ मिटर रहेता पनि ५० मिटर (सडक किनार देखि दुवै पट्टि २५ मिटर)को क्षेत्राधिकार खाली रहेको छ। निर्माणको चरणमा क्षेत्राधिकारको १९६.४५ हेक्टर भू-भाग अस्फाल्ट कंक्रीट सडक र पुलमा परिवर्तन हुनेछ।
माथिल्लो भागको माटो गुम्ने	माथिल्लो भागको माटोलाई तोकिएको स्थानमा भण्डारण गरिनेछ र मिडियनमा वृक्षारोपण गर्दा, बायो-ईन्जिनियरिङ् कार्यहरू र साइट पुनर्स्थापनाको लागि

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	प्रयोग गरिनेछ।
स्लोप अस्थिरता	चेनेज ५९०+५५० देखि चेनेज ५९१+००० सम्म पहिरो गएको क्षेत्र भएको कारणले सडकको दाँयापट्टि थप लेनको निर्माण गरिनेछैन। स्लोप संरक्षणका लागि बायो इन्जिनियरिंग घाँस तथा बिरुवा रोप्ने, ब्रश लेयरिड) र टेवा संरचनाहरू (आर.सि.सि पर्खाल, ग्याबियन पर्खाल, चेक ड्याम, नाला र ग्याबियन बोल्स्टर) को निर्माण गरिनेछ। चेनेज ५९६+३६४, चेनेज ६०४+९७५, चेनेज ६११+४००, चेनेज ६२७+१००, र चेनेज ६३९+७०० मा भएको उच्च भू-क्षय न्यूनीकरण गर्न इन्जिनियरिङका साथै बायो इन्जिनियरिङ प्रविधि अपनाइनेछ। प्रस्तावित पुलहरू निर्माण गरिने स्थानहरूमा नदि कटान न्यूनीकरणका कार्यहरू गरिनुका साथै, ४०,००० वर्ग मिटरमा भू-क्षय नियन्त्रणका कार्यहरू र पुल तथा नदी किनारको ३,२४० वर्ग मिटर मा स्लोप नियन्त्रण गर्नका लागि इन्जिनियरिङ प्रविधिको संयोजनमा बायो इन्जिनियरिङ प्रविधि अपनाइनेछ।
खानी र उत्खनन क्षेत्रको स्थापना र सञ्चालन	ढुंगा, गिट्टी, बालुवा जस्ता निर्माण सामग्रीहरू उत्खनन क्षेत्रबाट उत्खनन गरिनेछ। यी सामग्रीहरू ग्याबियन पर्खाल, रिटेनिंग पर्खाल, पुल तथा कल्भर्ट र अन्य संरचनाहरू निर्माण गर्न प्रयोग गरिनेछ। निर्माण कार्यको लागि करिब २८५,४०० क्यु.मि गिट्टी, ६१,१६० क्यु.मि बालुवा, ४०२,५०० क्यु.मि सब-बेस र २५९.५०० क्यु.मि बेस सामग्रीको आवश्यक पर्नेछ। ११ वटा खानी तथा उत्खनन क्षेत्रहरू पहिचान गरिएको छ। निर्माण सामग्रीको अव्यवस्थित उत्खनन गरिएमा भौतिक वातावरणमा असर, नदीको बहावमा असर, पर्नुका साथै जल तथा वायु प्रदुषण बढ्नेछ। उत्खनन कार्य संचालनको क्रममा नदीको प्राकृतिक बहावमा असर पर्ने छैन र निर्माण सामग्रीको ढुवानी गर्दा धुलोको उत्सर्जन न्यूनीकरण गर्न निर्माण सामग्री ढाकिनेछ। पहुँच मार्गमा कुनै क्षति भएमा पुरानै अवस्थामा मर्मत सम्भार गर्ने जिम्मेवारी निर्माण व्यवसायीको हुनेछ। न्युन बहावको समयमा खानी संचालनबाट नदीको तल्लो भागमा पर्ने प्रभाव न्यूनीकरण गर्न ५ मी देखि १० मी सम्म बफर जोन कायम गरिनेछ। उत्खनन क्षेत्रको प्राकृतिक रूपरेखा कायम राख्दै पुनर्स्थापना योजना अनुसार उत्खनन क्षेत्रको पुनर्स्थापना

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	गरिनेछ।
कामदार शिविर तथा निर्माण सामग्री भण्डारण स्थलको स्थापना	निर्माण व्यवसायीले बाहिरका कामदारहरूको लागि कामदार शिविरको स्थापना गर्नुपर्नेछ। कामदार शिविरमा फोहोर मैला व्यवस्थापन, ढल निकास, खानेपानी तथा शौचालय र मनोरंजन तथा आकस्मिक स्वास्थ्य सेवाको उचित योजना बनाइनु पर्नेछ। कामदार शिविर तथा साइट कार्यालयहरू वस्ती क्षेत्र वरिपरी भएमा हो-हल्ला तथा फोहोरमैलाका कारण सामुदायामा प्रतिकूल प्रभाव पर्न सक्दछ। निर्माण सामग्रीहरूको व्यवस्थित रूपमा भण्डारण नगर्दा धुलो उत्सर्जन तथा जल प्रदूषण बढ्न सक्दछ। निर्माण शिविरको लागि सम्भावित ४ स्थान र निर्माण सामग्रीहरूको भण्डारणका लागि ५ सम्भावित स्थानहरू पहिचान गरिएको छ। कामदार शिविरमा अग्नी नियन्त्रक यन्त्र, शौचालय तथा शावर, पिउने पानीको आपूर्ति, स्वच्छ खानाखाने ठाउँ, बिजुलीबत्तीको पहुँच, एलपीजी/मड्टिल लगायतका आधारभूत सुविधाहरू उपलब्ध गराइनेछ। प्राथमिक उपचारको सुविधा कामदार शिविरमै उपलब्ध हुनेछ र आकस्मिक दुर्घटनाहरूको लागि पालिका स्तरको स्वास्थ्य चौकी/उप-स्वास्थ्य चौकीसँग समन्वय गरिनेछ। कामदार शिविरमा महिलाहरूका लागि छुट्टै बस्ने कोठा र शौचालयको व्यवस्था गरिनेछ। शिविर तथा भण्डारण क्षेत्र छेकबार गर्नुक साथै निर्माण सामग्री ढाक्नुपर्नेछ। निर्माण कार्य पश्चात सम्पूर्ण शिविर तथा भण्डारण क्षेत्रहरू पुर्नस्थापना गरिनेछ।
क्रसर प्लान्ट, हट मिक्स प्लान्ट र ब्याचिङ प्लान्टको सञ्चालन	क्रसर प्लान्टको संचालनबाट धुलो उत्सर्जन हुने, ठुलो ध्वनि निस्कने र ग्रेजको चुहावट हुने भएकाले स्थानीय स्तरमा वायु, ध्वनि र माटो प्रदूषण हुनसक्छ। पानीको श्रोत नजिकै क्रसर प्लान्ट स्थापना गरेमा जल प्रदूषण पनि हुनसक्छ। पी.पी.ई को प्रयोग नगरेमा कामदारहरूको स्वास्थ्यमा प्रत्यक्ष असर पर्नेछ। प्लान्टहरू स्थापना गर्नको लागि स्थानीय सरोकारवाला तथा नगरपालिकाबाट अनुमति लिनुपर्नेछ। उपयुक्त स्थान प्राप्त गर्ने, छेकबार गर्ने र सुपरिवेक्षक परामर्शदाताबाट स्वीकृत प्राप्त गर्नुपर्ने, ढुङ्गा क्रशिड उपकरण तथा सिमेन्ट ब्याचिङ प्लान्टमा धुलो नियन्त्रक यन्त्र जडान गरि निर्माण कम्पनीको

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	स्पेसिफिकेसन अनुसार सञ्चालन गर्नुपर्नेछ। धुलो उत्सर्जन न्यूनीकरण गर्न क्रसर संचालनको समयमा पानी छर्किनुपर्ने, फोहोर पानी व्यवस्थापन गर्न सिल्टेशन पोखरी निर्माण पर्ने र दिनको समयमा मात्र प्लान्ट सञ्चालन गर्नुपर्नेछ। प्रयोग पश्चात साइट पुर्नस्थापना गर्नुपर्नेछ। प्लान्टको स्थापना गर्दा मानव बस्ती, पिउने पानीका श्रोत, खेती योग्य जमिन र खोला नदीनालाबाट टाढा हुनुपर्नेछ। क्रसर प्लान्ट, हट मिक्स प्लान्ट, ब्याचिङ प्लान्ट र अस्पल्ट प्लान्टको स्थापना र संचालनको लागि सम्भावित स्थलहरूमा चेनेज ६२२+१०० र चेनेज ६३९+९०० पहिचान गरिएको छ।
फोहोरमैलाको उत्पादन (जोखिमयुक्त, गैर-जोखिमयुक्त र तरल फोहोर)	सडक तथा पुल निर्माणको चरणमा निस्कासन हुने गैर-जोखिमयुक्त फोहोर अन्तर्गत मुख्यतः कामदार शिविर र कार्यालयबाट निस्कासन हुने खाना, कागज, प्लास्टिक आदि हुनेछन्। करिब ३०० कामदारहरू शिविरमा बस्नेछन् र प्रति दिन प्रति कामदार ०.२५१ के.जी ठोस फोहोर उत्पादन हुनेछ। तसर्थ, प्रतिदिन कामदार शिविरबाट ७५.३ के.जी ठोस फोहोर उत्पादन हुनेछ। यस्ता फोहोरहरू खुला ठाउँमा राख्दा/फ्याक्नाले भूमिगत तथा सतहको पानी दूषित हुनसक्दछ। यसका साथै कामदार शिविर र सवारी मर्मत कार्यहरूबाट सानो मात्रामा जोखिमयुक्त ठोस तथा तरल फोहोरको उत्पादन हुनेछ। इन्धनको चुहावटबाट जमिन तथा जल प्रदूषण हुनसक्छ जसको कारण वातावरण र मानव स्वास्थ्यमा नकारात्मक असर पर्नेछ। आयोजनाले जोखिमयुक्त, गैर-जोखिमयुक्त र तरल फोहोर सङ्कलन गर्न पर्याप्त संख्यामा र आकारका कन्टेनरहरू कामदार शिविरमा राख्नुपर्नेछ र नियमित रूपमा तोकिएको स्थानमा डिस्पोज गर्नुपर्नेछ। इन्धन, प्रयोग भएको तेल र बिटुमिनको भण्डारण गर्न कंक्रीट बेस र सम्पको निर्माण गरिनेछ। कामदारहरूको लागि पी.पी.ई, आकस्मिक सेवा, भेन्टिलेसन र अन्य सेनिटेरी सुविधाहरू उपलब्ध गराउनु पर्ने प्रावधान रहेकोछ। भान्साको फोहोर (अर्गानिक), कागज र प्लास्टिक (पून-प्रयोज्य) र गारबेज (पून गैर प्रयोज्य) जस्ता ठोस फोहोरको पृथकीकरण र संकलन गर्नुपर्नेछ। स्रोतमा फोहोर छुट्याउनका लागि क्याम्पसाइट, भान्साघर, कार्यालयहरूमा पर्याप्त संख्या र क्षमता भएका तीन प्रकारका फोहोर बिनहरू (फरक रङ्गका) राखिनेछ।

वातावरणीय प्रभावहरू	न्यूनीकरणका उपायहरू
	निर्माण कार्य सुरु गर्नु अघि निर्माण व्यवसायीले जोखिमयुक्त फोहरको व्यवस्थापन योजना सहितको फोहरमैला व्यवस्थापन योजना तयार गरि स्वीकृत प्राप्त गर्न आयोजना कार्यालय/सुपेरिवेक्षण परामर्शदाता समक्ष पेश गर्नुपर्नेछ। सो योजनामा जोखिमयुक्त सामाग्रीको प्रयोग, भण्डारण, ढुवानी र डिस्पोजका प्रावधान समावेश हुनुपर्नेछ।
पुलहरू तथा पुलेशा संरचनाको निर्माण	पानीको बढ्दो मात्रालाई समायोजित गर्न पुलेशाका संरचनाहरू डिजाइन गरिएको छ। ३० वटा ठूला र साना पुल, १५५ वटा कल्भर्ट र ३२,६२० मिटर सडक नाला निर्माण गरिनेछ। विद्यमान प्राकृतिक ड्रेनेज प्रणालीलाई ह्युमपाइप जस्ता अस्थायी उपायहरू प्रयोग गरेर बाधा पुर्याइने छैन। उत्खनन गरिएको अतिरिक्त बिग्रन निर्धारित स्थानमा भण्डारण गरिनेछ। पुल तथा पुलेशाका कार्यहरू मनसुनको समयमा नदी, खोला, पोखरीको नजिक/भिन्न निर्माण कार्य गरिनेछैन। बाढी न्यूनीकरण गर्न र प्राकृतिक बहाब कायम राख्न सबै पाइप कल्भर्टहरू बक्स कल्भर्टद्वारा प्रतिस्थापित गरिनेछ।
वायु तथा ध्वनी प्रदुषण र कम्पन	निर्माण अवधिभर दिनको दुई पटक पानी छर्कनु पर्ने, बालुवा र अन्य निर्माण सामाग्रीको ढुवानी गर्नु अघि पानी छर्कनु पर्नेछ। धुलोको उत्सर्जनमा न्युनिकरण गर्न सडक निर्माण गर्दा १० कि.मी को खण्ड बनाएर खण्डगत रूपमा गरिने र सडकको दुवै तर्फ आवश्यक संरचनाहरू निर्माण पछि मात्र पुराना अस्फाल्ट कंक्रीट निकालिने र नयाँ पेभमेन्ट गरिनेछ। कामदार शिविर, अस्फाल्ट प्लान्ट, हट मिक्स प्लान्ट, क्रसर प्लान्ट, संवेदनशील क्षेत्रहरू जस्तै बस्ती, स्कूल, अस्पताल र वन क्षेत्रहरूमा आवधिक रूपमा वायुको गुणस्तर अनुगमन गरिनेछ। सडकको मिडियन र सडक किनारको संवेदनशील क्षेत्रमा करिब १०,००० बिरुवाहरू वृक्षारोपण गरिनेछ।
पानीको गुणस्तरमा हास	सबै रसायन र इन्धनहरू कंक्रीट प्लेटफर्ममा भण्डारण गरिनेछ। क्रसर प्लान्टमा सेडिमेन्ट संकलन गर्न सेडिमेन्ट संकलन पोखरी निर्माण गरिनेछ र यसरी सङ्कलन गरिएको सेडिमेन्ट पुनः प्रयोगको लागि भण्डारण गरिनेछ। उत्खनन गरिएको बिग्रन र अन्य फोहोरहरू पानीमा फ्याँक्न निषेध गरिएको र मनसुनको समयमा नदी/खोलामा पुल तथा पुलेशाको काम गरिनेछैन। सतह र भूमिगत पानीको गुणस्तरको नियमित अनुगमन गरिनेछ।

वातावरणीय प्रभावहरू	न्यूनीकरणका उपायहरू
सञ्चालन चरण	
पहिरो तथा स्लोप अस्थिरता	पहिरो तत्काल हटाइने र स्लोपको स्थिरताको लागि इन्जिनियरिंग र बायोइन्जिनियरिंग प्रविधि अपनाइनेछ। सडकको क्षेत्राधिकार र भिरालो क्षेत्रमा वृक्षरोपण गरिनेछ। चेनेज ५९०+५५०, चेनेज ५९०+७००, चेनेज ५९१+००० संवेदनशील स्थानको रूपमा पहिचान गरिएको छ।
वायु र ध्वनि प्रदूषण	वायु र ध्वनि प्रदूषण न्युनिकरण गर्न सडकको नियमित मर्मत सम्भार गरिनेछ तथा शहरी र अर्ध शहरी क्षेत्रमा करिब १०,००० रुखहरू रोपिनेछ। संवेदनशील क्षेत्रहरू जस्तै विद्यालय, अस्पताल क्षेत्रमा ध्वनि अवरोधहरू स्थापना गरिनेछ। बस्ती तथा संवेदनशील क्षेत्रलाई हर्न निषेध क्षेत्र कायम गरिनेछ।
पुलेशा अवरोधको कारण बाढी र जल प्रदूषण	मनसुन अघि र पछि सडकको नियमित अनुगमन तथा मर्मतसम्भार गर्नुपर्नेछ। पुलेशा तथा नालाको नियमित सफाई गर्न सडक विभागले कर्मचारी नियुक्त गर्नेछ र स्लोप नियन्त्रणका लागि संरचनाहरू निर्माण गरिनेछ। मर्मत सम्भारका लागि पर्याप्त बजेट विनियोजन र आवश्यक कर्मचारीको परिचालन गरिनेछ।
रासायनिक वातावरण	
इन्धन र रसायन भण्डारणको कारणले प्रभाव इन्धन र रसायनको चुहावट	सबै कामदारहरूलाई बुट, माक्स, ग्लोब जस्ता पीपीई उपलब्ध गराइनेछ। इन्धनको चुहावट सङ्कलन गर्न चेम्बर सहितको पक्की भण्डारण स्थल निर्माण गरिनेछ। ग्रीज पोखिएका र तेलमा भिजेका सामग्रीहरू सङ्कलन गरि लेबल गरिएको कन्टेनरहरूमा भण्डारण गरिनेछ।
बिटुमेनको प्रयोग निर्माण चरणमा करिब ११२५ मेट्रिक टन बिटुमेन आवश्यक पर्नेछ	स्वचालित अस्फाल्ट प्लान्टको प्रयोग गरिनेछ, बिटुमेन ड्रमहरू निर्माण स्थल र कामदार शिविर भित्र सुरक्षित स्थानमा भण्डारण गरिने तथा पानीको श्रोतबाट करिब ५०० मिटर टाढा भण्डारण गरिनेछ। सबै इन्धन, ग्रीज तथा रसायनहरू कामदार शिविर भित्र निर्दिष्ट क्षेत्रमा भण्डारण गरिनेछ र सो क्षेत्रमा सिमित व्यक्तिको मात्र पहुँच हुनेछ। पोखिएका इन्धन वा रसायनहरू शोषण सक्ने गरि कंक्रीटको फ्लोर निर्माण गरिनेछ। नियमित अनुगमन गरि तथ्यांकहरू अद्यावधिक गरिनेछ।
जैविक वातावरण	

वातावरणीय प्रभावहरू	न्यूनीकरणका उपायहरू
निर्माण चरण	
वनस्पतिक तथा वन क्षेत्रमा पर्ने असर (७,११४ रुखहरू)	वन क्षेत्रमा सडकको चौडाइ २४ मिटर प्रस्ताव गरिएको छ जसको कारण रुखहरूको कटान र वन क्षेत्रमा पर्ने असर कम हुन्छ। वन क्षेत्रबाट काटिने रुखहरूको क्षतिपूर्ति स्वरूप पुरक वृक्षारोपण गरिनेछ। वन ऐन, २०७६ र वन नियमावली, २०७९ अनुसार पुरक वृक्षारोपण १:१० को अनुपातमा गर्नुपर्नेछ। सोहि अनुपातमा आयोजनाले ७१,१४० बिरुवा रोप्नेछ र ५ वर्षसम्मको हेरचाहको लागि डीएफओ सँग समन्वयमा गर्नेछ। पुरक वृक्षारोपणका लागि करिब ४४.४६ हेक्टर जमिन आवश्यक पर्नेछ। पुरक वृक्षारोपण निर्देशिका अनुसूची XVII मा समावेश गरिएको छ। निर्माण व्यवसायीले खाना पकाउन एल.पी.जी ग्याँसको व्यवस्था गर्नुपर्नेछ। वन क्षेत्रमा कुनै पनि प्रकारको अस्थायी संरचनाहरूको निर्माण गरिने छैन र वन्यजन्तु तथा वनस्पतिको संरक्षणको लागि कामदारहरूलाई सचेत गराइनेछ।
वन पैदावारमा पर्ने असर	कामदार शिविर तथा अन्य संरचना वन क्षेत्रमा निर्माण नगरिने, निर्माण कामदारले वन क्षेत्रमा काम गर्दा आचार संहिता पालना गर्नुपर्नेछ
संरक्षित प्रजातिमा असर	पुरक वृक्षारोपण गर्दा साल, तथा अन्य रैथाने प्रजातिलाई प्राथमिकता दिन सुझाइएको छ।
वन्यजन्तु तथा तिनीहरूको आवागमनमा असर	वन क्षेत्रमा कामदार शिविर तथा अन्य संरचनाहरू निर्माण गरिने छैन। वन्यजन्तुको संरक्षणको लागि करिब ३५ कि.मी वन क्षेत्रमा छेकबारको मर्मत गरिनेछ वन क्षेत्रमा वन्यजन्तु क्रसिंगको लागि अन्डर पास (कल्भर्ट) को निर्माण गरिनेछ। यस आयोजना क्षेत्रमा ३ वटा डेडीकेटेड वन्यजन्तु क्रसिंग र अरु जलवायु उत्थानशिलता र वन्यजन्तु मैत्री संरचना प्रस्ताव गरिएको छ जुन: चेनेज ६१२+६००, चेनेज ६१३+७०९, चेनेज ६१५+२६४ (कोठी पुल), चेनेज ६१६+८२५, चेनेज ६२८+३८९, चेनेज ६२९+४७६, चेनेज ६२९+६७९, चेनेज ६२९+८५३, चेनेज ६३०+९९३, चेनेज ६३१+१४१, चेनेज ६३२+१०८, चेनेज ६३२+३७७, चेनेज ६३४+६७९, चेनेज ६३५+३२६, चेनेज ६३८+००४, चेनेज ६३८+४२६, चेनेज ६३९+०२१, चेनेज ६३९+३९७, चेनेज ६३९+५६१ मा रहेको छन्। वन्यजन्तु क्रसिंगको

वातावरणीय प्रभावहरू	न्यूनीकरणका उपायहरू
	मापदण्ड नेपाल सरकारको वन्यजन्तु मैत्री संरचना निर्माण निर्देशिका, २०२२ बमोजिम हुनेछ। चेतावनी चिन्ह, गति सीमा र क्रसिंग क्षेत्रहरूमा वन्यजन्तुको प्रदर्शन बोर्ड राखिनेछ। वन्यजन्तुको चहलपहल हुने क्षेत्रमा वन्यजन्तुको उपस्थिति र महत्व सम्बन्धी सूचनामूलक साइनबोर्ड राखिनेछ। नेपाल सरकारको मपदण्ड अनुसार वन क्षेत्रमा मध्यम र साना वन्यजन्तु क्रसिंगको लागि बक्स कल्भर्टको निर्माण गरिनेछ। यी संरचनाहरूले सरीसृप तथा उभयचरलाई सहज आवतजावत गर्न सहयोग गर्नेछ। विद्यमान पाइप कल्भर्टलाई लम्बाई चौडाई बढी भएको बक्स कल्भर्टले प्रतिस्थापन गरिनेछ।
जलीय जीवनमा प्रभाव	उत्खनन् गरिनेछ र प्रभावित सबै स्थानहरू तत्काल पुनःस्थापना गर्नुपर्नेछ। पुल निर्माणका क्रममा ह्युम पाइप जडान गरी पानीको बहाव कायम गरिनेछ। निर्माण कामदारहरूद्वारा माछा मार्न प्रतिबन्ध गर्नुपर्नेछ। सबै रसायन, बिटुमिन र ईन्धनलाई पानीको श्रोतमा नपुग्ने गरि इम्पेर्भियस स्थानमा भण्डारण गर्नुपर्नेछ। मनसुनको समयमा खोलानाला नजिक निर्माण कार्य गरिने छैन।
सञ्चालन चरण	
वनस्पति तथा वन्यजन्तुमा असर	करिब ३५ कि मी वन क्षेत्रमा पुन छेकवार गरिनेछ र वन्यजन्तुको आवतजावतको लागि अन्डर पासको प्रस्ताव गरिएको छ। सडक किनारका रुखहरूको हेरचाह गरिनेछ र प्रतिपुरक वृक्षरोपण गरिनेछ।
वन्यजन्तुको आवतजावतमा असर,	वन्यजन्तुको सहज आवतजावतका लागि सबै कल्भर्ट तथा क्रसिंगको नियमित सरसफाई र मर्मत सम्भार गरिनेछ। वनडढेलो, वन्यजन्तु संरक्षणका लागि सवारी साधनबाट निस्कने फोहरको रोकथाम, गति सीमा र वन्यजन्तुसँग सम्भावित दुर्घटनाबारे सचेतना जगाउन कार्यशाला संचालन गरिनेछ। वन क्षेत्रमा रहेका पानीका मुहान/पोखरीको नियमित निरीक्षण तथा सरसफाई गरिनेछ। वन्यजन्तुको आवागमन कोरिडोरको मर्मत सम्भार गरिनेछ र अन्डरपासमा आवश्यक मात्रामा प्रकाश कायम गरिनेछ।
सामाजिक आर्थिक तथा संस्कृतिका वातावरण	
निर्माण चरण	

चातावरणीय प्रभावहरू	न्यूनीकरणका उपायहरू
निजी संरचनामा पर्ने असर	यस आयोजनाबाट १२७ निजी संरचनाहरू प्रभावित हुनेछन्। आयोजनाले प्रभावित घरधुरीलाई नगद क्षतिपूर्ति प्रदान गर्नुका साथै स्थानान्तरण तथा जीविकोपार्जन पुर्नस्थापनाको लागि थप लागत उपलब्ध गराउनेछ। आयोजनाले प्रभावित परिवारका सदस्यहरूलाई विभिन्न प्रकारका सीपमूलक तालिमहरू जस्तै खेलौना तथा कुशन बनाउने, होटल संचालन, साना तथा हलुका सवारी साधन चलाउने, ब्युटी पार्लर संचालन, मोबाइल फोन मर्मत सम्बन्धि तालिम प्रदान गर्नेछ। प्रभावित घरधुरीमा पर्ने असरलाई सम्बोधन र न्यूनीकरण गर्न पुनर्स्थापना कार्ययोजना तयार पारिएको छ।
सामुदायिक संरचना र सार्वजनिक सेवाहरूमा पर्ने असर	यस आयोजनाबाट २०६ सामुदायिक संरचना र २,३५८ सार्वजनिक सेवाहरूमा असर पुग्नेछ। सम्बन्धित सामुदायिक संरचना र सार्वजनिक सेवाहरू स्थानान्तरण गर्नु अघि स्थानीय वासी र सरोकारवालाहरूलाई पूर्व सूचित गरिनेछ। सडक निर्माण कार्यमा कुनै अवरोध उत्पन्न हुन नदिन सम्बन्धित सेवा प्रदायकलाई रकम स्थानान्तरण जस्ता कार्यका लागि आवश्यक प्रक्रिया पुरा गरिनेछ। सामुदायिक संरचनाहरू स्थानीय समुदाय र स्थानीय निकायको परामर्शमा पुर्नस्थापना वा स्थानान्तरण गरिनेछ र सोको लागत आयोजना लागतमा छुट्याइएको छ। पुल तथा बस्ती क्षेत्रमा सरोकारवाला निकायको परामर्शमा छुट्टै युटिलिटी डक्ट जडान गरिनेछ। सार्वजनिक सेवाहरूको स्थानान्तरण निर्देशिका अनुसूची XXI मा प्रस्तुत गरिएको छ।
पेशागत स्वास्थ्य र सुरक्षा	निर्माण व्यवसायीले पेशागत स्वास्थ्य र सुरक्षा योजना तयार गर्नेछ र स्वीकृत प्राप्त गरि कार्यान्वयन गर्नेछ। पेशागत स्वास्थ्य र सुरक्षा योजनाले निर्माणको चरणमा हुन सक्ने सम्पूर्ण जोखिमहरू न्यूनीकरण गर्न निर्देशन गर्नेछ। कामदारहरूका लागि पेशागत स्वास्थ्य सुरक्षा सम्बन्धी नियमित प्रशिक्षण कार्यक्रम (साप्ताहिक/दैनिक रुपमा टुलबक्स वार्ता) सञ्चालन गर्नुपर्नेछ। दुर्घटना नियन्त्रण र न्यूनीकरण गर्न कामदारहरूको लागि सुरक्षा तालिम उपलब्ध गराउने तथा आपतकालीन अवस्थाको सामना कसरी गर्ने भन्ने बारेमा सचेतनामुलक कार्यक्रम संचालन गरिनेछ। निर्माण व्यवसायीले कामदारहरूको सुरक्षाका लागि बुट, हेल्मेट, मास्क, पञ्जा, सुरक्षात्मक कपडा, चशमा, फेस शिल्ड

चातावरणीय प्रभावहरू	न्यूनीकरणका उपायहरू
	जस्ता व्यक्तिगत सुरक्षा उपकरणहरू प्रदान गर्नेछ। आपतकालीन प्रतिकार्य योजना कार्यान्वयनका लागि निर्माण स्थलमा अग्नि-नियन्त्रक यन्त्र, एम्बुलेन्स, चिकित्सक र उद्धारका सुविधाहरू उपलब्ध गर्नुपर्नेछ। निर्माण स्थल र शिविरमा प्राथमिक उपचारको सुविधा उपलब्ध गर्नुपर्नेछ।
धार्मिक स्थलहरूमा प्रभाव	आयोजना निर्माणको चरणमा सडकको क्षेत्राधिकार भित्र पर्ने १३ वटा मन्दिरहरूमा असर पर्नेछ। प्रभावित संरचनाहरू स्थानान्तरण गर्नु अघि स्थानीयवासी तथा सरोकारवालालाई पूर्व सूचित गर्नुपर्नेछ। प्रभावित सामुदायिक मन्दिरको पुन निर्माण गर्दा स्थानीय समुदाय र स्थानीय निकायको परामर्शमा गरिनेछ र सोको लागत आयोजना लागतमा विनियोजन गरिएकोछ। पहुँच मार्गमा क्षति हुन पुगेमा मर्मत गरिनेछ। निर्माणको समयमा पुरातात्विक मूल्यको कुनै पनि वस्तु/घटना फेला परेमा, निर्माण व्यवसायीले चान्स फाइन्ड प्रोटोकल निर्देशनहरू पालना गर्नुपर्नेछ।
सञ्चालन चरण	
क्षेत्राधिकारको अतिक्रमण	आयोजना/सडक विभागले सडकको क्षेत्राधिकार अतिक्रमणको बारेमा सचेतना कार्यक्रम सञ्चालन गर्नेछ। सडकको क्षेत्राधिकारमा बस्ती विकासलाई निरुत्साहित गर्नका लागि स्थानीय सरकारसँग समन्वयमा गर्नुपर्नेछ। विभिन्न सरकारी निकायहरूको संयुक्त प्रयास र पर्याप्त सार्वजनिक जानकारी सहित सचेतनात्मक गतिविधिहरू संचालन गर्नुपर्नेछ। अतिक्रमणलाई पूर्ण रूपमा हटाउनका लागि संयन्त्रहरू निर्माण गरिनेछ।
सडक सुरक्षा	सुरक्षा सुविधाहरू अन्तर्गत पैदल यात्री क्रसिंगको स्थापना र मर्मत सम्भार गरिने, व्यक्तिगत सुरक्षालाई ध्यानमा राखी समुदायको प्राथमिकताको आधारमा क्रसिङ स्थानहरू राखिनेछ। थप ट्राफिक चिन्हहरू राखिने तथा मर्मत सम्भार गरिनेछ, घना वस्ती, विद्यालय क्षेत्र तथा अन्य सार्वजनिक स्थलहरूमा गति अनुगमन गरिनेछ र राजमार्गमा अनुगमनका लागि ट्राफिक सिग्नल, सीसी क्यामेराको स्थापना गरिनेछ। सवारी चालक तथा स्थानीयलाई सडक सुरक्षा सम्बन्धी सचेतनामूलक तालिम प्रदान गरिनेछ।
सामुदायिक स्वास्थ्य र सुरक्षा	सहरी सडकको दुवैतर्फ साइकल लेन र फुटपाथ रहनेछ। निर्दिष्ट क्रसिंग पोइन्टहरू बाहेक सडकमा पैदल यात्रीहरूको क्रसिंग रोक्न अवरोधकहरूको

वातावरणीय प्रभावहरू	न्यूनीकरणका उपायहरू
	स्थापना गरिनेछ। बस्ती तथा संवेदनशील क्षेत्रमा हर्न निषेधित क्षेत्र कायम गरिनेछ। सामुदायिक वन क्षेत्र (सालझण्डी, प्रगती सामुदायिक वन र तिलौराकोट साझेदारी वन) मा पैदल यात्रु क्रशिंगको लागि जेब्रा क्रशिंग बनाइनेछ।
श्रमिकहरूको स्वास्थ्य र सुरक्षा	कामदारहरूलाई ट्रफिकबाट अलग गर्न कार्य क्षेत्रहरूको स्थापना गरिने, र बाँकी लेनहरूमा ट्रफिकको डाइभर्सन गरिने, सवारी साधनहरूबाट कामदारलाई बचाउन सुरक्षात्मक उपायहरूको प्रयोग गरिने, कार्य क्षेत्र रेखाङ्कन गर्न च्यानलिड उपकरणहरू जस्तै ट्रफिक कोनहरू र ब्यारेलहरू स्थापना गरिने, चेतावनी बत्तीहरू द्वारा ट्रफिक प्रवाहको नियमन गरिने, सम्भव भएमा फल्यागरहरूको प्रयोग गरिने र कार्य क्षेत्रहरूमा सवारीसाधनको गति न्यूनीकरण गरिनेछ।

परिच्छेद ९: वातावरणीय व्यवस्थापन योजना

वातावरणीय व्यवस्थापन योजना (EMP) लागत र जिम्मेवारी सहित विस्तृत न्यूनीकरण उपायहरूको साथ तयार गरिएको छ। न्यूनीकरणका उपायहरू कार्यान्वयन गर्ने समय र स्थान, लागत र न्यूनीकरणका उपायहरूको कार्यान्वयन र पर्यवेक्षणका लागि जिम्मेवार निकायहरूको विवरणसहितको वातावरणीय व्यवस्थापन योजना (EMP) तयार गरिएको छ। भौतिक पूर्वाधार तथा यातायात मन्त्रालय अन्तर्गतको सडक विभाग/आयोजना निर्देशनालय आयोजना कार्यान्वयन गर्ने निकायको रूपमा रहेको छ र आयोजना अन्तर्गत वातावरणीय सुरक्षाको समग्र कार्यान्वयनको लागि जिम्मेवार हुनेछ। पर्यवेक्षण परामर्शदाताहरूले (SC) वातावरणीय सुरक्षा गतिविधिहरूको निरीक्षण गर्न आफ्नो टोलीमा वातावरण विशेषज्ञ समावेश गर्नेछन् । यस आयोजनाको भौतिक, जैविक, सामाजिक-आर्थिक तथा सांस्कृतिक वातावरणमा प्रस्तावित न्यूनीकरण तथा अभिवृद्धिका उपायहरूको लागत अनुमान नेरु ५२८,३४५,४८४ प्रस्ताव गरिएको छ ।

परिच्छेद १०: वातावरणीय अनुगमन योजना

वातावरण संरक्षण नियमावली (EPR), २०७७ अनुसार वातावरणीय अनुगमनको जिम्मेवारी आयोजना प्रस्तावकको रहेको छ। वातावरणीय अनुगमनको मुख्य उद्देश्य आयोजना कार्यान्वयनको प्रारम्भिक चरणमा, आयोजना निर्माणको चरणमा तथा संचालनको चरणमा पर्न जाने प्रभाव पहिचान गरि निर्माण अघि पर्याप्त सुधारात्मक कार्य र सो सम्बन्धि उपायहरू सुझाउनु हो। न्यूनीकरणका उपायहरूको प्रभावकारिता कार्यान्वयन गर्न बुटवल-गोरूसिंगे सडक र पुल आयोजनाको स्तरोन्नतिका लागि वातावरणीय अनुगमन गर्न आवश्यक छ। वातावरणीय अनुगमनको लागि नेरु ११,३००,००० प्रस्ताव गरिएको छ।

१०.१. वातावरणीय अनुगमनका लागि जिम्मेवार निकायहरू

प्रस्तावित आयोजनासँग सम्बन्धित वातावरणीय व्यवस्थापनको जिम्मेवारीमा आयोजना निर्माण तथा संचालनका पक्षहरू समावेश गरिएको छन्, प्रत्येकमा विशेष गतिविधिहरूको लागि विशेष जिम्मेवारीहरू समेत रहेका छन्। प्रस्तावित आयोजना निर्माण अघि, निर्माणको समयमा, आयोजना संचालनको क्रममा वातावरणीय सुरक्षा उपायहरूको कार्यान्वयनका लागि जिम्मेवार मुख्य पक्षहरू निम्नानुसार रहेका छन् :

- भौतिक पूर्वाधार तथा यातायात मन्त्रालय
- सडक विभाग
- आयोजना निर्देशनालय (ए.डी.बी)/आयोजना कार्यान्वयन एकाई
- भू-वातावरण तथा सामाजिक एकाई
- सुपरिवेक्षण परामर्शदाता
- निर्माण कम्पनी

१०.२. गुनासो सुनुवाई संयन्त्र

निर्माण कार्य सुरु गर्नु अघि आयोजना निर्देशनालय/आयोजना कार्यान्वयन इकाई (PIU), साइट आयोजना कार्यालयले सामुदायिक बैठक आयोजना गरेर स्थानीय बासिन्दाहरूलाई सुचित गर्नेछ। कुनै पनि गुनासो आएमा निर्माण कम्पनी, परामर्शदाता र साइट आयोजना कार्यालयले तत्काल साइटमा गुनासो समाधान गर्न सक्नेछन्। साइट आयोजना कार्यालयबाट गुनासो समाधान नभएको अवस्थामा साइट आयोजना कार्यालयले आयोजना निर्देशनालय/पीआईयूमा उजुरी पठाउनेछ। आयोजना

निर्देशनालय/पीआईयू ले आयोजना प्रभावित व्यक्तिहरूसँग निरन्तर अन्तरक्रियाको माध्यमबाट गुनासोहरू समाधान गर्नेछ। आयोजना निर्देशनालयबाट गुनासो समाधान हुन सकेन भने भौतिक पूर्वाधार तथा यातायात मन्त्रालय तथा सडक विभाग द्वारा गठित गुनासो निवारण समितिमा लिखित कागजातसहित गुनासो पठाइन्छ। निर्माण कम्पनी, आयोजना कार्यालय, आयोजना निर्देशनालय/पी.आई.यु, भौतिक पूर्वाधार तथा यातायात मन्त्रालय तथा सडक विभाग द्वारा गुनासो सम्बोधन नगरिएको अवस्थामा प्रभावित व्यक्ति अदालतबाट गुनासोको कानूनी निवारण खोज्न सक्दछ। यद्यपि गुनासो सुनुवाई संयन्त्रले प्रभावित व्यक्तिहरूलाई कुनै पनि समयमा कानूनी उपचार खोज्नबाट रोक्दैन।

परिच्छेद १२: निष्कर्ष

बुटवल-गोरुसिंगे (५० कि.मि) सडकखण्ड २ लेनको रहेको छ र यस आयोजनाको उद्देश्य ३० वटा पुलहरू सहित बुटवल-गोरुसिंगे सडकखण्डलाई ४ लेनमा स्तरोन्नति गर्नु रहेको छ। यस सडकले पुर्व-पश्चिम राजमार्गको क्षमता गुणस्तर र सुरक्षा सुधारमा सहयोग गर्नेछ। प्रस्तावको कार्यान्वयनले रोजगारीको सृजना, सीप अभिवृद्धि, तथा सार्वजनिक सेवामा वृद्धि पुर्याउने भएकाले मानिसहरूको जनजीवनमा लाभदायी प्रभाव पार्नेछ।

प्रस्तावित बुटवल-गोरुसिंगे सडक हाल २ लेनको रहेको र पुलहरू सहित ४ लेनमा स्तरोन्नति गरिनेछ। यस सडकले पुर्व-पश्चिम राजमार्गको क्षमता गुणस्तर र सुरक्षा सुधारमा सहयोग गर्नेछ। प्रस्तावको कार्यान्वयनले रोजगारीको सृजना, सीप अभिवृद्धि, तथा बजारमा पहुँच पुर्याउने कारणले मानव जीवनमा महत्वपूर्ण लाभदायी प्रभाव पार्नेछ। यस सडकको स्तरोन्नतीबाट यात्रा सहज र छिटो हुनेछ, विद्यमान ट्रफिक जाम घटनुका साथै सडक दुर्घटना न्यूनीकरण हुनेछ, यात्रा समय, लागत र ईन्धनको खपत कम हुनेछ, र सवारी साधनहरूको पार्टपुर्जाहरू कम खीईने र टुक्रने हुन्छ। यस बुटवल-गोरुसिंगे सडकखण्डले लुम्बिनी प्रदेश र देशका अन्य भागलाई सडक सञ्जालमा आबद्ध गर्ने भएकाले यस सडकखण्डको ठूलो महत्व रहेकोछ।

निर्माण र संचालनको चरणमा पहिचन गरिएका अधिकांश नकारात्मक प्रभावहरू छोटो देखि लामो अवधिका, कम देखि मध्यम प्रभावका र अधिकांश स्थानीय र परिवर्तनीय प्रकृतिका रहेका छन्। वन र कृषि क्षेत्रको केहि क्षेत्राधिकारको भू-उपयोग परिवर्तन हुनेछ। चेनेज ५९०+५५० देखि चेनेज ५९९+००० सम्म सक्रिय पहिरो रहेको र स्लोप अस्थिरता न्यूनीकरण गर्न दाँया पट्टि थप लेनको निर्माण गरिनेछैन। हट मिक्स प्लान्ट, ब्याचिग प्लान्ट, र क्रसर प्लान्टको संचालन तथा पुल तथा सडकको निर्माणबाट वायु, ध्वनी र जल प्रदुषण हुनेछ।

निर्माणको चरणमा सडकको क्षेत्राधिकारबाट ७,९९४ रुखहरू कटान हुनेछ। वन नियमावली २०७९ अनुसार १:१० को अनुपातमा प्रतिपूरक वृक्षरोपण गरिनेछ। निर्माणको चरणमा वन क्षेत्रमा भएको तारबारमा असर पर्नेछ र करिब ३५ किमी तारबार मर्मतसम्भार गरिनेछ। यस आयोजनाबाट १२७ निजी संरचना, २०६ सामुदायिक संरचनाहरू र सार्वजनिक ट्युब वेल, बिजुली तथा टेलिफोनका पोलहरू, ट्रान्सफर्मर जस्ता २,३५८ सार्वजनिक उपयोगीताहरू प्रभावित हुनेछन। सबै

प्रभावित निजी र सामुदायिक संरचनाहरूको लागि विद्यमान कानून र पुर्नवास योजना अनुसार क्षतिपुर्ति प्रदान गरिनेछ।

आयोजनाले वातावरण व्यवस्थापन योजना र वातावरण अनुगमन योजना अन्तर्गत विस्तृत प्रभाव न्यूनीकरण तथा अभिवृद्धिका उपायहरू प्रस्ताव गरेको छ। प्रभाव न्यूनीकरण तथा अभिवृद्धिका लागि ने.रु. ५२८,३४५,४८४ प्रस्ताव गरिएको छ। यस प्रारम्भिक वातावरणीय परिक्षण प्रतिवेदनले वातावरण व्यवस्थापन योजनामा उल्लेखित न्यूनीकरणका उपायहरूको कार्यन्वयनबाट वातावरणमा कुनै पनि महत्त्वपूर्ण प्रभाव पर्ने छैन भन्ने सुनिश्चित गर्दछ। यस आयोजनाको लागि प्रारम्भिक वातावरणीय परिक्षण पर्याप्त रहेको र थप वातावरणीय अध्ययन वा वातावरणीय प्रभाव मुल्यांकन आवश्यक पर्ने छैन।

ANNEX XXIII: PHOTOGRAPHS

	
Visibility effect by air pollutants in study areas	Open burning in nearby road
	
Noise Measurement at STA01 (Butwal-Starting Point)	Air Quality Monitoring in forest area



Temple within RoW

Electric pole within RoW



Chautro within RoW



Animals crossing at Chainage



Resting place within RoW



Unstable slope at chainage



Buddha Stupa within RoW



Public Consultation

Consultation



Consultation with forest officials



Public hearing at Butwal Sub-metropolitan City



Public hearing



Public Notice attached in Resting Place



Public Notice attached in office of Ward 7, Banganda Municipality



Public Notice attached in office of Pipra Kathi Mahila Community Forest



Public Notice attached in Notice board of Health Post

