



Government of Nepal
Ministry of Infrastructure Development
Department of Roads

Development Cooperation Implementation Division
Accelerating Transport and Trade Connectivity in Eastern South Asia-Nepal Phase I
Project
Chakupat, Lalitpur

Request for Expression of Interest (REOI)

Notice No.: ACCESS/05/082/83

Date of Publication: 5th June, 2026 (2083/02/22)

It is notified that Accelerating Transport and Trade Connectivity in Eastern South Asia-Nepal Phase I Project (P177902) requested all the eligible Consultants to submit expression of Interest in providing the following services:

S. N.	Contract Identification No.	Service
1	ACCESS-DOR-CK-QCBS-2	Consulting services for Feasibility study for the Upgradation/Improvement of Chandrauta-Kohalpur Section and Detailed Design of the Chandrauta-Dhankhola and Lamahi-Kohalpur sections of East-West Highway (Mahendra Highway)

Interested consultants may obtain Terms of Reference (ToR) for the mentioned assignment title and further detail relevant information from <https://dor.gov.np/home/notices>. Expression of interest must be delivered in written form during office hours to the given address above (in person, or by e-mail) by 29th June, 2026.

-Project Director

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Department of Roads
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(P177902)
Chakupat, Lalitpur

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Contract Identification Number: ACCESS-DOR-CK-QCBS-2

Request for Expression of Interest (REoI)

Country: - Nepal

Name of project: **Accelerating Transport and Trade Connectivity in East South Asia-Nepal Phase I Project (P177902)**

Credit No.: 7159-NP

Assignment Title: Consulting services for Feasibility study for the Upgradation/Improvement of Chandrauta-Kohalpur Section and Detailed Design of the Chandrauta-Dhankhola and Lamahi-Kohalpur sections of East-West Highway (Mahendra Highway).

Reference No.: ACCESS-DOR-CK-QCBS-2

The Government of Nepal has received financing from the World Bank toward the cost of Accelerating Transport and Trade Connectivity in East South Asia-Nepal Phase I Project (P177902) (ACCESS) and intends to apply part of the proceeds for consulting services.

The consulting services ("the Services") include Feasibility study for the Upgradation/Improvement of Chandrauta-Kohalpur Section and Detailed Design of the Chandrauta-Dhankhola and Lamahi-Kohalpur sections of East-West Highway (Mahendra Highway).

Terms of Reference is available in the website of the Department of Roads: www.dor.gov.np/home/notices. Anticipated date for commencement of the services is November 2026 and the tentative duration of the assignment is about 15 months.

The Department of Roads, Development Cooperation Implementation Division (DCID) now invites eligible International Consulting firms ("Consultants") to indicate their interest in providing the Services. Interested Consultants should provide information demonstrating that they have the required qualifications and relevant experience to perform the Services. The short-listing criteria are:

- Core business and years in business
- Relevant experience of the Consulting Firm with similarity in nature, size, complexity within last 10 years.

- Experience of the firm in Multilateral Bank finance Project is preferable.
- Technical, Managerial and organizational capability of the firm (Professional staff relevant to the assignment)

(Note- Consultants shall mention the work experience indicating consulting service amount, duration of the assignment, commencement and completion year. For Road Project, the consultant shall mention detailed features of the road including length and number of lanes. For the Bridge project, the consultant shall mention detailed features of the bridge including span, total length and number of lanes.)

The attention of interested Consultants is drawn to paragraphs 3.16 - 3.17 of the World Bank's Procurement Regulations for IPF Borrowers, fifth Edition, September, 2025 setting forth the World Bank's policy on conflict of interest.

A consultant will be selected in accordance with the Quality & Cost Based Selection (QCBS) method set out in the World Bank's Procurement Regulations.

Consultants may associate with other firms to enhance their qualifications but should indicate clearly whether the association is in the form of a joint venture or a sub-consultancy. In the case of a joint venture, all the partners in the joint venture shall be jointly and severally liable for the entire contract, if selected. A Consulting Firm is not permitted to form association as Sub - Consultant with more than 2 (Two) Lead Consulting Firms. The Consultants' association, not stated clearly, shall be considered in the form of sub- consultancy.

Expression of interest must be delivered in written form during office hours to the address below (in person, or by mail, or by e-mail) by 29th June, 2026.

Interested Consultant may obtain further information about the service at the address below during office hour.

Department of Roads
Development Cooperation Implementation Division
Accelerating Transport and Trade Connectivity in East South Asia-Nepal Phase I Project (P177902),
Chakupat, Lalitpur
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TERMS OF REFERENCE (TOR)

for

FEASIBILITY STUDY FOR THE UPGRADATION/IMPROVEMENT

OF

CHANDRAUTA – KOHALPUR SECTION

AND DETAILED DESIGN OF THE CHANDRAUTA-

DHANKHOLA AND LAMAHI-KOHALPUR SECTIONS OF EAST-

WEST HIGHWAY (MAHENDRA HIGHWAY)

UNDER

ACCELERATING TRANSPORT AND TRADE CONNECTIVITY IN EASTERN SOUTH ASIA

(ACCESS) - NEPAL PHASE 1 PROJECT

CONTRACT IDENTIFICATION NO.: ACCESS-DOR-CK-QCBS-2

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A. Background

The East-West Highway is the major strategic road of the country running from east (Kakarbhitta) to west (Gaddachauki) side of Nepal with a length of 1027 km. The Government of Nepal is committed to upgrading the entire East-West Highway (Mahendra Highway) from the existing two-lane road to a four-lane standard to enhance road capacity and efficiency along the highway corridor. The upgrading to four-lane standard from Kakarbhitta to Chandrauta (657 km) section are currently in different stages, ranging from project preparation, detailed design, through to construction.

Government of Nepal (GoN), Ministry of Physical Infrastructure and Transport, Department of Roads (DoR) under the Accelerating Transport and Trade Connectivity in Eastern South Asia (ACCESS) Nepal Phase-1 intends to hire consulting services for conducting a feasibility study (FS) for the 165-km Chandrauta–Kohalpur section of the East–West Highway, followed by the detailed design (DD) of the most feasible sections identified through the FS. The Dhankhola–Lamahi section (approximately 40 km), which is already under upgradation to standard two-lane with grant support from the Millennium Challenge Corporation (MCC) shall be excluded for the detailed design. The consulting service is intended to be procured under World Bank’s (WB) Procurement Regulations for IPF Borrowers. The proposed feasibility study will assess the potential upgradation from the existing two-lane to four-lane standards, including roads and bridges, with the objective of developing a more climate-resilient, safe, cost-effective, environmentally sustainable, and inclusive road transport infrastructure.

The existing road from Chandrauta to Kohalpur is 165 km in length, with the majority of the length consisting of bituminous surfaced two lanes with unpaved shoulders. This section consists of total no. of 71 bridges (minor and major type). The road is quite old with average IRI around 12 along Chandrauta - Kohalpur section, indicating suboptimal riding quality. The timely maintenance has helped to maintain average SDI around 2, ensuring the road remains serviceable. The road section passes through the Banke National Park and the following junctions/ intersections/ places: Dhankhola, Bhaluwang, Lamahi, Ameliya, and Kohalpur. The annual average daily traffic (AADT) of the aforesaid sections has been excerpted from DOR website: www.dor.gov.np. Based upon the AADT the priority sub-sections have also been determined as shown in Table 1 below.

Table 1. Priority Road Sections

Sl. No.	Name of Section	Annual Average Daily Traffic in PCU (2024/25)	Priority	Remarks
1.	Chandrauta – Dhankhola (17 Km)	13912	1	(Traffic Count of Chandrauta West)
2.	Dhankhola-Lamahi (40 Km)	13912	2	(Traffic Count of Chandrauta West)
3.	Lamahi – Kohalpur (108 Km)	7814	3	(Traffic Count of Kohalpur East)

This work has been divided into three parts:

- a. Feasibility study of Chandrauta-Kohalpur (165 km),
- b. Preparation of detailed designs for upgradation/rehabilitation from the existing two-lane configuration to appropriate standards, either four-lane or standard two-lane with paved shoulders, as recommended by the feasibility study, and
- c. Environment and Social Assessment for upgradation/rehabilitation Works for the each section

Part I – Technical and Economic Feasibility study of about 165 km road from Chandrauta to Kohalpur

This part includes a technical and economic feasibility study for the upgradation of the existing 165 km road from Chandrauta to Kohalpur of the East-West/ Mahendra Highway to a four-lane standard from the existing two-lane standard of Double Bituminous Surface Dressing (DBSD) pavement. The Chandrauta–Dhankhola section, approximately 17 km long, traverses both the Terai plains and the Shivalik hills. This road section follows a largely circuitous alignment through the fragile and geologically weak Shivalik hills, necessitating alternative alignment studies and analyses, which may include high-level bridges/viaducts and/or short tunnels to enable expansion to four-lane standards. The 40 km Dhankhola–Lamahi segment, currently under rehabilitation with MCC grant support, runs partly through the Shivalik hills and partly across the plains of the Deukhuri Valley. The remaining stretch from Lamahi to Kohalpur passes through portions of the Deukhuri Valley plains and the Terai plains. The consultant shall conduct a feasibility study for a 30 years projection period, on the assumption that the cumulative duration required for the feasibility study, detailed design (if the project is found feasible), financial arrangements, procurement, and completion of the four-lane upgrade, designed for a 20-year period, will be at least 10 years. The order of priority has been specified in Table 1 above: first, the Chandrauta–Dhankhola section; second, the Dhankhola–Lamahi section; and finally, the Lamahi–Kohalpur section. . If upgradation of a road section to four-lane standards is not currently feasible, the consultant shall assess and identify the conditions and timeframe under which such upgradation may become feasible in the future.

The Department of Roads (DOR) has over 15 years of experience implementing the Design and Build (D&B) project delivery method for bridge projects under national contracts. The Development Cooperation Implementation Division (DCID) of DOR is currently procuring three bridges using the Standard Bidding Document (SBD)–RFP- Works Design & Build (Single-Stage Request for Proposals) approach under SRCTIP, which is financed by the World Bank. However, DOR has not yet applied the D&B method to road works. Recognizing the advantages observed in Design and Build Procurement of bridge projects, such as reduced costs, shorter delivery periods, and better management of design-related risks, DOR intends to adopt the D&B approach for future road upgrading and improvement

projects. Therefore, DCID DOR intends to prepare the norms required to prepare the estimate for Design and Build (D&B) of upgradation of a Highway to four (4) lanes from existing two (2) lanes and also prepare the norms for Design and Build (D&B) of reconstruction/rehabilitation of a Highway to standard two (2) lanes with paved shoulders from existing two (2) lanes, during this part of the study.

Part II – Detailed Design of Upgradation Works for the priority road sub-sections and associated bridges as identified through the Feasibility study in Part I.

This part includes:

- a) preparation of detailed design for upgradation of highway to four (4) lanes from existing two (2) lanes, or preparation of detailed design for reconstruction/rehabilitation to standard two (2) lanes (dedicated 2 lanes) from existing 2 lanes as recommended by the feasibility study,
- b) preparation of cost estimates and bidding document for Design-Bid-Build (Item Rate Contract) for highway upgradation to four lanes from existing two lanes or for reconstruction/rehabilitation of highway to standard two lanes with paved shoulders from existing two lanes, as recommended by the feasibility study, as prescribed in Table 2 below:
- c) Preparation of standard bidding documents for a Design and Build (D&B) approach covering road upgradation from existing two lanes to four lanes, as well as reconstruction/rehabilitation to standard two lanes with paved shoulders from the existing two-lane configuration.

Table 2. Recommended actions following the Feasibility Study

Sl. No.	Name of Section	Actions to carry out after Final Recommendation of Technical and Economic Feasibility Study Report		Remarks
		If Feasible within coming 10 years	If not Feasible within coming 10 years	
1.	Chandrauta – Dhankhola Section (approx. 17 Km)	Detail Design for upgradation works of highway to four (4) lanes from existing two lanes, preparation of cost estimates and bid documents for the same to be implemented as a Design-Bid-Build (Item Rate) Contract, including IEE/EIA and ESIA Report.	Detail Design for reconstruction/rehabilitation works of highway to standard two (2) lanes with paved shoulders from existing two lanes, preparation of cost estimates and bid documents for the same to be implemented as a Design-Bid-Build (Item Rate) contract, including IEE/EIA and ESIA Report. The scope under this shall, also cover the detailed design of parallel bridges adjacent to all existing bridges	

			together with their associated approach roads.	
2.	Lamahi – Kohalpur Section (approx. 108 Km)	Detail Design for Upgradation Works of Highway to four (4) lanes from existing two lanes, preparation of cost estimates and bid documents for the same to be implemented as a Design-Bid-Build (Item Rate) contract, including IEE/EIA and ESIA Report.	Detail Design for reconstruction/rehabilitation works of highway to standard two (2) lanes with paved shoulders from existing two lanes, preparation of cost estimates and bid documents for the same to be implemented as a Design-Bid-Build (Item Rate) Contract including IEE/EIA and ESIA Report. The scope under this shall, also cover the detailed design of parallel bridges adjacent to all existing bridges together with their associated approach roads.	

The **Detailed Design (DD)** of the priority sub-sections includes the following:

i. Chandrauta to Dhankhola Road Section (17 Km)

If the findings and recommendations of the Part I feasibility study suggest that Chandrauta to Dhankhola road section is feasible for four-lane upgrading, then this part involves the detailed engineering survey, investigation, and design of roads, bridges, intersection, animal crossing and other related infrastructure for the best alternative as suggested by the Part I study including preparation of cost estimate and bidding document to implement the project work as Design-Bid-Build (Item Rate) contract.

However, if the feasibility study suggests that the section is not feasible for four lane upgradations, then the options suggested in Table 2 above, shall be carried out based on the survey data, investigation reports and the Final Feasibility Study Report. This will result in the de-scoping of TOR.

ii. Lamahi to Kohalpur Road Section (approx. 108 Km)

If the findings and recommendations of the Part I feasibility study suggest that Lamahi to Kohalpur Road section is feasible for four-lane upgrading, then this part involves the detailed engineering survey, investigation, and design of roads, bridges, intersection, animal crossing and other related infrastructure including preparation of cost estimate and bidding document to implement the project work as a Design-Bid-Build (Item Rate) contract.

However, if the study suggests that the section is not feasible for four lane upgradations, then the options suggested in the Table above, shall be carried out based on the survey data,

investigation reports and the Final Feasibility Study Report that this will result in the de-scoping of TOR.

Part III – Environment and Social Assessment for Upgradation Works for the priority road sub-sections, as mentioned in Part II.

It involves social and environmental assessment (IEE/EIA) of the priority sub-sections as mentioned in Part II above in accordance with GON's Environment Protection Act (EPA), 2076 and Environment Protection Regulation (EPR), 2077. The consultant is also responsible for carrying out Detailed Environment and Social Impact Assessment (ESIA) that includes Biodiversity Management Plan (BMP), Critical Habitat Assessment (CHA) and Cumulative Impact Assessment (CIA) of the priority road sub-sections, as per applicable World Bank Guidelines and as per the DoR Reference Manual for Environmental and Social Aspects of Integrated Road Development, Acts and Regulations. The Consultant is required to consider these safeguards assessments to ensure that the specific findings from the Environmental and Social Assessments, Environmental Management Plan, Social Action Plan, Resettlement Action Plan, Vulnerable Communities Development Plan, Indigenous People's Plan, Gender Based Violence Action Plan, and any others, as required under World Bank ESF policies and/or national legislation, are fully integrated into the detailed design, fully costed and included in the bid documents, BOQs etc.

B. Detailed Scope of Work

B.1 Part I – Technical and Economic Feasibility study of about 165 km road section from Chandrauta to Kohalpur

B.1.1 Objectives of the Services (Part I)

The primary objectives of the consulting services under Part I are to:

- a. conduct a technical and economic feasibility study of about 165 km road from Chandrauta to Kohalpur of East-West/Mahendra Highway for upgradation from the existing 2-lane to 4-lane standard, considering climate-resilient, safe and cost-effective transport infrastructure.
- b. evaluate a series of project alternatives considering different investment levels, using an economic evaluation model (HDM-4) for the road.
- c. propose a phased investment plan (with proposed schedule and cost) for most feasible sections qualifying for upgradation.

B.1.2 General Scope of Services (Part I)

The details of the roads and bridges for the Feasibility Study are given in Table 1.

Table 1: Scope of the Activity

S. No	Description	Length	Upgrading scope
1.	Chandrauta – Kohalpur road section	165 Km	Upgrading of roads and bridges from existing 2-lane to 4-lane standards.
2.	Bridges on the above road sections as listed in Annex 1 to this ToR.	2234 m (Total of 71 bridges)	

The consulting services will include, but are not necessarily limited to the following:

- d. Review studies and documents related to the proposed feasibility study, including DoR planning documents; road traffic data including baseline of road accident data and available forecasts (vehicle, cargo, and passenger); relevant environmental and social impact studies; and available survey data (including maps, aerial photographs, etc.).
- e. Carry out desk study to assess the feasibility of upgrading the Chandrauta to Kohalpur Section to a 4-lane standard from the existing 2-lane. The desk study shall include but not be limited to the following:
 - Collection and study of existing topographical, geological and geotechnical, climatic, land use, hydrological, traffic, environmental, socio-economic data including community profile and presence of indigenous communities and marginalized groups, etc., using relevant sources.
 - Study of potential social impacts and risks related to natural hazards such as landslides, floods, erosion, cultural heritage sites etc.
 - Identifying preliminary alignment options by considering technical, environmental, and social factors, while exploring the potential inclusion of tunnels, bridges, and other structures during the selection process.
 - Preliminary cost estimates and economic assessment based on available data.
- f. Conduct a field survey to validate and supplement data gathered during the desk study.
 - The fieldwork will include reconnaissance surveys (drive along existing roads and walk along identified alternative alignment options for proposed construction).
 - Inspect the existing road conditions (including drainage, bridges, and other physical structures). Prepare an inventory of existing infrastructure, necessary improvements, and initial environmental and social impact findings.
 - Conduct topographic surveys.

- Conduct traffic counts including for both urban and rural sections and origin-destination surveys to project future traffic flows and loadings.
 - Conduct soil sampling, and geological/ geotechnical surveys to assess subsurface conditions and material properties.
 - Conduct field surveys to establish the current ecological, social, and physical conditions of the road corridor, especially within and adjacent to the national park that includes mapping sensitive habitats, wildlife corridors and areas of high conservation value and identifying species at risk, including endangered flora and fauna and assessing their vulnerability to road construction and operation.
 - Recommend engineering solutions such as wildlife crossings (underpasses, overpasses, canopy bridges), fencing and culverts to maintain ecological connectivity and reduce roadkill. Propose speed reduction zones, signage and noise barriers in sensitive stretches.
 - Identify environmental and social impacts, including potential displacement/resettlement, land acquisition needs, tree clearance, wildlife corridors, migratory crossings, critical habitats, cultural heritage and any other protected or sensitive areas as per World Bank ESS. The Consultant should attempt to identify at this stage any particularly vulnerable groups including indigenous groups whose social, economic, or environmental capability could be threatened by the proposed road construction or land acquisition. The consultant should identify and evaluate the environmental and social (E&S) risks for all alternative options and conduct comparative analysis of all options looking into potential impacts such as land acquisition, tree removal, cultural heritage, biodiversity, wildlife, the presence of indigenous peoples etc. Based on such comparative analysis, the consultant should select the options and design accordingly to avoid or minimize adverse impacts.
 - 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.
 - Study the hydrological regime based on an analysis of rainfall and flood records, supplemented by engineering field investigations, to establish the adequacy of climate resilient road embankment levels, culverts, and side ditches, and identify bed and slope protection required for the drainage structures and bridges.
 - Map areas that are vulnerable to flooding, landslides, or other climate-related events, and identify disaster risks.
- g. Based on the above findings and preliminary economic assessment, develop possible alignments options and design options for further evaluation. For the 17 km road section from Chandrauta to Dhankhola, develop possible alternative options considering the inclusion of viaducts, short tunnels, etc.

- h. Evaluate the technical viability of each alignment option. Analyze and prepare a preliminary design of road components based on traffic loads, climate and soil conditions. For upgrading works, this will include adjustments to alignments, improvements, or new construction of drainage, bridges, etc. For new road sections, provide alignment, profile, and cross-section on an appropriate scale with relevant details. The scale for the drawings must be agreed upon with DoR beforehand and not less than 1:25000. Perform preliminary designs for critical components such as tunnels, bridges, culverts, retaining walls, etc. Evaluate the ease of construction and also evaluate the availability of construction materials.
- i. The Consultant is required to provide work specifications, road geometry, bioengineering measures, and cost-effective road structures in their design.
- j. For each alternative option, assess the potential environmental and social impacts and propose mitigation measures. Include consultation with local communities affected by the project, possibly through community meetings, local leaders, and non-governmental and other community organizations. Mitigate adverse impacts to the extent possible through the project design (inclusive of such measures as supporting DOR Standards), with costs incorporated in the economic evaluation. In addition to negative impacts (such as blasting construction techniques) assessments, explore the opportunities to support environmental enhancement measures, such as forest and other natural resource conservation along the road corridor. Identify positive benefits to, for example, human resource development. If resettlement is required, advise the Government on the requirements for a resettlement plan and assist with defining the basis for the plan.
- k. Prepare the cost estimates for the project, including the cost of construction, detailed engineering, supervision, land acquisition, resettlement compensation, environmental monitoring cost, price escalation, and contingencies. The consultant is also required to incorporate the development cost of facility for long-distance buses and trucks to stop for the drivers to rest and recuperate in the cost estimate. The consultant is required to apply appropriate GON norms and specifications with proper and timely interactions with the concerned branches/ sections of DOR. In consultation with the DOR, develop a comprehensive list of unit item rates to form the basis of the estimate. Estimate the performance based maintenance cost for five years after completion of the project in the same manner.
- l. Assess the economic viability and financial sustainability of the project by evaluating the economic return of the project, using different standard evaluation methodologies including but not limited to the Net Present Value (NPV), Internal Rate of Return (IRR), Benefit-Cost Ratio (BCR) and others to justify the reformations.
- m. The Consultant will evaluate, using an economic evaluation model (HDM-4) for the road, a series of project alternatives considering different investment levels, which will be compared against a without-project alternative that will represent a do-minimum scenario or do-nothing scenario.

- n. Submit a comparative economic analysis on a “with project” and “without project” based on the above-mentioned indicators.
- o. By conducting a multi-criteria analysis of the above results, provide recommendation on the following:
 - i. Feasibility Study of Chandrauta-Dhankhola Section (17 Km) with best alternative for upgrading to four lanes from existing two lanes
- p. Prepare and submit concept design and drawings, engineering drawings and cost estimate as per the recommendation given in (o).
- q. Following the completion of the feasibility study, cost estimates, environmental studies and economic assessments, the Consultant will develop and present their recommendations regarding the timing, phasing of the upgrading of the relevant sub-sections (i.e., phased investment plan), and implementation of the proposed project components for each sub-section. Specifically, this will include recommendations regarding the most appropriate contracting procedures and packaging of the project components. These findings shall be presented to the client for final selection and approval.
- r. Prepare a Project Appraisal Report at the end of study period, which will bring together all the main findings with respect to the various components in such a form as to assist with possible project appraisal by the World Bank. The document would include details of each project sub-component, economic and financial costing, estimated benefits, and overall economic and technical justification as well as project implementation schedule and implementation arrangements.
- s. The Consultant will justify decision to move ahead with the selected priority sub-sections in Part II of the study, based on the outcome of the technical and economic feasibility study.

B.1.3 Detailed and Specific Scope of Services (Part I)

a. Feasibility study of road

Feasibility study shall be carried out with innovative ideas of different design alternatives to enhance the road capacity ensuring road safety, environmental and social sustainability and climate resiliency, universal access consideration, reducing travel time and facilitating the movement of both passenger and freight traffic and expand/upgrade the pavement considering present and future projected traffic volume proposing innovative pavement design and recommend for best alternative. Feasibility shall be carried out in consideration of technical, environmental, social, climate resilience and economic aspects. The Consultant shall also consider but not limited to following provisions:

- Socio economic studies
- Base line data survey

- Controlled access lanes with service lanes at market areas
- Environmental and Social screening of the Chandrauta to Kohalpur roads to preliminarily identify E&S risks and impacts and factor them in assessing the feasibility of the project and various alternatives from E&S perspective.
- The potential inclusion of tunnels, viaducts, bridges, and other structures along the areas having challenging mountainous terrain.
- Grade separated intersections at important junctions in order to minimize social and environmental risks and impacts and safety risks
- Physical interventions for speed reduction near urban high-density areas including but not limited to rumble strips, lane narrowing, table-top pedestrian crossings, etc., where grade intersections/ or other measures are not provisioned
- Bus bays with rigid pavement, truck lay byes, weighing stations
- Bus stations friendly to differently-abled people with solar powered digital information boards
- Parking areas at appropriate locations, etc.
- Holding lanes, entry lanes and exit lanes at suitable locations
- Additional bridges/culverts replacing the existing causeways, where necessary
- Foot path, railings, pedestrian crossings, and a number of road safety activities at places where there are schools and market (bazar) area
- Identification of existing utility services along the Right of Way of highway,
- U-turn facilities at regular interval (say 5 or 10 kms, as necessary)
- Flyovers/ overpasses/ underpasses at appropriate locations
- Roadside Rest areas (with gender friendly restrooms) at appropriate locations
- Special designs for wildlife crossings, and other environmental measures identified in the ESIA/ ESMP and relevant measures identified in DOR's guidelines for wildlife-friendly designs of road, bridge, culverts, and other features (e.g. embankments, etc.)
- Post-crash response mechanism

b. Feasibility Study of bridges

Feasibility of bridges should be carried out to enhance the capacity of bridges as well as cross drainage structures to match the proposed upgradation from 2 to 4 lane standard.

There are 42 minor and 29 major bridges on the Chandrauta to Kohalpur Section. Details are provided below in *ANNEX-1: List of Existing Bridges*

The design of the new bridges must be compatible with the proposed upgradation works of the road section considering the geometry, geotechnical, road safety and road congestion studies. The Consultant should propose innovative designs considering national context and the latest technology.

The design should be safe, reliable, wildlife -friendly, climate resilient, universal access features and cost effective with maximum use of appropriate technology minimizing any environmental and social risks and impacts associated with new bridge construction and/or bridge dismantling. The type, feature and condition of existing bridges should be given due consideration while designing any alternatives. The design should be based on the following factors:

- Suitably matching to the upgraded road alignment (both horizontal and vertical).
- Type, size, lane width and span of the proposed bridge.
- Present condition of each component and general features of the existing bridge.
- Topography, locations, environmental sensitive areas such as wildlife corridors and surrounding land uses at bridge site.
- Nature and structure of the soil underneath
- Other structures in proximity to each bridge
- Aesthetics of the surrounding area
- Availability of space for traffic diversion for traffic management during construction
- Road safety measures to be introduced after provision of proposed bridge
- Constructability and site compatibility
- Use of Precast or other advanced superstructure construction technology
- River training and other protection works required
- Social and environmental issues and mitigation
- Road users and pedestrians' expectations
- Other information as needed

All the options should be presented during the presentation of feasibility report and the options to be finalized based on the consultation and discussion with the client. The final report should document the process of identification and assessment/ranking of all alternatives considered related to bridges and justifying the proposed best alternative. The concept design and cost estimate should consider the possible maintenance or retrofitting or rehabilitation works of existing bridges.

c. Details of Survey and Studies

c.1. Topographical survey and mapping

The survey shall collect adequate data to show the following details in the subsequent topographical map:

- 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.)
- 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
- Existing power line details such as: high-tension poles, low-tension poles, transformers, sub stations, Streetlights poles, underground electrical supply (if any) etc.
- Tentative idea of Existing utilities and services details for cost implications such as: telephone lines, poles, cabinets, towers and underground lines (if any), water supply line details such as: supply mains, distribution lines, valves, valve chambers, underground water storage, fire hydrants, etc., 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, Existing buildings and structures details such as: religious shrines, tangible cultural heritage, community building governmental building,
- Existing or potential flood prone zones/ spots, low laying areas and river-bank cutting areas
- Production of a general alignment map of 100m wide road corridor in a scale 1:25,000 and with 1.0m contour interval and clearly showing the center-line of existing roads.
- Plan and profile of the recommended alignment showing all structure and drains at 1:25,000 horizontal and 1: 5,000 vertical scale
- Engineering geological map 1:50,000 scale
- Typical structures and typical cross-sections at 1:200 scale
- The use of modern drone survey technology is encouraged for faster results.

c.2. Hydrological Analysis

For feasibility study, the consultant shall carry out a brief hydrological study of the river and bridge site, which shall include the following:

- Catchment area of the river up to bridge site
- Nature, size and quantities of debris carried by the river
- Intensity, duration and distribution of rain in the catchment
- Existing bridge or other hydraulic structures across the river in the vicinity of the proposed bridge site with their details as much as possible
- 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
- Maximum discharge calculated by established formulas with different return periods and the peak discharge observed over a period of 100 years

- Velocity and depth of flow at the time of survey
- Shifting of the river in the past at proposed bridge site and in its vicinity
- River-bed degradation or aggradation (covering 500 m upstream and 500 m downstream!)
- Use of river as migration corridor of wildlife and fisheries
- Other information required for river control, design, construction and maintenance of the bridge

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

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

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:

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

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. The hydrological/hydraulic adequacy of the existing bridges shall also be assessed in accordance with current standards. If some existing bridges are seriously inadequate on meeting the standards, mitigation measures against disasters shall be proposed.

c.3. Geotechnical Investigation

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

- Determine the sub-soil condition through pitting (1m x 1m x1m) and Dynamic Cone Penetration (DCP) tests at minimum 6 locations of the road alignment.
- Conduct other tests as required by the geological, geotechnical survey and study.

c.4. Material Availability Survey

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:

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

The Consultant shall conduct study on the availability of construction materials like, earthwork for embankment filling, 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.

c.5. Traffic Study and Analysis, Axle Load Survey

For the design purpose the traffic study at the critical points including in all urban and rural sections 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, 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. 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. The Consultant shall ascertain from local inquiries 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.

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

c.6. Condition Assessment for Bridges, Culverts and Structures

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.

c.7. Inventory survey of Road and Roadside structures

The Consultants shall thoroughly conduct survey of the existing alignment of Roads and prepare a detailed inventory report.

c.8 Road Safety Audit

The Consultant shall conduct road safety audit and carry out assessment/analysis to use the findings in determining the most feasible road section and incorporate the findings to recommend for detailed designs (DD). The Consultant is required to follow the state of art/ technology in managing/improving the road safety in design for road and bridges including other interventions. The Consultant shall also make assessment and make sufficient provisions for managing road safety aspects and traffic management during construction including work-zone safety protocols, that to be included in the bidding documents.

d. Typical Design of Road

Typical Design of Road shall include the following:

- Design of typical highway cross-sections
- Design of typical cut and fill slopes
- Typical Structural design of retaining structures (Gabion, Masonry, Plum concrete, etc)
- Typical/ Preliminary Structural design of RCC structures (including bridges, grade separated interchanges and underpasses)
- Slope protection and Bio-engineering
- Wildlife passes/crossings

e. Preliminary Design of Bridges

Based on the collected information and results of the discussions mentioned above the consultants shall make preliminary 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 aspects shall be submitted to the client with recommendation of best alternate for each and every bridge.

The consultant shall do a condition assessment of existing Bridges and estimate the remaining life of the bridges. Based on the condition assessment of existing bridges and necessary technical and economic analysis, the consultant shall recommend the necessary maintenance or rehabilitation measures, wherever feasible. The consultant also recommend the options of construction of new single 4 lane bridge or one/two double lane bridges on either side of the existing bridges as necessary, with detailed cost benefit analysis and presenting a report to client for approval.

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 choice of two bridges or single bridge per site) 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.

The Consultant shall produce cost 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.

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.

f. Economic Analysis

- i. Review existing traffic data, conduct traffic counts and origin-destination and axle-load surveys, and forecast traffic for each candidate road sections for 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 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:
 - Measurable effect on trade competitiveness through delivery costs, transit times, and supply reliability – identify relevant baseline indicators and predict achievable target outcomes.

- Estimated increase to regional traffic volume and trade volumes generated by the enhanced road network by improving project roads.

v. Prepare and submit Economic Assessment Report, presenting the following:

- Introduction
- General Considerations
- Input Data for Vehicle Operating Cost Components and Other Components for Economic Analysis
- Economic Benefits (including those due to regional implications)
- Construction and Maintenance Alternatives and Cost Estimates
- Economic Analysis
- Sensitivity Analysis
- 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)

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

g. Miscellaneous Activities/Studies/Investigations

(i) Preparation of Norms for Design and Build (D&B) of Works

The consultant engaged under this service contract is also required to prepare norms for rate analysis for preparation of cost estimate for Design and Build (D&B) of Upgradation/Improvement, Reconstruction/Rehabilitation of the existing highways as follows:

1. Norms for rate analysis for preparation of cost estimate for Design and Build (D&B) for Upgradation and Improvement of Highway to four (4) lanes from existing two (2) lanes: Under this activity the consultant shall carry out but not limited to the following:
 - collect the cost estimate of the similar and comparable ongoing or planned contracts along the plains section of the East-West Highway (EWH)—including Kakarbhitta–Laukahi, Kamala–Kanchanpur, Kamala–Bagmati, Bagmati–Pathlaiya, Pathlaiya–Narayanghat, Narayanghat–Butwal, and Butwal–Gorusinghe–Chandrauta—covering approximately 600 km from Kakarbhitta to Chandrauta.

- analyze and segregate the required lengths of urban segments that need service lanes, rural segments without service lanes, bridges, overpasses, and other key features and their respective costs for each segment (urban section with service lanes, rural sections bridges, overpasses/underpasses, other key features) for each project.
 - Compute per kilometer cost for each segment of roads (urban and rural sections) and per running metre cost for bridges, overpasses/underpasses and other features including the design costs. These costs will be the base year costs and will be a basis for computation of cost estimate for the similar future projects by adjusting time value using the Nepal Rashtra Bank (NRB) Indices.
2. Norms for preparation of cost estimate for Design and Build (D&B) for Reconstruction/Rehabilitation of Highway to standard two (2) lanes with paved shoulders. This follows the similar steps of activities as elaborated in (1) above.

(ii) Notification of Commencement of key activities

The Consultant shall notify the Employer of the commencement time for key activities sufficiently in advance of their actual start, as outlined below:

- Field Survey/Inventory works
- Drilling of Boreholes
- Condition Assessment of the Bridges and other structures
- Design of Road and Bridges

(iii) Other Studies

If not covered by aforesaid, the Consultant 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.

B.2 Part II - Detailed Design of Upgradation Works for the priority road sub-sections and associated bridges as identified from the Feasibility study in Part I.

This part is to be applied to the sub-sections that were identified as a priority section and recommended for detail study as per the feasibility study conducted under Part I.

B.2.1 Objectives of the Services (Part II)

The main objectives of the consulting services under Part II are to:

- a. Carry out the detailed engineering design, with detailed survey, investigations and design of roads, bridges, intersections, animal crossing and level crossing for the upgradation of priority road Sub-Sections I and II (as mentioned in A. Background a. Part II above) from existing two-lane to four-lane road standards.
- b. The Detailed Project Report (DPR) would inter-alia include detailed highway design, design of pavement, design of cross drainage structures and bridges, design of Junction Improvement structures (including Vehicle Under Passes, Pedestrian Under Passes, Foot Over Bridges etc.), design of service roads, design of wildlife crossing structures, measures for maintenance and /or rehabilitation and/or replacement of existing bridges etc. incorporating road safety features and relevant environmental and social measures based on World Bank ESF, quantities of various items, detailed working drawings, detailed cost estimates, environmental and social study, social and environmental action plans as appropriate and prepare the necessary Standards, Specifications, Cost Estimates, Bill of Quantities, Contract packaging and preparation of Bid documents for international/ local competitive bidding.
- c. Ensure detailed project preparation incorporating aspects of value engineering, quality audit and road safety audit requirement in design and implementation.
- d. Conduct detail condition assessment of the existing bridges and design of measures for remedial maintenance and rehabilitation measures and/or replacement of existing bridges, and improvement measures for pedestrian safety at existing bridges in urban areas e.g., providing pedestrian footpath to existing bridge having no footpath.
- e. Conduct alternative analysis of design and construction techniques, etc. analyzing a) environmental and social b) climate resiliency and longevity c) constructability d) safety e) cost and f) other relevant risks and impacts for each alternative.
- f. Integrate relevant recommended environmental and social measures and recommendations of road safety assessment and audit analysis, e.g. wildlife passes, safety features, etc., into the detailed engineering designs and bid documents. The Consultant shall also integrate recommendations of the human capital assessment and analysis into the detailed engineering designs and bid documents.
- g. Maintain closest uniformity in data management with the HMIS.

B.2.2 Scope of the Services (Part II)

The consultancy services will include, but not necessarily be limited to, the following:

- a. The Consultant shall study the Feasibility Study (prepared under Part I) Report carried out for the Upgradation of the road.

- b. The Consultant shall thoroughly inspect the existing road sections including bridges and structures, including geometric features, and type and condition of drainage structures, River Training Works/Protection works and other major features and shall prepare a report about their condition including all the parameters in the *Standard Condition Assessment Format*. The condition and structural assessment survey shall be carried out under close supervision of senior experts of the Consultant.
- c. The Consultant shall carry out engineering surveys and investigations, including topographic surveys, as required to prepare detailed engineering designs, drawings as appropriate to prepare bills of quantities within reasonable accuracy.
- d. The Consultant shall take into consideration the necessary environmental and social studies with due consultations with relevant stakeholders, during the design processes, and identify sensitive areas and features such as climate vulnerability, wildlife corridors, cultural heritages, natural habitats and/or critical habitats etc. as well as screen for potential direct, indirect and induced impacts, and define required mitigation measures as part of the design including cost.
- e. The consultant shall conduct a comprehensive Environmental and Social Impact Assessment (ESIA) that includes Biodiversity Management Plan (BMP), Critical Habitat Assessment (CHA), Cumulative Impact Assessment (CIA) and develop mitigation strategies to safeguard the biodiversity, habitats and local communities of the study corridor.
- f. The Consultant shall integrate the environmental and social findings and recommendations in the technical design, cost estimate and bid documents. For better coordination the Consultant, besides regular meetings and sharing of data/information, shall be needed to organize workshops, consultation/ dialogues with stakeholders.
- g. The Consultant shall prepare detail design and drawings for the road pavement sections, retaining structures, slope protection measures, drains, cross drainages structures, bridges and intersections, flyovers, noise barrier walls, and all other items necessary for construction of a safe, efficient, resilient and inclusive road; applying sound engineering practices and integrating environmental and social measures in accordance with the ESIA/ESMP prepared separately and the World Bank ESF and Government's related regulations and policies.
- h. The Consultant shall identify sources, quarry sites and borrow areas, undertake field and laboratory testing of the materials to determine their suitability for various components of the work and establish quality and quantity of various construction materials and recommend their use based on techno-economic principles. The Consultant shall prepare mass haul diagram for haulage purposes giving quarry charts indicating the location of suggested/selected borrow areas, quarries and the respective estimated quantities.
- i. The Consultant shall collect details of important physical features along the alignment affecting the proposed project activities and should normally include buildings and structures, monuments, burial

grounds, cremation grounds, places of worship, railway lines (existing/planned), stream/ river/ canal, water mains, sewers, crossings, trees, plantations, utility services such as electric and telephone lines and poles, existing/planned optical fiber cables (OFC) etc. within the designated right-of-way of the road.

- j. The Consultant shall conduct hydrographic survey, utility survey, identification of Underground Structures and Other Obstacles Structure.
- k. The Consultant shall conduct road safety audit and carry out assessment analysis and incorporate the findings and recommendations into the detailed designs. The Consultant is required to follow the state of art/ technology in managing/improving the road safety in design for road and bridges including other interventions. The Consultant shall also make assessment and make sufficient provisions for managing road safety aspects and traffic management during construction including work-zone safety protocols, that to be included in the bidding documents.
- l. The Consultant shall adopt practical and cost-effective geometric (horizontal, vertical, intersection etc.) designs and pavement structural designs based on projected traffic levels, pavement structure studies, axle-load considerations, considering previous studies, traffic safety, environmental and social impact assessment, biodiversity management plan including relevant input and information.
- m. The Consultant shall prepare designs and drawings for major intersections and junctions with safety features based on international best practice.
- n. The Consultant shall determine the most cost-effective improvement option for the proposed road section. The Consultant shall prepare a Pavement Preservation Schedule and Instruction Manual adopting the latest technology in pavement management with forecast future maintenance needs that presents the most cost-effective overlay, crack sealing, and other treatments at the right times, in order to extend the life of the pavement for as long as possible in a cost-effective manner.
- o. The Consultant shall study the hydrological regime in detail, based on the catchment area, a vulnerability assessment and analysis of rainfall and flood records and future projections, 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.
- p. The Consultant shall assess possible use of water from roads for productive use in safe manner plus recharge and the design shall include provisioning of necessary crossing structures like culverts in consultation with local people, especially where roads pass through existing/ potential agriculture areas.
- q. The Consultant shall assess cross-drainage structure requirements and propose new additional structures (bridges, culverts, and causeways as appropriate) or improvements/replacement to structurally unsound structures, if any, considering these structures would also serve as wildlife crossing.

- r. The Consultant shall conduct detailed geotechnical field investigations (also showing possible locations of natural springs / wells / sand boiling), materials laboratory analyses, and prepare geotechnical design recommendations with bore logs as necessary to facilitate the resilient design of bridges and other structures.
- s. The Consultant shall prepare record of inventory of geologically sensitive areas like slip prone areas, areas subject to landslides, rock fall, erosion, activity etc.
- t. The Consultant shall prepare detailed plan for slope stabilization of existing as well as potential landslide areas, with detailed engineering design for proposed civil engineering structures and bio-engineering measures, prepare costs estimates and include them in bills of quantities. Similarly, the Consultant shall also prepare detailed plans for roadside development activities, including plantation of trees and shrubs in urban and non-urban locations, proposing maintenance for such measures and prepare cost estimates and include them in bills of quantities.
- u. The Consultant shall prepare and document standard and technical specifications for each work item, taking into account of relevant specifications and best practices in use in the country and internationally for similar works and relevant environmental and social measures based on the ESIA/ESMP and related plans.
- v. The Consultant shall prepare detailed engineering designs of road, pavement, bridges and other structures, and bills of quantities, and evaluate engineering, environmental and social management costs estimates for civil works with details of foreign and local components input.
- w. The Consultant shall integrate, as appropriate, environmental and social measures to avoid/minimize/ mitigate and offset adverse impacts into the detailed plans and designs and fully evaluate for cost for mitigation measures/interventions and include in Bill of Quantities and Bidding Documents etc.
- x. The Consultant shall prepare drone survey video of current status of road section and bridges including other structures throughout the road so that it could be compared to the status after project implementation.
- y. The Consultant shall prepare a short-animated video of road, bridges and intersections presenting the details of designs, features, concepts, traffic flow etc. with voice over and music appropriately. The Consultant shall prepare design visualization, still images and videos of proposed roadway and bridges.
- z. The Consultant shall prepare appropriate number of contract packages taking into account of the location of the project roads and findings of capacity assessment of the local construction industry.
- aa. The Consultant shall prepare and document a practical and resource-based project schedule taking into account the implementation of works in each contract package with detailed analysis and graphical representation showing critical construction activities and floats using CPM/PERT which shall justify the project duration of each contract package. The schedules shall accommodate

seasonal climatic effects at the work sites and take into account typical outputs based on similar earlier road projects.

- bb. Once the generic bid documents are discussed, agreed and finalized, the Consultant shall prepare and submit the bidding documents for each contract packages for design-bid-build (Item Rate Contract) in soft copy (original version) and hard copy (5 sets).
- cc. The Consultant shall conduct capacity development activities through regular interaction activities with the client team including residential trainings for at least 25 participants and in-house workshops for minimum 40 participants for the purpose of discussions and knowledge transfer on latest technologies, applied procedure, methods etc. on road/ bridge/other related structures' design & construction and current international practice on procurement, contract administration, contract management, disputes and its resolution.
- dd. The Consultant shall develop Project Quality Management Plan for the Client's application during the Contract Management.
- ee. The Consultant shall comply with DOR's Occupational Health and Safety Guideline for Road Infrastructure Development and Management, July, 2023 and/or shall refer to suitable best practices and include the applicable provisions in the bidding documents. Furthermore, the Consultant shall ensure that any sub-service providers appointed by the Consultant also adheres to the applicable OCHS Policies, Manual and Guidelines.

B.2.3 Detailed Survey, Investigations, and Design of Upgradation of Road and Bridge Works on the priority sub-section

a. Detailed Design of the priority Road Sub-Section

Detailed Survey, Investigations, and Design of Road shall be based on the recommendations of the Feasibility report for the priority sub-sections as agreed with DOR. The road design should accommodate the future generated traffic volume of at least 20 years considering it as a major highway in Nepal that joins East to West and trade routes linking Indian borders at South and China towards North. The required measures to address the concerns of environmental, social and road safety are to be incorporated in design.

In addition to the General Scope of Services the design shall also cover the Special features as listed below:

- i. The Consultant shall prepare the Detailed Engineering Design for execution of the upgradation of road works which shall include upgradation of road geometry, side drains, drainage structures, retaining and protection structures, slope stabilization and bioengineering works, road pavement works and miscellaneous ancillary works, such as toll facilities, rest areas,

- fueling station, pedestrian overpasses/underpasses, road safety features, special structures such as underpasses/overpasses to facilitate wildlife and domestic animal movement, and other relevant design measures for a wildlife friendly road (informed by ESIA and guidelines for wildlife friendly linear infrastructure), etc.
- ii. Design should refer to the standards in priority of (a) the Nepal Road Standard 2070 (2013), Pavement Design Guidelines 2021, Nepal Bridge Standards 2067 (2010) and other relevant standards of Department of Roads (b) IRC (Indian Road Congress) standards and (c) AASHTO and Best Practices. Relevant national standards and IRC Codes of Practice to be followed for design of highway and bridges are presented in Annex-II.
 - iii. All the design works shall be substantiated by design calculations and verified by international best practices especially for design of pavement thickness, retaining walls, cross drains, size and type of drains, capping layers for wet area and poor sub-grade strata.
 - iv. The consultant shall also determine road sections where the design speed of 100 kmph cannot be achieved.
 - v. As regards road safety, the Consultant should:
 - a. Review present practices followed in the highways on road safety issue and recommend site specific upgradations, where necessary. The consultant shall also review Road Safety Audit Manual prepared by National Road Safety Council (NRSC).
 - b. Identify road location stretches requiring upgradation works for road safety and prepare appropriate and cost-effective designs.
 - c. Identify the requirement of safety measures along the bridges and prepare the appropriate cost-effective designs
 - d. Incorporate road safety measures in the design based on international Research outcomes and Road safety audit or assessment Report. Incorporate the international best practices on road safety treatments with a particular focus on safety treatments for (a) head on crashes, (b) run off the road crashes, considering both the daytime and night traffic.
 - e. Identify the requirement of safety Crash Barriers along the vulnerable sections and other safety measures as necessary including cats eyes and reflective paints at permanent structures.
 - f. Identify the stretches, places and prepare appropriate plans for conducting awareness program for drivers, public, and children on road safety (taking into account stakeholder feedback through the consultation process).
 - g. Design suitable traffic safety features and road furniture including traffic signals, signs, markings, overhead sign boards, crash barriers, delineators etc. The locations of these features shall be identified and detailed in the reports and also shown in the drawings,

- according to international standards including amendment in DoR standards for road signs, if necessary.
- h. Identify the requirement of safety measures along the bridges and proper recommendation for the design and upgradation in existing bridges.
 - i. Evaluate construction-related traffic management and road safety issues, and propose a plan to address road safety concerns during the construction/upgrading phase of recommended upgradation works for road segments and bridges.
 - j. Prepare a detailed prioritized activity plan for each road section to address the road safety issues identified/ encountered during the safety audit, which may include structural/design recommendations, awareness raising and educational campaigns, emergency response plans and measures, institutional aspects / institutional strengthening measures to conduct monitoring and enforcement, provide emergency response in case of accidents, etc. (taking into account stakeholder feedback as appropriate through the consultation process).
 - k. Prepare a plan for effective post-crash response mechanism development considering both humanitarian and physical aspects.
- vi. Design shall consider the intersections at major junctions along the priority sub-sections (which may include areas like Ameliya, Kohalpur, and other locations) as necessary to maintain a Level of Service (LOS) B at the design speed of 100 kmph, referring to relevant International Standards and Practices.
 - vii. Design shall consider the provision of controlled access lanes at market areas and multiple lanes shall be separated by standard median throughout with greenery plans. Designs should consider the physical treatments for speed reductions in the urban areas of the corridor. Cross-sections in plain areas shall be compatible and harmonized with the ongoing upgradation of plain sections along the East–West Highway, to the extent rationally justifiable.
 - viii. Design shall consider the provision of separated footpaths, railings and pedestrian crossings (taking into account stakeholder feedback through the road safety consultation process) at market areas considering the concept of “universal access” and equality to all road users.
 - ix. Design should consider providing holding lanes, entry lanes and exit lanes at suitable locations as per the suggestions of the stakeholders’ consultation during ESIA study and recommendation of feasibility study referring to the relevant International Standards and Practices
 - x. The road alignment should be properly designed harmonizing to the highway standards accordingly.
 - xi. The Consultant shall design suitable Bus bays/stops, Toll stations, Truck lay byes, weighing stations, parking areas, rest areas, pedestrian crossings, wildlife crossings, noise barrier walls, and other ancillary items and prepare suitable separate designs. Rigid Pavement or any other

- appropriate pavement should be considered at the bus-bays/ parking lots. The bus stops/stations shall be spacious, with shades, chairs, friendly to differently abled people, accommodating several components like Digital Information boards, Digital maps and information, Restrooms (gender friendly), cabin for Security personnel etc.
- xii. All the design works must follow the requirement and standard acceptable to DoR and should be based on current proven and accepted national and international practices.
 - xiii. The Consultant shall use the data collected during the hydrological survey and determine the type of the cross-drainage structure and its capacity, roadside drainage and subsurface drainage. Existing drainage structures should be used wherever possible.
 - xiv. The Consultant shall prepare the design drawings with sufficient detail for bidding purpose and also for execution of the construction works in appropriate size, scale and format acceptable to DoR.
 - xv. Prepare appropriate and cost-effective designs, cost estimates, specifications.
 - xvi. Before finalizing the design drawings, the Consultant's team needs to agree the quality assurance procedures for finalizing design drawings with the DoR and the DoR forms a Departmental Team to finalize the design drawings with proper verification in the field by checking the alignment and verify the survey details and the design drawings with proper verification in the field by checking the alignment.
 - xvii. Final design and drawings shall be prepared and submitted only after field verification and approval from DoR. The final design and drawings as well as other documents incorporate site-specific environmental mitigation measures.
 - xviii. The Consultant shall furnish the important documents, reports, drawings and other necessary information in the DoR acceptable format in soft copies compatible with DoR's Highway Management Information System. At a minimum, all deliverables shall be furnished in both the original document format (for example, MS Word, Excel, AutoCAD, etc.), PDF format, and hard copies.

b. Detailed Design of Bridges

- i. The location of new bridges shall be chosen so as to eliminate the need to close the Mahendra Highway for any length of time, harmonize with the highway geometric standards, and ensuring the safety of the existing bridge.
- ii. The design of bridges should be carried out to enhance the capacity of bridges and other cross drainage structures to match the upgradation works to enhance the road capacity, resilience and road safety, with consideration for additional widening, if cost effective.

- iii. The existing **71 bridges** have varying carriageway widths from 6 m to 9m. The table in **Annex 1** lists the various features of bridges on this section. The scope of this TOR also includes the upgradation of culvert into bridge, if suggested by the hydrological study report.
- iv. Bridges along the road section will be considered for new construction works based on the recommendation of the feasibility study. The design of the new bridges must be compatible with the proposed design relative to the upgradation works of the adjacent road section considering the geometry, geotechnical, road safety and road congestion studies. The Consultant should propose innovative ideas considering national context and the latest technology.
- v. The design should be climate-resilient, safe, reliable, wildlife-friendly, pedestrian-friendly and cost effective with maximum use of appropriate technology minimizing any environmental and social risks and impacts associated with new bridge construction and/or bridge dismantling. The type, feature and condition of existing bridges should be given due consideration while designing any alternatives. The design shall, at a minimum, consider the following factors:
 - Suitably matching to the upgraded road alignment.
 - Type, size, lane width and span of the proposed bridge.
 - Present condition of each component and general features of the existing bridge.
 - Load carrying capacity of the existing bridges.
 - Theoretical structural analysis of the existing bridges and its make.
 - Topography, locations, environmental sensitive areas such as wildlife corridors and surrounding land uses at bridge site.
 - Nature and structure of the soil underneath
 - Other structures in proximity to each bridge
 - Aesthetics of the surrounding area
 - Availability of space for traffic diversion for traffic management during construction
 - Road safety measures to be introduced after provision of proposed bridge
 - Climate resilience and robustness
 - Constructability
 - Time to construct
 - Use of Precast superstructure construction technology
 - River training and other protection works required
 - Social and environmental issues and mitigation measures as identified in the ESIA/ ESMP and related plans such as the biodiversity management plan
 - Road users and pedestrians' expectations

- Other information as needed

Alternative design options should be presented, discussed, and the best option to be finalized based on the consultation and discussion with the DoR. The consultant shall design the bridges following the philosophy of Limit Stated Method of design in accordance with the Nepal Bridge Standard, 2067. In the absence of relevant provisions, the IRC (Indian Roads Congress) standards shall be followed, and where necessary, other recognized international codes may be used. The final report should document the process of identification and assessment/ranking of all alternatives considered related to bridges and justifying the proposed best alternative.

B.2.4 Additional Specification: Design Characteristics and Expected Surveys

a. Climate Resilient and Inclusive Design

Given extreme climate and weather uncertainties in Nepal, the Consultant shall consider climate and weather resilience in all aspects of the detailed design, and especially in bridge and drainage design. At a minimum, consider: i) innovative bio-engineering and nature-based solutions where possible, ii) scour protection at all substructure units and streambanks adjacent to abutments beyond that which is normally required by standard, iii) river training works, iv) additional freeboard to account for hydrologic and design flow uncertainty due to catchment area conditions and climate change, v) design bridges, culverts, and approaches to withstand overtopping, vi) ensuring that all drainage structures are designed to be self-cleaning to the extent possible, and vii) oversizing large culverts to provide an additional factor of safety and potential wildlife crossing, viii) additional wildlife crossing such as underpass and overpass and ix) adopt preventative measures in design including public awareness program to avoid public misuse of bridges underneath through depositing market garbage / toileting at bearing platform in bridge abutment head particularly on bridges which are close to urban locations. The Consultant is required to add these or similar recommendations in the report accordingly.

Inclusive design (also called universal design) makes places usable by everyone, regardless of age, ability and circumstance. It is based on the simple principle that designing for the widest range of people creates better designs and benefits everyone. The road and bridge detailed design should ensure that the proposed infrastructure is more inclusive and amenable, particularly to pedestrians and cyclists.

b. Design of Road

Design of Road shall include the following:

- i. Design of the vertical and horizontal alignment for design speeds appropriate as per NRS 2070 and subsequent revision if any.

- ii. Design of highway cross-section. Drawings shall include proposed vs. existing cross sections every 20m.
- iii. Based on the data collected from reconnaissance and topographic surveys, the sections with geometric deficiencies, if any, should be identified and suitable measures for improvement should be suggested for implementation.
- iv. The data on accident statistics should be compiled and reported showing accident type and frequency so that black spots are identified along the project road section. The possible causes of accidents should be investigated into and suitable cost-effective remedial measures suggested for implementation.
- v. Inclusion of 2 x additional ducts at signalized intersection crossings to allow for the installation of services such as fiber optical telecommunication lines in the future.
- vi. Design of cut and fill slopes.
- vii. Structural design of retaining structures (Gabion, Masonry, Plum concrete, etc.).
- viii. Structural design of all RCC structures (including of bridges, grade separated interchanges and underpasses).
- ix. Design of advanced slope protection measures, bio-engineering and green road, followed by rigorous geotechnical and slope stability analysis, wherever applicable.
- x. Service lanes along settlement areas and bus bays.
- xi. Identification and design of road crossings for pedestrians and Vehicles from one side of road to another side.
- xii. Identification and design of wildlife passes/crossings.
- xiii. Identification of roadside service area and its design like bus lay by, weighing stations etc.
- xiv. Production of design drawings (A0 size or appropriate) showing plan in 1:1000 scale, Longitudinal profile in 1000H to 200 or 100V scale, cross-sections at 20 m interval in 1:200 or 1:100 scale
- xv. The design team shall present and demonstrate the compatibility of the design to the DCID team on-site prior to final approval.

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.

c. Design of Pavement

While designing the pavements, the Consultant shall:

- i. Design axle load as per NRS 2070.
- ii. Design shall consider the AADT data which needs to be collected by the Consultant at the particular junction/road sections, direct traffic counting at critical junctions.
- iii. Design of pavement on the bridges and approach roads.

The pavement design task shall also cover working out the maintenance and strengthening requirements and periodicity and timing of such treatments.

d. Design of Drainage Structures

While designing the drainage structures, the Consultant shall use the data collected during the hydrological survey and road safety audit, and prepare the following:

- i. Design of the appropriate surface and sub-surface drainage system;
- ii. Design of the appropriate cross-drainage structures;
- 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/rainwater inlets/manholes to take storm water safely to the nearby natural stream;
- vi. Maximize the use of the existing structures.
- vii. Retrofit safety measures in existing culverts while upgrading to 4 lane.

The Consultant shall also prepare drainage layouts on a plan scale of 1:1000, showing all drainage structures and contours of road surface and surrounding landscape.

e. Design of Bridges

- i. Based on the collected information and results of the discussions mentioned above, the Consultant shall design the bridges following the standard codes of practice, norms and guidelines acceptable to the DoR. 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 aspects (including wildlife habitat and behavior) shall be submitted to the client with recommendation of best alternate for each and every bridge.

- ii. The Consultant shall conduct a thorough condition assessment of existing Bridges as specified in separate heading in this TOR, to assess the need for strengthening/rehabilitation of existing bridges or for bridge replacement/new construction. Then, the Consultant shall study the possibility of construction of the following alternatives:
 - (a) Rehabilitation of existing bridge and provide another 2-lane bridge beside the existing bridge with footpath on outer side.
 - (b) Singular 4-lane bridge with footpath on either side.
 - (c) Singular two-lane bridge on either side of the existing bridge with footpaths on outer sides.
 - (d) Two separate singular two-lane bridges with footpaths on outer sides.
- iii. Each option above to be presented with detailed cost benefit analysis and a report to Client for approval.
- iv. 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 or 4 lanes (depending upon the width of the road) with footpath. The Consultant 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.
- v. Utilize hydraulic modeling software (e.g., HEC-RAS, various 2D modeling solutions) to inform design and to analyze scour potential at and near bridge substructure units (for example abutments, piers, and bents) given climate risks and include climate resilient scour mitigation measures in design. Develop a cohesive strategy for the movement or restriction of movement of water underneath the roadway embankment, in accordance with DOR standards and international best practices, and incorporate into design.
- vi. 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.
- vii. All activities related to field studies, design and documentation shall be done as per the latest guidelines, standard codes of practice (Nepal Bridge Standards 2067) and norms. The Consultant shall work in close coordination with the Bridge Branch of Department of Roads in every step of design of bridges.
- viii. Each design shall be site specific and comprehensive comprising design drawings for all components of a bridge including designs for all ancillary activities such as false works, road safety measures, approach roads, river protection works, and slope treatment works

including bio-engineering works. The DoR design review and check team shall confirm the appropriateness of each ancillary provisions and their design standards.

- ix. The design Consultant is required to liaise and cooperate in a proactive manner with the DoR Bridge Branch and Bridge Design Checking Expert (as available), supplying design information for checking in accordance with an agreed schedule. It is the design Consultant's responsibility to resolve all technical issues raised by the checking expert (as available) and DoR relating to the design in order to get the approval from DoR.
- x. The design team shall present and demonstrate the compatibility of the design to the DCID team on-site prior to final approval..

f. Topographical survey and mapping

The topographical survey shall collect adequate data to show the following details in the subsequent topographical map:

- i. Topography survey with details such as: trees & forest, water bodies, wildlife habitat and movement corridors, sacred/ cultural & religious sites (including natural features with cultural values, e.g., trees, cliffs, etc.), 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 right of way (RoW) limits (Buildings, Taharas, shops etc.). Collect a copy of the cadastral maps of both the sections and determine the sections where a 50m right of way (RoW) may be disputed.
- iii. Details of existing cross-drainage structure details (including wildlife crossing if any) 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 riverbank structure details
- iv. Existing power line (electricity transmission line) alignments and elevations (if buried) such as: high-tension poles, low-tension poles, transformers, sub stations, Streetlights poles, underground electrical supply (if any) etc.
- v. Existing telecommunication alignments and elevations (if buried) 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 both sides of road within the RoW

- viii. Existing buildings and structures details such as: religious shrines, tangible cultural heritage, community building governmental building, and residential building, type of foundation and tentative depth of foundation of the building
- ix. Existing or potential flood prone zones/ spots, low laying areas and riverbank cutting areas
- x. Survey and Production of a map of a minimum 100 m wide road corridor in 1:1000 scale and with 0.20m contour interval and clearly showing the centerline of existing roads and all features. The Consultant may consider and propose wider bandwidth or additional survey areas, if necessary, for design.
- xi. 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 benchmarks at a distance of every 300m along the road and on both sides of the riverbanks in case of bridges.
- xii. While conducting the topographical survey for bridge design, the survey area should cover a minimum distance of 500m upstream, 200m downstream and 200m from the riverbanks on either side of the river at the proposed bridge site or more if necessary, for analysis and design. In case of the topographical survey of the bridge site, the topographic map should show the following:
 - (a) Contours at 0.2 m intervals;
 - (b) Flood lines on either side of the river in the entire area surveyed;
 - (c) Both banks of the river;
 - (d) River cross section at 25 m intervals, or less if required for modeling, analysis, and/or design; one cross section along the proposed bridge axis showing cross profile of 1m interval using suitable method;
 - (e) Details of government and/or public establishments on the riverbanks, details of existing river training works (if any);
 - (f) Traverse lines, benchmarks reference lines and/or points with respect to which the present topo map is prepared;
 - (g) The angle and direction of skew, if the bridge is proposed to be aligned skew;
 - (h) The foundation type and zone of influence of the existing foundation of the bridge or any other structures adjacent to the proposed bridge site;
 - (i) Other information relevant to design, construction and/or maintenance of the bridge.

g. Hydrological Survey and Analysis

- i. For determination of all design data the Consultant shall carry out a detailed hydrological survey and study of the river and bridge sites, which shall include the following:
 - (a) Catchment area of the river up to bridge site;
 - (b) Nature, size and quantities of debris carried by the river;
 - (c) Intensity, duration and distribution of rain in the catchment;
 - (d) Existing bridge or other hydraulic structures across the river in the vicinity of the proposed bridge site with their details as much as possible;
 - (e) 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;
 - (f) Cross sections covering 100m on either side. Beyond flood lines of the river at proposed bridge site, at about 500m. u/s and about 200m 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.);
 - (g) 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;
 - (h) Maximum discharge calculated by established formulas with different return periods and the peak discharge observed over a period of 100 years;
 - (i) Velocity and depth of flow at the time of survey;
 - (j) Shifting of the river in the past at proposed bridge site and in its vicinity;
 - (k) River-bed degradation or aggradation (covering 500 m upstream and 500 m downstream);
 - (l) Use of river as migration corridor of wildlife and fisheries;
 - (m) Other information required for river control, design, construction and maintenance of the bridge.
- ii. The hydrological survey shall collect secondary data, preferably from the governmental sources, to determine the following:
 - (a) Unit hydrograph for the catchment of River for bridge construction
 - (b) Size of the opening and location of cross drainage structure
 - (c) Minimize modification to the natural drainage pattern
- iii. 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:

- (a) Design discharge
 - (b) Scour depth, Maximum Scour depth
 - (c) Linear waterway needed to be provided
 - (d) Anticipated soil condition for foundation
 - (e) The most feasible proposed bridge site
 - (f) River- training & approach roads
 - (g) Type of proposed foundation, substructure and superstructure
- iv. 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. The hydrological/ hydraulic adequacy of the existing bridges shall also be assessed in accordance with current standards. If some existing bridges are seriously inadequate on meeting the standards, mitigation measures against disasters shall be proposed.

h. Geotechnical Investigation

- i. For the pavement design, bridge designs, structures and buildings, the following geotechnical tests should be performed as per site requirement:
- (a) Determine the sub-soil condition through pitting (1m x 1m x 3m) and Dynamic Cone Penetration (DCP) tests at 2 locations each 100m of the road alignment and adding necessary locations to determine.
 - in-situ density and moisture content, Characterization (grain size and Atterberg limits) and field CBR using DCP at each test pit,
 - Laboratory moisture-density characteristics (modified AASHTO compaction) and Laboratory CBR as well as swelling test
 - (b) Determine the sub-soil condition through 2m deep pitting and DCP test at each 25 m interval where a retaining wall of height more than 3 m is required.
 - (c) Determine strength and bearing capacity of the existing pavement through falling-head deflectometer test at 500m interval.
 - (d) Conduct moisture-density characteristics (modified AASHTO compaction) and Laboratory CBR.
 - (e) Determine the stability of the cut slopes using appropriate stability analysis or through study, field surveys and investigation of materials at site.
 - (f) Conduct other tests as required by the geological, geotechnical survey and study.
 - (g) Benkelman Beam test for existing pavement evaluation (if necessary).
- ii. 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 practicable, boreholes shall be drilled at the planned foundation location of each abutment and pier. Generally, the tests listed in Table 2 are 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 25 m, whichever is maximum
2	Granular soil (gravels, boulders)	dimension of the foundation footing, or 20 m, whichever is maximum
3	Rocks (soft or hard)	Not exceeding 8 m and a minimum 5 m

The above-mentioned depths are indicative. The Consultant shall decide the actual required depth of soil investigation according to the field conditions 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 boring, if there is any change of soil strata, the number of samples 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 Consultant shall take site photographs, video or other documentation as appropriate for all site investigation, surveys and studies.

i. Seismological Study

The Consultant shall collect and refer to the available data regarding the seismic records of the area. The Consultant shall conduct seismic vulnerability analysis 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.

j. Material Availability Survey

- i. The Consultant shall conduct the material availability survey and study for subgrade, sand, gravel, boulders, timber, etc., with their engineering properties, quantities and lead up to the road works site and bridge site. The quarry site of materials with their available quantities should be shown on a sketch plan with reference to bridge /road construction site. 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:
 - (a) Suitable quarry site for subgrade, boulder, sub-base/base/pavement aggregates, concrete aggregates, sand, fill materials
 - (b) Materials to be transported from elsewhere
 - (c) Materials to be imported from outside Nepal, their source and route of transport
 - (d) Source of water for construction, location of boring if groundwater water to be used
- ii. The Consultants will assess local capacity to produce adequate material for the different phases of the construction. Based on this assessment, they will make recommendations to use existing

quarries and/or to open new quarries. Procedures associated with the opening of new quarries should be detailed, when necessary, in coordination with the ESIA consultant.

- iii. The Consultant shall prepare mass haul diagram for haulage purposes giving quarry charts indicating the location of suggested/selected borrow areas, quarries, and the respective estimated quantities.

k. Traffic Study and Analysis, Axle Load Survey

For the design purpose, the traffic study at the critical points including in all urban and rural sections and intersections shall be made. Conduct traffic counts in strategic locations (e.g., adjacent to major junctions) along the Section, validate these counts against DoR data and the limited count data presented in the feasibility study report, adjust the forecast analysis from the feasibility study as appropriate, and update feasibility study recommendations, as appropriate, during detail design. 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, and other factors as appropriate. Consider peak hour volumes, peak hour factors, seasonal adjustment factors, passenger vehicle equivalent conversions, and other adjustments as appropriate to recommend widening scenarios.

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. 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. 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.

Conduct turns movement volume counts at all major junctions and selected minor junctions with substantial traffic volume, as appropriate to inform design options and to incorporate into design. Junction survey information shall be collected and thoroughly analyzed prior to starting work on the preliminary and detailed design. This is necessary to adequately inform access control decisions, which need to be made prior to the start of detailed design in order to avoid rework and design schedule delays.

In-person surveys, community engagement, and coordination with E&S Consultant and others as appropriate to propose pedestrian crossing and other ancillary feature locations.

Based upon the above-mentioned studies and investigations, the Consultant shall make the best use of their technical know-how and professional skill to arrive at conclusion and recommend the most cost-effective design parameters. The Consultant shall discuss with comparative study in detail all possible options and shall recommend the most appropriate option.

l. Condition Assessment for Bridges, Culverts and Structures

The Consultant shall thoroughly inspect the existing Bridges, Culverts (including wildlife crossing if any) and structures including collection of basic data of structures, condition inventory with video and still photographic support. Alongside visual inspection, the Consultant shall carry out detailed inspection with the aid of different advanced inspection tools and instruments such as Rebound Hammer, Inspection Hammer, Crack Scale etc. The inspection will also include under-bridge inspection for super-structure. The consultant must verify existing inventory data BMS for accuracy and update if required and must input all condition data and rate them as per the Inspection Guideline 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 Consultant. If the bridge is identified to be in a distressed condition based upon the visual condition survey, supplementary testing shall be carried out as per DOR Guidelines for Inspection and Maintenance of Bridges, Vol.-I and Vol.-II, IRC-SP:35: Guidelines for Inspection and Maintenance of Bridges as required. Selection of tests may be made based on the specific requirements of the structure. The Consultant shall assess the maintenance intervention (matching with the Maintenance Classification and definition in practice in the DoR) and the report shall include all necessary information regarding short, medium- and long-term works, work plan with the details regarding quantity, necessary specification, cost etc. The consultant shall use the Standard Condition Assessment format.

m. Inventory survey of Road and Roadside structures

The Consultant 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, roadside barriers, and other details.

n. Design of Major Intersections

The Consultant shall conduct all traffic volume surveys, origin-destination surveys, and other surveys as necessary to inform the design of Major Intersections. The Consultant shall utilize one or more state of the art traffic modeling software packages (such as VISSIM, Synchro, SimTraffic, or others) to model the existing condition and proposed options using the traffic volumes and turn movements forecasted

at different points in time. Prepare and present short traffic simulation videos depicting options for each junction to the DOR.

o. Road Safety Audit, Traffic Safety Features, Road Furniture and Road Markings

- i. The Consultant shall conduct a complete road safety audit and analysis, and design suitable traffic safety features and road furniture including traffic signals, signs, markings, overhead sign boards, crash barriers, delineators etc. The locations of these features shall be given in the reports and also shown in the drawings. The road safety audit shall consider forecasted crash numbers and severities, the cumulative economic costs of crashes without mitigation, and the costs and benefits of mitigations measures.
- ii. DPR shall undergo the exercise of Road Safety Audit through the Road Safety Auditor (separate from design team) and recommendations mentioned be incorporated.
- iii. All roadside signs and other furniture placed or retained within the proposed roadway clear zone shall be crashworthy or protected by roadside barrier.
- iv. Ensure that all auxiliary lanes (including turn lanes, ramp acceleration/deceleration lanes, and others) have adequate deceleration/acceleration length, storage length, and taper length in the design year to mitigate the risks of rear-end collisions and traffic delays.
- v. Based on proposed site conditions, the Consultant shall conduct a thorough roadside barrier warranting process considering whether the hazard is within the clear zone, hazard severity, roadway geometrics, and an economic analysis.
- vi. The Consultant shall i) conduct a systematic and thorough safety analysis presenting existing deficiencies, ii) set road safety performance improvement goals for the designer to include during detailed design, iii) collect, analyze, forecast and consider vehicle crash/fatality history in developing the list of road safety mitigations.

p. Weighing Station, Parking Areas and Rest Areas

The Consultant shall select suitable sites for weighing stations, parking areas and rest areas and prepare suitable separate designs in this regard. The common facilities like petrol pump, first-aid medical facilities, police office, restaurant, vehicle parking etc. should be included in the general layout for planning.

The Consultant should take into consideration the provisions for persons with disabilities in way side amenity centers /rest areas and provide ramp facilities, exit /entrance door with minimum clear opening of 900 mm and special toilet facilities for use of handicapped persons.

q. Wildlife Survey

The Consultant will conduct a wildlife study for the areas under Protected Area of East West Highway including areas of Community Forest (CF) during the Design stage to determine the location, design and numbers of underpasses that will be required to be constructed. The study will involve suitable methods such as field surveys, transect survey, public & stakeholder consultations, camera trapping (making 2x2 km² grid), habitat mapping, GIS based analysis etc. to establish the biodiversity baseline conditions (locations and number of wildlife crossings, wildlife species crossing the road and their seasonal behavior, number of wildlife–vehicle collisions etc.). This will be done in close consultation with Banke National Park, Bardiya National Park and other local forestry officials and Forestry User Groups. The Consultant with Wildlife Expert shall coordinate with the Environmental Specialist and include his/her findings in the ESIA, BMP, EMP and EIA Reports.

r. Utility shifting proposal and estimates

i. Identify type and location of all existing utilities within the proposed ROW

The Consultant will review information available with all utilities agencies in the region, study available maps/plans, coordinate/ consult with DOR, Nepal Electricity Authority, Nepal Telecommunication Cooperation (NTC) and other necessary bodies, locals and municipal bodies to ascertain the presence and location of utilities and future plan, including but not limited to water-mains, telephone, electricity and fiber-optic installations in and around the project road.

ii. Plan for utilities in future road design

The Consultant is required to identify utilities that will require shifting to enable construction of the proposed project road.

The Consultant shall incorporate space required for elevated and under-ground utilities corridors and utilities crossings as required for existing and future utilities in consultation with user departments.

iii. Develop a utilities relocation plan

The Consultant is required to develop and submit a utilities relocation plan in consultation with DOR and user departments clearly identifying current utilities and suggested relocations along with crossings as required.

The Consultant shall plan, and conduct discussions, consultations and joint site visits required for the planning of utilities shifting and the development of required drawings and proposals. The consultant shall coordinate and collect information from all utility agencies (like NEA, Nepal Telecom etc.) for preparing estimates for utility relocation.

The Consultant shall prepare all necessary details including costing, documents and suggested relocation plan to be submitted to user department and agreed with the user department for facilitating the upgradation of the road.

s. Procurement Assistance

Procurement of works shall be carried out in accordance with WB's Procurement Procedure or as agreed with DoR. The Consultant shall prepare bidding documents, necessary standard/special specifications, contract packaging and any other appropriate assistance. Multiple civil works bid packages are anticipated.

t. Capacity Development

The consulting services shall include organizing in-house, national and overseas training for capacity development of DoR personnel in different disciplines. The in-house and national trainings shall be conducted for the following discipline based on the final design of the Priority Sub-Section I, using final design of Priority sub-section as an example:

1. Highway Pavement Design
2. Procurement of Road Construction Works under Design and Build (D&B) method of Procurement including preparation of Bidding Document with ITB, the Employer's Requirement and Specifications, Schedule of Activities and Schedule of Payments, Conditions of Contract, Special Provisions etc
3. Design of Bridges (Limit state design of Superstructure, Substructure and Foundation)
4. and/or any other relevant subject

All the trainings shall be conducted by each international key Expert on their respective topic. The consultant shall also conduct capacity development in-house workshops (Seven numbers) for dissemination of the information and the progress of the activities of the consultant's services.

The Consultant shall propose the capacity development component in their technical proposal and include the cost in their financial proposal.

u. Miscellaneous Activities/Studies/Investigations

(i) Alternative Procurement Options for Future Investment

The consultant engaged under this service contract is also required to prepare Standard Bidding Document for Design and Build (D&B) of Upgradation/Improvement, Reconstruction/Rehabilitation of the existing highways as follows

1. Standard Bidding Document for Design and Build (D&B) of Upgradation and Improvement to four lanes standard from existing two lanes, under WB financing, including preparation of Employer's Requirements, and other documents.
2. Standard Bidding Document for Design and Build (D&B) of Reconstruction/Rehabilitation of Lamahi-Kohalpur Section of E-W Highway to standard two lanes with paved shoulders from existing two lanes under WB financing, including preparation of Employer's Requirements and other documents.

(ii) Notification of Commencement of key activities

The Consultant shall notify the Employer of the commencement time for key activities sufficiently in advance of their actual start, as outlined below:

- Field Survey/Inventory works
- Drilling of Boreholes
- Condition Assessment of the Bridges and other structures
- Design of Road and Bridges

(iii) Other Studies

If not covered by aforesaid, the Consultant 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.

B.3 Part III - Environment Assessment for Upgradation Works for the priority road sub-sections, as mentioned in Part II.

The main objectives of the consulting services under Part III are to conduct Environmental and Social Assessment of priority road Sub-Sections I and II (as mentioned in A.(0)Background) of Mahendra Highway and associated bridges as per Government of Nepal's rules and regulation EPA, 2076 and EPR, 2077. The consultant is also responsible for preparing Environment and Social Impact Assessment Study (ESIA) as per the World Bank ESF requirements.

B.3.1 Scope of Services for ESIA

The ESIA will be undertaken in compliance with ESS1 requirements and other relevant ESSs, as follows:

ESS1: Assessment and Management of Environmental and Social Risks and Impacts

The ESIA will be prepared to assess all risks and impacts related to relevant standards (ESS2, ESS3, ESS4, ESS5, ESS6, ESS7, ESS8), including stakeholder engagement and assessment and management of environmental and social risks and impacts of contractors. The ESIA will also identify and collect baseline data on disadvantaged and vulnerable groups in the project area and assess project impacts on them and propose management measures to address impacts.

A cumulative impact assessment will also be conducted as part of the ESIA, including BMP, CHA and assessment of the potential cumulative impacts of other past, current and future activities and development in the project area of influence and following the IFC Good Practice Hand Book on Cumulative Impact Assessment (CIA).

The ESIA will make use of the World Bank's findings on institutional capacity assessment of the DoR in terms environment, social and health & safety staffing and capacity building. The results of these studies will be integrated into the ESIA.

The ESIA will collect relevant baseline information on the physical, biological, chemical, socio-economic and cultural characteristic of the project area of influence of the selected priority sub-section. These include but not limited to topography, land uses, geology, terrestrial and aquatic flora and fauna and biodiversity, habitats (critical, natural, modified), air and water quality, socio-economic, livelihood and household data, identify and assess trends of vulnerability among vulnerable and disadvantaged groups, land acquisition and involuntary resettlement.

The ESIA will follow the indicative outline below and shall specifically address the requirements under the new ESF, as follows:

ESS2: Labor and Working Conditions

The ESIA will assess labor risks and working conditions on different types of project workers as per ESS2. The assessment will include risk from project activities and key labor risks such as hazardous work, child labor and forced labor, migrant or seasonal workers, discrimination against women, Gender Based Violence, assess potential for discrimination against vulnerable groups in terms of access to jobs and project-related opportunities, etc., labor influx, occupational health and safety, possible accidents and incidents on site, emergencies, among others.

The ESIA will identify project workers (direct workers, contracted workers, primary supply workers, community workers) and develop measures consistent with the written Labor Management Procedures (LMP) developed for the project, which set out the way in which project workers will be managed, in accordance with the requirements of national law and this ESS. The procedures will address the way in which this ESS will apply to different categories of project workers including direct workers and the

way in which the Borrower will require third parties to manage their workers. A standalone GRM for direct workers and contracted workers should be developed based on the LMP. This GRM is not the same as the Project level GRM.

ESS3: Resource Efficiency and Pollution Prevention and Management

The ESIA needs to assess the risks and impacts related to ESS3, including identification on use of resource efficient technologies and techniques during construction and operation. The management of solid and liquid wastes, including the safe disposal of hazardous materials, is an essential consideration under ESS3. In addition to that, calculation of greenhouse gas emissions from the construction and operation of the selected priority sub-section will be calculated. The assessment of construction material extraction will also be included in the assessment and potential construction material sources will be identified and assessed for E&S risks and impacts. In addition, the impact analysis and measures will need to ensure that key risks and impacts are addressed and managed.

ESS4: Community Health and Safety

Consistent with the requirements of the ESS4, the ESIA will assess the potential risks and impacts of the project in relation to traffic and road safety, community exposure to STDs/AIDs, sexual exploitation and Abuse and sexual harassment from project influx, and exposure to hazards that may be extended by excavations, pits, and trenches. The analysis of these health and safety issues must take account of both project construction and operation activities within the main corridor and ancillary facilities such as borrow pits, quarry sites, tipping points/spoils disposal areas, and workers' camps. Landslides and slope collapse are common in Nepal. As such the Consultant – in consultation with Design Consultants – will assess the potential for these hazards at the critical sections of the road and recommend engineering measures for minimizing or eliminating such risks during construction and operation of the road. Where the construction activities open up wildlife inhabited areas, the ESIA will assess risks and propose measures to minimize wildlife-human conflicts. The ESMP resulting from the ESIA will include an Emergency Preparedness and Response Plan (ERP).

ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement

The ESIA needs to assess the risks and impacts related to land acquisition as well as physical and economic displacement. Based on the RF for the project, the assessment will address issues related to land acquisition for project purposes, estimated amount of land to be acquired, the numbers of PAPs that may be displaced (either physical and/or economic and restriction of access), typologies of PAPs based on the extent of the displacement impacts, entitlements, livelihood restoration, financial assistance and skills training. An indicative list of resettlement benefits will be indicated in the ESMP and then detailed out in the RAP.

ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

The ESIA will collect baseline information on biodiversity, including identification and assessment of any critical habitats, natural habitats and modified habitats in accordance with ESS6 within the project area of influence (50-m ROW, 300-m direct impact area and 2-km indirect impact area). It will identify any sensitive areas such as wildlife migration corridor/pathway, bat roosting areas, etc. within the project area of influence. The critical habitat assessment will follow the ESS6 criteria, IFC PS6 criteria and IFC PS6 thresholds and a detailed methodology for the assessment will be clearly spelled out and agreed with the World Bank before carrying out the actual assessment.

The ESIA should demonstrate the application of mitigation hierarchy (avoidance, reduction/minimization, mitigation, and compensation/offset) in terms of the final design and alignment options, among others, of the proposed road.

The ESIA should make clear that there is a protected area present along the project corridor, the presence of Critically Endangered, Endangered, Vulnerable and Threatened Species, natural and critical habitats for which the project needs to demonstrate that the project is not causing net loss to natural habitats and is achieving net gain for critical habitats that could be adversely affected by the project. The requirements of ESS6 for natural habitats and critical habitats will need to be assessed and met, including analysis of various alternatives and measures to achieve no net loss on natural habitats and net gain on critical habitats.

A detailed and stand-alone Biodiversity Management Plan (BMP) applying the mitigation hierarchy will accompany the ESMP. The BMP will include specific measures and monitoring parameters for critically endangered, endangered, vulnerable and threatened species and other species and ecosystems that will be affected by the project to achieve no net loss of natural habitats and achieve net gain of critical habitats. If offset is required based on the assessment and application of mitigation hierarchy, this will be included in the BMP as a last resort. Critical Habitat Assessment (CHA) is essential for areas where the roads passes from the Protected Areas.

The assessment and management plan, including specific measures for wildlife, will apply the updated 2019 version of the ADB Guidelines on Design of Roads in Biodiversity Rich Areas of Asia and the draft Nepal Guidelines for Construction of Wildlife Friendly Linear Infrastructure and other Good International Industry Practices.

ESS7: Indigenous Peoples

Based on the feasibility and paragraph 8 of ESS7, the ESIA should identify the presence of indigenous people (IPs) with the project's Direct Area of Influence; collect baseline information on such populations; assess potential project impacts on such them; and provide recommendations for mitigating impacts and extending project benefits to such IPs. Analysis of risks & impacts needed with specific

reference, as a mitigation measure, to the Indigenous Peoples Development Plan. The ESIA should assess the requirements of FPIC and propose procedures and process to be followed to obtain FPIC, if required. IPDP is required to meet the requirements of the new WB ESF and the IPPF for the project.

ESS8: Cultural Heritage

The cultural heritage baseline survey will be part of the ESIA and project impacts on CH will also be covered by the ESIA. Accordingly, the ESMP will apply the mitigation hierarchy to manage impacts on CH. In addition, chance find procedures will also be included in the ESMP for inclusion in the bidding documents and contractors' contract.

ESS10: Stakeholder Engagement and Information Disclosure

A Stakeholder Engagement Plan (SEP) developed for the overall project will be used to map out stakeholders and engage them all throughout the life of the project. The objectives of the Stakeholder Engagement Plan (SEP) is to establish a systematic approach to stakeholder engagement that will help the implementing entity identify key stakeholders – project affected parties and other interested parties– and build and maintain constructive relationships with them, in particular the project-affected parties. The SEP will assess the level of stakeholder interest and support for the project, enable stakeholder views to be taken into account in project design, and environmental and social performance, promote and provide means for inclusive engagement throughout the project life-cycle, ensure that appropriate project information is disclosed to stakeholders in a timely, understandable, accessible, and appropriate manner and format, provide citizens with accessible and Gender Equality and Social Inclusion(GESI) inclusive means to raise issues and grievances and enable the project implementing entity to respond to and manage such grievances.

B.3.2 Scope of Services for IEE/EIA Study

a) Social Assessment

The consultants will carry out the following tasks but are not limited to:

- i. Conduct 20% poverty & social assessment taking into account socio-economic 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 socio-economic 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.
- 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, SEA/SH 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. Prepare GBV action Plan.
- 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.
- viii. Submit a draft final Poverty and Social Analysis (PSA) report to DOR for review and comments. Incorporate comments and finalize the PSA accordingly.

b) Resettlement and Indigenous People Assessment

The consultants will carry out Resettlement and Indigenous People Planning of the project roads and bridges in accordance with World Bank ESF requirements 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 cadastral and census survey and assessment of possible land acquisition/resettlement impacts for the candidate road alignments in accordance with WB ESF requirements. 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 WB ESF document. 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. Prepare a resettlement action plan (RAP) as necessary acceptable to the Government in compliance with the WB's Safeguard Policy document ESF, and Government related acts and policies.
- iv. 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.
- v. 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.
- vi. 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.
- vii. 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.
- viii. 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.
- ix. Assess the capacity of the Government in implementing the proposed RAP, recommend improvements and actions required before land acquisition, and proposed necessary training to enable the DOR and the Government to implement the RAP 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 RAP and IPP implementation (if required), and (iii) recruit consultants for external monitoring and evaluation.
- x. 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.
- xi. Collect digital cadastral sheets and 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.

c) Environmental Assessment

The consultants will carry out Environmental Assessment (EA) of the project roads and bridges in accordance with Government's acts, regulations and policies. The EA can require Environmental Impact

Assessments (EIA) or Initial Environmental Examination s(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), 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 listed in 'Annex 3' of EPR, 2077, draft terms of reference for the EIA study and scoping, to be submitted to the Ministry concerned for approval. After the approval of the TOR and scoping 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 listed in 'Annex 2' of EPR, 2077, undertake IEE study and prepare an IEE report including an environment management plan (EMP) in accordance with EPR, 2077;
- iv. Carry out a climate risk and vulnerability assessment (CRVA) 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. Ensure that the IEE/EIA study be carried out by taking into account Government's EA guidelines, and that the EI/IEEA report and its summary be prepared in accordance with the EPR, 2077. 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;
- vi. 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;
- vii. Recommend occupational and community health and safety measures, and proper Grievance Redress Mechanism for the affected people in the course of the project cycle;
- viii. Finalize EIA or IEE report including EMPs and their summaries, as required. Prior to finalization, draft reports should be submitted to DOR for review.
- ix. Environmental Assessment (EA) report should perform census study in coordination with respective Divisional Forest Office (DFO) and concerned National Parks and Wildlife reserves, 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.

- x. 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.
- xi. 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. The counting of trees shall be conducted accurately to avoid chances of errors in estimate of trees and time required for site verification during the tree-cutting approval process.
- xii. 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.
- xiii. There should have coherency in the design report and the EA report.
- xiv. Environmental Management Plan should be precise and applicable as per Nepalese standards/norms.

d) Noise, Air pollution and Water Quality Parameters

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 DOR and WB. 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 DoR. and WB.

e) Ecological / Biological Survey

The Wildlife Expert will carry out wildlife survey based on available secondary data as well as primary data to be collected. Wildlife expert should recommend the location and number of plots/transects where primary data collection is undertaken based on secondary data review and field visit during scoping phase. The ecologist should undertake flora survey to identify the plant species (other than trees to be identified under b). ix. above) in the survey area. Critical habitat screening as per WB ESS 5 should be also carried out to determine the presence of critical habitat in the study area. Based on the ecological survey and critical habitat screening and/or assessment, the wildlife expert should recommend the 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/IEE Reports.

C. Minimum and Details Qualifying Criteria

I) Minimum Qualification Requirement of Consulting Firm

S.N.	Minimum qualification Criteria	Compliance	Status
1	Corporate Registration	Yes/No	Pass/Fail
2	Year of Standing min. 10 year (Each member in case of JV)	Yes/No	Pass/Fail
3	JV Agreement in case of Firms in JV	Yes/No	Pass/Fail
4	Power of attorney	Yes/No	Pass/Fail
5	Adherence to code of Ethics and Anti Corruption Policy	Yes/No	Pass/Fail
6	Shall have design experience as follows: Single Entity or Lead Partner (in case of JV): (i) At least one experience of detailed design of four or more lanes road having length ≥ 75 Km OR At least one experience of detailed design of four or more lanes road having consulting fee of at least 1.4 million USD, and (ii) Detailed design of at least one multi-span bridge having span ≥ 40 m or Length ≥ 120m. Other JV Partners: (i) At least one experience of detailed design of multi-lane road having length ≥ 30 Km.	Yes/No	Pass/Fail
Note 1: The above information must be supported with copies of respective certificates.			
Note 2: Consultants are allowed to form a joint venture with each other to enhance their qualification.			
Note 3: Maximum no of partner in a JV firm: Three.			
Note 4: A consultant shall not submit more than one REOI, either individually or as joint venture.			
Note 5: The EOI of consulting Firm will be rejected if any Firm associated in JV has been debarred by the World Bank.			

The consultant (firm) must have sufficient qualification and experience to carry out the assignment.

II) Details of the Qualification Requirement for short listing

Details of Qualifying Criteria	
Description of Criteria	Marks out of 100
A) Core Business of the firm	10
B) General Experience of Firm	15
C) Relevant Experience to the assignment	70
D) Technical, Managerial and Organizational capability of the Firm	5
A) Core Business of the firm	Maximum 10 Marks
Active Years in consulting service	As consultant
a. Number of active years in consulting services	≤10= 0 marks
b. Number of active years in consulting services	≥20= 10 marks
B) General Experience of Firm	Maximum 15 Marks
Work Experience	As consultant
a. Number of projects of general experience in civil engineering: Consulting amount greater than US\$ 1.4 million	1.5 marks for each job
C) Relevant Experience to the assignment	Maximum 70 Marks
Work Experience	As consultant
a. Number of project of i) detailed design of four or more lanes road having length ≥ 75 Km or ii) detailed design of four or more lanes road having consulting fee of at least 1.4 million USD	5.0 marks for each job, Maximum 50 marks
b. Detailed design of multiple span bridge having span ≥ 40 m.	2.0 marks for each job, Maximum 10 marks
c. Experience of the firm in Multilateral Bank financed projects in the road transport sector: Number of projects in the road transport sector (assignment value less than US\$ 1.4 million will not be considered)	2.0 marks for each job, Maximum 10 marks
D) Technical, Managerial and Organizational capability of the Firm	Maximum 5 Marks
Technical capability- Professional staff in the organization relevant to the assignment	
a. Number of Full timer Professional Staffs	≤10= 0 marks
b. Number of Full timer Professional Staffs	≥50= 5 marks

Note 6: For criteria A and criteria D, in between marks will be given on prorata basis.
Note 7: Previous experience work as a sub consultant will not be considered for evaluation.
Note 8: Completed or substantially completed projects will be considered for evaluation.
Note 9: The completed/substantially completed projects within last 10 (ten) years counted from REOI submission deadline shall be considered for evaluation.
Note 10: Minimum Pass Marks to obtain as a whole is 70%.
Note 11: If more than one Consultant secures equal score, preference will be given to the Consultant with more experience in the criteria C.a.. Similarly, the second preference will be given to C.c. criteria.

D. Team Composition and Qualification Requirements for Professional Staff/ Experts

International firms are encouraged to form association with national Consultants. Estimated 28.4 person-months of professional experts with international experience, 283.8 person-months of other professional experts are estimated to carry out the assignment. However, the firm should assess their own estimates of professional input requirements. Tentative person-month detail required for assignment is provided under Table 4, however, the Consultant is free to assess and propose the required input to complete the scope of services.

Table 4: Staff Input

D.1 PROFESSIONAL EXPERTS WITH INTERNATIONAL EXPERIENCE

Position	Quantity	No. of Person-Months	Total Person Months
Key Experts			
K-1: Team Leader (Highway/ Transportation Engineer)	1	15.4	15.4
K-2: Bridge/ Structural Engineer	1	10	10
K-3: Procurement Specialist	1	3	3
Sub-Total (International Experts Input)			28.4

D.2 NATIONAL KEY AND NON-KEY EXPERTS

Position	Quantity	No. of P-Months	Total Person Months
National Key Experts			
K-4: Highway Engineer	3	10	30
K-5: Bridge/ Structural Engineer	7	14	98
K-6: Geotechnical Engineer	3	14	42
K-7: Hydrologist	3	11	33
K-8: Environmentalist	3	11	33
K-9: Wildlife Expert/ Forest Specialist/ Ecologist	1	4	4
K-10: Procurement Specialist	1	5.5	5.5
National Non-Key Experts			
Social Development Expert/Gender Specialist	1	4	4
Geologist	1	11	11
Material Engineer	1	5	5
Road Safety expert	1	3.7	3.7
Socio-Economist/Transport Economist	1	14.6	14.6
Sub-Total (National Experts Input)			283.8

Notes:

1. The above key staff composition and estimated total professional staff man-month is Client's estimate. The Consultant is advised to assess their own requirement and propose their own staff composition and staff input requirement for efficient performance of their job as per the Terms of Reference. If the proposed consultant's team is found inadequate or not sufficient during the performance of the services, then additional staff shall be provided by the Consultant at their own cost.
2. The Consultant shall avoid replacing any Key Staff to the extent possible. If a replacement becomes necessary due to reasons beyond the Consultant's reasonable control, such as retirement, death, medical incapacity, or similar circumstances, the Consultant shall provide a replacement with qualifications and experience equal to or greater than those of the original Key Staff member
3. The Professional Staff composition and estimated total Professional Staff man month for detail design (Part II) and environment assessment (Part III) has been estimated for detail design of improvement of about 125 km of priority section/s, detail design of construction of about 71 bridges.
4. A Technical Proposal shall be considered unsuitable and shall be rejected for further evaluation if it does not respond to important aspect of TOR.

5. The consultant is required to submit monthly timesheets for all deployed international and national key experts together with the Monthly Progress Report (MPR). Additionally, the consultant shall inform the Employer of the deployment schedule for all key experts providing intermittent inputs.

D-3 Qualification Requirements of Experts

The qualification requirements for the evaluation of key experts and the minimum qualification requirements for other experts are set out in Table below:

KEY EXPERTS

1.	K-1: Team Leader (TL)/ (Highway/ Transportation Engineer) (International Experience) – (1 no.) The Team Leader (TL)/ (Highway/ Transportation Engineer) will take the overall responsibility for the Feasibility Study, Detailed Engineering Design and Environmental Assessment of the project in accordance with the Terms of Reference and also for the conduct and the co-ordination of all professional inputs. S/He will be responsible to the Project Director (PD). S/He will assist and advice the PD, Project Coordination/ Unit (PCU), and Project Team members on all aspects of the Project implementation. S/He will also maintain contact and liaison with the related Project offices, Units of DOR, Federal offices to ensure that the project is implemented in accordance with the Government's / DOR's policies and objectives. The Team Leader will be leading the team of consultant for all the works and required to coordinate for the Parts I, Part II and Part III. TL shall be responsible for overall implementation of Project.	
i.	Educational Qualification	
	Minimum: Bachelor degree in Civil Engineering Preferable: Master Degree in Highway /Transportation /Construction Management/ Engineering Management/ Project Management or related field.	
ii.	Experience	
	Total general Experience	Minimum: 15 years Preferable: 25 years
	Experience in Related Field, Road/Bridge Works	Minimum: 10 years Preferable: 20 years

	Experience in the Proposed Field of Expertise	Requirements: - Shall have international experience of detailed design of two road projects outside the native country as Team Leader/ Project Manager. - Experience of detailed design of two road projects in ICB Contract of size equal or more than US \$20.00 million as Team Leader /Project Manager/ Highway Engineer. - Shall have experience of detailed design of minimum two road projects (minimum 4 lane) of length ≥ 40km. - Shall have experience of feasibility study minimum two road projects (minimum 4 lane) of length ≥ 40km. Note: (Only those projects shall be taken into consideration having experience greater than or equal to one year.)
		Preferable: Experience in a greater number of Projects in above three sub-criteria.
iii.	Language	Communicate fluently in English Language
2.	K-2: Bridge/ Structural Engineer (International Experience) – (1 no.) Bridge/ Structural Engineer with International Experience will have the overall responsibility for the feasibility study and detailed design of the bridges along the alignment including assistance in Environmental and Social Study.	
i.	Educational Qualification	
	Minimum: Master's Degree in Bridge Engineering/Structural Engineering Preferable: Post master's degree in the Bridge Engineering / Structural engineering.	
ii.	Experience	
	Total Experience	Minimum: 15 years

		Preferable: 20 years
	Experience in Related Field, Road/Bridge Works	Minimum: 10 years Preferable: 15 years
	Experience in the Proposed Field of Expertise	Requirements: - Shall have experience of detailed design of at least 5 no. of two or more lanes highway bridges outside native country. - Shall have experience of detailed design of at least 5 no. of highway bridges (two or more lanes width bridges of each with Total length $\Rightarrow$100m). - Shall have experience of detailed design of at least 1 no. of Viaduct (two or more lane width with Total length $\Rightarrow$200m). - Shall have experience of feasibility study of at least 5 no. of two or more lanes highway bridges.
		Preferable: Experience in a greater number of Projects in above two sub-criteria.
iii.	Language	Communicate fluently in English Language
3.	K-3: Procurement Specialist (International Experience) – (1 no.) The Procurement Specialist / Contract Specialist will be responsible for preparing bidding documents.	
i.	Educational Qualification	
	Minimum:- Bachelor degree in Civil Engineering Preferable: - Master's degree in Transportation Engineering/Highway Engineering/ Contract Management/ Construction Management	
ii.	Experience	
	Total Experience	Minimum: 15 years

		Preferable: 20 years
	Experience in Related Field, Road/Bridge Works	Minimum: 10 years Preferable: 15 years
	Experience in the Proposed Field of Expertise	Requirements: Shall have experience of Bid Document Preparation using FIDIC Condition of Contract of at least 3 no. of road/ bridges work as Contract/Procurement Specialist
		Preferable: Experience in a greater number of Projects in above two sub-criteria.
iii.	Language	Communicate fluently in English Language
4.	K-4: Highway Engineer– (3 nos.) Highway Engineer will assist/ coordinate with the Team Leader to perform the feasibility study and the detailed engineering design of the highway including assistance in Environmental and Social Study.	
i.	Educational Qualification	
	Minimum: Bachelor degree in Civil Engineering Preferable: Master’s Degree in Highway/Transportation or related field	
ii.	Experience	
	Total Experience	Minimum: 15 years Preferable: 20 years
	Experience in Related Field, Road/Bridge Works	Minimum: 10 years Preferable: 15 years
	Experience in the Proposed Field of Expertise	Requirements:

		▪ Shall have experience of pavement design works in at least 3 no. of road projects with Bituminous Pavement. ▪ Shall have experience of detailed design of minimum two road projects (four or more lanes width) of length ≥ 40 km.
		Preferable: ▪ Experience in a greater number of Projects in above two sub-criteria.
iii.	Language	Communicate fluently in English Language
5.	K-5: Bridge/ Structural Engineer – (7 nos.) Bridge Structural Engineer will assist/ coordinate with the Team Leader and Bridge/ Structural Engineer (with International Experience) to perform the feasibility study and the detailed engineering design of the bridges including assistance in Environmental and Social Study.	
i.	Educational Qualification	
	Minimum: Bachelor degree in Civil Engineering Preferable: Master's Degree in Bridge Engineering/Structural Engineering	
ii.	Experience	
	• Total Experience	Minimum: 15 years Preferable: 20 years
	• Experience in Related Field, Road/Bridge Works	Minimum: 10 years Preferable: 15 years
	• Experience in the Proposed Field of Expertise	Requirements: ▪ Shall have experience as Bridge/ Structural Engineer in at least three contracts related to detailed design of highway bridges.

		Shall have experience of detailed design of at least 5 no. of highway bridges (two or more lane width bridges of each with Total length $\geq 100\text{m}$).
		Preferable: Experience in a greater number of Projects in above two sub-criteria.
iii.	Language	Communicate fluently in English Language
6.	K-6: Geotechnical Engineer– (3 nos.) Geotechnical Engineer will assist/ coordinate with the Team Leader to perform all aspects of geotechnical activities in feasibility study and detailed design of road and bridges including assistance in Environmental and Social Study.	
i.	Educational Qualification	
	Minimum: Bachelor degree in Civil Engineering Preferable: Master's Degree in Geotechnical Engineering	
ii.	Experience	
	Total Experience	Minimum: 15 years Preferable: 20 years
	Experience in Related Field, Road/Bridge Works	Minimum: 10 years Preferable: 15 years
	Experience in the Proposed Field of Expertise	Requirements: - Shall have experience as geotechnical engineer for detailed design of at least 5 no. of highway bridges (two or more lane width). - Shall have experience as geotechnical engineer for detailed design of minimum two road projects (four or more lane width) of length $\geq 40\text{km}$. - Shall have experience as geotechnical engineer for detailed design of at least one road tunnel.

		Shall have experience as geotechnical engineer for analysis and detailed design of slope failure.
		Preferable: Experience in a greater number of Projects in above two sub-criteria.
iii.	Language	Communicate fluently in English Language
7.	K-7: Hydrologist– (3 nos.) Hydrologists shall be responsible for analyzing and managing the water-related aspects of the highway project during both the feasibility and detailed design phases including assistance in Environmental and Social Studies, with specific focus on bridge design during the detailed design phase. The expert will assess river flow, flood risks, and watercourse behavior to ensure that bridge structures are designed to withstand hydrological forces such as high-water levels, flooding, and scouring.	
i.	Educational Qualification	
	Minimum: Master's degree in Hydrology/ Water Resource Management or related Engineering discipline	
ii.	Experience	
	Total Experience	Minimum: 15 years Preferable: 20 years
	Experience in Related Field, Road/Bridge Works	Minimum: 10 years Preferable: 15 years
	Experience in the Proposed Field of Expertise	Requirements: - Shall have experience as hydrologist in at least two contracts related to detailed design of highway bridges. - Shall have experience of hydrological analysis for detailed design of at least 3 no. of highway bridges (two or more lane width bridges of each with Total length $\geq 100\text{m}$).

iii.	Language	Communicate fluently in English Language
8.	K-8: Environmentalist– (3 no.) Environmentalism shall be responsible all the tasks related to environmental assessments, analyses and regulations, as per the requirement of the Government of Nepal and World Bank.	
i.	Educational Qualification	
	Minimum: Master's degree in Environmental Engineering/Science or related field	
ii.	Experience	
	Total Experience	Minimum: 15 years Preferable: 20 years
	Experience in Related Field, Road/Bridge Works	Minimum: 10 years Preferable: 15 years
	Experience in the Proposed Field of Expertise	Requirements: - Experience of preparation of EIA/ESIA for three road projects as an Environmentalist/ Environmental Safeguard Specialist or similar position. - Experience of implementation of EIA/ESIA in two Donor funded Road Projects (World Bank/ADB/JICA etc) as an Environmentalist/ Environmental Safeguard Specialist or similar position.
iii.	Language	Communicate fluently in English Language
9.	K-9: Wildlife Expert – (1 no.) Wildlife Expert shall be responsible for assessing and mitigating the impacts of road design on wildlife and their habitats, ensuring compliance with environmental regulations, and integrating wildlife-friendly infrastructure into the project, as per the requirement of the Government of Nepal and World Bank.	
i.	Educational Qualification	

	Minimum: Master's degree in Wildlife Biology/ Biodiversity Conservation/ Bio-Diversity Engineering or related field	
ii.	Experience	
	Total Experience	Minimum: 15 years Preferable: 20 years
	Experience in Related Field, Road/Bridge Works	Minimum: 10 years Preferable: 15 years
	Experience in the Proposed Field of Expertise	Requirements: - Experience in 3 projects of similar nature (Road / Bridge Projects) as Wildlife/Biodiversity Expert. - Familiar with IFC PS6 and ESS6 requirements and methodology. - Have applied IFC PS6 in similar assignments..
iii.	Language	Communicate fluently in English Language
10.	K-10: Procurement Specialists – (1 no.) The Procurement Specialist / Contract Specialist shall be responsible for preparing bidding documents.	
i.	Educational Qualification	
	Minimum: Master's degree in Engineering/ Contract Management/ Construction Management/ Law/ related field	
ii.	Experience	
	Total Experience	Minimum: 15 years Preferable: 20 years
	Experience in Related Field, Road/Bridge Works	Minimum: 10 years in procurement field related to road and bridge works Preferable: 15 years

	Experience in the Proposed Field of Expertise	Requirements: Minimum experience of preparation of international bidding/ contract documents for 3 projects of similar nature of Road / Bridge works.
iii.	Language	Communicate fluently in English Language

NATIONAL NON-KEY EXPERTS

1.	Geologist – (1 no.) The Geologist shall be responsible for analyzing and managing the geological aspects of the highway and bridge project during both the feasibility and detailed design phases including assistance in Environmental and Social Study. The geologist will also coordinate with other experts to identify sources of construction materials, and provide guidance on mitigating geological hazards like landslides, soil liquefaction, and subsidence as well as assess fault lines and seismic activity to identify potential risks and determine the suitability of the terrain for construction.	
i.	Educational Qualification	
	Minimum: Master's degree in Geology or related Engineering discipline	
ii.	Experience	
	Total Experience	Minimum: 10 years
	Experience in Related Field, Road/Bridge Works	Minimum: 8 years
	Experience in the Proposed Field of Expertise	Requirements: - Shall have experience as geologist in at least two contracts related to detailed design of highway with length ≥ 40km. - Shall have experience as geologist for detailed design of at least 3 no. of highway bridges (two or more lane width bridges).

iii.	Language	Communicate fluently in English Language
2.	Material Engineer – (1 no.) Material Engineer shall be responsible for evaluating and selecting appropriate materials for the highway and bridges. The materials engineer will conduct assessments of potential construction materials and determine their suitability based on local availability, cost, and performance characteristics.	
i.	Educational Qualification	
	Minimum: Master's degree in Geotechnical/ Material Engineering or related field	
ii.	Experience	
	Total Experience	Minimum: 10 years
	Experience in Related Field, Road/Bridge Works	Minimum: 8 years
	Experience in the Proposed Field of Expertise	Requirements: - Shall have experience as material engineer in at least two contracts related to detailed design of highway with length ≥ 40km. - Shall have experience as material engineer for detailed design of at least 5 no. of highway bridges (two or more lane width bridges).
iii.	Language	Communicate fluently in English Language
3.	Road Safety Expert – (1 no.) Road Safety Expert shall be overall responsible for the design work related to traffic safety and will coordinate with other experts while performing road safety-related tasks as required.	
i.	Educational Qualification	
	Minimum: Master's degree in Transportation Engineering/ Highway Engineering/ Traffic Engineering	
ii.	Experience	
	Total Experience	Minimum: 10 years

	• Experience in Related Field, Road/Bridge Works	Minimum: 8 years
	• Experience in the Proposed Field of Expertise	Requirements: ▪ Shall have experience of road safety works in at least 3 nos. of road projects of length ≥ 40km in detail design phase as road safety specialist. ▪ Shall have experience of road safety audit in at least 2 nos. of road projects
iii.	Language	Communicate fluently in English Language
4.	Social Development/ Resettlement Specialist – (1 no.) Social Development/Resettlement Specialist shall be responsible for managing social impact assessments and resettlement planning for the highway and bridge project. The specialist will evaluate potential social impacts on local communities, develop resettlement action plans to ensure appropriate compensation as per the rules of Government of Nepal and engage with stakeholders as required.	
i.	Educational Qualification	
	Minimum: Master's degree in Social Science/ Anthropology/ Sociology/ Rural Development/ Economics or related field	
ii.	Experience	
	• Total Experience	Minimum: 10 years
	• Experience in Related Field, Road/Bridge Works	Minimum: 8 years
	• Experience in the Proposed Field of Expertise	Requirements: ▪ Experience of preparation of EIA/ESIA for three road projects as a Social Safeguard/ Development Specialist or similar position. ▪ Experience of implementation of EIA/ESIA in two Donor funded Road Projects (World

		Bank/ADB/JICA etc) as a Social Safeguard Specialist or similar position.
iii.	Language	Communicate fluently in English Language
5.	Socio-economist/Transport Economist – (1 no.) Socio-economist/Transport Economist shall be responsible for evaluating the economic viability of the highway project. The expert will conduct traffic demand forecasting, cost-benefit analysis (CBA), and socio-economic impact assessments, ensuring that the project's benefits justify the costs.	
i.	Educational Qualification	
	Minimum: Master's Degree in Transport Economics/ Transportation Engineering	
ii.	Experience	
	• Total Experience	Minimum:10 years
	• Experience in Related Field, Road/Bridge Works	Minimum: 8 years
	• Experience in the Proposed Field of Expertise	Requirements: ▪ Shall have experience as Transport Economist for design of at least 2 no. of highway projects with minimum 4 lane, length ≥ 40km. ▪ Specific experience in economic analysis for road sector investments using HDM 4, minimum 2 assignments.
iii.	Language	Communicate fluently in English Language

E. Time Schedule and Reporting Requirement

The consulting services shall be implemented over 15 (Fifteen) calendar months from the commencement date. The Contract type will be Lump Sum Contract. The Consultant's service is basically divided into two Parts as:

S. N.	Description	Expected Duration
Part I	Technical and Economic Feasibility study of about 165 km road from Chandrauta to Kohalpur	6 calendar months from the commencement of services

S. N.	Description	Expected Duration
Part II and III	Detailed Design and Environment Assessment of Upgradation/Improvement Works for the priority road sub-sections and associated bridges as identified from the Feasibility study in Part I.	9 calendar months from the completion of Part I
	Total	15 calendar months from the commencement of services

The Consultant shall submit the reports in minimum 5 hard copies and soft copy in specified manner and as enumerated in Table-5: Reports and Submissions.

The Consultant shall initially submit 3 copies of documents/reports as draft in ring/spiral binding form. After approval from the client, the Consultant shall submit 5 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, shall be tracked on GPS and shall be submitted on compatible format. The Consultant shall also produce separate-colored posters in appropriate paper size of each road and bridge showing detailed plan, profile and other relevant information.

E.1 Reports and Submissions

Table-5: Reports and Submissions

No.	Preparatory Outputs	Submission Deadline (no. months/days after the commencement date)	Remarks
Part I - Technical and Economic Feasibility study of about 165 km road from Chandrauta to Kohalpur			
	Inception Report including Design Basis Report	0.5 month	Feasibility Study
i.	Technical and Economic Feasibility study report of Chandrauta – Kohalpur Section – Draft Report Volume I: Chandrauta-Dhankhola Section Volume II: Dhankhola-Lamahi Section Volume III: Lamahi-Kohalpur Section	4.5 months	Draft report

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No.	Preparatory Outputs	Submission Deadline (no. months/days after the commencement date)	Remarks
ii	a. Norms for Design and Build (D&B) of Upgradation and Improvement to four lane standards from existing two lanes b. Norms for Design and Build (D&B) of Reconstruction/Rehabilitation of Highway to standard two (2) lanes with paved shoulders from existing two (2) lanes	4.5 months	Draft
	Comments from Client	15 days after draft report submission	
iii.	Technical and Economic Feasibility study report of Chandrauta – Kohalpur Section – Final Report Volume I: Chandrauta-Dhankhola Section Volume II: Dhankhola-Lamahi Section Volume III: Lamahi-Kohalpur Section	6 months	Final report
iv.	a. Norms for Design and Build (D&B) of Upgradation and Improvement to four lane standards from existing two lanes b. Norms for Design and Build (D&B) of Reconstruction/Rehabilitation of Highway to standard two (2) lanes with paved shoulders from existing two (2) lanes	6 months	Final
Part II - Detailed Design of Upgradation Works for the priority road sub-sections and associated bridges as identified from the Feasibility study in Part I., and			
Part III – Environment Assessment for Upgradation Works for the priority road sub-sections and associated bridges as identified from the Feasibility study in Part I.			
i.	Submission of Concept Design Report with possible alternatives for road and bridges to initiate presentation/ discussions with the DOR team. The		The Consultant may propose the timeline for submission of various

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No.	Preparatory Outputs	Submission Deadline (no. months/days after the commencement date)	Remarks
	Concept Design should be based on the Field Survey Reports: Inventory, Condition Survey, Ground Survey Mapping, Traffic Volume Counts and Updated Recommendations, Hydrological, Geological and Soil Investigation Reports, Environmental data, Social data, Road Crash data, Road Safety audit. Also, the Concept Design should take into consideration the preliminary assessment report on environmental and social issues along the road and bridges.		design reports for road and bridges in different segments for road and bridges respectively
	Chandrauta-Dhankhola Road Section	7 months	
	Lamahi-Kohalpur Road Section	7.5 months	
ii	Draft Detailed Design Report: based on the selected concept and standards, prepare and submit Draft Detailed Design Reports for the selected road sub-section and bridges including the Design, Drawings, geological/ geotechnical, hydrological, construction material, rate analysis, cost estimate, draft bidding documents with specification. Also, the Detailed Design should take into consideration the assessment reports on environmental and social issues along the road and bridges (to be done by a separate consultant).		
	Chandrauta-Dhankhola Road Section	10 months	
	Lamahi-Kohalpur Road Section	11.5 months	
iii.	Draft EIA/IEE Report of Road and Bridge, including Biodiversity/Ecological Assessment: Prepare and submit the Draft EIA/IEE Report for the proposed road and bridge project, in accordance with applicable environmental regulations and standards. The report shall be based on the detailed project		

TOR for Feasibility Study for the Upgradation/Improvement of Chandrauta-Kohalpur Section and Detailed Design of the Chandrauta-Dhankhola and Lamahi-Kohalpur Sections of Mahendra Highway

No.	Preparatory Outputs	Submission Deadline (no. months/days after the commencement date)	Remarks
	design, incorporating the assessment of potential environmental and social impacts during pre-construction, construction, and operation phases.		
	Chandrauta-Dhankhola Road Section	10 months	
	Lamahi-Kohalpur Road Section	11.5 months	
iv.	Draft ESIA Report along with CIA and BMP		
	Chandrauta-Dhankhola Road Section	10 months	
	Lamahi-Kohalpur Road Section	11.5 months	
v	(a) Standard Bidding Document for Design and Build (D&B) of Upgradation and Improvement to four lane standards from existing two lanes including preparation of Employer's Requirements, and other documents (b) Standard Bidding Document for Design and Build (D&B) of Reconstruction/Rehabilitation works of Highway to standard two (2) lanes with paved shoulders from existing two lanes including preparation of Employer's Requirements, and other documents	11.5 months	Draft
vi.	Small-scale workshop to present, review, discuss the detailed design and IEE/EIA report		After the submission of draft report
	Comments on Draft Report	1 month after draft report submission	
vii.	Final EIA/IEE Report of Road and Bridge: Based on the review, feedback, and comments received on the Draft EIA/IEE Report, finalize and submit the Final EIA/IEE Report for the proposed road and bridge project. The Final Report shall incorporate all required		

TOR for Feasibility Study for the Upgradation/Improvement of Chandrauta-Kohalpur Section and Detailed Design of the Chandrauta-Dhankhola and Lamahi-Kohalpur Sections of Mahendra Highway

No.	Preparatory Outputs	Submission Deadline (no. months/days after the commencement date)	Remarks
	revisions and updates, ensuring full compliance with national environmental regulations and the relevant institutional framework.		
	Chandrauta-Dhankhola Road Section	13 months	
	Lamahi-Kohalpur Road Section	14 months	
viii.	Final ESIA Report along with CIA and BMP		
	Chandrauta-Dhankhola Road Section	13 months	
	Lamahi-Kohalpur Road Section	14 months	
ix.	Final Detailed Design Report: Based on the review, feedback and comments provided on the Draft, finalize and submit the Final Detailed Design Report for the selected road sub-section and bridges including detailed design, the drawings, geological/geotechnical, hydrological, road safety audit, construction material, rate analysis, cost estimate, bidding documents with specification and EMP. The final report shall also include the animated video showing the existing road/ bridges improved with the proposed design. Including the updated drone information, they need to update based on final design.		
	Chandrauta-Dhankhola Road Section	13 months	
	Lamahi-Kohalpur Road Section	14 months	
x.	Monthly Progress Report	Expected within one week of the end of each calendar month	

No.	Preparatory Outputs	Submission Deadline (no. months/days after the commencement date)	Remarks
xi.	(a) Standard Bidding Document for Design and Build (D&B) of Upgradation and Improvement to four lane standards from existing two lanes including preparation of Employer's Requirements, and other documents (b) Standard Bidding Document for Design and Build (D&B) of Reconstruction/Rehabilitation works of Highway to standard two (2) lanes with paved shoulders from existing two lanes including preparation of Employer's Requirements, and other documents	15 months	Final

E.2 Additional Details on Expected Outputs

a. Inception Report

- i. Complete report detailing the Consultant's intended means, methods, design standards, reference documents to be used, and assumptions for design. The report should effectively demonstrate that the Consultant possesses a firm grasp on the required scope of work.
- ii. Prepare a quality assurance/quality control (QA/QC) plan for the necessary, investigation and design review process. Ensure that all major project deliverables conform to accepted design practices and comply with national and international design standards and best practices as appropriate. The QA/QC Plan shall contain procedures that will be used to ensure that a quality product is provided for each design component and deliverable and shall list what documentation will be submitted to verify that the procedures have been followed. Include sample checklists, or similar documentation, that will be used to indicate that an internal quality review has been performed.
- iii. Prepare a survey plan that summarizes the methodologies and instrumentation proposed to provide the survey mapping accuracies required for effective design and construction. It is incumbent upon the Consultant to ensure that the survey plan and survey will result in sufficient mapping to complete all design and environmental permitting activities associated with this project.

- iv. Prepare a field investigation plan. This shall include pavement condition surveys proposed, drilling and sampling of existing pavement, proposed geotechnical drilling and soil sample location maps, and a narrative summary.
- v. Prepare a complete schedule (Gantt or bar chart) of the survey, investigation and designer's activities to complete all items required in this scope, clearly depicting the critical path(s) and the float for each activity. Provide a narrative detailing any foreseen schedule risks and the designer plan for mitigating any future schedule issues.
- vi. Prepare for the construction cost estimate.

b. Concept Design Submission

Prepare conceptual level drawings and reports depicting preliminary items of work and impacts that include:

- i. High-level location maps that include plan view schematic locations of the work.
- ii. Roadway drawings that include typical sections, plan and profile sheets (where the alignment is changing) or straight-line schematic sketches with chainage (where the alignment is not changing), critical cross sections, locations of existing and proposed key features such as bridges, flyovers, pedestrian crossings, wildlife crossings, bus lay-bys, buildings, retaining walls, noise walls, median crossing locations, roadside barrier, and other ancillary features, locations of existing and proposed culverts and drainage structures, horizontal and vertical locations of all existing utilities, and mapping and topography, represented on plan and profile sheets.
- iii. Plans and cross sections for all major and unique junctions.
- iv. Typical plans, typical cross sections, and locations for all minor junctions.
- v. Conceptual-level type, size, and location drawings for each proposed bridge, flyover, wildlife crossings, pedestrian crossing, and other structures.
- vi. Complete detailed benefit cost analysis and life cycle cost analysis for each bridge, considering different bridge types, alignments, widths, and other design features.
- vii. Preliminary land acquisition plans if required for the work, depicting the proposed limits of work, the existing and proposed right of way, proposed full and partial, land acquisition takes, and summary table of proposed takes for each impacted parcel.
- viii. Include detailed geotechnical report providing boring logs, materials lab analyses results, geotechnical analyses, and design recommendations. Recommendations are to be incorporated into concept and final design.
- ix. Prepare concept design report, including information on the proposed design standard and with the design work completed at this stage.

- x. Provide information necessary for designer and stakeholders to make key decisions prior to starting work on detailed design. Key decisions requiring DoR approval prior to proceeding with detailed design may include but are not limited to: i) locations of flyover ramps, pedestrian crossings, wildlife crossings, bus lay-bys, etc., ii) junction types, turning lanes, and conceptual plan drawings, iii) bridge construction schematics (i.e. concentric vs. eccentric, iv) bridge types selected for each bridge, v) whether to design structures and the roadway to accommodate cost-effective future widening, and vi) other items as appropriate.
- xi. The designer shall prepare concise and informative summaries informing each decision using decision matrices summarizing the key benefits, risks, and costs for each option, the designer's recommended option, and a narrative summarizing the reasons for the designer's recommendation.

F. Terms of Payment

The Consultant will be paid on a lump sum basis. The total fees shall be paid based on various milestones achieved. The payment shall be released by the DoR based on the approval of the IA on the outputs/report delivered by the Consultant, after ensuring that these outputs/report conform to the requirements. The details of the percentage payments are indicated below.

Part I: Technical and Economic Feasibility study of about 165 km road from Chandrauta to Kohalpur			
S.N.	Deliverables	Payment (% of contract price)	Remarks
1.	Inception Report	2	
2.	Feasibility Study Report of Chandrauta – Kohalpur Road Section – Draft Report Volume I: Chandrauta-Dhankhola Road Section Volume II: Dhankhola-Lamahi Road Section Volume III: Lamahi-Kohalpur Section	5	
3.	Feasibility Study Report of Chandrauta – Kohalpur Section – Final Report including the followings: Volume I: Chandrauta-Dhankhola Road Section Volume II: Dhankhola-Lamahi Road Section Volume III: Lamahi-Kohalpur Road Section	5	After approval of Final Report

Part I: Technical and Economic Feasibility study of about 165 km road from Chandrauta to Kohalpur			
S.N.	Deliverables	Payment (% of contract price)	Remarks
4.	a) Norms for Design and Build (D&B) of Upgradation/Improvement of Highway to four (4) lanes from existing two (2) lanes b) Norms for Design and Build (D&B) of Reconstruction/Rehabilitation of Highway to standard two (2) lanes with paved shoulders from existing two (2) lanes	2	
	Total of Part-I	14	

Part-II: Detailed Design of Upgradation Works for the priority road sub-sections and associated bridges as identified through the Feasibility study in Part I.			
S.N.	Deliverables	Payment (% of contract price)	
A. Priority Sub-Section I: Chandrauta - Dhankhola (17 Km.)			
1.	Detail Design for Upgradation/Improvement Works of Highway to four lanes from existing two lanes, Cost Estimate and Bid Document for the same as Design-Bid-Build (Item Rate) Contract– Draft Report	8	
2.	Detail Design for Upgradation/Improvement Works of Highway to four lanes from existing two lanes, Cost Estimate and Bid Document for the same as Design-Bid-Build (Item Rate) Contract– Final Report	4	
	Total of A (Part-II)	12	
B. Priority Sub-Section II: Lamahi - Kohalpur (108 Km.)			
1.	Detail Design for Upgradation Works of Highway to four lanes from existing two lanes, Cost Estimate and Bid Document for the same as Design-Bid-Build (Item Rate) Contract– Draft Report	46	
2.	Detail Design for Upgradation Works of Highway to four lanes from existing two lanes, Cost Estimate and Bid Document for the same as Design-Bid-Build (Item Rate)– Final Report including the following: (a) Preparing Standard Bidding Document for Design and Build (D&B) of Upgradation to four lane standards from existing two lanes including	25	

Part-II: Detailed Design of Upgradation Works for the priority road sub-sections and associated bridges as identified through the Feasibility study in Part I.			
S.N.	Deliverables	Payment (% of contract price)	
	preparation of Employer's Requirements, and other documents (b) Preparing Standard Bidding Document for Design and Build (D&B) of Reconstruction/Rehabilitation works of Highway to standard two (2) lanes with paved shoulders from existing two lanes including preparation of Employer's Requirements, and other documents		
	Total of B (Part-II)	71	

Part III – Environment and Social Assessment for Upgradation Works for the priority road sub-sections, as mentioned in Part II.			
S.N.	Deliverables if Feasible	Payment (% of contract price)	
1.	IEE/EIA and ESIA Report of Chandrauta Dhankhola and Lamahi Kohalpur Section (Total 125 Km.) – Final Report	3	
	Total of C (Part-III)	3	
	Total of Part II and Part III	86	
	Total of Part I, II and Part III	100	

G. Consultants Facilities, Client's Input and Counterpart Personnel

The Consultant shall be fully responsible to mobilize the necessary professional (key and non-key) staff and also should arrange all the administrative, technical and support staff needed to carry out the services. The inputs provided in part C of this ToR (i.e. Team Composition and qualification requirements for professional staff/experts) are the minimum inputs required and the Consultant is required to assess the works requirement and may add additional inputs (Engineers, Technical Support, Administrative Support, specialists etc.), as required and should propose the additional inputs in their technical proposal and financial proposal. All international key experts shall be present in Nepal during the consultancy service period and the consultant shall not mobilize any of the key and non-key experts on home-based inputs. 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 Consultant shall arrange the necessary air transportation, land transportation including necessary vehicles for all type of surveys to deliver their services, effectively. The Consultant shall also arrange accommodation, travel and visas necessary for international staffs.

The Consultant shall establish an office space at Kathmandu (within 2 Km radius of DoR Office at Chakupat, Lalitpur for better coordination) and other sub offices as necessary to complete the job. The Consultant shall arrange necessary 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.

Data and Assistance to be Provided by the Client

The Client will provide all the available study reports and related information available with the Client. The Client will also help the Consultant team to coordinate with the DOR offices, Bridge Branch, and other governmental offices for related activities, as necessary. For the approved international staff, the Client may support the Consultant to process visa.

H. ANNEX-1: List of Existing Bridges

TOR for Feasibility Study for the Upgradation/Improvement of Chandrauta-Kohalpur Section and Detailed Design of the Chandrauta-Dhankhola and Lamahi-Kohalpur Sections of Mahendra Highway

S. No.	Bridge / River Name	District	MRM Chainage (Km)	Length of Bridge (m)	Carriageway Width(m)	Span No	Bridge Type	Category	No. of Borehole to be driven	Remarks
1	Jangali Khola	Kapilbastu	667.715	8.6	8.6	1	RCC Slab	Minor	1	
2	Chor Khola	Kapilbastu	668.28	38.8	7.6	1	RCC T-Beam	Major	1	
3	Dry Nala (Thade khola)	Kapilbastu	668.61	7.5	9	1	RCC Slab	Minor	1	
4	Dry nala	Kapilbastu	669.38	7.1	9	1	RCC Slab	Minor	1	
5	Mama Khola	Kapilbastu	669.74	6.7	8.8	1	RCC Slab	Minor	1	
6	Kaila khola	Kapilbastu	670.14	7	7.5	1	RCC Slab	Minor	1	
7	Dry nala	Kapilbastu	670.61	6.8	8.8	1	RCC Slab	Minor	1	
8	Surai naka (Surai Khola)	Kapilbastu	670.84	84	7	3	RCC T-Beam	Major	3	
9	X	Kapilbastu	671	150				Major	2	
10	Y	Kapilbastu	671.1	200				Major	2	

TOR for Feasibility Study for the Upgradation/Improvement of Chandrauta-Kohalpur Section and Detailed Design of the Chandrauta-Dhankhola and Lamahi-Kohalpur Sections of Mahendra Highway

11	Nala no. 1	Kapilbastu	671.26	8.6	8.6	1	RCC Slab	Minor	1
12	Tintre khola(Nala no.2)	Kapilbastu	671.6	10.6	8.5	1	RCC Slab	Minor	1
13	Nala no.3	Kapilbastu	673	10.6	8.3	1	RCC Slab	Minor	1
14	Dry Nala no. 4	Kapilbastu	673.6	10.7	8.9	1	RCC T-Beam	Minor	1
15	Dhan Khola	Dang	675.9	26.5	7	1	RCC T-Beam	Major	2
16	Padmini Khola	Dang	716.32	11.5	7.35	1	RCC Slab	Minor	1
17	Kari Sota	Dang	720.34	21.2	7	2	RCC Slab	Minor	2
18	Unchanimbhu Khola	Dang	722.8	32	7.5	3	RCC Slab	Minor	2
19	Hattisar Khola	Dang	725.58	10.75	7	1	RCC Slab	Minor	1
20	Bhauka Khola	Dang	726	21.6	7	2	RCC Slab	Minor	2
21	Bathaniya Khola	Dang	729	21.5	7	2	RCC Slab	Minor	2
22	Bhatarkunda Khola	Dang	730.89	26.5	7	1	RCC T-Beam	Major	2

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23	Rehar Khola	Dang	733.76	26.65	7.1	1	RCC T-Beam	Major	2
24	Tilkanya Branch	Dang	739.48	11	7.5	1	RCC Slab	Minor	1
25	Chow Khola-1	Dang	741.875	10.8	7	1	RCC Slab	Minor	1
26	Chow Khola-2	Dang	741.95	24.3	7	1	RCC T-Beam	Major	2
27	Chow Khola-3	Dang	743.151	24.5	7	1	RCC T-Beam	Major	2
28	Simal Sota	Dang	745.44	26.5	7	1	RCC T-Beam	Major	2
29	Bakhari Khola	Dang	745.8	21.4	7.1	1	RCC T-Beam	Major	2
30	Kali Khola	Dang	747.79	21.4	7.1	1	RCC T-Beam	Major	2
31	Godia Khola	Dang	749.655	21.9	7	2	RCC Slab	Minor	2
32	Sirangi Khola	Dang	750.5	42.9	7.1	4	RCC Slab	Minor	2
33	Firangi Khola	Dang	751.15	21.6	7	2	RCC Slab	Minor	2
34	Gangari Nala	Dang	753.17	21.4	7	2	RCC Slab	Minor	2
35	Shiv Khola	Dang	753.39	32.1	7	3	RCC Slab	Minor	2

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36	Loki Khola	Banke	755.09	16.4	7	1	RCC T-Beam	Major	2
37	Bharley Khola	Banke	756.51	42.8	7	4	RCC Slab	Minor	2
38	Skew	Banke	756.71	15.3	7	1	RCC Slab	Major	2
39	Gothelawa Nala	Banke	756.91	21.2	7	1	RCC T-Beam	Major	2
40	Tilkanya Khola	Banke	758.87	17.6	7	2	RCC Slab	Minor	2
41	Ooj Khola	Banke	761.81	53.75	7	5	RCC Slab	Minor	2
42	Bains Khola	Banke	763.98	29.4	7.1	2	RCC Slab	Minor	2
43	Dapariya	Banke	766	10.7	7	1	RCC Slab	Minor	1
44	Ranigajari	Banke	766.68	11.7	7	1	RCC Slab	Minor	1
45	Bairiya	Banke	767.69	42.65	7	4	RCC Slab	Minor	2
46	Dongi nala	Banke	769.04	29.2	7	1	RCC T-Beam	Major	2
47	Skew	Banke	769.99	9	6.8	1	RCC Slab	Minor	1
48	Sauri	Banke	770.88	43.2	7	4	RCC Slab	Minor	2

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49	Khochani	Banke	771.32	21.45	7	1	RCC T-Beam	Major	2
50	Kale Khola	Banke	773	10.7	7	1	RCC Slab	Minor	1
51	Gabar	Banke	775.55	53.2	7	2	RCC T-Beam	Major	2
52	Bhatti Khola	Banke	776.37	16.4	7	1	RCC T-Beam	Major	2
53	Lumba Khola	Banke	781.34	64.2	7	3	RCC T-Beam	Major	2
54	Gantahawa	Banke	784.05	17.4	7	2	RCC Slab	Minor	2
55	Thin Kholi	Banke	785.38	21.4	7	2	RCC Slab	Minor	2
56	Jhuri Khola	Banke	785.66	64.2	7	3	RCC T-Beam	Major	2
57	Skew	Banke	786.26	12.6	6	1	RCC Slab	Minor	1
58	Skew	Banke	786.675	11.45	7	1	RCC Slab	Minor	1
59	Gandhali	Banke	787.3	32.1	7	3	RCC Slab	Minor	2
60	Sukhar	Banke	787.39	105.8	7	4	RCC T-Beam	Major	3
61	Khairi	Banke	789.01	104.7	7	4	RCC T-Beam	Major	3

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62	Skew	Banke	790.045	12.6	6.98	1	RCC Slab	Minor	2
63	Muguwa	Banke	798.96	44.5	7.5	5	RCC Slab	Minor	2
64	Obhary Bridge	Banke	805.1	20.5	7.5	1	RCC T-Beam	Major	2
65	Paruwa Sota	Banke	807.5	40.3	7	2	RCC T-Beam	Major	2
66	Changai Nala	Banke	811.39	21.3	7.1	2	RCC Slab	Minor	2
67	Naya Gaon	Banke	813.21	10	7	1	RCC Slab	Minor	1
68	Geruaa Nala	Banke	815.19	21.35	7	1	RCC T-Beam	Major	2
69	Jhijhari Khola	Banke	815.74	63.4	7	3	RCC T-Beam	Major	2
70	Rohini	Banke	822.35	43.27	7	2	RCC T-Beam	Major	2
71	Duduwa nala	Banke	823.63	43.2	7	2	RCC T-Beam	Major	2

ANNEX-2: Relevant Standards and Codes of Practice

The Consultant shall design the Highway and the Bridge structures in accordance with but not limited to the following design standards and/or specifications.

- i) Nepal Road Standard 2073 (2013),
- ii) Guidelines for the design of Flexible Pavement 2021, Published by Department of Roads (DOR), Nepal
- iii) Pavement Design Guidelines (Rigid Pavement), Published by Department of Roads (DOR), Nepal
- iv) Nepal Bridge Standards-2067, Published by Department of Roads
- v) Guidelines on Hydrologic and Hydraulic Analysis and River Training works for Bridge Design, Department of Roads, 2022
- v) Standard Specification for Road and Bridge 2078 published by Department of Roads (DOR), Nepal
- vi) The publications by Indian Road Congress (IRC) with latest revisions as referenced below in Table below:

Code No.	Title
IRC: SP:84-2019	Manual of Specifications & Standards for Four Laning of Highways
IRC:86 -2018	Geometric design standards for urban roads and streets
IRC:35-2015	Code of Practice for Road Markings
IRC:67-2012	Code of Practice for Road Signs.
IRC:65-2017	Guidelines for Roundabouts
IRC: SP:88-2019	Road Safety Audit Manual.
IRC:99-2018	Guidelines for Traffic Calming Measures.
IRC:80-1981	Type designs for pick-up bus stops (on rural highways).
IRC: 30 - 1968	Standard Letter and Numbers of Different Heights for use on Highway Signs
IRC: 79 - 1981	Recommended Practice for Road Delineators
IRC: 93 - 1985	Guidelines on Design and Installation of Road Traffic Signals
IRC: SP:31-1997	New Traffic Signs
IRC SP: 41- 1994	Guidelines for the Design of At-Grade Intersection in Rural and Urban Areas
IRC: 6-2017	Standard Specifications and Code of Practice for Road Bridges, Section-II Loads and Stresses
IRC: 112-2020	Code of Practice for Concrete Road Bridges
IRC: 22-2015	Standard Specifications and Code of Practice for Road Bridges, Section VI – Composite Construction
IRC: 45-1972(reprint 1996)	Recommendations for Estimating the Resistance of Soil Below the Maximum Scour Level in the Design of Well Foundations of Bridges
IRC: 78-2020	Standard Specifications and Code of Practice for Road Bridges, Section VII- Foundations and Substructures

Code No.	Title
IRC:27-2009	Specifications for Bituminous Macadam
IRC:83-2015 (Part-I)	Standard Specifications and Code of Practice for Road Bridges, Section IX Bearings, Part I : Roller & Rocker Bearings (Second Revision)
IRC:83-2018 (Part II)	Standard Specifications and Code of Practice for Road Bridges, Section IX – Bearings (Elastomeric Bearings), Part II (Second Revision)
IRC:83-2018 (Part III)	Standard Specifications and Code of Practice for Road Bridges, Section IX — Bearings, Part III: POT, POT-CUM- PTFE, PIN and Metallic Guide and plane sliding Bearings (First Revision)
IRC: SP:60-2002	An Approach Document for Assessment of Remaining Life of Concrete Bridges
IRC: SP:61-2004	An Approach Document on Whole Life Costing for Bridges in India
IRC: SP: 84 - 2014	Manual for Specifications & Standards for Four Laning of Highways Through Public Private Partnership (First Revision)
IRC SP -13-2014	Guidelines for the design of small bridges & culverts (First Revision)
IRC-24-2010	Standard Specifications and Code of Practice for Road Bridges, Steel Road Bridges (Limit State Method) (Third Revision)
IRC:22-2015	Standard Specifications and Code of Practice for Road Bridges, Section VI — Composite Construction (Limit States Design) (Third Revision)
	Durability Provisions for Reinforced & Pre stressed Concrete Structures” by Indian Institution of Bridge Engineers- 1994.
IS 6403	Code of practice for determination of bearing capacity of shallow foundations
IS 2911 (Part 1/Sec 2): 2010:	Design and construction of Pile Foundations – Code of practice
IS 800:2007	Code of practice for design of Steel Structures
IS 14268: 1995	Uncoated stress relieved low Relaxation Seven-Ply strand for Pre-stressed concrete- Specification
IS 14593: 1998	Design and construction of Bored Cast-In-Situ Piles founded on Rocks– Guidelines
IS 1786 – 1985 –Third Revision	Specification for High strength deformed steel bars and wires for concrete reinforcement.
IS 2062 – 2011	Hot rolled medium and high tensile structural steel-specifications
EN 10338 – 2009	Hot rolled and cold rolled non-coated products of multiphase steels for cold forming. Technical delivery conditions

vii) Other International Standards: AASHTO Design Guidelines (Latest Edition), etc