Bidding DocumentFor Procurement of

Construction of Double Lane Dual Carriageway Standard Expressway Road, Bridge and Allied Works

Ch: 57+400 to Ch: 65 +160

ICB Contract I.D.: KTFT/ICB/WORKS/R&B/078/079/4

Employer: Kathmandu- Terai/Madesh Fast Track (Expressway) Road Project, Nepali Army, Government of Nepal

September 2021

KATHMANDU

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BIDDING DOCUMENT

TECHNICAL BID

PROCUREMENT OF WORKS

International Competitive Bidding (ICB)

Two Envelope Bidding Procedure

Procurement of

Kathmandu- Terai/MadeshFast Track (Expressway) RoadProject

Construction of Double Lane Dual Carriageway Standard Expressway Road, Bridge and Allied Works

Ch: 57+400 to Ch: 65 +160

Issued on: 17 September 2021

Bid Document issued to:All eligible Nepalese and Foreign Bidders

ICB No: KTFT/ICB/WORKS/R&B/078/079/4

Project Name:Kathmandu- Terai/Madesh Fast Track (Expressway) Road Project

Office Name: Kathmandu- Terai/Madesh Fast Track (Expressway) Road Project (KTFT)

Office Address:Bhadrakali, Kathmandu, Nepal

Financing Agency: Government of Nepal

ABBREVIATIONS

BD ..... Bidding Document

BDF…….. Bidding Forms

BDS..... Bid Data Sheet

BOQ …….. Bill of Quantities

COF …… Contract Forms

DB…… Design & Build

DBO……..Design Build & Operate

DP ……. Development Partners

DoLIDAR ……. Department of Local Infrastructure Development and Agricultural Roads

DoR …….. Department of Roads

EPC……. Engineering Procurement and Construction

ELI ……. Eligibility

EQC ..... Evaluation and Qualification Criteria

EXP …… Experience

FIN ……. Financial

GCC ..... General Conditions of Contract

GoN ..... Government of Nepal

ICB ..... International Competitive Bidding

ICC..... International Chamber of Commerce

ITB ..... Instructions to Bidders

JV …….. Joint Venture

LIT …….. Litigation

NA …….. Nepali Army

NCB ……... National Competitive Bidding

PAN …… Permanent Account Number

PPA …….. Public Procurement Act

PPMO …… Public Procurement Monitoring Office

PPR ……... Public Procurement Regulations

PL ..... Profit and Loss

PCC …….. Particular Conditions of Contract

SBD..... Standard Bidding Document

R&B…… Road and Bridge

TS..... Technical Specifications

UR…… Unit Rate

VAT …… Value Added Tax

WRQ …….. Works Requirements

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INVITATION FOR BIDS

Government of Nepal (GoN)

Nepali Army

Kathmandu- Terai/Madesh-Fast Track (Expressway) Road Project

Invitation for Bids for theConstruction of Double Lane Dual Carriageway Standard Expressway Road, Bridge and Allied Works

Contract Identification No: **KTFT/ICB/WORKS/R&B/078/079/4**

First Date of Publication: 17 September 2021

1. The Government of Nepal [GoN] has allocated funds towards the cost of **Kathmandu-Terai/Madesh-FastTrack (Expressway) Road Project** and intends to apply part of the funds to cover eligible payments under the Contract forConstruction of Double Lane Dual Carriageway Standard Expressway Road, Bridge and Allied Works from Ch.57+400 to Ch. 65+160; Contract ID: KTFT/ICB/WORKS/R&B/078/079/4. Bidding is open to all eligible Nepalese and Foreign Bidders.

2. **Kathmandu- Terai/Madesh-Fast Track (Expressway) Road Project** invites electronic bids from eligible bidders forthe Construction ofDouble Lane Dual CarriagewayExpresswayRoad, Design and Construction of Bridges, Slope Protectionand Allied Worksunder International Competitive Bidding- Single Stage, Two Envelop Bidding Procedure, in accordance with but notlimited to, the following scope of works;

   2.1 Construction of Double Lane Dual Carriageway Expressway Primary Class (Asian Highway Design Standard 1993) Level of Services (LOS)-A including all the components.

   2.2 Design and Construction of Double LaneBridgeWorksincluding all the components.

   2.3 Details of major components of the proposed Contract are as follows:

   a)**T**win Bridges: 12 Nos. (Contractor's Design)

   b) Vehicle Overpass: 2 Nos. (Contractor's Design)

   c) Expressway Road and Slope Protection Works (Ch.59+880 toCh. 59+900 and Ch. 63+390 to Ch. 64+030) (Contractor's Design)

   d) River Training Works

   e) Expressway and Service Road Works

f) Slope Protection/Stabilization Works

g) Cross Drainage, Vehicle and Pedestrian UnderpassWorks

h) All associated works such as retaining structures, road furniture, road safetyetc.

Only eligible bidders with the following key qualifications shall participate in this bidding:

- Minimum Average Annual Construction Turnover of the best 3 years within the last 10 years: ***[NPR 11,45,00,00,000.00]***
- Minimum Work experience of similar size and nature: Two Contracts on Road/Highway/Expressway Works with a value of NPR 4,35,00,00,000.00 each, within last 10 Years.
- Minimum Work experience of similar size and nature: Two Contract on (EPC/DB/DBO) on Bridge Works with a value of NPR. 11,70,00,00,000.00 each, within last 10 years.
- Submission of Concept paper for Understanding of the Project and Proposed Design for Bridgeand Slope Protection WorksSatisfactory to the Employer.

3. Eligiblebiddersmay obtain further information at the office of**Kathmandu-Terai/MadeshFast Track (Expressway) Road Project, Nepali Army Headquarter, Bhadrakali, Kathmandu; Telephone:+977-1-4267060, Email:ft-procmgmt@nepalarmy.mil.np,** during office hours, or may visit PPMO website:www.bolpatra.gov.np/egp.

4. A complete set of bidding documents may be downloaded from PPMO's website: www.bolpatra.gov.np. Bidders submitting their bids electronically, should deposit a non-refundable cash deposit of **NRS 20,000 (Twenty Thousand Nepalese Currency),** as a cost of bidding documents in the project's Rajaswa (revenue) account **No. 00101000000001001001, Office Code: 345013587, Rajaswo (Revenue) Shirshak No:14229, Nepal Bank Limited**, **Bhugolpark, Kathmandu,** in favour of KTFT and the scan copy (pdf format) of the bank deposit voucher shall be uploaded by the bidder at the time of electronic submission of the bids.

5. Pre-bid meeting shall be held at the office of**Kathmandu- Terai/Madesh-Fast Track (Expressway) Road Project, Bhadrakali, Kathmandu**at 13:00 hours local time on 18 October 2021.

6. Electronic bids must be submitted through PPMO website www.bolpatra.gov.np/egp,on or before 12:00 hours (local time) on 2 November 2021. Bids received after this deadline will be rejected.

7. Under the Single Stage, Two Envelope Procedure, Bidders are required to submit the Technical Bid and the Price Bid, as per the provision of ITB 21 of the Bidding Documents.The Bid documents shall be duly signed on each page by theauthorized personnel.The bids must have the same bidder name in which the bidding documents has been purchased or paid for.

8. The bidswill be opened in the presence of Bidders' representatives who choose to attend at13:00 hours (local time) on 2 November 2021atthe office of **Kathmandu-Terai/Madesh-Fast Track (Expressway) Road Project**,**Bhadrakali,Kathmandu,** Nepal.

9. Bids must be valid for a period of 120 days after bid opening date and must be accompanied by a scanned copy of the bid security in pdf format amounting to a minimum of **NPR. 59,25,00,000.00** which shall be valid for 30 days beyond the validity period.

10. If the last date for purchasing or submission falls on a government holiday then the next working day shall be considered the last date. In such case, the validity period of the bid security shall remain the same as specified for the original last date of bid submission.

11. It is recommended that interested eligible bidders visit the project site to familiarize themselves with the site conditions at site in order to ensure the sufficiency of their bids.Costs incurred for preparation of bid applications and site visits are to be borne by the bidder.

12. **Kathmandu- Terai/MadeshFast Track (Expressway) Road Project** reserves the right to accept or reject any or all bid applications, cancel the bidding process and reject all bid applications without assigning any reason whatsoever. The bidder shall have no right to claim any cost associated with the preparation of bidding document under such circumstances.

13. The prospective bidders may also visit Nepali Army website: www.nepalarmy.mil.np/fasttrack/home regarding the Invitation for bids.

Address:

The Project Chief

Kathmandu- Terai/Madesh Fast Track (Expressway) Road Project

Nepali Army,

Bhadrakali, Kathmandu, Nepal

Telephone: +977-1-4267060

Email: ft-procmgmt@nepalarmy.mil.np

PART I:BIDDING PROCEDURES

Section 1 - Instructions to Bidders

This section specifies the procedures to be followed by Bidders in the preparation and submission of their Bids. Information is also provided on the submission, opening, and evaluation of bids and on the award of Contract.

Table of Clauses

A. General

1. Scope of Bid

1.1 In connection with the Invitation for Bids indicated in the Bid Data Sheet (BDS), the Employer, as indicated in the BDS, issues this Bidding Document for the procurement of Works as specified in Section 5(Works Requirements). The name, identification, and number of Contracts of the International Competitive Bidding (ICB) are provided in the BDS.

1.2 Throughout this Bidding Document:

(a) the term "in writing" means communicated in written form and delivered against receipt;

(b) except where the context requires otherwise, words indicating the singular also include the plural and words indicating the plural also include the singular; and

(c) "day" means calendar day.

2. Source of Funds

2.1 **GoN Funded:** In accordance with its annual program and budget, approved by the GoN, the implementing agency **indicated in the BDS** plans to apply a portion of the allocated budget toward the cost of the project named in the BDS. The GoN intends to apply a portion of the allocated budget to eligible payments under the contract(s) for which this Bidding Document is issued.

Or

Public Entities' own Resource Funded: In accordance with its annual program and budget, approved by the public entity, the implementing agency indicated in the BDS plans to apply a portion of the allocated budget to eligible payments under the contract(s) for which this Bidding Document is issued.

Or

DP Funded: The GoN has applied for or received financing (hereinafter called "funds") from the Development Partner (hereinafter called "the DP") **indicated in the BDS** toward the cost of the project **named in the BDS**. The GoN intends to apply a portion of the funds to eligible payments under the contract(s) for which this Bidding Document is issued.

2.2 DP Funded: Payment by the DP will be made only at the request of

the GoN and upon approval by the DP in accordance with the terms and conditions of the financing agreement between the GoN and the DP (hereinafter called the "Loan Agreement"), and will be subject in all respects to the terms and conditions of that Loan Agreement. No party other than the GoN shall derive any rights from the Loan Agreement or have any claim to the funds.

3. Fraud and Corruption

3.1 The Government of Nepal (GoN) requires that the procuring entities as well as bidders, suppliers, and contractors and their sub-contractors under GoN/DP-financed contracts, shall adhere to the highest standard of ethics during the procurement and execution of such contracts. In this context , the Employer;

(a) defines, for the purposes of this provision, the terms set forth below as follows:

(i) "corrupt practice" means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party;

(ii) "fraudulent practice" means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;

(iii) "coercive practice" means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

(iv) "collusive practice" means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party.

(v) "obstructive practice" means:

(aa) deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a GoN/DP investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or

from pursuing the investigation; or

(bb) acts intended to materially impede the exercise of the GoN's/DP's inspection and audit rights provided for under sub-clause 3.5 below.

(b) will reject bid(s) if it determines that the bidder has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract in question;

(c) will sanction a firm or individual, including declaring ineligible, for a stated period of time, to be awarded a GoN/DP-financed contract if it at any time determines that the firm has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for, or in executing, a GoN/DP-financed contract.

3.2 The Bidder shall not carry out or cause to carryout the following acts with an intention to influence the implementation of the procurement process or the procurement agreement :

(a) give or propose improper inducement directly or indirectly,

(b) distortion or misrepresentation of facts,

(c) engaging in corrupt or fraudulent practice or involving in such act,

(d) interference in participation of other competing bidders,

(e) coercion or threatening directly or indirectly to cause harm to the person or the property of any person to be involved in the procurement proceedings,

(f) collusive practice among bidders before or after submission of bids for distribution of works among bidders or fixing artificial/uncompetitive bid pricewith an intention to deprive the Employer the benefit of open competitive bid price,

(g) contacting the Employer with an intention to influence the Employer with regards to the bids or interference of any kind in examination and evaluation of the bids during the period from the time of opening of the bids until the notification of award of contract.

3.3 PPMO on the recommendation of the Employer may **blacklist** a Bidder for a period of one (1) to three (3) years for its conduct including the following grounds and seriousness of the act

committed by the bidder:

(a) if convicted by a court of law in a criminal offence which disqualifies the Bidder from participating in the contract,

(b) if it is established that the contract agreement signed by the Bidder was based on false or misrepresentation of Bidder's qualification information,

(c) if it at any time determines that the firm has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for, or in executing, a GoN/DP-financed contract.

(d) If the Successful Bidder fails to sign the Contract.

3.4 A bidder declared blacklisted and ineligible by the GoN, Public procurement Monitoring Office (PPMO) and/or the DP in case of DP funded project, shall be ineligible to bid for a contract during the period of time determined by the GoN, PPMO and/or the DP.

3.5 The Contractor shall permitthe GoN/DP to inspect the Contractor's accounts and records relating to the performance of the Contractor and to have them audited by auditors appointed by the GoN/DP, if so required by the GoN/DP.

3.6 DP Funded: In pursuance of the fraud and corruption policy, the DP.

(a) Will reject a Bid if it determines that the bidder recommended for award has directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract in question;

(b) Will cancel the portion of the loan/ credit/ grant allocated to a contract if it determines at any time that representative(s) of the GoN or of a beneficiary of the fund engaged in corrupt, fraudulent, collusive, or coercive practices during the procurement or the execution of that contract, without the GoN having taken timely and appropriate action satisfactory to the DP to address such practices when they occur.

3.7 A bidder declared blacklisted and ineligible by the GoN,Public Procurement Monitoring Office (PPMO) and/or the DP in case of DP funded project, may be ineligible to bid for a contract during the period of time determined by the GoN,PPMO and/or the DP.

3.8 In case of a natural person or firm/institution/company which is already declared blacklisted and ineligible by the GoN, any other new

or existing firm/institution/company owned partially or fully by such Natural person or Owner or Board of director of blacklisted firm/institution/company; shall not be eligible bidder.

4. Eligible Bidders

4.1 A Bidder may be a natural person, private entity, or government-owned entity—subject to ITB 4.5—or any combination of them in the form of a Joint Venture (JV) under an existing agreement, or with the intent to constitute a legally-enforceable joint venture. In the case of a JV:

(a) all partners shall be jointly and severally liable for the execution of the Contract in accordance with the Contract terms. Maximum number of JV and other provision for JV shall be as per specified in the BDS. The qualification requirement of the parties to the JV shall be as specified in Section 3; Evaluation and qualification Criteria, and

(b) the JV shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the parties of the JV during the bidding process and, in the event the JV is awarded the Contract, during Contract execution.

4.2 A Bidder, and all parties constituting the Bidder, shall have the nationality of Nepal or any country or eligible countries mentioned in the BDS. A Bidder shall be deemed to have the nationality of a country if the Bidder is a citizen or is constituted, or incorporated, and operates in conformity with the provisions of the laws of that country. This criterion shall also apply to the determination of the nationality of proposed sub Contractors or suppliers for any part of the Contract including related services.

4.3 A Bidder shall not have a conflict of interest. A Bidder found to have a conflict of interest shall be disqualified. A Bidder may be considered to be in a conflict of interest with one or more parties in this bidding process, if:

(a) they have controlling partners in common; or

(b) they receive or have received any direct or indirect subsidy from any of them; or

(c) they have the same legal representative for purposes of this bid; or

(d) they have a relationship with each other, directly or through

common third parties, that puts them in a position to have access to information about or influence on the Bid of another Bidder, or influence the decisions of the Employer regarding this bidding process; or

(e) a Bidder participates in more than one bid in this bidding process. Participation by a Bidder in more than one Bid will result in the disqualification of all Bids in which the party is involved. However, this does not limit the inclusion of the same sub Contractor in more than one bid; or

(f) a Bidder or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the Contract that is the subject of the Bid; or

(g) a Bidder or any of its affiliates has been hired (or is proposed to be hired) by the Employeras Engineer for the Contract.

4.4 A firm that is under a declaration of ineligibility by the GoN/DP in accordance with ITB 3, at the date of the deadline for bid submission or thereafter, shall be disqualified. The list of debarred firm is available at the electronic address specified in the BDS.

4.5 Enterprises owned by GoN shall be eligible only if they can establish that they are legally and financially autonomous and operate under commercial law, and that they are not a dependent agency of the GoN.

4.6 Bidders shall provide such evidence of their continued eligibility satisfactory to the Employer, as the Employer shall reasonably request.

4.7 In case a prequalification process has been conducted prior to the bidding process, this bidding is open only to prequalified Bidders.

4.8 Firms shall be excluded in any of the cases, if

(a) by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Employer's country prohibits any import of goods or Contracting of works or services from that country or any payments to persons or entities in that country.

(b) DP Funded: as a matter of law or official regulation, Nepal prohibits commercial relations with that country, provided that the DP is satisfied that such exclusion does not preclude effective competition for the supply of goods or related

services required;

(c) DP Funded: a firm has been determined to be ineligible by the DP in relation to their guidelines or appropriate provisions on preventing and combating fraud and corruption in projects financed by them.

4.9 Domestic Bidder shall be eligible only if the bidder has obtained Permanent Account Number (PAN) and Value Added Tax (VAT) Registration Certificate(s) and Tax Clearance Certificate or proof of submission of income return as stated in BDS from the Inland Revenue Office. Foreign bidder shall be eligible only if the bidder submits the documents indicated in the BDS at the time of bid submission and a declaration to submit the document(s) indicated in the BDS at the time of contract agreement.

5. Eligible Materials, Equipment and Services

5.1 The materials, equipment and services to be supplied under the Contract shall have their origin in any source countries as defined in ITB 4.2 above and all expenditures under the Contract will be limited to such materials, equipment, and services. At the Employer's request, Bidders may be required to provide evidence of the origin of materials, equipment and services.

For purposes of ITB 5.1 above, "origin" means the place where the materials and equipment are mined, grown, produced or manufactured, and from which the services are provided. Materials and equipment are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that differs substantially in its basic characteristics or in purpose or utility from its components.

B. Contents of Bidding Document

6. Sections of Bidding Document

6.1 The Bidding Document consist of Parts I, II, and III, which include all the Sections indicated below, and should be read in conjunction with any Addenda issued in accordance with ITB 8.

Part I Bidding Procedures

Section 1 - Instructions to Bidders (ITB)

Section 2 - Bid Data Sheet (BDS)

Section 3 - Evaluation and Qualification Criteria (EQC)

Section 4 - Bidding Forms (BDF)

Part II Requirements

Section 5 – Employer's Requirements (WRQ)

Section 6 – Preamble to Bill of Quantities/Schedule of Prices

Part III Conditions of Contract and Contract Forms

Section 7 - General Conditions of Contract (GCC)

Section 8 - Particular Conditions of Contract (PCC)

Section 9 - Contract Forms (COF)

6.2 The Invitation for Bids issued by the Employer is not part of the Bidding Document.

6.3 The Employer is not responsible for the completeness of the Bidding Document and their Addenda, if they were not obtained directly from the source stated by the Employer in the Invitation for Bids.

6.4 The Bidder is expected to examine all instructions, forms, terms, and specifications in the Bidding Document. Failure to furnish all information or documentation required by the Bidding Document may result in the rejection of the bid.

7. Clarification of Bidding Document, Site Visit, Pre-Bid Meeting

7.1 A prospective Bidder requiring any clarification of the Bidding Document shall contact the Employer in writing at the Employer's address indicated in the BDS or raise anyquestion or curiosity during the pre-bid meeting if provided for in accordance with ITB 7.4. The Employer shall be required to make available as soon as possible the answer to such question or curiosity in writing to any request for clarification, provided that such request is received as mentioned in BDS. The Employer shall forward copies of its response to all Bidders who have acquired the Bidding Document in accordance with ITB 6.3, including a description of the inquiry but without identifying its source. Should the Employer deem it necessary to amend the Bidding Document as a result of a request for clarification, it shall do so following the procedure under ITB 8 and ITB 22.2.

7.2 The Bidder is encouraged to visit and examine the Site of Works and its surroundings and obtain for itself, on its own risk and responsibility, all information that may be necessary for preparing the bid and entering into a Contract for execution of

the Works. The costs of visiting the Site shall be at the Bidder's own expense.

7.3 The Bidder and any of its personnel or agents will be granted permission by the Employer to enter upon its premises and lands for the purpose of such visit, but only upon the express condition that the Bidder, its personnel, and agents will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.

7.4 The Bidder's designated representative is invited to attend a pre-bid meeting, if provided for in the BDS. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

7.5 The Bidder is requested, as far as possible, to submit any questions in writing, to reach the Employer as mentioned in BDS.

7.6 Minutes of the pre-bid meeting, including the text of the questions raised, without identifying the source, and the responses given, together with any responses prepared after the meeting, will be transmitted promptly to all Bidders who have acquired the Bidding Document in accordance with ITB 6.3. Any modification to the Bidding Document that may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an addendum pursuant to ITB 8 and not through the minutes of the pre-bid meeting.

7.7 Non attendance at the pre-bid meeting will not be a cause for disqualification of a Bidder.

8. Amendment of Bidding Document

8.1 At any time prior to the deadline for submission of bids, the Employer may amend the Bidding Document by issuing addenda.

8.2 Any addendum issued shall be part of the Bidding Document and shall be communicated in writing to all who have obtained the Bidding Document from the Employer in accordance with ITB 6.3.

8.3 To give prospective Bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer

may, at its discretion, extend the deadline for the submission of bids, pursuant to ITB 22.2.

C. Preparation of Bids

9. Cost of Bidding

9.1 The Bidder shall bear all costs associated with the preparation and submission of its Bid, and the Employer shall in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

10. Language of Bid

10.1 The Bid, as well as all correspondence and documents relating to the bid exchanged by the Bidder and the Employer, shall be written in the language specified in the BDS. Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages in the language specified in the BDS, in which case, for purposes of interpretation of the Bid, such translation shall govern.

11. Documents Comprising the Bid

11.1 The Bid shall comprise two envelopes submitted simultaneously, one called the Technical Bid containing the documents listed in ITB 11.2 and the other the Price Bid containing the documents listed in ITB 11.3, both envelopes enclosed together in an outer single envelope.

11.2 The Technical Bid shall comprise the following:

(a) Letter of Technical Bid;

(b) Completed Schedules, in accordance with ITB 12;

(c) Bid Security, in accordance with ITB 19;

(d) Alternative Technical Bids, at Bidder's option and if permissible, in accordance with ITB 13;

(e) Written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 20.2;

(f) Documentary evidence in accordance with ITB 17 establishing the Bidder's qualifications to perform the Contract;

(g) Technical Proposal in accordance with ITB 16;

(h) In the case of a bid submitted by a JV, the JV agreement, or letter of intent to enter into a JV including a draft agreement,

indicating at least the parts of the Works to be executed by the respective partners; and

(i) Any other required documents, which is not against the provision of Procurement Act/Regulation and Directives issued by PPMO as specified in the **BDS**.

11.3 The Price Bid shall comprise the following:

(a) Letter of Price Bid;

(b) CompletedSchedule of Prices andSchedule of Payment in accordance with ITB 12 and ITB 14, or as stipulated in the BDS;

(c) alternative price Bids, at Bidder's option and if permissible, in accordance with ITB 13;

(d) Any other document required in the BDS.

11.4 The Bidder is solely responsible for the authenticity of the documents submitted by the Bidder.

12. Letter of Bid and Schedules

12.1 The Letter of Technical Bid and Priced Bid, Schedules, and all documents listed under Clause 11, shall be prepared using the relevant forms in Section 4 (Bidding Forms), if so provided. The forms must be completed without any alterations to the text, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested.

13. Alternative Bids

13.1 Unless otherwise indicated in the BDS, alternative bids shall not be considered.

13.2 When alternative times for completion are explicitly invited, a statement to that effect will be included in the BDS, as will the method of evaluating different times for completion.

13.3 When specified in the BDS pursuant to ITB 13.1, and subject to ITB 13.4 below, Bidders wishing to offer technical alternatives to the requirements of the Bidding Document must first price the Employer's designor requirements as described in the Bidding Document and shall further provide all information necessary for a complete evaluation of the alternative by the Employer, including drawings, design calculations, technical specifications, breakdownof prices, and proposed design and constructionmethodology and other relevant details.

13.4 When specified in the BDS, Bidders are permitted to submit alternative technical solutions for specified parts of the Works. Such parts will be identified in the BDS and described in Section 6 (Employer'sRequirements). The method for their evaluation will be stipulated in Section 3 (Evaluation and Qualification Criteria).

14. Bid Prices and Discounts

14.1 The prices and discounts quoted by the Bidder in the Letter of Price Bid and in the Schedules shall conform to the requirements specified below.

14.2 The Bidder shall submit a Price bid for the whole of the works described in ITB 1.1 by filling in prices for all items of the Works, as identified in Section 4 (Bidding Forms). In case of Unit Rate Contracts, the Bidder shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Items against which no rate or price is entered by the Bidder will not be paid for by the Employer when executed and shall be deemed covered by the rates for other items and prices in the Bill of Quantities.

14.3 The price to be quoted in the Letter of Price Bid shall be the total price of the Bid, excluding any discounts offered.

14.4 Unconditional discounts, if any, and the methodology for their application shall be quoted in the Letter of Price Bid, in accordance with ITB 12.1.

14.5 If so indicated in ITB 1.1, bids are invited for individual Contracts or for any combination of Contracts (packages). Bidders wishing to offer any price reduction for the award of more than one Contract shall specify in their bid the price reductions applicable to each package, or alternatively, to individual Contracts within the package. Price reductions or discounts shall be submitted in accordance with ITB 14.3, provided the bids for all Contracts are submitted and opened at the same time.

14.6 Unless otherwise provided in the BDS and the Conditions of Contract, the prices quoted by the Bidder shall be fixed. If prices quoted by the Bidder are subject to adjustment during the performance of the Contract in accordance with the provisions of the Conditions of Contract, the Bidder shall furnish the indices and weightings for the price adjustment formulae in the Table of Adjustment Data in Section 4 (Bidding Forms) and the Employer

may require the Bidder to justify its proposed indices and weightings.

14.7 The bidder is subject to local taxes such as VAT, social charges or income taxes on nonresident international personnel, and also duties, fees, levies on amounts payable by the employer under the Contract. All duties, taxes, and other levies payable by the Contractor underthe Contract, or for any other cause, as of the date 30 days prior to the deadline for submission of bids, shall be included in the rates and prices and the total bid price submitted by the Bidder.

15. Currencies of Bid and Payment

15.1 The bid unit rates and the prices shall be quoted by the bidder entirely in Nepalese currency if not otherwise specified in the BDS.

15.2 Bidders shall indicate the portion of the bid price that corresponds to expenditures incurred in Nepalese currency in the Schedule of Payment Currencies included in Section 4 (Bidding Forms).

15.3 Bidders expecting to incur expenditures in other currencies for inputs to the Works supplied from outside the Employer's country and wishing to be paid accordingly may indicate up to three convertible foreign currencies included in daily publication of Nepal Rastra Bank foreign currency exchange rate in the Schedule of Payment Currencies included in Section 4 (Bidding Forms).

15.4 The rates of exchange to be used by the bidder for currency conversion during bid preparation shall be the selling rates for similar transactions prevailing on the date 30 days prior to the deadline for submission of bids published by Nepal Rastra Bank. Bidders should note that for the purpose of payments, the exchange rates confirmed by Nepal Rastra Bank as the selling rates prevailing 30 days prior to the deadline for submission of bids shall apply for the duration of the Contract so that no currency exchange risk is borne by the bidder.

15.5 Foreign currency requirements indicated by the bidders in the Schedule of Payment Currencies shall include but not limited to the specific requirements for

(a) expatriate staff and labor employed directly on the Works;

(b) social, insurance, medical and other charges relating to such expatriate staff and labor, and foreign travel expenses;

(c) imported materials, both temporary and permanent, including

fuels, oil and lubricants required for the Works;

(d) depreciation and usage of imported Plant and Contractor's Equipment, including spare parts, required for the Works;

(e) foreign insurance and freight charges for imported materials, Plant and Contractor's Equipment, including spare parts; and

(f) Overhead expenses, fees, profit, and financial charges arising outside the Employer's country in connection with the Works.

15.6 Bidders may be required by the Employer to clarify their foreign currency requirements, and to substantiate that the amounts included in the unit rates and prices and shown in the Schedule of Payment Currencies are reasonable and responsive to ITB 15.3 above, in which case a detailed breakdown of its foreign currency requirements shall be provided by the Bidder.

15.7 Bidders should note that during the progress of the Works, the foreign currency requirements of the outstanding balance of the Contract Price may be adjusted by agreement between the Employer and the Contractor in order to reflect any changes in foreign currency requirements for the Contract, in accordance with Sub-Clause 14.15 of the Conditions of Contract. Any such adjustment shall be effected by comparing the percentages quoted in the bid with the amounts already used in the Works and the Contractor's future needs for imported items.

16. Documents Comprising the Technical Proposal

16.1 The Bidder shall furnish a Technical Proposal including a statement of work methods, equipment, personnel, schedule and any other information as stipulated in Section 4 (Bidding Forms), in sufficient detail to demonstrate the adequacy of the Bidders' proposal to meet the work requirements and the completion time.

17. Documents Establishing the Qualifications of the Bidder

17.1 To establish its qualifications to perform the Contract in accordance with Section 3 (Evaluation and Qualification Criteria) the Bidder shall provide the information requested in the corresponding information sheets included in Section 4 (Bidding Forms).

17.2 Domestic Bidders, individually or in joint ventures, applying for eligibility for domestic preference shall supply all information required to satisfy the criteria for eligibility as described in ITB 34 if margin of preference for domestic bidders is applicable in

accordance with ITB 34.

18. Period of Validity of Bids

18.1 Bids shall remain valid for the period specified in the BDS after the bid submission deadline date prescribed by the Employer. A bid valid for a shorter period shall be rejected by the Employer as non-responsive.

18.2 In exceptional circumstances, prior to the expiration of the bid validity period, the Employer may request Bidders to extend the period of validity of their Bids. The request and the responses shall be made in writing. If a bid security is requested in accordance with ITB 19, it shall also be extended 30 days beyond the deadline of the extended validity period. A Bidder may refuse the request without forfeiting its bid security. A Bidder granting the request shall not be required or permitted to modify its Bid and to include any additional conditions against the provisions specified in Bid Documents.

19. Bid Security

19.1 The Bidder shall furnish as part of its bid, in original form, a bid security as specified in the BDS. In case of e-submission of bid, the Bidder shall upload scanned copy of Bid security letter at the time of electronic submission of the bid. The Bidder accepts that the scanned copy of the Bid security shall, for all purposes, be equal to the original. The details of original Bid Security and the scanned copy submitted with e-bid should be the same otherwise the bid shall be non-responsive.

19.2 The bid security shall be, at the Bidder's option, in any of the following forms:

(a) an unconditional bank guarantee from Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law or;

(b) a cash deposit voucher in the Employer's Account as specified in BDS.

In the case of a bank guarantee, the bid security shall be submitted
either using the Bid Security Form included in Section IV (Bidding Forms) or in another Form acceptable to the Employer. The form must include the complete name of the Bidder. The bid security shall be valid for minimum thirty (30) days beyond the original validity period of the bid, or beyond any period of

extension if requested under ITB 18.2.

19.3 The bid security issued by any foreign Bank outside Nepal must be counter guaranteed by a Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law in Nepal.

19.4 Any bid not accompanied by an enforceable and substantially compliant bid security, if required in accordance with ITB 19.1, shall be rejected by the Employer as nonresponsive.In case of e-Submission, if the scanned copy of an acceptable Bid Security letteris not uploaded with the electronic Bid then Bid shall be rejected.

19.5 The bid security of unsuccessful Bidders shall be returned withinthreedays, once the successful bidder has furnished the required performance security and signed the Contract Agreement pursuant to ITB 41.1 and ITB 42.1.

19.6 The bid security shall be forfeited if:

(a) a Bidder requests for withdrawal or modification of its bid, except as provided in ITB 18.2:

(i) during the period of bid validity specified by the Bidder on the Letter of Technical Bid and Price Bid, in case of electronic submission;

(ii) from the period twenty-four hours prior to bid submission deadline up to the period of bid validity specified by the Bidder on the Letter of Technical Bid and Price Bid, in case of hard copy submission.

(b) a Bidder changes the prices or substance of the bid while providing information pursuant to clause 27.1;

(c) a Bidder involves in fraud and corruption pursuant to clause 3.1;

(d) the successful Bidder fails to:

(i) furnish a performance security and evidence of line of Credit in accordance with ITB 41.1;

(ii) sign the Contract in accordance with ITB 42.1; or

(iii) accept the correction of arithmetical errors pursuant to clause 32 ;

19.7 The Bid Security of a JV shall be in the name of the JV that submits the bid. If the JV has not been legally constituted at the time of bidding, the Bid Security shall be in the names of all

future partners as named in the letter of intent mentioned in ITB 4.1.

20. Format and Signing of Bid

20.1 The Bidder shall prepare one original of the documents comprising the bid as described in ITB 11 and clearly mark it "ORIGINAL". Alternative bids, if permitted in accordance with ITB 13, shall be clearly marked "ALTERNATIVE". In addition, the Bidder shall submit copies of the bid in the number specified in theBDS**,** and clearly mark each of them "COPY." In the event of any discrepancy between the original and the copies, the original shall prevail.

In case of e-submission of bid, the Bidder shall submit his bid electronically in PDF or web forms files as specified in ITB Clause 21.1(b), If a Bidder submits both the electronic bid and a bid in hard copy within the bid submission deadline, then the submitted Bids shall be accepted for evaluation provided that the facts and figures in hard copy confirm to those in electronic bid. If there is any major discrepancy in fact and figures in the electronic bid and bid in hard copy, it shall be treated as two separate bids from one Bidder and both the Bids shall be disqualified, as per ITB Clause 4.3 (e).

20.2 The original and all copies of the bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation as specified in the BDS and shall be attached to the bid. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the bid, except for un-amended printed literature, shall be signed or initialed by the person signing the bid.

20.3 Any amendments such as interlineations, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the bid.

D. Submission and Opening of Bids

21. Sealing and Making of Bids

21.1 Bidders may always submit their bids by mail or by hand or by courier. When so specified in the BDS, bidders shall have the option of submitting their bids electronically. Procedures for submission, sealing and marking are as follows:

(a) Bidders submitting bids by mail, by hand or by courier

i. Bidders shall enclose the original of the Technical Bid, and the original of the Price Bid and each copy of the Technical Bid and Price Bid, including alternative bids, if permitted in accordance with ITB 13, in separate sealed envelopes, duly marking the envelopes as: "ORIGINAL TECHNICAL BID", "ORIGINAL PRICE BID", "ALTERNATIVE BID" and "COPY OF TECHNICAL BID" and "COPY OF PRICE BID". These envelopes containing the original and the copies shall then be enclosed in one single envelope.

ii. The inner and outer envelopes shall:

(aa) bear the name and address of the Bidder;

(bb) be addressed to the Employer as provided in BDS 22.1;

(cc) bear the specific identification of this bidding process indicated in BDS 1.1;

(dd) The outer envelope and the inner envelope containing Technical Bid shall bear a warning not to open before the time and date for the opening of Technical Bid in accordance with ITB 25.1.

iii. The inner envelope containing the Price Bid shall bear a warning not to open until advised by the Employer in accordance with ITB 25.7

iv. If all envelopes are not sealed and marked as required, the Employer will assume no responsibility for the misplacement or premature opening of the bid.

(b) Electronic Bid Submission **P**rocedures:Bidders submitting Bids electronically shall follow the electronic bid submission procedure specified in this clause as follows:

i. For e-submission, the bidder is required to register in the e-GP portal https://www.bolpatra.gov.np. for downloading and submitting the bid electronically.

ii. Interested bidders may either purchase the bidding documents from the Employer's office as specified in the invitation for bid (IFB) or bidders registered in the e-GP portal of PPMO may download the bidding document from http://www.bolpatra.gov.np after login. If bidders choose to download the bidding document and submit the bid electronically, then the cost of the bidding document shall be deposited as specified in IFB. In addition, electronic scanned copy (.pdf format) of the bank deposit voucher/cash receipt should also be submitted along with the electronic bid files.

iii. The bidder shall then prepare/fill the documents and forms included in the issued bid documents or the downloaded bid documents from the e-GP portal of PPMO - http://www.bolpatra.gov.np. as applicable. The required documents and forms shall be prepared in PDF form and/or shall be filled in the web forms in the e-GP system as specified below:

Technical Bid:

S. N.	Document	Requirement	Remarks
1	Letter of Technical Bid	Mandatory	PDF/ Web Forms
2	Bid Security (Bank Guarantee)	Mandatory	PDF
3	Company/Firm Registration Certificate	Mandatory	PDF
4	VAT registration Certificate	Mandatory	PDF
5	Tax Clearance Certificate/Tax return submission evidence/evidence of time extension	Mandatory	PDF
6	Power of Attorney of Bid signatory	Mandatory	PDF
7	Business Registration (Licence) Certificate	Mandatory, if Applicable	PDF
8	Bank Voucher for cost of bid document	Mandatory	PDF
9	Joint venture agreement	Mandatory	Mandatory in case of JV Bids Only
10	Qualification Information	Mandatory	Web Forms (Experience, Turnover, etc.)
11	Additional Document , if any	If relevant	PDF

Price Bid;

S. N.	Document	Requirement	Remarks
1	Letter of Price Bid	Mandatory	PDF/Web Forms
2	Applicable Price Adjustment Table	Mandatory if applicable	No Price adjustment will be treatedif the indices in the Price Adjustment Table are not provided.
3	Completed Bill of Quantities and Schedule of Prices	Mandatory	Complete Cost as per proposed Bill of Quantities (for Employer's Design Works) and Schedule of Prices (for Contractor's Design Works)

Note:

a) Bidders (all partners in case of JV) should verify/update their profile documents as appropriate for the specific bid before submitting their bid electronically.

iv) The Bidder shall then upload the PDF bid files and submit the complete bid online through e-GP portal of PPMO- http://www.bolpatra.gov.np within the specified date and time.

v) Bidders are advised to download the bid submission report to

ensure that all the documents/ files are up to date and complete.

vi) The Bidder / Bid shall meet the following requirements and conditions for e-submission of bids;

aa) The e-submitted bids must be readable through open standards interfaces. Unreadable and or partially submitted bid files shall be considered incomplete andshall not be consideredfor further bid evaluation.

bb) In addition to electronically submitted PDF files/web forms, the Bidder shall be required to submit original bid security letter/ documents and clarifications as specified in ITB Clause 27. If a bidder does not submit the original Bid security letter and requested documents and or clarifications within the specified time limit then the bid shall not be considered for furt00her evaluation.

cc) If major discrepancy is found between the electronically submitted PDF bid files and the documents/ clarifications provided by the Bidder as per ITB Clause 27, then the bid shall not be considered for further evaluation.

dd) The facility for submission of bid electronically through e-submission is to promote transparency, non-discrimination, equality of access, and open competition in the bidding process. The Bidders are fully responsible to use the e-submission facility properly in e-GP portal of PPMO-http://www.bolpatra.gov.np as per specified procedures and in no case the Employer shall be held liable for Bidder's inability to use this facility.

ee) When a bidder submits electronic bid through the PPMO e-GP portal, it is assumed that the bidder has prepared the bid by studying and examining the complete set of the Bidding documents including specifications, drawings and conditions of contract.

ff) Bidders who submit electronic bid should deposit the bidding document fee as specified in IFB and upload the scan copy (in pdf format) of the deposit voucher at the time of bid submission. The deposited amount shall be verified by the Employer during the bid evaluation process. The submitted Bid shall be non-responsive and shall not be evaluated if the cost for bidding document is not deposited as specified in the IFB.

22. Deadline for Submission of Bids

22.1 Bids must be received by the Employer at the address and no later than the date and time indicated in the BDS.

In case of e-submission, the standard time for e-submission is Nepal Standard Time as set out in the server. The e-procurement system will accept the e-submission of bid from the date of publishing of notice and will automatically not allow the e-submission of bid after the deadline for submission of bid.

The Employer may, at its discretion, extend the deadline for the submission of bids by amending the Bidding Document in accordance with ITB 8, in which case all rights and obligations of the Employer and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.

23. Late Bids

23.1 The Employer shall not consider any bid that arrives after the deadline for submission of bids, in accordance with ITB 22. Any bid received by the Employer after the deadline for submission of bids shall be declared late, rejected, and returned unopened to the Bidder.

24. Withdrawal, and Modification of Bids

24.1 A Bidder may withdraw, or modify its bid after it has been submitted either in hard copy or by e-submission. Procedures for withdrawal or modification of submitted bids are as follows:

(i) Bids submitted in hard Copy

a) Bidders may withdraw or modify its bids by sending a written notice in a sealed envelope, duly signed by an authorized representative, and shall include a copy of the authorization in accordance with ITB 20.2 before 24 hours prior to the deadline of submission of bids. The corresponding modification of the bid must accompany the respective writtennotice. All notices must be:

(aa) prepared and submitted in accordance with ITB 20 and ITB 21,and in addition, the respective envelopes shall be clearly marked "WITHDRAWAL", "MODIFICATION;" and

(bb) received by the Employer twenty four hour prior to the deadline prescribed for submission of bids, in accordance with ITB 22.

(cc) The bidder shall clearly specify on envelope whether "MODIFICATION"' is of Technical Bid or Price Bid.

ii) E-submitted bids.

a) Bidder may submit modification or withdrawal prior to the deadline prescribed for submission of bid through e-GP system by using the forms and instructions provided by the system. Once a Bid is withdrawn, bidder will not be able to submit another bid response for the same bid.

24.2 Bids requested to be withdrawn in accordance with ITB 24.1 shall be returned unopened to the Bidders after completion of the bid opening.

24.3 Bidder may submit request for withdrawal or modification only one time.

24.4 No bid may be withdrawn if the bid has already been modified.

24.5 Except in case of any modification or correction in bid document made by procuring entity, Bidder may submit request for withdrawal or modification only one time.

24.6 In case of hard copy bid, no bid may be withdrawn if the bid has already been modified; except in case of any modification or correction in bid document by procuring entity.

24.7 Request for withdrawal or modification must be made through the same medium of submission. Request for withdrawal or modifications through different medium shall not be considered.

24.8 The following provisions apply for withdrawal or modification of the Bids:

(i) In case of bids submitted in hard copy no bid shall be withdrawn or modified in the interval between 24 hours prior to the deadline for submission of bids and the expiration of the period of bid validity specified by the Bidder on the Letter of Bid or any extension thereof.

(ii) In case of e-submitted bids no bids shall be withdrawn or modified in the interval between deadline for submission of bids and the expiration of the period of bid validity specified by the Bidder on the Letter of Bid or any extension thereof.

25. Bid Opening

25.1 The Employer shall open the bids in public at the address, date and time specified in the BDS in the presence of Bidders` designated representatives and anyone who choose to attend.Then the Employer shall segregate the Technical Bid and Price Bid separately. The Price Bids will remain unopened and will be held in custody of the Employer until the specified time of their opening. If the Technical Bid and Price Bid are submitted

together in one inner envelope, the Employer may reject the entire Bid.

25.2 The Employer shall download the e-submitted Bid files. The e-procurement system allows the Employer to download the e-submitted bid files (report) only after bid opening date and time after login simultaneously by at least two members of the Bid OpeningCommittee.

25.3 After downloading each e-bid, electronically submitted Technical Bid shall be opened at first in the same time and date as specified above. Electronic Bids shall be opened one by one and read out. The e-submitted technical bids must be readable through open standards interfaces. Unreadable and or partially submitted bid files shall be considered incomplete.

25.4 Thereafter, envelopes marked "WITHDRAWAL" shall be opened and read out and the envelope with the corresponding Bid shall notbe opened, but returned to the Bidder. No bid withdrawal shall be permitted unless the corresponding withdrawal notice containsa valid authorization to request the withdrawal and is read out at bid opening. Next, envelopes marked "MODIFICATION" shall be opened and read out with the corresponding bid. NoTechnical Bid and/or Price Bid modification shall be permitted unless the corresponding modification notice contains a valid authorization to request the modification and is read out and recorded at bid opening. Only the Technical Bid, both Original as well as Modification, are to be opened, read out, and recorded at the opening. Price Bids, both Original and Modification, will remain unopened in accordance with ITB 25.1.

25.5 All other envelopes holding the Technical Bid shall be opened one at a time, reading out: the name of the Bidder; whether there is a modification; the presence of a bid security and any other details as the Employer may consider appropriate. Only Technical Bids read out and recorded at bid opening shall be considered for evaluation. No bid shall be rejected at opening of Technical Bids except for late bids, in accordance with ITB 23.1.

25.6 The Employer shall prepare a record of the opening of Technical Bids that shall include, as a minimum: the name of the Bidder and whether there is a withdrawal, or modification; andthe presence or absence of a bid security. The Bidders' representatives who are present shall be requested to sign the record. The omission of a

Bidder's signature on the record shall not invalidate the contents and effect of the record.

25.7 At the end of the evaluation of the Technical Bids, the Employer will invite bidders who have submitted substantially responsive Technical Bids and who have been determined as being qualified for award to attend the opening of the Price Bids. The date, time, and location of the opening of Price Bids will be advised in writing by the Employer. Bidders shall be given reasonable notice for the opening of Price Bids.

25.8 The Employer will notify Bidders in writing who have been rejected on the grounds of their Technical Bids being substantially nonresponsive to the requirements of the Bidding Document and return their Price Bids unopened.

25.9 The Employer shall conduct the opening of Price Bids of all Bidders who submitted substantially responsive Technical Bids, in the presence of Bidders` representatives who choose to attend at the address, on the date, and time specified by the Employer. The Bidder's representatives who are present shall be requested to sign a register evidencing their attendance.

25.10 All envelopes containing Price Bids shall be opened one at a time and the following read out and recorded:

a) the name of the Bidder;

b) whether there is a modification;

c) the Bid Prices, including any discounts and alternative offers; and

d) any other details as the Employer may consider appropriate.

Only Price Bids, discounts, modifications, and alternative offers read out and recorded during the opening of Price Bids shall be considered for evaluation. No Bid shall be rejected at the opening of Price Bids.

25.11 The Employer shall prepare a record of the opening of Price Bids that shall include, as a minimum, the name of the Bidder, the Bid Price (per lot if applicable), any discounts, modifications and alternative offers. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record.

E. Evaluation and Comparison of Bids

26. Confidentiality

26.1 Information relating to the examination, evaluation, comparison, and postqualification of bids and recommendation of Contract award, shall not be disclosed to Bidders or any other persons not officially concerned with such process until information on Contract award is communicated to all Bidders.

26.2 Any attempt by a Bidder to influence the Employer in the evaluation of the bids or Contract award decisions may result in the rejection of its bid.

26.3 Notwithstanding ITB 26.2, from the time of bid opening to the time of Contract award, if any Bidder wishes to contact the Employer on any matter related to the bidding process, it may do so in writing.

27. Clarification of Bids

27.1 To assist in the examination, evaluation, and comparison of the Technical and Price Bids, and qualification of the Bidders, the Employer may, at its discretion, ask any Bidder for a clarification of its Bid. Any clarification submitted by a Bidder that is not in response to a request by the Employer shall not be considered. The Employer's request for clarification and the response shall be in writing. No change in the substance of the Technical Bid or prices in the Price Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Price Bids. In case of e-submission of bid, upon notification from the Employer, the bidder shall also submit the original of documents comprising the Technical and Price Bid as per ITB 11 for verification of submitted documents for acceptance of the e-submitted bid.

27.2 If a Bidder does not provide clarifications of its bid by the date and time set in the Employer's request for clarification, its bid may be rejected.

28. Deviations, Reservations, and Omissions

28.1 During the evaluation of bids, the following definitions apply:

a) "Deviation" is a departure from the requirements specified in the Bidding Document;

b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements

specified in the Bidding Document; and

c) "Omission" is the failure to submit part or all of the information or documentation required in the Bidding Document.

29. Determination of Responsiveness

29.1 The Employer's determination of a bid's responsiveness is to be based on the contents of the bid itself, as defined in ITB11.

29.2 A substantially responsive Technical Bid is one that meets the requirements of the Bidding Document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that,

(a) if accepted, would:

(i) affect in any substantial way the scope, quality, or performance of the Works specified in the Contract;or

(ii) limit in any substantial way, inconsistent with the Bidding Document, the Employer's rights or the Bidder's obligations under the proposed Contract; or

(b) if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive bids.

29.3 The Employer shall examine the technical aspects of the Bid submitted in accordance with ITB 16, Technical Proposal, in particular, to confirm that all requirements of Section 5 (Employer's Requirements) have been met without any material deviation, reservation or omission.

29.4 If a bid is not substantially responsive to the requirements of the Bidding Document, it shall be rejected by the Employer and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.

29.5 In case of e-submission bids, the Employer evaluates the bid on the basis of the information in the electronically submitted bid files. If the Bidder cannot substantiate or provide evidence to establish the information provided in e-submitted bid through documents/ clarifications as per ITB Clause 27, the bid shall not be considered for further evaluation.

29.6In Case, a corruption case is being filed to Court against the Natural Person or Board of Director of the firm/institution /company or any partner of JV, such Natural Person or Board of Director of the firm/institution /company or any partner of JV such bidder's bid

shall be excluded from the evaluation, if public entity receives instruction from Government of Nepal.

29.7 Except in case of e-submission, the Financial Bid of the bidder, which is evaluated as substantially non-responsive in technical bid, shall be returned to the respective bidders.

30. Nonconformities, Errors, and Omissions

30.1 Provided that a bid is substantially responsive, the Employer may waive any non-conformities in the bid that do not constitute a material deviation, reservation or omission.

30.2 Provided that a Technical Bid is substantially responsive, the Employer may request that the Bidder submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities in the Technical Bid related to documentation requirements. Requesting information or documentation on such nonconformities shall not be related to any aspect of the Price Bid. Failure of the Bidder to comply with the request may result in the rejection of its bid.

30.3 Provided that a Technical bid is substantially responsive, the Employer shall rectify quantifiable nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price may be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component. The adjustment shall be made using the methods indicated in Section 3 (Evaluation and Qualification Criteria).

30.4 If minor discrepancies are found such as in technical specification, description, feature which do not make the bid to be rejected, then the cost, which is calculated to the extent possible due to such differences shall be included while evaluating the bid.

30.5 If the value of such non-conformities is found to be more than fifteen percent of the quoted amount of the bidder on account of minor discrepancies pursuant to ITB 30.4, such bid shall be considered ineffective in substance and shall not be involved in evaluation.

31. Qualification of the Bidder

31.1 The Employer shall determine to its satisfaction during the evaluation of Technical Bids whether Biddersmeet the qualifying criteria specified in Section 3 (Evaluation and Qualification Criteria).

31.2 The determination shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to ITB 17.

31.3 An affirmative determination of qualification shall be a prerequisite for the opening and evaluation of a Bidder's Price Bid. A negative determination shall result into the disqualification of the Bid, in which event the Employer shall return the unopened Price Bid to the Bidder.

32. Correction of Arithmetical Errors

32.1 During the evaluation of Price Bids, the Employer shall correct arithmetical errors on the following basis:

(a) if there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected;

(b) if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and

(c) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.

32.2 If the Bidder that submitted the lowest evaluated bid does not accept the correction of errors, its bid shall be disqualified and its bid security may be forfeited.

33. Conversion to Single Currency

33.1 For evaluation and comparison purposes, the currency(ies) of the bid shall be converted into a single currency as specified in the BDS.

34. Domestic Preference

34.1 Unless otherwise specified in the BDS, a domestic preference shall be a factor in bid evaluation.

35. Subcontractors

35.1 The Employer may permit subcontracting for certain specialized works as indicated in Section 3. When subcontracting is permitted by the Employer, the specialized sub-contractor's experience shall be considered for evaluation. Section 3 describes

the qualification criteria for sub-contractors.

Bidders may propose subcontracting up to the percentage of total value of contracts or the volume of works as specified in the BDS.

36. Evaluation of Price Bids

36.1 The Employer shall evaluate Price Bid of each bid for which the Technical Bid has been determined to be substantially responsive. The Employer shall use the criteria and methodologies listed in this Clause. No other evaluation criteria or methodologies shall be permitted.

36.2 To evaluate a Price bid, the Employer shall consider the following:

(a) the bid price, excluding Value Added Tax, Provisional Sums, and the provision, if any, for contingencies in the SummaryBill of Quantities,for Unit Rate Contracts, or Schedule of Prices for lump sum Contracts, but including Day work items, where priced competitively;

(b) price adjustment for correction of arithmetic errors in accordance with ITB 32;

(c) price adjustment due to discounts offered in accordance with ITB 14.4;

(d) converting the amount resulting from applying (a) to (c) above, if relevant, to a single currency in accordance with ITB 33;

(e) adjustment for nonconformities in accordance with ITB 30.3;

(f) application of all the evaluation factors indicated in Section 3 (Evaluation and Qualification Criteria);

36.3 The estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in bid evaluation.

36.4 If this Bidding Document allows Bidders to quote separate prices for different Contracts, and to award multiple Contracts to a single Bidder, the methodology to determine the lowest evaluated price of the Contract combinations, including any discounts offered in the Letter of Bid, is specified in Section 3 (Evaluation and Qualification Criteria).

36.5 If the bid for an Unit Rate Contract, which results in the lowest

Evaluated Bid Price is seriously unbalanced or front loaded**or extremely low** in the opinion of the Employer, the Employer may require the Bidder to produce detailed price analysis for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analysis, taking into consideration the schedule of estimated Contract payments, the Employer may require that the amount of the performance security be increased at the expense of the Bidder as **mentioned in BDS** to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract **or may consider the bid as non–responsive**.

36.6 In case of e-submission bids, the Employer evaluates the bid on the basis of the information in the electronically submitted bid files. If the Bidder cannot substantiate or provide evidence to establish the information provided in e-submitted bid through documents/ clarifications as per ITB Clause 27, the bid shall not be considered for further evaluation.

36.7 In Case, a corruption case is being filed to Court against the Natural Person or Board of Director of the firm/institution /company or any partner of JV, such Natural Person or Board of Director of the firm/institution /company or any partner of JV such bidder's bid shall be excluded from the evaluation, if public entity receives instruction from Government of Nepal.

37. Comparison of Bids

37.1 The Employer shall compare all substantially responsive bids in accordance with ITB 36.2 to determine the lowest evaluated bid.

38. Employer's Right to Accept Any Bid, and to Reject Any or All Bids

38.1 The Employer reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids at any time prior to Contract award, without thereby incurring any liability to Bidders. In case of annulment, all bids submitted and specifically, bid securities, shall be promptly returned to the Bidders.

F. Award of Contract

39. Award Criteria

39.1 The Employer shall award the Contract to the Bidder whose offer has been determined to be the lowest evaluated bid and is substantially responsive to the Bidding Document, provided further that the Bidder is determined to be qualified to perform

the Contract satisfactorily.

40. Letter of Intent to Award the Contract/ Notification of Award

40.1 The Employer shall notify the concerned Bidder whose bid has been selected in accordance with ITB 39.1 within seven days of the selection of the bid, in writing that the Employer has intention to accept its bid and the information regarding the name, address and amount of selected bidder shall be given to all other bidders who submitted the bid.

40.2 If no bidder submits an application pursuantto ITB 43.1 within a period of seven days of the notice provided under ITB 40.1, the Employer shall, accept the bid selected in accordance with ITB 39.1 and Letter of Acceptance shall be communicated to the selected bidder prior to the expiration of period of Bid validity, to furnish the performance security and sign the contract within fifteen days.

40.3 At the same time, the Employer shall affix a public notice on the result of the award on its notice board and may make arrangements to post the notice into its website, if it has; and if it does not have, into the website of the Public Procurement Monitoring Office, identifying the bid and lot numbers and the following information: (i) name of each Bidder who submitted a Bid; (ii) bid prices as read out at Bid Opening; (iii) name and evaluated prices of each Bid; (iv) name of bidders whose bids were rejected and the reasons for their rejection; and (v) name of the winning Bidder, and the Price it offered, as well as the duration and summary scope of the Contract awarded.

In Case, a corruption case is being filed to Court against the Natural Person or Board of Director of the firm/institution /company or any partner of JV, such Natural Person or Board of Director of the firm/institution /company or any partner of JV such bidder's bid shall be excluded from the evaluation, if public entity receives instruction from Government of Nepal.

41. Performance Security and Line of Credit

41.1 Within Fifteen (15) days of the receipt of Letter of Acceptance from the Employer, the successful Bidder shall furnish the performance security in accordance with the Conditions of Contract, as specified below from Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law in

Nepalusing Sample Form for the Performance Security included in Section 9 (Contract Forms), or another form acceptable to the Employer. The performance security issued by any foreign Bank outside Nepal must be counter guaranteed by Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law in Nepal.

i) If bid price of the bidder selected for acceptance is up to 15 (fifteen) percent below the approved cost estimate, the performance security amount shall be 5 (five) percent of the bid price.

ii) For the bid price of the bidder selected for acceptance is more than 15 (fifteen) percent below of the cost estimate, the performance security amount shall be determined as follows:

Performance Security Amount = [(0.85 x Cost Estimate –Bid Price) x 0.5] + 5% of Bid Price.

The Bid Price and Cost Estimate shall be inclusive of Value Added Tax.

Within Fifteen (15) days of the receipt of Letter of Acceptance from the Employer, the successful Bidder shall furnish the Letter of Commitment for Bank's Undertaking for Line of Credit of the amount as specified in the BDS, using Sample Form for the Line of Credit included in Section 9 (Contract Forms); andat the date and time as designated for signing of the agreement,heshall be present in person or be represented through a legally authorized representative at the Employer's officefor signing of contract agreement on his part.

41.2 Failure of the successful Bidder to submit the above-mentioned Performance Security and Line of Credit or to make his appearance/ representation to sign the Contract Agreement shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid securitywithout prejudice to any other remedies the Employer has under the applicable law. In that event the Employer may award the Contract to the next lowest evaluated Bidder whose offer is substantially responsive and is determined by the Employer to be qualified to perform the Contract satisfactorily. In such case, the award process shall be repeated according to ITB 40.

42. Signing of Contract

42.1 The Employer and the successful Bidder shall sign the Contract Agreement within the period as stated ITB 41.1.

42.2 Within thirty (30) days from the date of issuance of notification pursuant to ITB 40.1 unsuccessful bidders may request in writing to the Employer for a debriefing seeking explanations on the grounds on which their bids were not selected. The Employer shall promptly respond in writing to any unsuccessful Bidder who, requests for debriefing.

42.3 If the bidder whose bid has been accepted fails to sign the contract as stated ITB 42.1, the Public Procurement Monitoring Office shall blacklist the bidder on recommendation of the Public Entity.

43. Complain and Review

43.1 If a Bidder is dissatisfied with the Procurement proceedings or the decision made by the Employer in the intention to award the Contract, it may file an application to the Chief of the Public Entity (Employer) within Seven (7) days of providing the notice under ITB 40.1 by the Public Entity, for review of the proceedings stating the factual and legal grounds.

43.2 Late application filed after the deadline pursuant to ITB 43.1 shall not be processed.

43.3 The chief of Public Entity(Employer) shall, within five (5) days after receiving the application, give its decision with reasons, in writing pursuant to ITB 43.1:

(a) whether to suspend the procurement proceeding and indicate the procedure to be adopted for further proceedings; or

(b) to reject the application.

The decision of the chief of Public Entity shall be final for the Bid amount,lessthan Rupees Twenty Million (NRs. 20,000,000).

43.4 If the Bidder is not satisfied with the decision given in accordance with ITB 43.3, or the decision is not given within five (5) days of receipt of application pursuant to ITB 43.1, it can, within seven (7) days of receipt of such decision, file an application to the Review Committee of the GoN, stating the reason of its disagreement on the decision and furnishing the relevant supporting documents. The application may be sent by hand, by post, by courier, or by electronic media at the risk of the Bidder itself.

43.5 Late application filed after the deadline pursuant to ITB 43.4 shall not be processed.

43.6 Within three (3) days of the receipt of application from the Bidder, pursuant to ITB 43.4, the Review Committee shall notify the concerning Public Entity to furnish its procurement proceedings, pursuant to ITB 43.3.

43.7 Within three (3) days of receipt of the notification pursuant to ITB 43.6, the Public Entity shall furnish the copy of the related documents to the Review Committee.

43.8 The Review Committee, after inquiring from the Bidder and the Public Entity, if needed, shall give its decision within one (1) month of the receipt of the application filed by the Bidder, pursuant to ITB 43.4.

43.9 The Bidder, filing application pursuant to ITB 43.4, shall have to furnish a cash amount or Bank guarantee from Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law equivalent to one percent (1%) of its quoted amount with the validity period of at least ninety (90) days from the date of the filing of application pursuant to ITB 43.4.

43.10 If the claim made by the Bidder pursuant to ITB 43.4 is justified, the Review Committee shall return the security deposit pursuant to ITB 43 to the applicant, within seven (7) days of such decision made.

Section 2 - Bid Data Sheet

This section consists of provisions that are specific to each procurement and supplement the information or requirements included in Section 1, Instructions to Bidders.

A. General

ITB 1.1	The number of the Invitation for Bids is :**ICB4**
ITB 1.1	The Employer is: **Kathmandu- Terai/Madesh Fast Track (Expressway) Road Project (KTFT)** **Nepali Army** **Bhadrakali, Kathmandu, Nepal** **Tel: +977 1 4267060** **Email:ft-procmgmt@nepalarmy.mil.np**
ITB 1.1	The name of the ICB is: **Construction of Double Lane Dual Carriageway Standard Expressway Road, Bridge and Allied Works** The identification number of the ICB is: **KTFT/ICB/WORKS/R&B/078/079/4** The number and identification of lots comprising this ICB is: **one**
ITB 2.1	The name of the Project is: **Kathmandu- Terai/Madesh Fast Track (Expressway) Road Project(KTFT)** The Development Partner(DP) is: **Not Applicable** The implementing agency is: **Government of Nepal** **Nepali Army** **Kathmandu- Terai/Madesh Fast Track (Expressway) Road Project (KTFT)** **Bhadrakali, Kathmandu, Nepal**
ITB 4.1 (a)	Maximum number of partner in a joint venture shall be : **3 (three)**
ITB 4.2	Eligible countries -**All Countries**
ITB 4.4	A list of debarred firms is available at **http:/www.ppmo.gov.np**

ITB 4.9	Tax Clearance Certificate or Proof of submission of income return for: Fiscal Year **2019/020**or latest as legally acceptable and applicable in bidder's respective country and Certificate of Incorporation. The foreign bidder shall declare to submit the following documents at the time of contract agreement Company Registration VAT /PAN Registration But, Resident foreign bidder shall submit PAN/VAT certificate and tax clearance certificate for Fiscal Year **2076/077** or proof of submission of Income Return for **2077/078.** The Domestic Bidder shall submitTax Clearance Certificate for Fiscal Year **2076/077** or proof of submission of Income Return for **2077/078.**

B. Bidding Document

ITB 7.1	For **clarification purposes** only, the Employer's address is: Attention:**Kathmandu- Terai/Madesh Fast Track (Expressway) Road Project (KTFT)** Street Address: **Nepali Army** **Bhadrakali, Kathmandu** Country: **Nepal** Telephone: **+977 1 4267060** Email: **ft-procmgmt@nepalarmy.mil.np** Clarifications shall be sought in writing. The bidder may seek clarifications through email or directly through a letter. The employer shall provide clarifications in writing and shall be shared to all firms obtaining the Bid Documentsand shall be issued to all the applicants in the form of addenda/addendum.
ITB 7.4	A Pre-Bid meeting **shall** take place at the following date, time and place: Date:18 October 2021 Time: 13:00 hours Place: KTFT Project Office
ITB 7.5	Time for request: Requests for clarification should be received by the

	Employer no later than 15 days prior to the deadline for submission of bids.

C. Preparation of Bids

ITB 10.1	The language of the bid is: **English** **Note**: Notarized submission is required in translated copies in English for all languages other than English.
ITB 11.2 (i)	The Bidder shall submit with its bid the following additional documents: Not Applicable
ITB 11.3 (b)	In accordance with ITB 12 and ITB 14, the following schedules shall be submitted with the bid, including the Bill of Quantities and Schedule of Prices: Not Applicable.
ITB 11.3 (d)	The Bidder shall submit with its bid the following additional documents: (a) (Not Applicable)
ITB 13.1	Alternative bids "shall not be" permitted.
ITB 13.2	Alternative times for completion "shall not be" permitted.
ITB 13.4	Alternative technical solutions shall be permitted for the following parts of the Works: "Not Applicable"
ITB 14.6	Price adjustment:There will be no Price Adjustment for the Contractor's Design Workswith Lump Sum Prices. But, Employer's Design Works with Unit Rate (UR) will be subject to price Adjustment.
ITB 15.1	The bid unit rates and the prices shall be quoted by the bidder entirely in Nepalese Currency.
ITB 18.1	The bid validity period shall be: One Hundred Twenty (120) days.
ITB 19.1	The Bidder shall furnish a bid security, from Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law with a minimum of NPR.59,25,00,000.00 which shall be valid for 30 days beyond the validity period of the bid.

ITB 19.2 (b)	Employer's Account to deposit the Bid Security (if in Cash): Name of Office: District Treasury Control Office, Payment Center-2 Bank Name: Nepal Bank Limited Office Code no: 345013587 Bank Address: Bhugolpark, Kathmandu Account Number:00201000002003000001
ITB 20.1	In addition to the original of the bid, the number of copies is: Electronic copy only.
ITB 20.2	The written confirmation of authorization to sign on behalf of the Bidder shall indicate: a) The name and description of the documentation required to demonstrate the authority of the signatory to sign the Bid such as a Power of Attorney; and (b) In the case of Bids submitted by an existing or intended JV, an undertaking signed by all parties (i) stating that all parties shall be jointly and severally liable, and (ii) nominating a Representative who shall have the authority to conduct all business for and on behalf of any and all the parties of the JV during the bidding process and, in the event the JV is awarded the Contract, during contract execution.

D. Submission and Opening of Bids

ITB 21.1	Bidders shallsubmit their bids electronically only.Electronic bids must be submitted through PPMO website**www.bolpatra.gov.np/egp.**
ITB 25.1	The bid opening shall take place at: Street Address: **KTFT Office, Bhadrakali** Floor: Procurement Management Division City: **Kathmandu** Country: **Nepal** Date: 2 November 2021 Time: 13:00 Hours Nepal Standard Time(NPT)

E. Evaluation and Comparison of Bids

ITB 33.1	The currency that shall be used for bid evaluation and comparison purposes to convert all bid prices if permitted and expressed in various

	currencies into a single currency is: Nepalese Currency.
ITB 34.1	**Domestic Preference:** Applicable as per Criteria 1.6 of Section 3.
ITB 35.1	Contractor's proposed subcontracting: Maximum percentage of subcontracting permitted is: up to 25% of the total contract amount.
ITB 36.4	If this Bidding Document allows Bidders to quote separate prices for different Contracts and to award multiple Contracts to a single Bidder: **Not Applicable**
ITB 36.5	The amount of the performance security be increased by Eight (8) percent of the quoted bid price.

F. Award of Contract

ITB 41.1	Letter of Commitment for Bank's Undertaking for Line of Credit shall be of NPR. 3,80,00,00,000.00

Section 3 - Evaluation and Qualification Criteria

This Section contains all the criteria that the Employer shall use to evaluate bids and qualify Bidders through post-qualification exercise. GoN requires bidders to be qualified by meet1ing predefined, precise minimum requirements. The method sets pass-fail criteria, which, if not met by the bidder, results in disqualification. In accordance with ITB 32 and ITB 36, no other methods, criteria and factors shall be used. The Bidder shall provide all the information requested in the forms included in Section 4 (Bidding Forms).

Table of Criteria

1 Evaluation

The evaluation will be carried out on the basis of the criteria and methodologies set out in the ITB Clause 36 in line with thePublic Procurement Act and Regulations.

1.1 Adequacy of Technical Proposal

Evaluation of the Bidder's Technical Proposal will include an assessment of the Bidder's technical capacity, to mobilize key equipment and personnel for the contract consistent with its proposal regarding work methods, scheduling, and material sourcing in sufficient detail and fully in accordance with the requirements stipulated in Section 5 (Employer's Requirements).

1.2 Multiple Contracts(Not Applicable)

Pursuant to Sub-Clause 36.4 of the Instructions to Bidders, if Works are grouped in multiple contracts, evaluation will be as follows:

When, Works are grouped in multiple contracts and pursuant to Sub-Clause 36.4 of the Instructions to Bidders, the Employer will evaluate and compare Bids on the basis of a contract, or a combination of contracts, or as a total of contracts in order to arrive at the least cost combination for the Employer by taking into account discounts offered by Bidders in case of award of multiple contracts.

Qualification Criteria for Multiple Contracts:

The criteria for qualification shall be the sum of the minimum requirements for respective individual contracts as specified under items 2.3.2, 2.3.3, and 2.4.2b.

With respect to the Contracts of Similar Size and Nature under item 2.4.2(a). of Section III, the evaluation shall be done as below:

N is the minimum number of contracts as per Note (2) of 2.4.2 Specific Construction Experience

V is the minimum value of a single contract as per Note (3) of 2.4.2 Specific Construction Experience

i. Minimum requirements for combined contract(s) shall be the aggregate requirements for each contract for which the bidder has submitted bids as follows, and N1,N2,N3, etc. shall be different contracts:

Contract 1: N1 contracts, each of minimum value V1;

Contract 2: N2 contracts, each of minimum value V2;

Contract 3: N3 contracts, each of minimum value V3;

etc.

and

ii. Total number of contracts is equal or less than N1 + N2 + N3 +--but the total value of all such contracts is equal or more than N1 x V1 + N2 x V2 + N3 x V3 +---.

1.3 In Case, other than Multiple Contracts

Bidders have the option to Bid for any one or more Contracts. The contracts will be awarded to the Bidder or Bidders offering the lowest evaluated cost to the Employer, subject to the selected Bidder(s) meeting the required qualification which shall be the sum of the minimum requirements for respective individual contracts as specified under items Required Bid Capacity as per 2.3.3. Under this case, Contract shall be awarded based on Least Cost Combination to the Employer.

1.4 Completion Time

An alternative Completion Time, if permitted under ITB 13.2, will be evaluated as follows:

(Not Permitted)

1.5 Alternative Technical Solutions

Not Applicable

1.6 Domestic Preference

In comparing domestic bids with foreign bids, a Domestic preference as per ITB 34.1 shall be granted to eligible domestic contractors, as defined below, in accordance with the following provisions.

(a) For application of domestic preference, all responsive bids shall first be classified into the following two categories:

(i) **Category I:** Bids offered by domestic contractors (domestic bidder firms, institutions, or company either in single or in joint venture (all partners)) ; and

(ii) **Category II:** Bids offered by International firms, institutions or company or collaboration with domestic firms, institutions, company

(b) The lowest evaluated bid of each category shall then be determined by comparing all evaluated bids in each category among themselves.

(c) Such lowest evaluated bids shall next be compared with each other and if, as a result of this comparison, a bid from **Category I** is found to be the lowest, it shall be selected for the award of contract.

(d) If, however, as a result of the comparison under (c) above, the lowest bid is found to be from **Category II**, it shall be further compared with the lowest evaluated bid from **Category I**. For the purpose of this further comparison only an upward adjustment (domestic preference) shall be made to the lowest evaluated bid price of **Category II** by **adding an amount equal toFive(5%)** of the bid price. If, after such comparison, the **Category I** bid is determined to be the lowest, it shall be selected for the award of contract; if not, the lowest evaluated bid from **Category II** shall be selected.

1.7 Quantifiable Nonconformities, Errors and Omissions

The evaluated amount of quantifiable nonconformities, errors and/or omissions shall be determined by ascertaining the price of such effect on an equal basis by adjusting the same to the quoted price of the bid. A bid having minor deviations and having no material deviation to cause any serious effect upon the scope, quality, characteristics, terms and conditions, performance or any other requirements stated in the bidding documents and acceptable to the Employer can be considered to be substantially responsive.

2. Qualification

2.1 Eligibility

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	

2.1.1 Nationality

Nationality in accordance with ITB Sub-Clause 4.2.	must meet requirement	must meet requirement	must meet requirement	not applicable	Forms ELI –1; ELI –2 with attachments

2.1.2 Conflict of Interest

No conflicts of interest in accordance with ITB Sub-Clause 4.3.	must meet requirement	existing or intended JV must meet requirement	must meet requirement	not applicable	Letter of Technical Bid

2.1.3 Government-owned Entity

Applicant required to meet conditions of ITB Sub-Clause 4.5.	must meet requirement	must meet requirement	must meet requirement	not applicable	Forms ELI -1, ELI - 2 with attachments

2.1.4GoN/DP Eligibility

Not having been declared ineligible by Development Partner, as described in ITB Sub-Clause 4.4.	must meet requirement	must meet requirement	must meet requirement	Not applicable	Letter of Technical Bid

2.1.5 UN Eligibility

Not having been declared ineligible based on a United Nations resolution or Employer's country law, as described in ITB Sub-Clause 4.8.	must meet requirement	must meet requirement	must meet requirement	Not applicable	Letter of Technical Bid

2.1.6 VAT and PAN Registration

a. Domestic Bidder	Bidders required to meet conditions of ITB Sub-Clause 4.9.	must meet requirement	existing or intended JV must meet requirement	must meet requirement	Not applicable	PAN and VAT registration certificate Tax Clearance/Tax Return
b. Foreign Bidder	Bidders required to meet conditions of ITB Sub-Clause 4.9.	must meet requirement	existing or intended JV must meet requirement	must meet requirement	Not applicable	Declaration to submit PAN and VAT Registration Certificate at the time of Contract agreement

2.2 Pending Litigation

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	

2.2.1 Pending Litigation

All pending litigation shall be treated as resolved against the Applicant and so shall in total not represent more than **75 percent** of the Applicant's net worth	must meet requirement by itself oras partner to past or existing JV	not applicable	must meet requirement by itself oras partner to past or existing JV	not applicable	Form LIT – 1

2.3 Financial Situation

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	

2.3.1 Historical Financial Performance

Submission of audited financial statementsor, if not required by the law of the bidder's country, other financial statements acceptable to the Employer, for the last **5 (Five) years** to demonstrate the current soundness of the bidder's financial position. As a minimum, the bidder's net worth for the last year, calculated as the difference between total assets and total liabilities should be positive.	must meet requirement	not applicable	must meet requirement	not applicable	Form FIN - 1 with attachments

Note:

a) In-case of more than one financial statements for a year (in-case when the bidder is working in different joint ventures at the same period) a consolidated financial statement should be submitted showing all income and expenditures.

b) The financial information provided by aBidder shall be reviewed in its entirety to allow a truly informed judgment, and the pass-fail decision on the financial position of the Bidder shall be determined.

2.3.2 Average Annual Construction Turnover

Minimum average annual construction turnover of **NPR 11,45,00,00,000.00** calculated as total certified payments received for contracts in progress or completed, within best three years out of last Ten fiscal years.	must meet requirement	must meet requirement	must meet 25% of the requirement	must meet 40% of the requirement	Form FIN - 2

2.3.3 Required Bid Capacity					
The bidding capacity of the bidder should be equal to or more than **NPR 20,00,00,00,000.00**	must meet requirement	must meet requirement	must meet 25 % of the requirement	must meet 40% of the requirement	Form FIN - 3,4

2.4 Experience

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	

2.4.1 General Construction Experience

Experience under construction contracts in the role of contractor, subcontractor, or management contractor for at least the last **5 (five)** years.	must meet requirement	not applicable	must meet requirement	not applicable	Form EXP -1

2.4.2 Specific Construction Experience

(a) Contracts of Similar Size and Nature

Similar Experience;					
(1) Participation as Prime contractor, management contractor, or subcontractor, in at least 2 (two)contractswithin the last Ten Years, eachwith a value of at least **NPR 4,35,00,00,000.00** that includes Construction of Double Lane Dual Carriageway Road or Highway or Expresswayof minimum four lane standard (minimum 20m formation width) and 4.5 (Four and Half) km in lengththat have been successfully orsubstantially completedand shall be similar to the proposed works.	must meet requirement	must meet requirement	not applicable	not applicable	Form EXP - 2(a)
(2) Participation as Prime contractor, management contractor, or subcontractor, in at least 2 (Two) contractswithin the last Ten Years, each with a value of at least **NPR 11,70,00,00,000.00** that includes EPC/Turnkey or Design and Build or Design, Build and Operateof Bridge Workswith at least 3(Three) number of double lane Bridge of 300m length and at least one pier height ≥ 45mthat have been successfully orsubstantially completed and	must meet requirement	must meet requirement	not applicable	not applicable	Form EXP - 2(a)

shall be similar to the proposed works.					

Note:

a) The evaluation will be based on the specified criteria and the declaration made by the Bidder and to substantiate the above mentioned qualifications, the bidder shall submit certificates of successful completion/substantial completion from the respective Employers.

b) Construction Experience in Key Activities

For the above or other contracts executed during the period stipulated in 2.4.2(a) above, a minimum construction experience in the following key activities:					
(i) **Road or Highway or ExpresswayWorks:** For the above or other contracts executed,the bidder should have successfully completed at leastthe following work activitieswithin agreed contract period in the last 10 years**.** **a)** The bidder should have successfully completed at least **19,000 Cum** ofasphalt concrete or Dense bituminous Macadamwork **b)** The bidder should have successfully completed at least**17,000 Cum**of RCC Concrete Grade ≥M20 for road structures other than bridges.	must meet requirement	must meet requirement	not applicable	not applicable	Form EXP - 2(b)

2.5 Understanding about the project and proposed design

Understanding about the project					
Submission of concept	must meet	must meet	not	not	Form

paper highlighting detail about understanding of the project from planning to completion stage including surveying, geotechnical investigation, geo-physical investigation, environmental and social safeguard study, designing, construction, operation and maintenance for Bridgeand Slope ProtectionWorkssatisfactory to the Employer.	requirement	requirement	applicable	applicable	DES – 1(a)
Understanding about the Proposed design					
Submission of design methodology for the Bridgeand Slope ProtectionWorks including design finalization procedure, assurance about design and relevant codes satisfactory to the Employer.	must meet requirement	must meet requirement	not applicable	not applicable	Form DES – 1(b)

2.6 Personnel

The Bidder must demonstrate that it has the personnel for the key positions that meet the following

Requirements:

S.N.	Position	No.	Minimum Qualification	Total Work Experience [Years]	Experience in Similar Works [years]
For the Contractor's Design Works (for Design Part only)					
1.	Bridge Engineer (Design)	2	Master's Degree in Bridge / Structural Engineering	15	Seven Years of experience in the related field and shall have experience of Design Works of Two Bridges of Minimum 300m Length and ≥30m ofPier height.
2.	Highway Engineer (Design)	1	Master's Degree in Highway / Transportation	15	Seven Years of experience in the related field and shall have experience of Design of Highway/Expressway including Inter-change of at least one Highway/Expressway project.

S.N.	Position	No.	Minimum Qualification	Total Work Experience [Years]	Experience in Similar Works [years]
			Engineering		
3.	Highway Engineer (Pavement Design)	1	Master's Degree in Highway / Transportation Engineering	15	Seven Years of experience in the related field and shall have experience of Design of Road/Highway/Expressway pavement of at least one Highway/Expressway project.
4.	Geotechnical Engineer	2	Master's Degree in Geotechnical Engineering	15	Five Years of experience in the related field and shall have experience in Geotechnical report of Open and Deep/Pile Foundations for at least one multi span Bridge. Seven Years of experience in the related field and shall have experience in design of Slope stability works in at least one Highway/Expressway Project.
5.	Geologist	2	Master's Degree in Geology	15	Five Years of experience in the related field and shall have experience in geological investigation on slope, highway, bridge
6.	Hydrologist	1	Master's Degree in Hydrology/Water Resources	15	Five Years of experience in the related field and shall have experience in Hydrological analysis report of at least one multi span Bridge.
For the Construction of all works					
7.	Project Manger	1	Bachelor's Degree in Civil Engineering	20	Ten years of experience in the related field as a Project Manager or Contract Manager or Equivalent and shall have experience of at least one Bridge of Highway/Expressway and one 30m pier Height Bridge of 300m

S.N.	Position	No.	Minimum Qualification	Total Work Experience [Years]	Experience in Similar Works [years]
					length.
8.	Deputy Project Manager/Contracts Manager	1	Bachelor's Degree in Civil Engineering	15	Seven Years of experience in the related field as a deputy Project Manager or Deputy Contract manager or equivalent and shall have experience of at least one Bridge or Highway/Expressway on contract.
9.	Quality Manager	1	Bachelor's Degree in Civil Engineering	15	Seven Years of experience in the related field and shall have experience in supervision of at least one Highway/Expressway Project.
10.	Health, Safety and Environment Protection Engineer	1	Bachelor's Degree in Civil / Environment Engineering	12	Five Years of experience in the related field and shall have experience in supervision of at least one Highway Project
11.	Highway Engineer (Supervision)	2	Bachelor's Degree in Civil Engineering	12	Five Years of experience in the related field and shall have experience in supervision of at least one Highway/Expressway Project.
12.	Bridge Engineer (Supervision)	3	Master's Degree in Structural / Bridge Engineering	15	Seven Years of experience in the related field and shall have experience in Supervision Bridge Works of Highway/Expressway Project.
13.	Geotechnical Engineer	2	Master's Degree in Geotechnical Engineering	15	Five Years of experience in the related field and shall have experience in supervision of Slope stability works in at least one Highway/Expressway Project.
14.	Geologist	2	Master's degree in Geology	15	Five Years of experience in the related field and shall have experience in geological investigation on slope, highway and bridge foundation.

Note:

a) The bidder must submit the evidences/certificates of all above requirements along with the bid. The evaluation is based on pass/fail criteria. If the bidder failed to submit the above requirements the bidder will be disqualified.

b) The proposed personnel shall be assigned to the project works and shall not be changed during implementation of the project unless otherwise agreed by the Employer, if awarded the contract.

c) The Bidder shall provide details of the proposed personnel and their experience records in the relevant Information Forms included in Section 4 (Bidding Forms).

d) The bidder must submit the duly signed Curriculum Vitae for the above mentioned personnel. The successful bidder if awarded the contract shall be responsible for the deployment of the necessary personnel for timely completion of the project. The number of personnel shown are indicative only and shall be used solely for the purpose of the evaluation of the bidder.

2.7 Equipment

The Bidder must demonstrate that he/she is in a position to deploy the key equipment listed below for the execution of the contract :

No.	Equipment (Type and Minimum Capacity)	Quantity Min. (Nos.)	Remarks
1.	Hydraulic Excavator - ≥1.1 cum rock bucket	5	
2.	Loader- ≥3 Cubic Meter	5	
3.	Concrete mixing station (Fully computerized Automatic Batching Plant) Min. production capacity of - ≥60cum/hr	1	
4.	Concrete transit Mixer Truck - >6cum	4	
5.	Mobile Crane - ≥50Ton	2	
6.	Pile Driving/Boring Machine - ≥1.20m diameter with Tremie, Funnel all complete	2	
7.	Dump Trucks/Dumpers- ≥25t capacity	12	
8.	Generator - ≥200KVA	1	
9.	Motor Graders with Blade width≥3.75m	4	
10.	Asphalt Batching Plant≥60Ton/hr Capacity	1	

11.	Asphalt paver Machine with paving width≥3.75m and having Sensor for level control	1	
12.	Pneumatic Roller≥10Ton Capacity	3	
13.	Vibratory Steel Roller≥12Ton Capacity	2	
14.	Water Tanker ≥ 6000liters capacity	2	
15.	Bitumen Distributor≥3000 liters capacity	1	
16.	Concrete Pump Car≥20Ton capacity	1	
17.	Cargo Crane Truck≥200Ton capacity	1	
18.	Cargo Trolley Truck -≥ 40 Ton-≥ 40 m Long	2	

Note:

a) The bidder must submit the evidences/certificates of all above requirements along with the bid. The evaluation is based on pass fail criteria. If the bidder failed to submit the above requirements, the bid will be disqualified.

b) In case of Equipment to be leased/hired the same procedures as mentioned above shall apply. The Bidder must demonstrate that it has the required equipment and bidder shall provide details of the proposed equipment in the relevant information forms included in Section 4 (Bidding Forms).

c) The Bidder/Leaseholdershall be solely responsible for the data provided. However, this shall not limit the right of employer to verify the authenticity of submitted information.

d) The Bidder shall provide further details of proposed items of equipment using the relevant Form in Section 4(Bidding Forms).

e) The numbers of proposed equipment shown above are indicative only which shall be used solely for the purpose of evaluation of the bidder for qualification purpose only. The bidder must demonstrate that, based on known commitments, they will be available for timely use for this contract. The bidder shall be solely responsible for deployment of adequate no. of necessary equipment for timely completion of the contract.

f) The availability of the specified equipment may be subject to verification prior to contract award. The terms of any lease or hire agreement for equipment should include provision that the equipment will remain on the site (or be vested in the employer) in the event of default of Contractor.

Section 4 - Bidding Forms

This Section contains the forms which are to be completed by the Bidder and submitted as part of his Bid.

Table of Forms

Letter of Technical Bid

The Bidder must accomplish the Letter of Bid in its letterhead clearly showing the Bidder's complete Name and Address.

Date: .....

Bidding No.: .....

Invitation for Bid No.: .....

To:.....

We, the undersigned, declare that:

(a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB) Clause 8;

(b) We offer to execute in conformity with the Bidding Documents the following Works:
.....

(c) Our bid shall be valid for a period of **120 (One hundred twenty**)days from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(d) If our bid is accepted, we commit to obtain a performance security in accordance with the Bidding Document;

(e) Our firm, including any subcontractors or suppliers for any part of the Contract, have nationalities from eligible countries or any countries **[insert the nationality of the Bidder, including that of all parties that comprise the Bidder if the Bidder is a consortium or association, and the nationality of each Subcontractor and Supplier];**and meet the requirements of ITB 3.7, &3.8**,**

(f) We, including any subcontractors or suppliers for any part of the contract, do not have any conflict of interest in accordance with ITB 4.3;

(g) We are not participating, as a Bidder or as a subcontractor, in more than one bid in this bidding process in accordance with ITB 4.3, other than alternative offers submitted in accordance with ITB 13;

(h) Our firm, its affiliates or subsidiaries, including any Subcontractors or Suppliers for any part of the contract, has not been declared ineligible by the law of Nepal or official regulations or by an act of compliance with a decision of the United Nations Security Council;

(i) We are not a government owned entity / We are a government owned entity but meet the requirements of ITB 4.5;[1]

(j) We understand that this bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract agreementis prepared and executed;

(k) Commissions or gratuities, if any, paid or to be paid by us to agents relating to this bid, and to contract execution if we are awarded the contract, arelisted below:

Name and address of agents	Amount and currency	Purpose of commission or gratuity
1. 2. [if none, state "none"]		

(l) We including any subcontractors or suppliers for any part of the contract do not have any conflict of interest in the proposed procurement proceedings and we have not been blacklisted as per ITB 3.4 and punished for an offense relating to the concerned profession or business;

(m) We agree to permit the Employer or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by the Employer;

(n) If our Bid is accepted, we commit to mobilizing key equipment and personnel in accordance with the requirements set forth in Section 3 (Evaluation and Qualification Criteria) and our technical proposal, or as otherwise agreed with the Employer;

(o) We are solely responsible for the authenticity of the documents submitted by us. The document and information submitted by us are true and correct. If any document/information given is found to be concealed at a later date, we shall accept any legal actions by the Employer; and that

(p) We are committed to submit the Letter of Commitment for Bank's Undertaking for Line of Credit of ……..Millions at the time of executing thecontract agreement, if the bid is awarded to us.

Name .....

[1] *Use one of the two options as appropriate.*

In the capacity of .....

Signed .....

Duly authorized to sign the Bid for and on behalf of .....

Date.....

Letter of Price Bid
(Please Refer to Price Bid)

Bill of Quantities andSchedule of Prices

(Please Refer Price Bid)

Schedule of Payment Currencies

(Please Refer to Price Bid)

Tables of Adjustment Data

(Refer Price Bid)

Bid Security

Bank's Name, and Address of Issuing Branch or Office
(On Letter head of the Commercial bank or any Financial Institution eligible to issue Bank Guarantee as per prevailing Law)

Beneficiary: ..... name and address of Employer …….

Date: ……...

Bid Security No.: .....

We have been informed that . ……. .[insert name of the Bidder] (hereinafter called "the Bidder") intendsto submit its bid (hereinafter called "the Bid") to you for the execution of ……... name of Contract . …… under Invitation for Bids No. …… ("the IFB").

Furthermore, we understand that, according to your conditions, bids must be supported by a bid guarantee.

At the request of the Bidder, we……. ……*(insert the name and address of Bank)* do hereby irrevocably undertake to pay you any sum or sums not exceeding in total of . . …….....*(insert the amount in figures*)(. ……..) *(insert the amount in words*) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Bidder is in breach of its obligation(s) under the bid conditions, because the Bidder:

(a) has withdrawn or modified its Bid during the period of bid validity specified in the Form of Bid; or

(b) does not accept the correction of errors in accordance with the Instructions to Bidders (hereinafter "the ITB"); or

(c) having been notified of the acceptance of its Bid by the Employer during the period of bid validity, (i) fails or refuses to execute the Contract Agreement, or (ii) fails or refuses to furnish the performance security, in accordance with the ITB.

(d) isfound to have been involved in fraud and corruption

This guarantee will remain in force up to and including the date ……number……days after the deadline for submission of Bids as such deadline is stated in the instructions to Bidders or as it may be extended by the Employer, notice of which extension(s) to the Bank is hereby waived. Any demand in respect of this guarantee should reach the Bank not letter than the above date.

This Bank guarantee shall not be withdrawn or released merely upon return of the original guarantee by the Bidder unless notified by you for the release of the guarantee.

. . .Bank's seal and authorized signature(s) . . .

Note:

The bid security of ……..……. has been counter guaranteed by the Bank ……..……... ...…… on ……..……..……. (Applicable for Bid Security of Foreign Banks).

Bidder's Qualification

To establish its qualifications to perform the contract in accordance with Section 3 (Evaluation and Qualification Criteria) the Bidder shall provide the information requested in the corresponding Information Sheets included hereunder.

Form ELI – 1: Bidder's Information Sheet

Bidder's Information	
Bidder's legal name	
In case of JV, legal name of each partner	
Bidder's country of constitution	
Bidder's year of constitution	
Bidder's legal address in country of constitution	
Bidder's authorized representative (name, address, telephone numbers, fax numbers, e-mail address)	

Attached are copies of the following original documents.

1. In case of single entity, articles of incorporation or constitution of the legal entity named above, in accordance with ITB 4.1 and 4.2.

2. Authorization to represent the firm or JV named in above, in accordance with ITB 20.2.

3. In case of JV, letter of intent to form JV or JV agreement, in accordance with ITB 4.1.

4. In case of a government-owned entity, any additional documents not covered under 1 above required to comply with ITB 4.5.

Form ELI - 2: JV Information Sheet

Each member of a JV must fill in this form

JV / Specialist Subcontractor Information	
Bidder's legal name	
JV Partner's or Subcontractor's legal name	
JV Partner's or Subcontractor's country of constitution	
JV Partner's or Subcontractor's year of constitution	
JV Partner's or Subcontractor's legal address in country of constitution	
JV Partner's or Subcontractor's authorized representative information (name, address, telephone numbers, fax numbers, e-mail address)	

Attached are copies of the following original documents.

1. Articles of incorporation or constitution of the legal entity named above, in accordance with ITB 4.1 and 4.2.

2. Authorization to represent the firm named above, in accordance with ITB 20.2.

3. In the case of government-owned entity, documents establishing legal and financial autonomy and compliance with commercial law, in accordance with ITB 4.5.

Form LIT - 1: Pending Litigation

Each Bidder or member of a JV must fill in this form

Pending Litigation

❑ **No pending litigation in accordance with Criteria 2.2 of Section 3 (Evaluation and Qualification Criteria)**

❑ **Pending litigation in accordance with Criteria 2.2 of Section 3 (Evaluation and Qualification Criteria)**

Year	Matter in Dispute	Value of Pending Claim in US$ Equivalent	Value of Pending Claim as a Percentage of Net Worth

Form FIN - 1: Financial Situation

Each Applicant or member of a JV must fill in this form

Financial Data for Previous 5 Years [in NRs or Equivalent US$]					
	Year 1	**Year2**	**Year3**	**Year4**	**Year5**

Information from Balance Sheet

Total Assets					
Total Liabilities					
Net Worth					
Current Assets					
Current Liabilities					

Information from Income Statement

Total Revenues					
Profits Before Taxes					
Profits After Taxes					

❑ Attached are copies of financial statements (balance sheets including all related notes, and income statements) for the last five years, as indicated above, complying with the following conditions.

- All such documents reflect the financial situation of the Applicant or partner to a JV, and not sister or parent companies.
- Historic financial statements must be audited by a certified accountant.
- Historic financial statements must be complete, including all notes to the financial statements.
- Historic financial statements must correspond to accounting periods already completed and audited (no statements for partial periods shall be requested or accepted).

Note: Financial reports, including balance sheets, profit and loss statements and auditor's reports for the last 5years should be attached.All financial reports shall be either certified copies of the Annual Accounts submitted to the Inland Revenue offices or Company Registrar's office; or shall be notarial certified as True copies of originals.

Form FIN - 2: Average Annual Construction Turnover

Each Bidder or member of a JV must fill in this form.The information supplied should be the Annual Turnover of the Bidder or each member of a JV in terms of the amounts billed to clients for each year for work in progress or completed in US Dollars at the rate of exchange **at the end of the period reported**.

Annual Turnover Data for the Last 10Years (Construction only)			
Year	**Amount Currency**	**Exchange Rate**	**US$ Equivalent**
Average Annual Construction Turnover			

Bidder shall have to submit the relevant documentary evidence to substantiate the facts/figures.

Form FIN - 3: Bid Capacity

Each Bidder or member of a JV must fill in this form

Bid Capacity = [(7 x A) – B]

A = Average Annual Turnover of best three years out of last ten fiscal years.

B = Annual Value of the existing commitments and works (ongoing) to be completed, calculated from **FIN-4.**

SN	Name of Bidder	Pan No.	A, in Million	B, in Million	Bid Capacity, in Million
1					
2					
3					

Total Bid Capacity:

Signature of Bidder

Bidder shall have to submit the relevant documentary evidence to substantiate the facts/figures.

Form FIN-4: Current Contract Commitments / Works in Progress

Bidders and each partner to a JV should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued.

Current Contract Commitments (For Calculation of B with reference of FIN-3)									
No.	**Name of Contract**	**Name of the Contractor/s**	**Employer's Contact Address, Tel, Fax**	**Contract Share in %** **(a)**	**Contract Amount in Millions** **(b)**	**Contract Date (yyyy-mm)** **(c)**	**Initial or Revised Contract Duration (months)** **(d)**	**Value of outstanding works [In Millions, NRS]#** **(e)**	**Estimated Time in Month to Complete the outstanding works** **(f) = (c) + (d) – Date of Invitation of Bid** **(f)**
1									
2									
3									
4									

Signature of Bidder

 # The Outstanding Works means Contract Price (excluding Vat) minus Work Evaluated by Employer till the reference date. Bidder shall have to submit the relevant documentary evidence to substantiate the facts/figures.

Note 1: "B" shall be calculated as : $B = \sum \left[\frac{(e) \times (a)}{(f)} \right] x\, 12$ **, If (f) is less than 12, then value of (f) shall be taken as 12.**

Note 2: IfInitialorRevisedContract Date isrunoutwithrespectto Date of Invitation of Bid, theEstimated Time in Monthto Complete theoutstandingworksshall be takenequalto 12 months.

Form EXP – 1:General Construction Experience

Each Bidder or member of a JV must fill in this form

General Construction Experience				
Starting Month Year	**Ending Month Year**	**Years**	**Contract Identification and Name and Address of Employer Brief Description of the Works Executed by the Bidder**	**Role of Bidder**

Bidder shall have to submit the relevant documentary evidence to substantiate the facts/figures.

Form EXP – 2 (a):Specific Construction Experience

Fill up one (1) form per contract.

Contract of Similar Size and Nature			
Contract No. . . . . **of**	**Contract Identification**		
Award Date		**Completion Date**	
Role in Contract	❑ **Contractor**	❑ **Management Contractor**	❑ **Subcontractor**
Total Contract Amount	**US$ ……..**		
If partner in a JV or subcontractor, specify participation of total contract amount	**Percent of Total**	**Amount**	
Employer's Name **Address** **Telephone/Fax Number** **E-mail**			
Description of the similarity in accordance with Criteria 2.4.2(a) of Section 3			
Note: **Refer criteria 2.4.2(a)against which the bidder is required to demonstrate similarity in the box on the right-hand-side**.			

Form EXP – 2 (b):Specific Construction Experience in Key Activities

Fill up one (1) form per contract

Contract with Similar Key Activities			
Contract No. . . . . **of**	**Contract Identification**		
Award Date		**Completion Date**	
Role in Contract	❑ **Contractor**	❑ **Management Contractor**	❑ **Subcontractor**
Total Contract Amount	**US$ …….**		
If partner in a JV or subcontractor, specify participation of total contract amount	**Percent of Total**	**Amount**	
Employer's Name **Address** **Telephone Number** **Fax Number** **E-mail**			
Description of the key activities in accordance with Criteria 2.4.2(b) of Section 3			
Note: **The criteria 2.4.2 (b) against which the bidder is required to demonstrate in the box on the right-hand-side production rates achieved by him on previous contracts.**			

Form DES– 1 (a):Format for Understanding about the project

Biddertosubmit a brief description for the followings, to show his understanding about the project;

1. Knowledge about project area
2. Knowledge about planning stage
3. Approach towards surveying and types of surveys to be done,
4. Approach for geotechnical investigation and reporting details
5. Types of environmental and social safeguard study to be done including the way such studies shall be conducted, Environmental Protection Plan
6. Approach for designing
7. Procurement detailing including subcontracting
8. Construction stage detailing (approach, quality assurance and control mechanism)
9. Health Safety Plan
10. Finalization of construction & modality of handover
11. Mechanism for operation and maintenance

Form DES– 1 (b): Format for the Concept for Proposed Design

Bidder to submit a brief description for the followings, to show his understanding about the design of the Bridges, Toll Plaza and Interchange Works;

1. Design methodology

2. Design finalization procedure

3. Assurance about design

4. Relevant codes for design

Form PER – 1: Proposed Personnel

Bidders should provide the names of suitably qualified personnel to meet the specified requirements for each of the positions listed in Section 3 (Evaluation and Qualification Criteria). The data on their experience should be supplied using the Form below for each candidate.

No.	Name	Position*	Academic Qualification	Total Work Experience [Years]	Experience in Similar Works [years]

1.					
2.					
3.					
4.					
5.					

***As listed in Section 3 (Evaluation and Qualification Criteria).**

Form PER – 2: Resume of Proposed Personnel

The Bidder shall provide all the information requested below. Fields with asterisk (*) shall be used for evaluation.

Proposed Position*		
Personal Information	**Name**	**Date of Birth**
	Professional qualifications	
Present employment	**Name of employer**	
	Address of employer	
	Telephone	**Contact (manager/personnel officer)**
	Fax	**E-mail**
	Job title	**Years with present employer**

Summarized professional experience over the last twenty years in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.

From*	**To***	**Company, Project, Position and Relevant Technical and Management Experience***

Form EQU-1 Proposed Equipment

The Bidder shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key equipment listed in Section 3 (Evaluation and Qualification Criteria). A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Bidder. The Bidder shall provide all the information requested below, to the extent possible. Fields with asterisk (*) shall be used for evaluation.

For the equipment under Bidder's ownership

No.	Equipment Type and Characteristics	Total Nos. of Equipment under Bidder's Ownership	No. of Equipment engaged/proposed for ongoing/committed contracts	Nos. of Equipment proposed for this contract
1.				
2.				
3.				
4.				

(ii) For the Equipment to be leased/hired

No.	Equipment Type and Characteristics	Total Nos. of Equipment under the ownership of lease/hire provider	No. of Equipment engaged/committed for other works	Nos. of Equipment proposed to be leased/hired for this contract
1.				
2.				
3.				
4.				

Type of Equipment*		
Equipment Information	**Name of manufacturer**	**Model and power rating**
	Capacity*	**Year of manufacture**
Current Status	**Current location**	
	Details of current commitments	
Source	**Indicate source of the equipment** **□ Owned □ Rented □ Leased □ Specially manufactured**	

The following information shall be provided only for equipment not owned by the Bidder.

Owner	**Name of owner**	
	Address of owner	
	Telephone	**Contact name and title**
	Fax	**email**
Agreements	**Details of rental / lease / manufacture agreements specific to the project**	

Technical Proposal Format

1. **Personnel**
2. **Equipment**
3. **Site Organization**
4. **Method Statement**
5. **Mobilization Schedule**
6. **Construction Schedule**
7. **Schedule of Sub-contractors**
8. **Planned Progress Chart (S-Curve)**
9. **Bidder's Quality Manual**
10. **Bidder's Health and Safety Manual**
11. **Bidder's Environment Protection Procedures**
12. **Schedule of Proposed Material's suppliers, manufactures,**
13. **Schedule of proposedImported Materials**
14. **Schedule of proposedImported Equipment and plant**
15. **Others**

1. Personnel

a) In addition to the key personnel prescribed in Section 3- Clause 2.6,bidder shall submit a schedule comprised of all the proposed manpower indicating position/categories and numbers of each category to be employed in this contract. The following table is provided for guidance purpose only.

S.N	Position/Category	Nos.	Remarks
1	**Project Manager**	**1**	
2	**Deputy Project Manager**	**1**	
----	**----------**		
----	**----------**		
----	**----------**		
----	**----------**		
----	**----------**		
----	**Skilled Laborers**		
----	**Unskilled laborers**		

b) Bidder shall include a histogram table and graph detailing the utilization of manpower along the project duration. The following table is provided for guidance purpose only.

Manpower	Months								
	1	**2**	**3**	**4**	**..**	**..**	**..**	**..**	**..**
Key Personnel									
Administrativa Staff									
Site Supervisión Staff									
Drivers/ Operators									
Skilledworkers									

Unskilledworkers									
Others									

2. Equipment

a) In addition to the key plant and equipment prescribed in Section 3-Clause 2.7, the bidder shall submit a schedule comprised of all equipment and plant indicating categories and number for each category to be employed in this contract. The following table is provided for guidance purpose only.

S.N.	Type of Equipment & Plant	Nos.	Remarks

b) Bidder shall include a histogram table and graph detailing the utilization of Equipment and Plant along the project duration. The following table is provided for guidance purpose only.

Type of Equipment and Plant	Months								
	1	2	3	4	..	..	..	..	..

3. Site Organization

The Bidder shall show hereinan Organogram format the organization of his site personnel showing clearly designated duties and responsibilities and the chain of command throughout the structure. Included in the chart shall be the names of respective personnel.

4. Method Statement

The Bidder shall provide here a brief description of the Works. The description shall indicate how each activity is to be undertaken. The method statement shall comprise brief description of work, references, responsibilities, material required, equipment required, manpower required, safety hazards and control measures, quality control measures, preparatory works if any, construction procedure and attachments relevant to the execution of the intended activity.

5. Mobilization Schedule

The Bidder shall provide here a general description of the arrangements and methods which he proposes to adopt for the detailed site investigation, design and execution of the Works which shall include but not be limited to:-

i) Mobilization period including periods required for establishing the Contractor's offices, workshops etc. and the facilities required for the Engineer and his staff if applicable.

ii) Mobilization procedure for the detailed site investigation and design works.

iii) Sources of Contractor's equipment and mobilization periods for items of plant.

6. Work Schedule

The Bidder shall provide here his proposed schedulefor carrying out necessary survey, investigations, designs and construction of the Works within the prescribed Time for Completionof the works.The schedule shall be presented in the form of a linked **bar chart** showing main construction activities with**appropriate logic links and Milestones.** The proposed schedule shall include the establishment of contractor's site camp and offices, mobilization of manpower and equipment, detailed site survey and soil/geotechnical investigation, detailed design including approval of construction drawings, submission of construction plan and other required documents, execution of major work activities, testing and commissioning, as built drawings and submission of close out report as a minimum.

7. Schedule of Subcontractors

The bidder shall enter in the following table a list of the sections and appropriate value of the work for which he proposes to use subcontractors, together with the names and addresses of the proposed subcontractors. The bidder shall also enter a statement of similar works previously executed by the proposed subcontractors, including description, location and value of work, year completed, and name and address of the employer/engineer.

Item Nos.	Description of work	Approximate value (US$ or equivalent)	Name and address of Subcontractor	Statement of similar works executed

Notwithstanding such information the bidder, if awarded the Contract, contractor shall remain entirely and solely responsible for the satisfactory execution and completion of the Works assigned the sub-contractorand the maintenance of such works as specified in the Contract.

8. Planned Progress Chart (S-Curve)

Bidder to submit an expected progress chart (S-Curve) showing the expected progress against the proposed duration of the works. No amount shall be shown which may be the reason for rejection of the bid. The proposed progress curve shall be prepared based on the proposed work schedule.

9. Bidder's Quality Manual

Bidder shall submit a copy of his/her Quality Manual. If the Quality Manual is not available, the bidder shall submit a general descriptionoutlining the plans, process, and procedures to be implemented for the quality assurance and control of the project works.

10.Bidder's Health and Safety Manual

Bidder shall submit a copy of his/her Health and Safety Manual.If the Health and Safety Manualnot available, the bidder shall submit a general descriptionoutlining the plans, process, and procedures for the fulfillment of the Health and Safety requirements of the contract works**.**

11. Bidder's Environment Protection Plan

Biddershall submita copy of his/her Environment Management Plan. If the Environment Management Plan not available, the bidder shall submit a general description outlining the plans, process, and procedures for the fulfillment of Environmental protection requirements of the contract works.

12. Details of Proposed materials with manufactures, supplier's information

Bidder to submit the schedule of proposed materials with manufacturer/supplier and place of inspection of the materials required for the execution of the works as below.

S.N.	Description of Material	Manufacturer	Supplier	Place of Inspection of the Material
1	Cement			
2	Re-bars			
	Etc.			

13. Detailsof Proposed to be Importedmaterials if any

If the Bidder wishes to import any materials, to be utilized for the contract in compliance with this bid document and the rules and regulation of Nepal, shall submit a schedule of the materialsproposed to be importedthrough Master List based on the Bill of Quantities and/or Schedule of Prices.

14. Details of Proposed to be Imported Equipment, if any

If the Bidder wishes to import anyconstruction equipment to be utilized for the contract, in compliance with this Bid and the rules and regulation of Nepal, shall submit a schedule of the equipment so proposed to be imported Equipment.

15. Others (insert additional requirement if applicable]

PARTII REQUIREMENTS

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Section 5. Employer's Requirements

(Provided separately bound)

Note:

Tender/Bid Drawings for the Employer's Design Works and Indicative Drawings for Contractor's Design Works are provided in separately bound Volume.

Section 6- Preamble ofBill of Quantities/Schedule of Prices

(Refer to Price Bid)

PART III CONDITIONS OF CONTRACT AND CONTRACT FORMS

Table of Contents

Section 7: General Conditions of Contract

The General Conditions of Contract shall be the FIDICConditions of Contract for Plant and Design–Build for Electrical & Mechanical Plant, and for Building and Engineering Works, Designed by the Contractor, Second Edition 2017, published by the FédérationInternationale des Ingénieurs–Conseils (FIDIC) , available at http://www.fidic.org/

Section 8: Particular Conditions of Contract

There are a number of Sub-Clauses in the General Conditions which require data to be provided by the Employer and/or the Contractor and inserted into the Contract Data (Particular Conditions – Part A). However, there are no Sub-Clauses in the General Conditions which require data or information to be included in the Special Provisions (Particular Conditions – Part B).

ProvisionsfoundintheContractdocumentsunderSpecialProvisions(ParticularConditions –PartB) indicate that the General Conditions have been amended orsupplemented.

"The provisions found in the Special Provisions (Particular Conditions – Part B) take precedence over the equivalent provisions found under the same Sub-Clause number(s) in the General Conditions, and the provisions of the Contract Data (Particular Conditions Part A) take precedence over the Special Provisions (Particular Conditions – Part B)."

Note :

1. Clause numbers in the PCC correspond to those in the GCC.

2. This contract includes both of the Contractor's design and the Employer's design works. Although the GCC correspond to the Contractor's design, the Part A- Contract data and Part B- Special provisions are prepared to address both the Contractor's design and the Employer's design works.

Particular Condition Part A: Contract Data

GCC Ref. Sub-Clause

Particulars

Data

1.1.20

Where the Contract allows for Cost Plus Profit, percentage profit to be added to the Cost.

Not Applicable

1.1.27

Defects Notification Period (DNP)

1825 Days

1.1.30

Employer's Name and Address

Kathmandu- Terai / Madesh Fast Track (Expressway) Road Project (KTFT)

Nepali Army Headquarter Bhadrakali, Kathmandu, Nepal

Tel: +977 1 4267060

Email:ft-procmgmt@nepalarmy.mil.np

1.1.35

Engineer's name and address

M/s Yooshin Engineering Corporation, Korea - Korea Expressway Corporation, Korea - Pyunghwa Engineering Consultants Ltd. Korea In Association with Garima International Design Associates Nepal Pvt. Ltd. (GIDAN), Nepal and SITARA Consult Pvt. Ltd, Ward No.-10, Buddhanagar, Kathmandu, Nepal

1.1.87

Time for Completion

970 Days

1.3(a)(ii)

Agreed methods of electronic transmission

Through Official Email ID:

ft-procmgmt@nepalarmy.mil.np

1.3(d)

Address of Employer for communications

Kathmandu- Terai / Madesh Fast Track (Expressway) Road Project (KTFT)

Nepali Army Headquarter Bhadrakali, Kathmandu, Nepal

Tel: +977 1 4267060

Email:ft-procmgmt@nepalarmy.mil.np

1.3(d)

Address of Engineer for communications

Ward No.-10, Buddhanagar, Kathmandu, Nepal

1.3(d)

Address of Contractor for communications

Contractor (Selected Bidder)to Provide

1.4

Contract shall be governed by the law of

Nepal

1.4

Ruling language

English

1.4

Language for communications

English

1.8

Number of additional paper copies of Contractor's Documents

05(Five) copies

1.9

Period for notification of errors, faults or other defects in the Employer's Requirements

Within 45 (Forty Five) days from the commencement date

1.15

Total liability of the Contractor to the Employer under or in connection with the Contract
Equal to Contract Price stated in the Contract Agreement

2.1

After receiving the Letter of Acceptance, the Contractor shall be given right of access to all or part of the Site within

14(Fourteen) days prior to Commencement Date.

2.4

Employer's Financial Arrangements

Funds allocated by Government of Nepal

4.2

Performance security (as percentage of the contract price in currencies)

The amount of the Performance Security shall be 05%(Five Percent) of the Bid Price in case the Bid Price is up to 15% lower than the Engineer's estimate.

If the Bid Price is lower by more than 15% of the Engineer's estimate, the Contractor shall submit the Performance Security in accordance with Clause 27 (4) of the Public Procurement Act, 2063(2007).

Formula for Performance Security= [(0.85 x Cost Estimate – Bid Price) x 0.5] + 5% of Bid Price.

Performance Security should be provided in Nepalese Currency.

4.4(a)

Maximum allowable accumulated value of work subcontracted (as a percentage of the accepted Contract Amount)
25(Twenty Five) %

4.4(b)

Parts of the Works for which subcontracting is not permitted
For The Contractor's Design Works: Construction of Bridges and Slope Protection/Stabilization Works.

4.7.2

Period for notification of errors in the items of reference
Within 30 (Thirty) days after Commencement Date.

4.19

Period of payment for temporary utilities
Not Applicable

4.20

Number of additional paper copies of additional reports
05(Five) copies

4.24

Milestones

Description of Mile stones	Time for Completion	Delay Damages
Completion of detail Survey, geological and hydrological studies, geotechnical investigation, submission of all reports, completion of detailed designs and drawings for the Contractor's Design Works	180 days from the Commencement date	0.05 % (as a percentage of the Design Price per day of delay)
Completion of All Construction Works	970 days from the Commence	0.05%(as a percentage of the Contract Price per

	nt date	day of delay)
Maximum amount of Delay Damages for Milestones – 10 % of the Contract Price		

6.5

Normal working hours on the site
08(Eight) hours

8.3

Number of additional paper copies of programme
05(Five) copies

8.8

Delay Damages payable for each day of delay.
0.05% per day of the Contract Price

8.8

Maximum amount of Delay Damages
10 % of the Contract Price

13.4(b)(ii)

Percentage rate to be applied to Provisional Sums for overhead charges and profit

5%

14.2

Total amount of Advance Payment (as a percentage of Accepted Contract Amount

Not exceeding 20% of Contract price excluding Provisional Sum (PS) as per PPA and PPR.

The amount not exceeding half the amount of the approved advance may be paid for the first time and the remaining amount may be paid on the basis of the work progress.

14.2

Currency or currencies of Advance Payment

Currencies and proportions in which the Contract Price is payable

14.2.3

Percentage deductions for the repayment of the Advance Payment

25(Twenty five) %

14.3

Period of Payment

After the end of each month

14.3(b)

Number of additional paper copies of Statements

05(Five) copies

14.3(iii)

Percentage of Retention

05 (Five) %

14.3(iii)

Limit of Retention Money (as a percentage of Accepted Contract Amount)

05 (Five)%

14.5(b)(i)

Plant and Materials for payment when shipped
Not Applicable

14.5(c)(i)

Plant and Materials for payment when delivered to theSite
Not Applicable

14.6.2

Minimum amount of Interim Payment Certificate (IPC)
02(Two) % of Accepted Contract Amount

14.7(a)

Period for payment of Advance Payment to the Contractor
14 (Fourteen) days

14.7(b)(i)

Period for the Employer to make interim payments to the Contractor under Sub-Clause14.6[Interim Payment]

28 (Twenty Eight) days

14.7(b)(ii)

Period for the Employer to make payments to theContractor under Sub-Clause14.13 [Final Payment]
56 (Fifty Six) days

14.7(c)

Period for the Employer to make final payment to theContractor
56 (Fifty Six) days

14.8

Financing charges for delayed payment (percentage points above the average bank soft term lending rate as referred to under sub-paragraph (a))

03% per annum for local currency

14.11.1(b)

Number of additional paper copies of draft Final Statement

05(Five) copies

14.15

Currencies for payment of Contract Price

Local Currency(NPR)

14.15(a)(i)

Proportions or amounts of Local and Foreign Currencies are:

Local Currency (NPR): 70%

Foreign Currency (US$):30%

14.15(c)

Currencies and proportions for payment of Delay Damages

In the Currencies and the proportions as the Contract Price is Payable.

14.15(g)

Rates of exchange

The foreign currency exchange policies and guidelines ofNepal Rastra Bank (Central Bank of Nepal)shall apply for the rates of exchange.

17.2(d)

Forces of nature, the risks of which are allocated to the Contractor

Not Applicable

19.1

Permitted deductible limits

Insurance required for the Works

Not Applicable

Insurance required for Goods

Not Applicable

Insurance required for liability of breach of professional duty.

Not Applicable

Insurance required against liability for fitness for purpose (if any required)

Not Applicable

Insurance required for injury to persons and damages to property

Not Applicable

Insurance required for injury to employees

Not Applicable

19.2(1)(b)

Additional amount to be insured (as a percentage of the replacement value)

15(Fifteen) %

19.2(1)(iv)

List of Exceptional Risks which shall not be excluded from the insurance cover for the Works

Not Applicable

19.2.2

Extent of insurance required for Goods

Not Applicable

Amount of insurance required for Goods

Not Applicable

19.2.3(a)

Amount of insurance required for liability for breach of professional duty

1.15 times of Design Price

19.2.3(b)

Insurance required against liability for fitness for purpose

Yes, for the Contractor's Design Works

19.2.3

Period of insurance required for liability for breach of professional duty

2795 Days

19.2.4

Amount of insurance required for injury to persons and damaged to property

Local currency 1 million per person and 3 million for property irrespective of number of events.

19.2.5

Amount of insurance required for injury to employees

Local currency 2 million per person

19.2.6

Other insurances required by Laws and by local practice (Motor-Vehicle liabilities)

Local currency 10 million per accident

21.6

Arbitration : **International Arbitration**

International arbitration shall be:

(i) Administered by: Singapore International Arbitration Centre (SIAC) shall be the institution to administer the arbitration

(ii) Conducted in accordance with the rules of: the United Nations Commission on International Trade Law (UNCITRAL)

21.6

Arbitration: **Domestic Arbitration**

Domestic arbitration shall be:

(i) Administered by: Nepal Council of Arbitration (NEPCA) shall be the institution to administer the arbitration

(ii) Conducted in accordance with the rules of: the United Nations Commission on International Trade Law (UNCITRAL)

21.6

Place of Arbitration

Kathmandu, Nepal

Particular Condition Part B: Special Provision

Clause 1	General Provisions
Sub-Clause 1.1	**Definitions** **1.1.4 "Base Date"** means the date 30 days before the last date for submission of Tender(Bid). Base Date shall be taken as the date of conversion of foreign currency into local currency,as published by the Nepal Rastra Bank (The Central Bank of Nepal) for the payment to the Contractor during the contract period . **"PPA"** means Public Procurement Act, 2063(2007), the Procurement Law of the Country(Nepal). **"PPR"** means Public Procurement Regulations, 2064(2007), the Procurement Law of the Country(Nepal) **"Milestone"** means a part of plant and/or part of the Works stated in the Contract Data (if any), and described in detail in the Employer's Requirements as a Milestone, which is to be completed by the time of for completion stated in Sub-Clause 4.24 (Milestone) but is not to be taken over by the Employer after completion. "**Milestone Certificate"** means the certificate issued by the Engineer under Sub-Clause 4.24 (Milestone Works)
1.1.14 Contractor's Documents	**"Contractor's Documents"** After the Word " technical nature " add " in performing the works, whether or not approved by the Engineer"
1.1.21 Country	**"Country"** means Nepal in which the site is located, where the Permanent works shall be executed**.**
1.1.25 Day	**After full stop add the following:** **"Month"** means calendar month according to the Gregorian calendar **"Year" means 365 days according to Gregorian calendar**
1.1.42 Foreign Currency	**"Foreign Currency" means United States Dollars(USD)**
1.1.49 Laws	Delete definition in its entirety and replace with: **"Laws"** means (a) all federal, national, state/provincial or local laws,

	legislation, statutes, acts, decrees, rules, ordinances, codes, judgments, orders, treaties, regulations, directives, requirements, by-laws, codes of practice and other laws, government restrictions or announcements or interpretation thereof and other subordinate legislation, enacted or issued by any legally constituted federal, national, state/province, local, statutory or government authority as may apply at any time in Nepal (including labor laws, immigration, trade, customs, road and traffic laws), or anywhere else the Works are to be performed; (b) the requirements, rules and regulations of any federal, national, state, local, statutory or government authority, including legislation and regulations covering the registration and licensing of the Contractor necessary for the proper execution of the Works in accordance with the Contract; and (c) Guidelines of all federal, national, state, local, statutory or public authorities, with which the Contractor is legally required to comply.
1.1.52 Local Currency	**"Local Currency " means Nepalese Rupees (NPR or NRS)**
1.1.65 Permanent Works	**Delete the contents of this sub-clause and replace with the following:** **"Permanent Works"** means the permanent works (including Plant and Equipment when it is installed in the site) to be designed and executed by the Contractor, as described and shown in and/or reasonable to be interfered under Contract, including those described by a Provisional Sum.
1.1.73 Schedule of Payments	**"Schedule of Payments"** means the Payment Schedule forming part of the Contract, which in respect of any section or item of the works to be carried out, sets out the manner in which the Contract Price has been calculated and will be paid, and which may include provisional Sums.
1.1.76 Section	**"Section"** There is no Section of sectional completion.
1.1.77 Site	**"Site"** In the first line after "places where the" insert: "Temporary and"

	Delete "and any other places as may be specified in the Contract as forming part of the Site" and replace with "as shown on the Employer's Bid Drawings and/or maps set out in the Employer's Requirements" At end of definition insert: "Unless so designated, compound, lay down and storage areas not shown on the Employer's Bid Drawings and/or map/maps set out in the Employers Requirements, but which are arranged, agreed and/or paid for directly by the Contractor shall not form part of the Site." Also add the following paragraph: **(i)) "Access Route "** has the meaning given in Sub-Clause 4.15(Access Route). (ii) "**Best Industry Practice"** means the relevant practices, methods, standards and acts generally followed by international construction contractors with respect to the planning, design, procurement, construction, commissioning, testing, operating, maintenance and repair of works with characteristics and in a location comparable to those of the Works at the Site and includes the performance of the work: (a) in a sound and workmanlike manner, with all due care and skill and applying internationally accepted engineering, procurement, construction and management practices and procedures, (b) in a timely manner with due expedition and without unnecessary or unreasonable delay, using specified internationally accepted standards (or if no standards are specified, those standards which are approved by the Engineer) for the quality and quantity of Materials, Plant and workmanship applicable to works having characteristics comparable to those of the Works, and (c) with all Materials and workmanship suitable for their respective purposes and properly certified where appropriate (iii) **"Government Authority"** means the Government of Nepal, any governmental department, States/Provinces and their owned entity, ministry(ies), commission, board, bureau, agency, regulatory authority, instrumentality, judicial, legislative or administrative body of Nepal, or any subdivision of any of them. (iv) "**Intellectual Property Rights"** means all current and future

registered and unregistered rights in respect of copyright, designs, circuit layouts, trademarks, commercial descriptions, trade names, know-how, confidential information, moral rights, patents, inventions and discoveries and all other intellectual property as defined in article 2 of the convention establishing the World Intellectual Property Organization in 1967.

(v) "**Other Contractors"** means any other contractors (other than the Contractor) appointed by the Employer to execute any other works, as notified to the Contractor form time-time.

(vi) "**Prohibited Activity"** means any of the following:

(a) production or activities involving harmful or exploitive forms of forced labour or child labour,

(b) production of or trade in any product or activity deemed illegal under applicable Laws or international conventions and agreements or which are subject to international phase-outs or bans, such as:

(i) pharmaceuticals, pesticides, and herbicides,

(ii) ozone-depleting substances,

(iii)polychlorinated biphenyls and other hazardous chemicals,

(iv)wildlife or wildlife products regulated under the Convention on International Trade in Endangered Species of Wild Fauna and Flora, and

(v) trans-boundary trade in waste or waste products

(c) production of or trade in weapons and munitions, including paramilitary materials,

(d) production of or trade in alcoholic beverages,

(e) production of or trade in tobacco,

(f) gambling, casinos and equivalent enterprises,

(g) production of or trade in radioactive materials, including nuclear reactors and reactor components,

(h) use of, production of or trade in unbounded asbestos fibres, and

(i) commercial logging operations in forests.

	(vii) **"Prohibited Materials" means** Materials which: (a) affect or put at risk the health or safety of any person who may come into contact with the Works (whether during their construction or after their completion), or; (b) either by themselves or as a result of their use in a particular situation or in combination with other Materials, which would or are likely to have the effect of reducing the normal life expectancy or performance of any other material or structure in which the Materials are incorporated or to which they are affixed.
Sub-Clause 1.2 **Interpretation**	In relation to the meaning of "consent" under sub-paragraph (g), it should be noted that this does not mean "approve" or "approval" which, under some legal jurisdictions, may be interpreted as accepting or acceptance that the requested matter is wholly satisfactory - followingwhichtherequestingpartymaynolongerhaveanyresponsibility orliabilityforit. At the end of sub-paragraph (j) delete the full stop, replace with a semicolon and insert the following sub-paragraphs: (k) unless otherwise stated in the Employer's Requirements, the "International System of Units" (the metric system) shall apply to this Contract in every respect; (l) the words "include", "including" or "for example" shall be deemed to be followed by the expression "without limitation" or "but not limited to", whether or not they are followed by such phrases or words of like import; (m) references to any Clause, Sub-Clause, Appendix or Annex are references to the clauses, sub-clauses, appendices or annexes of these Conditions of Contract; (n) where a word, term, phrase or abbreviation is defined, another part of speech or grammatical form in respect of that word or expression will have a corresponding meaning; (o)a reference to anything (including an amount) is a reference to the whole and each part of it; (p) whenever the date for the performance of any payment obligation falls on a date that is not a working day (being a day on which banks are not generally open for business in Nepal), such date shall be extended to the next succeeding working day; and (q) Bid/tender, Bidder/tenderer, Bidding/tendering, and other similar expressions are synonymous for purposes of these Bidding and

	Contract Documents.
Sub-Clause 1.3 – Notices and Communication	Insert the following paragraphs at the end of this Sub-Clause: "The system of electronic communication shall be email or facsimile. If E-mail: Letters, Notices and other communication shall be attached in PDF format, drawings shall be in Auto-cad, Programmes shall be in scheduling of software as approved by the Engineer. The address for the communication is specified below: Employer: Kathmandu- Terai/Madesh- Fast Track (Expressway) Road Project Address:Bhadrakali, Kathmandu Attention: BikashPokharel Designation: Brigadier General Telephone No.:+977 1 4267060 Email :**ft-procmgmt@nepalarmy.mil.np** Contractor: Address: … … … … … … … … … … … Attention: … … … … … … … … … … … Telephone No: … … … … … … … … … … Fax: … … … … … … … … … … … E-mail: … … … … … … … … … … … Communication will be deemed to be effective as follows: (a) in the case of personal delivery or registered mail, on delivery; (b) in the case of facsimiles, forty-eight (48) hours following confirmed transmission; (c) In case of E-mail, forty-eight (48) hours following confirmed transmission."
Sub-Clause 1.4- Law and Language	Add the following sub-paragraphs: a) The language of the Contract is English.

	b) The laws of Nepal shall apply to the Contract. c) The Contract shall in all respects be read and construed and shall operate as a Nepalese Contract in conformity with the laws of Nepal. d) The language for communication shall be in English.
Sub-Clause 1.6- Contract Agreement	Delete the contents of this Sub-Clause 1.6 in its entirety and replace with the following: "After the successful Contract Negotiation the Contract shall become legally effective when the Parties sign the Contract Agreement within 15 days after the Contractor receives the Letter of Acceptance. If the Contractor constitutes a Joint Venture (joint venture, association, consortium or other unincorporated grouping of two or more entities or persons) each member to the Joint Venture shall be required to sign the Contract Agreement. No compensation, whatsoever, will be applicable, or paid, before the legally effective date."
Sub-Clause 1.7 - Assignment	Delete the contents of this Sub-Clause in its entirety and replace with the following: (a) The Contractor agrees that the Employer, at its absolute discretion and at a date to be determined by the Employer, may assign, novate, transfer, dispose and/or charge the benefit of the whole or any part of the Contract, of any or all of its rights, interests, obligations or liabilities under the Contract. (b) In the event of any sale, assignment, novation, transfer or disposal by the Employer, the Contractor must do all things and execute all documents necessary (including a deed of novation if applicable) to effect the sale, assignment, novation, transfer or disposal. (c) The Contractor shall not be entitled to assign or novate the Contract, in whole or in part, nor any benefit, interest, right or obligation under the Contract, nor payment due under the Contract, without the prior consent of the Employer, which may be given or withheld at the Employer's absolute discretion. (d) Any modification to the constitution of the Contractor or a Joint Venture to its participation, which have the effect of such modification in the effective control of the Contractor, shall be deemed to be an assignment that requires the prior approval to the Employer under this clause.

Sub-Clause 1.9 –Error in The Employer's Requirements	**Add the following paragraph before the first paragraph of this Sub Clause**; "This Sub Clause is not applicable for the Employer's Design Works."
Sub-Clause 1.12- Confidentiality	Replace the second sentence in second paragraph **"The Contractor shall not publish, ------"**by: "The Contractor, and members in the case of a Joint Venture, shall not publish, permit to be published, or disclose any particulars of the Works in any trade or technical paper or elsewhere without the prior approval of the Engineer. However, the Contractor, and all members in the case of a Joint Venture, will be permitted to disclose any publicly available information, or information otherwise required to establish his qualifications to compete for other projects."
Sub-Clause 1.13- Compliance with Laws	Insert the new sub-paragraphs (e), (f) and (g) as follows: (e) The contractor shall complete the Works in accordance with the permits, licenses and approvals referred to, and to the satisfaction of the relevant authorities. The Contractor shall be responsible for arranging inspections by all relevant authorities and for obtaining a "Certificate for Completion" (or its equivalent) form such authorities and other approvals as necessary to ensure completion of the Works in accordance with this Contract. (f) Neither the Contractor, nor any of the Contractor's Personnel, shall engage in any of the following activities and practices, either directly or indirectly, in connection with the Works or the Project: i) Offer, give, receive or solicit, directly or indirectly, anything of value with a view to improperly influencing the actions of another person or party (including the Employer), including acts intended to violate or derogate a duty owned by a recipient in order for the prayer to obtain an undue advantage or avoid an obligation, ii) acts or omissions that knowingly or recklessly mislead, or are attempts to mislead, a person or party (including the Employer) to obtain a financial or other benefit or to avoid an obligation, including any misrepresentation, iii) impair or harm, or any threat to impair or harm, directly or indirectly, a person or party, or the property of a person or party (including the Employer), with a view of improperly influencing the actions of that person or party, iv) conclude an arrangement with any other person or party (including the Employer) which achieves, or is designed to achieve, an improper purpose, including improperly

	influencing the actions of another person or party (through the provision of a gift, inducement, bribe, reward or otherwise), v) activities which constitutes money laundering or financing of terrorism under applicable Laws, and vi) any prohibited activities. (g) The Contractor shall indemnify and hold harmless the Employer, the Employer's Personnel and their respective agents against and from all claims, damages, losses and of expenses (including legal fees and expenses) arising out or in connection with any failure to comply with this sub-clause 1.13 [Compliance with Laws]. Insert at the end of the Sub-Clause 1.13: "However, the Contractor shall submit, in good time, the details of Goods and foreign manpower to the Employer, who shall then promptly endorse the documents as appropriate and assist the Contractor in order to obtain all resident permit, import permits or licenses required for these manpower and Goods. The Contractor shall not make the Employer responsible against the delay caused by him."
Sub-Clause 1.14 - Joint and Several Liability	Insert at the end the following new paragraphs: "In the event the Contractor does constitute a Joint Venture (joint venture, association, consortium or other unincorporated grouping of two or more members or persons), the Contractor shall deliver to the Employer, prior to the signing of the Contract Agreement, the final and binding and duly notarized Joint Venture Agreement confirming to the Joint Venture Agreement submitted in the bid documents. The Joint Venture Agreement shall include at least the following: (a) the percentage and areas of sharing of the Works between the Joint Venture members; (b) level of responsibility within the Joint Venture and nomination of the lead member; and (c) other information requested by the Employer. The final notarized Joint Venture Agreement shall be maintained in its current form throughout the execution of the Contract and the Contractor shall not modify the said Agreement in any way whatsoever without the prior consent of and at the sole discretion of the Employer. The Contractor shall submit copies of all notarized

	changes to the said Agreement, as agreed to by the Employer, to the Employer within 14 days of their occurrence."
Sub-Clause 1.15 - Limitation of Liability	Delete Sub-Clause 1.15 and substitute: "Except as stated in this Sub-Clause, neither Party shall be liable to the other Party for loss of use of any Works, loss of profit, loss of any contract or for any indirect or consequential loss or damage which may be suffered by the other Party in connection with the Contract. The Contractor's liability to the Employer under or in connection with the Contract shall be limited as follows: (a) For failure to comply with Sub-Clause 8.2 [Time for Completion], the limit shall be the maximum amount of Delay Damages stated in the Contract Data; (b) for loss of profit, loss of any contract or loss of use of any part of the Permanent Works (after taking over under the Contract), caused by: (i) limits attributable to the Contractor , the limit shall be the Contract Price stated in the Contract Agreement; (ii) damage to the works caused by the Contractor, the limit shall be the Contract Price stated in the Contract Agreement; (iii) damage caused by the Contractor to the Employer's property other than the works, the limit shall be fifty(50) percent of the Contract Price stated in the Contract Agreement; (iv) any other matter attributable to the Contractor, the limit shall be fifty(50) per cent of the Contract Price stated in the Contract Agreement; (c) for damage caused by the Contractor to the Works , the limit shall be required value of cover of insurance under Sub-Clause 19.2.1 (The Works); (d) for damage caused by the Contractor to the Employer's property other than the Works, the limit shall be required value of over of insurance under Sub-Clause 19.2.4 (Injury to persons and damaged property); (e) for death or injury to the Employer's personnel by a cause attributable to the Contractor, the limit shall be required value of cover of insurance under Sub-Clause 19.2.5(Injury to Employees); (f) for the Contractor's indemnity to the Employer for third party claims under the first paragraph of Sub-Clause 17.4(Indemnities by the Contractor), there shall be no limit; (g) for the Contractor's indemnity to the Employer under the

	second paragraph of Sub-Clause 17.4(Indemnities by the Contractor), the limit shall be required value of cover of insurance under Sub-Clause 19.2.3 (Liability of breach of professional duty) ; (h) for all matters other than those described in sub-paragraph (b) to (g) above and other than those under Sub-Clause 17.3(Intellectual and Industrial Property Rights), the limit shall be the Contract Price stated in the Contract Agreement. The Employer's liability to the Contractor under or in connection with the Contract shall be limited as follows: (i) for loss of profit, loss of any contract or any other direct loss caused by termination of the contract under Sub-Clause 15.5 [Termination for Employer's Convenience] and Sub-Clause 16.2 [Termination by Contractor], the limit shall be twenty percent (20%) of the Contract Price stated in the Contract Agreement ; (ii) for damage caused by the Employer or Employer's Personnel to the Temporary Works or Plant and MaterialsnotincludedinthePermanentWorks, thelimitshallbethirtypercent(30%)oftherequiredvalueof cover of the insurance under Sub-Clause 19.2.1 [*TheWorks*]; (iii) for damage caused by the Employer or Employer's personnel to the Contractor's Equipment ,Materials, Plant and or Temporary Works , the limit shall be the required value of cover of insurance under Sub-clause 19.2.2(Goods); (iv) for death or injury to the Contractor's personnel by a cause attributable to the Employer , the limit shall be the required value of cover of insurance under Sub-Clause 19.2.5(Injury to Employees); (v) for the Employer's indemnity to the Contractor for third party claims under Sub-Clause 17.5(Indemnities by the Employer);there shall be no limit; and (vi) for all matters other than those described in Sub-paragraph (i) to (v) above and other than under Sub-Clause 17.3(Intellectual and Industrial Property Rights) the limit shall be in accordance with Sub-clause 14.14 [Cessation of Employer's Liability] as may be amended under Sub Sub-Clause 21.6 [Arbitration]. This Sub-Clause shall not limit liability in any case of fraud, gross negligence, deliberate default or reckless misconduct by the defaulting party

Clause-2	The Employer
Sub-Clause 2.1 -Right of Access to the Site	Delete the first paragraph and replace with: "Subject to sub-clause 4.15 [*Access Route*] the Employer shall give the Contractor right of access to and possession of all the parts of the site to enable the Contractor to commence the Works at least 14 days prior from Commencement Date, unless otherwise stated in the Employer's Requirements. The right and possession may not be exclusive to the Contractor. If, under the Contract, the Employer is required to give (to the Contractor) possession of any foundation, structure, plant or means of access, the Employer shall do so in the time and manner stated in the Employer's Requirements." Delete the words **"to EOT and/or payment of such Cost Plus Profit"** in third paragraph. Delete the Words **"and/or Cost Plus Profit** "in fourth paragraph. Delete the fifth paragraph and replace with: "However , the Employer may withhold any such right or possession until the evidence (to the satisfaction of the Employer) of those insurance policies the Contractor is required to obtain in accordance with Clause 19 [Insurances], the Health and Safety Management Plan, the Environment Protection Plan and the Quality Management Plan to be prepared by the Contractor in accordance with this Contract and any other plans, documents or other materials to be prepared by the Contractor which are stated in the Employer's Requirements as being required to be provided to be given access to, and possession of the site, have been received. The Contractor shall be responsible for making its own arrangements, at his own cost, for the use of land should the areas provided by the Employer be insufficient for the Contractor's needs."
Sub-Clause 2.2- Assistance	In the first paragraph after the word **"requested"** insert "**in writing**" Insert the following paragraphs at the end of this Sub-Clause: "The Contractor shall inform the Engineer in writing of the details of the Contractor's Equipment, Plants and Materials to be imported into Nepal for use on the Works at least 56 days prior to arrival of shipment at disembarkation port. The Contractor shall be responsible for transport from the Port of disembarkation to the Site or location of the Works.

	Notwithstanding any reasonable assistance provided by the Employer, the contractor shall be solely responsible for obtaining such laws, permits, licenses, approval or clearances and the payment of all charges, fees and duties required, and the Contractor shall indemnify and hold the Employer harmless against and form the consequences of any failure to do so."
Sub-Clause 2.6 **Employer-Supplied Materials and Employer's Equipment**	In case of the Employer-supplied materials listed in the Employer's requirements , after the last paragraph of the Sub-Clause 2.6, add the following: "The Employer shall supply to the Contractor the Employer –supplied Materials listed in the Employer's Requirements at the time(s) stated in the Employer's requirements(If not stated, within the times that shall be required to enable the Contractor to proceed with execution of the works in accordance with the programme). When made available by the Employer, the Contractor shall visually inspect the Employer-supplied Materials and shall promptly give a notice to the Employer's representative of any shortage, defects or default in them. Thereafter, the Contractor shall rectify such shortage, defects or defaults to the extent instructed by the Employer's representative. After this visual inspection, the Employer-Supplied Materials shall come under the care, custody and control of the Contractor. In case of the Employer's Equipment listed in the Employer's requirements, after the last paragraph of the Sub-Clause 2.6, add the following: "The Employer shall make the Employer's Equipment listed in the Employer's Requirements available to the Contractor at the time(s) stated in the Employer's requirements (If not stated, within the times that shall be required to enable the Contractor to proceed with execution of the works in accordance with the programme). Unless expressly stated otherwise in the Employer's Requirements, the Employer's Equipment shall be provided for the exclusive use of the Contractor. When made available by the Employer, the Contractor shall visually inspect the Employer-supplied Materials and shall promptly give a notice to the Employer's representative of any shortage, defects or default in them. Thereafter, the Contractor shall rectify such shortage, defects or defaults to the extent instructed by the Employer's representative.

	The Contractor shall be responsible for the Employer's Equipment while it is under the Contractor's control and /or any of the Contractor's personnel is operating it, driving it, directing it, using it or in control of it. The contractor shall not remove from the site any items of the Employer's equipment without the consent of the Employer. However, consent shall not be required for vehicles transporting Goods or Contractor's personnel to or from the site."
Clause 3	**The Engineer**
Sub-Clause 3.5 Engineer's Instructions	At the end of Sub-Clause 3.5, add the following : "If the Engineer or the Engineer's representative : (a) gives an oral instruction; (b) receives a written confirmation of the instruction, from the Contractor, within three working days after giving the oral instruction ; and (c) does not reply by issuing a written rejection and /or instruction within three working days after receiving the confirmation then, the Contractor's confirmation shall constitute the written instruction of the Engineer or the Engineer's Representative (as the case may be)".
Sub-Clause 3.8 Meetings	In first paragraph after the last word, add following: "The planned timetable of all meetings such as management meetings, site meetings, technical meetings and progress review meetings, shall be as per scheduled in the Employer's Requirements". Replace all instances of "management meeting" with "all meetings".
Clause 4	**The Contractor**
Sub-Clause 4.1- Contractors General Obligations	Delete the first paragraph and replace with: "The contractor shall plan, perform detailed survey, geological and geotechnical investigation, design and prepare drawings,construct, execute and complete the Works corresponding to the Contractor's design works as specified in the Employer's Requirement. Simultaneously the Contractor shall plan and execute the works corresponding to the Employer's design works in accordance with the drawings and specifications provided in the Employer's Requirement. The Contractor shall remedy any defects in the works in accordance

	with the Contract, with and as per : (a) best Industry Practice (b) all the applicable Laws and the terms of any licenses, permits and consents, (c) the Employer's Requirements, and (d) the Programme The Contractor warrants that, when completed, the Works shall be fit for purpose for which the Works are intended as described in the Contract." Between the fourth and fifth paragraph insert: "The Contractor shall conduct his operation in such a manner as to avoid injury or damage to adjacent property or facilities. It shall be the responsibility of the Contractor, before commencing any works to ascertain from records or otherwise, the existence, the position and ownership of adjacent property or facilities."
Sub-Clause 4.2 **Performance Security**	**Performance Security** Delete the Sub-clause in its entirety and replace with: "The Contractor at his own cost shall obtain and submit Performance Security for his proper performance of the Contract, within 15 days after the receipt of the Letter of Acceptance/Award. The Performance Security shall be in the form of an on-demand and unconditional guarantee, issued by a Class "A" commercial bank located in Nepal, or if issued by a foreign bank, it shall be counter-guaranteed by a Class "A" commercial bank in Nepal, and shall be subject to approval of the Engineer. the Contractor shall submit the Performance Security in accordance with the Public Procurement Act, 2063 and its regulations. The Contractor shall ensure that the Performance Security is valid and enforceable until issuance of the Performance Certificate and the Contractor has complied with Sub-Clause 11.11(Clearance of the Site). The Performance Security less any amounts due shall be returned to the Contractor within one month after issuance of the Performance Certificate. If the terms of the Performance Security specify its expiry date by

	reference to a fixed date, and the Contractor has not become unconditionally entitled to receive the Performance Certificate by the date 28 days before the expiry date, the Contractor shall extend the validity of the Performance Security until the Works have been completed, any defects have been remedied, the site has been cleared and the Performance Certificate has been issued. In the event that the Contractor does not extend the validity as required, the Employer has the right to call in the full amount of the Performance Security and hold it as cash security until such time as the Contractor supplies a replacement Performance Security acceptable to the Employer. The Employer will then return the cash retained as security to the Contractor once a replacement Performance Security has been provided by the Contractor which complies with the requirements of this Sub-Clause, less such amounts as required to cover the reasonable costs incurred by the Employer as a result of the failure by the Contractor to extend the validity of the Performance Security as required. The Contractor waives any right that it may have to obtain an injunction or any other remedy or right against any party in respect of the Employer having recourse to the Performance Security."
Sub-Clause 4.3- Contractors Representative	At the end of the first paragraph insert "If the Contractor constitutes a joint venture, association, consortium or other unincorporated grouping of two or more persons, the lead partner shall provide the Contractor's Representative.": In the second paragraph delete "the main engineering discipline applicable to the works and replace with "Civil Engineering". The Contractor's Representative shall also be fluent in English. Insert at the end of the second paragraph: "If the Contractor's Representative is not fluent in English, the Contractor shall make competent interpreters available during all working hours, in a number sufficient for the Contractor's Representative to properly perform their delegated powers, functions and/or authority". Insert at the end of last paragraph: "If any of these persons is not fluent in English, the Contractor shall make competent interpreters available during all working hours, in a number sufficient for those persons to properly perform their delegated powers, functions and/or authority".
Sub-Clause 4.4 - Subcontractors	At the end of Sub-Clause insert the following sub-paragraphs: (a) The Contractor shall not subcontract: (i) the whole of the Works, and

	(ii) any part of the Works without the prior approval of the Engineer (which may be withheld in his absolute discretion, or be given subject to any condition which he determines necessary in the circumstances). (b) The Contractor shall not be required to obtain consent for labour sub-contracts or for other sub-contracts for non-critical items if the amounts payable under such other sub-contracts are less than Five Million Nepalese Rupees (NPR5,000,000). Non critical items means goods, part of goods, permanent equipment or part of any equipment for which any defect would not: (a) jeopardize the specified guaranteed capacity of the Works, decrease the Works safety factor, (c) increase the cost of operation of the Works, (d) delay the Programme, and (e) any or all of the above. (c) The Contractor shall ensure that the requirements imposed on the Contractor by Sub-Clause 1.12 [Confidentiality] and Clause 6 [Staff and Labour] apply equally to each Subcontractor; (d) The Contractor shall be responsible for the acts or defaults of the Subcontractor or supplier as if they were the acts or defaults of the Contractor and any approval given by the Employer of the appointment of a particular Subcontractor or supplier shall not relieve the Contractor of, or alter any of its liabilities or obligation under the Contract. (e) The Contractor shall be responsible for the works executed by the subcontractors and shall give warranty of the subcontractor's works to the Employer. (f) The Contractor shall pay all sums due to its Subcontractors and suppliers by the due date for payment. At the end of second paragraph, add: "The Contractor shall give reasonable opportunity from the country Nepal to tender for subcontractors for the works, and shall use reasonable endeavours to employ such contractors as Subcontractors". Insert at the end of last paragraph: "All the subcontracts relating to the Works shall include provisions which entitle the Employer to require the subcontracts to be assigned to the Employer under sub-paragraph (a) of Sub-Clause 15.2.3(After Termination)".

	"If a Subcontractor's obligations to the Contractor extend beyond the expiry date of the Defects Notification Period (DNP) which is applicable to the Subcontractor's work and the Contractor receives an instruction from the Engineer to do so not less than 7 days before this expiry date, the Contractor shall assign the benefit of such obligations to the Employer. Unless otherwise stated in the assignment, the Contractor shall have no liability to the Employer for the work carried out by the Subcontractor after the assignment takes effect."
Sub-Clause 4.5 – Nominated Subcontractors	At the end of first paragraph add the following: "The Contractor shall ensure that the requirements imposed on the Contractor by Sub-Clause 1.12 [Confidentiality], Sub-Clause 1.13 [Compliance with Laws] and Clause 6 [Staff and Labour] apply equally to each nominated subcontractor."
Sub-Clause 4.8 – Health and Safety Obligations	Delete Sub-paragraph (a) in its entirety and replace with: (a) Comply with all applicable safety regulations and requirements of relevant Authorities, the requirements as stated in the Employer's Requirements or any other document forming part of the Contract documents, as may be amended form time to time; At the end of sub-paragraph (f) delete "and", at the end of sub-paragraph (g) delete ".", replace with ";and" and add the following sub-paragraph (h): (h) provide the Engineer and/or the Engineer's representative with reasonable access to the Contractors records and facilities, both on and off the Site, to enable the Engineer to access the Contractor's compliance with this Sub-Clause. At the end of last paragraph insert the following paragraph: "The Contractor shall designate a competent employee specially trained and experienced to act as Health & Safety Officer, who will administer and be responsible for the implementation of the Health and Safety Manual. S/he shall carry out frequent and regular safety inspections of the working areas, materials, and equipment. The name and qualifications of the Health & Safety Officer shall be submitted for approval to the Engineer prior to his/her appointment. Whenever required by the reiterated notification of non-compliances of Contractor or his Subcontractors to applicable safety standards and regulations, the Engineer in writing shall ask the Contractor to replace the Health & Safety Officer by suitable one." "The Contractor shall be responsible for enforcement of the health and safety provisions to his subcontractor(s) employed at the Site. Prior to the start of any major construction activity or hazardous operation, the Contractor shall submit to the Engineer for comments and approval a specific plan for safety precautions covering such particular operation. All significant occurrence such as accidents, injuries or diseases

	caused by construction equipment, high-voltage electric shocks, exposure to hazardous materials, slides, cave-ins or whatever cause shall be immediately reported to the Engineer describing in detail the dynamics of all serious and fatal injuries and diseases, which are connected to the Works, and a comprehensive report shall be submitted as soon as possible to the Engineer. In case of a fatal accident, only rescue and emergency teams and operators shall be permitted at the place of the occurrence."
Sub-Clause4.9- **Quality Management and Compliance Verification System**	Add Sub-Clause 4.9.4 with "4.9.4 Quality Manager "The Contractor at site shall employ a Quality Manager as one of the key Personnel, of the required qualification and experience as specified in the Employer's Requirement".
Sub-Clause 4.10 – Use of Site Data	At the end of this Sub-Clause add the following: "For the Contractor's design works: (i) The Contractor shall be responsible for any data or information acquired and or generated or likely to be acquired and or generated related with the design of works as specified under the Contractor's design works. (ii) The Employer shall be responsible for genuineness or reasonableness of, any data or information provided to the Contractor by the Employer and the Engineer or his representative at any time, and the Contractor shall perform its own investigation with due diligence to verify the accuracy and completeness of all such data or information. The Contractor shall be deemed to have also satisfied himself before tendering with: (a) Existing conditions and nature of existing roads and bridges and other means of access to the Site; (b) Presence of artificial obstructions on ground or underground or above ground, boulders, released water or the like; (c) People's rights and interests which may be interfered with or affected by the construction and completion of the Works, and remedying of any defects therein; (d) Geological, Geotechnical, Hydrological and climatic conditions

	and the effects there from; (e) Stability of existing slopes in the Site; and (f) Nature of the surface and subsurface on or in which the Permanent Works or Temporary Works are to be executed or in the immediate vicinity of the works and the nature and extent of surface water or water contained in the subsoil to which the Works may be affected by rainfall. The contractor shall be fully responsible for any of his failure, error or omission in obtaining any relevant information which may in any way influence or affect the execution of the works."
Sub-Clause 4.13 – Right of Way and Facilities	At the end of the Sub-Clause add the following: "The Contractor shall make available and coordinate for use of such special and/or temporary rights-of-way, including access to Site to Other Contractors, employed by the Employer. Such use by Other Contractor shall be free of charge."
Sub-Clause 4.15 – Access Routes	In the first line of first paragraph delete the words " at the Base Date," At the end of this Sub-Clause add the following : "The Contractor shall pay attention towards the permissible load-bearing capacities of the existing road and bridges along the public road network. The Contractor shall be responsible for verifying and demonstrating that any of his vehicles or equipment which he intends to pass over any of these and other existing road and bridges in the area will not damage or endanger the integrity or safety of the bridges and roadways, any associated structures, other traffic and vehicles or the general public. The Contractor has the obligation to verify, through the Competent Authority, the suitability of the roads and bridges to withstand the foreseen transport loads and to execute all the works necessary to upgrade / strengthen the above-mentioned infrastructures. The Contractor shall submit to the Engineer a copy of all such requests for approval or permission within 30 days of submission of the original request to the Competent Authority, including all supporting drawings, calculations and other information."
Sub-Clause 4.16 – Transport of Goods	Insert at following paragraphs the end of Sub-Clause 4.16: "The Contractor shall obtain the Engineer's permission prior to delivering to the Site any item of Goods which is identified in the

	Employer's Requirements as requiring such permission. No such Goods shall be delivered without this permission, which shall not relieve the Contractor from any duty,obligation or responsibility under or in connection with the Contract" "The Contractor shall be responsible during the execution of the Works for establishing the most suitable modes of transport and subdivision of Plant components compatible with the available transportation facilities and shall hold the Employer harmless against any unforeseen difficulties concerning transportation of Goods to the Site." "Space needed for open and covered areas of electromechanical equipment, which are part of the Construction Areas, shall be clearly identified by the Contractor and approved by the Engineer." "Prior notification shall be given by the Contractor to the Engineer of any intention to apply for permission to transport a Special Load. 'Special Load' shall mean such load as in outside the normal limits imposed by the Department of Roads in Nepal, in respect of dimension and /or weight."
Sub-Clause 4.17 – Contractor's Equipment	At the end of Sub-Clause 4.17, add the following paragraphs: "Each item of the Contractor's Equipment shall become the property of the Employer (free from liens and other encumbrances) when it arrives on the Site. The vesting of property from the Contractor to the Employer shall not: (a) affect the responsibility or liability of the Employer under the Contract; (b) prejudice the Contractor's right to exclusive use of all items of the Contractor's Equipment for the purpose of the works; and/or (c) relieve the Contractor from any duty, obligation or responsibility in respect of the Contractor's Equipment."
Sub-Clause 4.18 – Protection of the Environment	Insert after the first paragraph of the Sub-Clause: "The Contractor shall develop an Environment Protection Plan with respect to the Environment Management Plan (EMP)(as detailed in the Employer's Requirements) prepared by the Contractor and subsequently approved by the Engineer for review and approval within twenty one (21) days from the Commencement Date, with the following main objectives but not limited to. • The Works shall endeavor to cause minimum impact on the environment;

	• The Contractor shall, in all operations, economize on natural resources and energy; • The Works shall be carried out considering the importance of human health and safety; • All legal requirements and regulations related to the environment shall be complied with; • The Contractor shall train, inform and stimulate his staff towards involvement, participation and responsibility in environmental matters; • The Contractor shall be responsible that high environmental standards are implemented by subcontractors." Insert at the end of the Sub-Clause: "The Contractor shall plan and adopt his work methodology and operate equipment in such a way that the construction activities shall have the least possible impact on the environment and the nearby residents. Those will include management of disposal and storage of excavated material for re-use, protection of cultural and archaeological sites, air quality, water quality, ground water, noise and ground vibration and protection of flora and fauna. The Contractor shall appoint an Environmental and Social Safeguard Officer for the Works within 15(Fifteen) days of the Commencement Date whose broad responsibility is to guide the construction personnel on environmental matters and communicate with the Engineer and the project affected community people. If the Contractor fails to comply with any of its environmental obligations under the Contract or otherwise at Law, the Employer/ Engineer may take whatever action is necessary to remedy such failure and deduct the cost of such action from moneys due or becoming due to the Contractor. Furthermore, notwithstanding any other right or remedy the Employer/ Engineer may have under or in connection with the Contract or otherwise at Law, the Contractor shall indemnify and hold the Employer harmless against and from all damages, losses and expenses (including fines, remediation costs, legal fees and expenses) resulting from any non-compliance with the Contractor's obligations under this Sub-Clause."
Sub-Clause 4.19 –	Delete the Sub-Clause in its entirety and replace with:

Temporary Utilities	"The Contractor at his own cost shall be responsible for the provision of all power, water and other services, the Contractor or any of his Subcontractors may require, for the performance of the Works. The contractor may, at his own convenience, risk and cost, request to avail of national grid electricity supply being aware that energy and power may be subject to shut down. The Contractor shall make arrangements with the relevant authorities, organizations or companies for such supply and payment, if any. The Contractor shall make his own arrangement for generating power from stand-by generators in case the power supply from the national grid is not available."
Sub-Clause 4.20 – Progress Report	Insert new Sub-paragraphs as follows: Each progress report shall include: "(i) critical path analysis updated to reflect the actual progress of the works; (ii) S-curve updated to display actual versus early and late planned progress; (iii) details of all matters affecting, or likely to affect, the cost of the Works and particulars of the preventative and remedial measures which have been, is being, or may be taken in respect of those matters; (iv) any other matters as may be set out in the Contract or other information reasonably required by the Engineer from time to time; and (v) such other matters as are required to be included, in accordance with the Employer's Requirements." In addition to the progress reports, the Contractor shall prepare environmental reports, to be submitted in the same number of copies and at the same time as the monthly progress reports, to cover all specified environmental monitoring, including all incidents and issues that have arisen during the period. If the Contractor fails to submit the monthly progress and environmental reports in accordance with this Sub-Clause 4.20 [Progress Reports], the Engineer may, at the Employer's sole discretion, withhold payments to the Contractor for not fulfilling the contractual obligations in a percentage to be estimated from time to

	time according to the deviation from the requirements, until such reports have been submitted."
Sub-Clause 4.22 – Contractor's Operation on Site	Between the second and third paragraphs insert the following: "Dust arising from any construction activity and movement of equipment and vehicles at or near the Site shall be adequately controlled by the Contractor to the satisfaction of the Engineer."
Insert new Sub-Clauses 4.24-4.32 as follows:	
New Sub-Clause 4.24-Milestone	"The Engineer shall require the Contractor to complete certain parts of Works within certain times as described in the Employer's requirement as "Milestones" The Contractor shall complete the works of each Milestone (including all works which is stated in Employer's Requirement as being required for the Milestone to be considered complete) within the time for completion of the Milestone as stated in the Contract Data , calculated from the Commencement date. The Contractor shall include, in the Detailed programme and each revised programme, under sub-paragraph (a) of Sub-Clause 8.3(Programme), the time for completion of each Milestone. Sub-paragraph (d) of Sub-Clause 8.4(Advance Warning) and Sub-Clause 8.5(Extension of Time for Completion) shall apply to each Milestone, such that "Time for Completion under Sub-Clause 8.5 shall be read as the Time for Completion of such Milestone under this Sub-Clause. The Contractor may apply, by the Notice to the Engineer, for a Milestone Certificate not earlier than 14 days before the works of the Milestone will, in the Contractor's opinion, be complete. The Engineer shall , within 28 days after receiving the Contractor's notice : (a) issue the Milestone Certificate to the Contractor, stating the date on which the works of the Milestone were completed in accordance with the Contract , except for any minor outstanding work and defects (as shall be listed in the Milestone Certificate); or (b) Reject the application, giving reasons and specifying the work required to be done and defects required to be remedied by the Contractor to enable the Milestone Certificate to be issued. The Contractor shall then complete the work referred to in sub-paragraph (b) of this Sub-Clause before issuing a further Notice of

	application under this Sub-Clause. If the Engineer fails either to issue the Milestone Certificate or to reject the Contractor's application within the above period of 28 days, and if the works of a Milestone are complete in accordance with the Contract, the Milestone Certificate shall be deemed to have been issued on the date which is 14 days after the date stated in the Contractor's Notice of application. If the Contractor fails to complete the works of the Milestone within the time of completion of the Milestone (with any extension under this Sub-Clause) : (i) the Contractor shall subject to Sub-Clause 20.2(Claims for Payment and/or EOT), pay Delay Damages to the Employer for this default; (ii) such Delay Damages shall be the amount stated in the Contract Data , for every day which shall elapse between the time for completion for the Milestone(with any extension under this Sub-Clause) and the date stated in the Milestone Certificate; (iii) the total amount of Delay Damages for all Milestones shall not exceed the maximum amount stated in the Contract Data(this shall not limit the Contractor's liability for Delay Damages in any case of fraud , gross negligence, deliberate default or reckless misconduct by the Contractor."
New Sub-Clause 4.25 – Fuel Supply	"The Contractor shall plan and coordinate his total fuel usage at the Works, to satisfy for his total requirements for the duration of the Contract. For the storage of fuel supply: (a) locations and methods for storing fuel at the Site shall comply with applicable Laws of Nepal; (b) the Contractor shall provide sufficient fuel storage capacity to provide for performing the Works,; and (c) The Contractor's Storage tanks shall always have at least 30 days fuel supply on hand at current usage."
New Sub-Clause 4.26 – Parent Company Guarantee	"If applicable, the Contractor shall provide a Parent Company Guarantee, by the ultimate parent company of the Contractor, at the time of signing the Contract Agreement.

	If, at any time and for any reason, the Parent Company Guarantee is not enforceable, then the Employer is entitled to suspend any and all payments to the Contractor until the Contractor has provided the Employer with a new, satisfactory and enforceable Parent Company Guarantee form an entity, with sufficient financial standing to guarantee the performance of all of the Contractor's obligations under the Contract."
New Sub-Clause 4.27 – Import and Custom Laws and Regulations	"In connection with the performance of the Contract, the Contractor acknowledges that the Laws of the Country (Nepal) which may specifically refer to import, and customs regulations shall apply, to the furnishing and shipment of any Plant, Materials, products or components required for the Works. The Contractor specifically acknowledges that the Laws of Nepal may prohibit, among other things, the importation of certain products or components."
New Sub-Clause 4.28 – Tax, Levies and Duties	"The Contractor shall give all notices and pay all taxes, customs or other import and export duties, rates (including all handling and freight charges, wharfage and harbour dues, shipping and other rates and charges and taxes of whatever nature) required to be given or paid in order to comply in all respects with the provisions of the Law, including but not limited to, any Regulation or Bylaws of any State/Provincial Government and/or local body authority(Municipalities : Rural, Urban, Sub-Metropolitan and Metropolitan) and /or which may be applicable in connection with the fulfillment of the Contract.All such expenses are deemed to be included within the Contract Price"
New Sub-Clause 4.29 - Land Owners and Access Route Owners	"Notwithstanding any other provision of the Contract, the Contractor shall: (a) establish and maintain a regular and direct dialogue with the owners of the land on which the Site is located, the owners of any access routes on, near or to the Site and other major users of the access routes on, near or to the Site, in order to co-ordinate their respective activities and usage requirements; (b) be responsible for paying any levy, Tax or any amount payable to the Land Owners or Access Route Owners, or complying with any other conditions of the Land Owners or Access Route Owners, in order to secure ongoing access to the Site; (c) pay any costs, including costs associated with the maintenance and upgrade or improvement of any access route on, near or adjacent to the Site, which are reasonably incurred by a Access Route Owner as a result of or in connection with the Contractor's use of that access route, with no additional

	cost to the Employer; (d) take all reasonable precautions to prevent damage or deterioration to access routes on, near or to the Site, including all public roads and bridges adjacent to the Site; (e) choose transportation routes, select vehicles and distribute deliveries to the Site, so as to minimise the traffic impact in, on or around the Site; (f) permit the Land Owners and Access Route Owners to have free and unrestricted access to the access routes on, near or to the Site, as and when they reasonably require; (g) fully co-operate with the Access Route Owners, in relation to the maintenance of access routes on, near or to the Site and to inform the Engineer, if he considers that the carrying out of maintenance activities on access routes is materially hindering the Contractor's ability to access the Site; (h) carefully co-ordinate and interface the Works with any maintenance, upgrading or improvement activities to be carried out by the Access Route Owners; and **(i)** fully comply with any use and safety rules imposed from time-to-time by the Access Route Owners."
New Sub-Clause 4.30 - Explosives	"(a) No explosives of any kind shall be used by the Contractor without prior consent of the Engineer. (b) Where explosives are required to be used by the Contractor in connection with the Works and the Contractor has obtained the consent of the Engineer, he shall at all times: (i) liaise with and obtain such permission as is required from any Government authority, public body and/or private party who is, or is likely to be, directly or indirectly affected by the use of explosives by the Contractor, and (ii) post sufficient warning signs and flags when undertaking any blasting activities in accordance with the Contractor's site safety manual, and to the satisfaction of the Engineer."
New Sub-Clause 4.31 - Assignment and Novation of Manufacturer's Warranties.	"The Contractor shall procure that any warranty, express or implied, with respect to any Plant or Materials used in the construction of the Works made or given by the manufacturer, Subcontractor, supplier, or other seller thereof, will be made in favor of the Employer, or will be assigned or otherwise made available to the Employer or such entity that the Employer nominates. The Contractor must ensure that all warranties given by the manufacturer, Sub-contractor or supplier thereof, or any other seller

	thereof, will be capable of novation from the Employer to any entity to be nominated by the Employer. To the extent that the warranties cannot be made in favor of the Employer, assigned or otherwise made available to the Employer, the Contractor agrees (at its cost) to use its best endeavors to enforce such rights as the Contractor may have, for the benefit of the Employer.
New Sub Clause 4.32 - Delayed Drawing or Instructions	Corresponding to the Employer's design works, the Contractor shall give a Notice to the Engineer whenever the Works are likely to be delayed or disrupted if any necessary drawing or instruction is not issued to the Contractor within 21 days from the planned commencement date of the respective activity. The Notice shall include details of the necessary drawing or instruction, details of why and by when it should be issued, and the nature and amount of the delay or disruption likely to be suffered if it is late. If the Contractor suffers delay and/or incurs Cost as a result of a failure of the Engineer to issue the notified Drawings or Instructions within a time which is reasonable and is specified in the notice with supporting details, the contractor shall give a further notice to the Engineer and shall be entitled to claim subject to Sub Clause 20.1 Contractor's Claim.
New Sub Clause 4.33- Domestic Preference Security	If the Contractor consists of a joint venture which is awarded the Contract through the application of the domestic preference, the Contractor: **(i)** throughout the execution of the Contract, shall not modify the work-sharing characteristics of the joint venture with which it satisfied the criteria of eligibility for the award of the Contract under domestic preference; and **(ii)** concurrently with the above Performance Security, the Contractor shall provide additional security ("the domestic preference security") of 1.0 (one)% of the Contract Price to guarantee that such characteristics of the joint venture will not be so modified.
Clause 5	**Design**
Sub-Clause 5.1 - General Design Obligation	**Delete and replace the word " works" after the word "design of" at the end of first line of first paragraph,** "the Contractor's Design Works as stipulated in the Employer's

	Requirement." **Add the following paragraph at the end of the sub-clause:** "For the Contractor's design works : The Contractor shall submit the names, qualification and experiences of the Design Key Experts (Designers), to the Engineer for consent." The Contractor shall submit all the required design and drawings accompanied by detailed calculations, including design philosophy, references (if any) and standards, to the Employer, in accordance with Sub-Clause 5.2 [Contractor's Documents] and the Employer's Requirements, for review, before commencement of the construction works. The Contractor warrants that he and his designers have the experience and capability necessary for the design. The contractor at all reasonable times shall be available to discuss with the Engineer whichever design matter, until issue of the Performance Certificate."
Sub-Clause 5.2 - Contractors Documents	Sub-Clause 5.2.1 : <u>Preparation by Contractor</u> At the end of the Sub-Clause 5.2.1 insert : "The Engineer shall have the right to inspect the preparation of all these documents, wherever they are being prepared." Sub-Clause 5.2.2: <u>Review by Engineer</u> also insert subparagraph (c) with following: "That the Engineer under the applicable law may be required for the mandatory review /checking of certain elements of design by an authorized professional or other legally recognized individual and /or verification that such design is in accordance with the applicable law, before such design can be implemented in the Works."
Sub-Clause 5.4 -Technical Standards and Regulations	In the first paragraph delete 'the country's technical standards" and replace with: "those technical standards referred to in the Employer's Requirements or where no technical standards are referred to in the Employer's Requirements, with accepted international standards approved by the Engineer."
Sub-Clause 5.5-Training	Delete the first paragraph entirely and replace with: "The training of employees of the Employer (and/or other identified

	personnel) by the Contractor is specified in the Employer's Requirements." At the end of second paragraph insert the following: "The Contractor shall submit the Training Manual within after 56 days of the Commencement of the Works, for the Engineer's review and consent."
Sub-Clause 5.6 - As-Built Records	Delete the first paragraph entirely and replace with: "As built records to be prepared by the Contractor are specified in the Employer's Requirements." Insert the following at the end of this Sub-Clause: "The Contractor shall supply the Engineer with five (5) hard copies and one (1) soft copy in editable format of each as-built record."
Sub-Clause 5.7 – Operations and Maintenance Manuals	Delete the first paragraph entirely and replace with: "An Operation and Maintenance (O&M) Manuals to be prepared by the Contractor are specified in the Employer's Requirements." Delete the fourth paragraph entirely and replace with : "The Contractor, 90 days before commencement of the Tests on Completion, shall submit provisional O&M Manuals for the Works to the Engineer under Sub-Clause 5.2.2 (Review by the Engineer)."
Clause 6	**Staff and Labor**
Sub-Clause 6.1 – Engagement of Staff and Labor	In the first paragraph delete "make arrangements" and replace with: "be responsible for ----------." Insert the following paragraphs at the end of this Sub-Clause: "Without limiting this Sub-Clause, the Parties agree that: (a) foreign manpower engaged by the Contractor in relation to the Works shall be limited only to those providing skills required specifically for the purposes of the Works and shall only be employed in connection with the Works, where such manpower and/or skills are not reasonably available within Nepal; (b) all unskilled workmen employed in connection with the execution of the Works shall be Nepalese citizens, unless the Contractor can show that in any particular trade or skill,

	Nepalese citizens are not available in the numbers required in order to perform the Works; (c) the Contractor shall be responsible for making all arrangements for, and shall bear all the costs of, obtaining of all necessary visas, permits, documents or other official permission for the movement of staff of labor as may be necessary for the purpose of or in connection with the Works; (d) the contractor shall make all necessary arrangements for the transport, to any place as required for burial, of any of his foreign employees or members of their families who may die in Nepal. The Contractor shall also be responsible, to the extent required by the local regulations, for making any arrangements with regards to funeral of any of his local employee who may die while engaged upon the Works; and (e) The Contractor shall arrange for the provision of a sufficient supply of suitable food for all his staffs and labours, and his Subcontractors' staffs and labours, for the purpose of or in connection with the Contract."
Sub-Clause 6.2 – Rates of Wages and Conditions of Labor	Insert the following paragraphs at the end of this Sub-Clause: "The Contractor shall inform the Contractor's Personnel about their liability to pay personal income taxes in respect of such of their salaries, wages, allowances, and any benefits as are subject to taxes under the Laws of Nepal, and the Contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such Laws."
Sub-Clause 6.3 – Recruitment of Persons	Insert the following paragraphs at the end of this Sub-Clause: "Furthermore, any personnel who is retired or terminated or has left the service voluntarilyfrom the service of the Employer or the Engineer, the Contractor shall not recruit the said personnel within two years of his/her retirement or termination or voluntarily left , from the Employer or the Engineer. The foregoing provision shall not exclude the Contractor from recruiting by means of advertisements place in general circulation media for any other technical or skilled personnel including engineers required for the execution of the Works."
Sub-Clause 6.4 – Labor Laws	Insert the following paragraphs at the end of this Sub-Clause: "The Contractor shall at all times take all reasonable precautions to

	prevent any unlawful, riotous or disorderly conduct by or amongst his staff and labor and for the preservation of peace and protection of person and property in the neighborhood of the Works. The Contractor is obliged to notify immediately to the Engineer of any labor conflict or riot faced by him or his subcontractors that could influence the progress of the Works. The Contractor shall be responsible for ensuring observance and compliance by his sub-contractors, of the provisions for this Sub-Clause."
Sub-Clause 6.5 – Working Hours	Insert the following paragraph at the end of this Sub-Clause: 'The Engineer will take into account in giving its consent to a request from the Contractor made under the paragraph 'b' of this sub-clause to work on locally recognized days or rest and/or outside the specified working hours, the following, but without being limited thereto; The nature and extent of the work in request, the resources planned to be deployed, the superintending arrangements, the safety arrangements, quality assurance set up and the hold points/ witness points, all as planned by the Contractor."
Sub-Clause 6.7 – Health and Safety of Personnel	.Insert the following paragraphs at the end of Sub-clause; "The Contractor shall not employ any workforce who are suffering from an infectious disease or are known to be carrier of an infectious disease and shall have all workforces engaged on the construction of water-works certified by a medical officer acceptable to the Engineer as an non-carrier of any water borne disease. The Contractor shall fully follow with the COVID-19 precautionary measures and comply with COVID-19 protocols as set out in the Country's guidelines. The Contractor shall ensure that all the Contractor's Personnel are fully conversant with the regulations, policies and procedures, and the Contractor shall enforce the rule that any employee committing a serious breach of such regulations, policies and procedures may be instantly dismissed and may not be re-employed. If the Contractor fails to comply with any of its health and safety obligations under the Contract (including this Sub-Clause 6.7), the Employer's Requirements or otherwise at Law, the Engineer may take

	whatever action is necessary to remedy such failure and deduct the cost of such action from moneys due or becoming due to the Contractor. In the event of serious or fatal accidents, the Contractor shall leave unchanged the conditions existing at the place of the accident so that the relevant Government Authorities may proceed with their investigations to ascertain the causes of the accident and carry out any of their statutory duties. The Contractor shall be responsible for all damage or injury resulting from any failure by the Contractor to comply with this Sub-Clause 6.7 [Health and Safety] and shall indemnify and hold harmless the Employer, the Employer's Personnel and their respective agents against and from all claims, damages, losses and expenses (including legal fees and expenses) arising out of or in connection with any failure to comply with this Sub-Clause 6.7 [Health and Safety].”
Sub-Clause6.8- Contractor’s Superintendence	Insert at the end of sub-paragraph(a) of Sub-Clause 6.8: “or, if not, the Contractor shall make competent interpreters available during all working hours , in a number sufficient for those persons to properly perform their superintendence duties”
Sub-Clause 6.9 – Contractors Personnel	At the end of sub-paragraph (d) after “environment” delete the “;” and add “and is considered by the Engineer to be undesirable or detrimental to the Project.” At the end of Sub-Clause insert the following paragraphs:: “The Contractor shall, at its own cost and expense, replace any member of the Contractor's Personnel who is removed in accordance with this Sub-Clause 6.9 [Contractor's Personnel], with a competent substitute, approved by the Engineer, and shall under no circumstances re-employ any person removed in accordance with this Sub-Clause 6.9 [Contractor's Personnel], in connection with the Works, without the consent of the Engineer.” “The Contractor shall not be entitled to any extension to the Time for Completion or Milestones Date, any other relief whatsoever by virtue of the operation of this Sub-Clause 6.9 (Contractor's Personnel).”
Sub-Clause 6.10 – Contractor’s Records	At the end of sub-paragraph (a) insert : “(name, age, gender, identification number, wages paid to all workers and other information as asked by the Engineer)” At the end of sub-paragraph(b) insert:

	"(operating, standby, under repair, expected date of returning of equipment under repair to operating condition and others as asked by the Engineer)"
Sub-Clause 6.12 –Key Personnel	Insert at the end the last paragraph of Sub-Clause: "If any of the Key Personnel are not fluent in this language the Contractor shall make competent interpreter(s) available during all working hours, sufficient for that person to properly perform the duties under the Contract."
	Insert new Sub-Clause 6.13 to Sub-Clause 6.24
Sub-Clause 6.13 – Foreign Personnel	"The Contractor may bring into the Country any foreign personnel who are necessary for the execution of the works to the extent allowed by the applicable laws. The contractor shall ensure that these personnel are provided with the required residence visas and work permits. The Engineer shall, if requested by the Contractor, use all reasonable endeavors in a timely and expeditious manner to assist the Contractor in obtaining any local, state, national, or government permission required for bringing in the Contractor's personnel" " The contractor shall be responsible for the return of these personnel to the place where they were recruited or to their domicile. In the event of the death in the Country of any of these personnel or members of their families, the Contractor at his cost shall similarly be responsible for making the appropriate arrangements for their return or burial. of imported Contractor's Personnel."
Sub-Clause 6.14 – Supply of Foodstuffs	"The contractor shall arrange for the provision of a sufficient supply of suitable food at reasonable price for the Contractor's personnel for the purposes of or in connection with the Contract."
Sub-Clause 6.15-Supply of **Water**	"The Contractor shall, having regard to the local conditions, provide on the Site an adequate supply of drinking and other water for the use of the Contractor's Personnel."
Sub-Clause 6.16-Measures against insect and pest nuisance	"The Contractor shall at all times take the necessary precautions to protect the Contractor's Personnel employed on the Site from insect and pest nuisance, and to reduce the danger to their health. The Contractor shall comply with all the regulations of the local health authorities, including use of appropriate insecticide."
Sub-Clause 6.17 – Alcoholic liquor or Drugs	"The Contractor shall not, other than in accordance with the laws of the Country , import, sell, give, barter or otherwise dispose of any alcoholic liquor or drugs, or permit or allow importation ,sale, gift,

	barter or disposal thereto by the Contractor's Personnel."
Sub-Clause 6.18-Arms and Ammunition	"The Contractor shall not give, barter, or otherwise dispose of , to any person , any arms or ammunition of any kind , or allow the Contractor's Personnel to do so."
Sub-Clause 6.19-Festivals and Religious Customs	"The Contractor shall respect the Country's recognized festivals, days of rest and religious or other customs."
Sub-Clause 6.20-Funeral arrangements	"The Contractor shall be responsible to the extent required by local regulations, for making any funeral arrangements for any of the Contractor's local employees who may die while engaged upon the Works."
Sub-Clause 6.21-Forced Labor	"The Contractor shall not employ forced labor, which consists of any work or service, not voluntarily performed, that is exacted from an individual under threat of force or penalty, and includes any kind of involuntary or compulsory labor, such as indentured labor, bonded labor or similar labor –contracting arrangements."
Sub-Clause 6.22-Child Labor	"The Contractor shall not employ children (any natural persons under the age of eighteen (18) years) in a manner that is economically exploitative, or likely to be hazardous, or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development."
Sub-Clause 6.24- Non-Discrimination and Equal opportunity	"The Contractor shall not make employment decisions on the basis of personal characteristics unrelated to inherent job requirements. The Contractor shall base the employment relationship on the principle of equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitments and hiring, compensation (including wages and benefits), working conditions and terms of employment, termination of employment, and discipline."
Clause 7	**Plants , Materials and Workmanship**
Sub-Clause 7.4 – Testing by the Contractor	After the second paragraph insert the following: "The Contractor shall submit a Testing Plan for the Works (including any Sections of the Work) in a format acceptable to the Engineer, which complies with the requirements of the Contract under Sub-Clause 4.9 (Quality Management and Compliance Verification System) and Sub-Clause 8.3 (Programmes). The Testing Plan shall be submitted in accordance with the Sub-Clause 5.2 (Contractor's Documents)], for the Engineer's review under Sub-Clause 5.2.2

	(Review by Engineer). The Testing Plan shall include a detailed description of: (a) the location of the test; (b) the types of tests to be carried out and the applicable standards; (c) the number and frequency of the tests; (d) the test conditions (including normal operating conditions and emergency conditions); (e) required attendees at the tests; (f) the form of the test results; and (g) Any other requirements (if any) set out in the Employer's Requirements. The Plant, Materials and Workmanship shall be subject to the tests and their procedures as specified in the Employer's Requirements. Workshop tests, to be listed in the Quality Control Plan to be submitted to the Engineer for approval, shall include all necessary references to applicable Standards, acceptance criteria, and indication. Separate plan for the Site tests, to be submitted to the Engineer approval before the start-up of the Commissioning period, shall also include all necessary references to applicable Standards, acceptance criteria and detailed proposed procedures for all main tests." Add at the end of this Sub-Clause 7.4 the following new paragraphs: "The Engineer and his representative and any other person nominated by the Engineer shall be entitled during manufacture to inspect, examine, to be present at any test and check the progress of manufacture of all plant to be supplied under the contract. This shall take place on the Contractor's/Sub-contractor's premises during working hours. The Contractor shall cooperate with the Engineer and any other representatives of the Engineer in this regard. If the test is undertaken outside the Country, the Contractor shall provide and make all necessary arrangements for the Engineer and/or his representative to attend and witness all tests undertaken outside the Country and costs therefore shall be deemed to be included in the Contract Price stated in the Contract Agreement. No such inspection, examination or testing shall release the Contractor

	from any obligation under the contract. Notification by the Contractor for inspection and testing which does not afford the Engineer sufficient time to obtain visas for the country(s) where inspection or testing will be carried out, shall not be deemed a delay for which the Engineer is responsible. Provided, that as a result of the Contractor's method of working not being in accordance with the Contract, the Engineer has reasonable grounds to suspect that any Materials, Plant or workmanship used in any part or parts of the Works may not be in accordance with the provisions of the Contract, the Engineer may require the Contractor to carry out any test and/or opening-up of covered works, which in the opinion of the Engineer is necessary to verify the quality of such Materials, Plant or workmanship in such part or parts of the works. The cost of any test and/or opening-up so required shall be borne by the Contractor regardless of whether or not such test or opening-up shows the materials, plant or workmanship to be in accordance with the provisions of the Contract and to the satisfaction of the Engineer. The Contractor shall not be entitled to claim any extension of time and/or money as a result of having to carry out such tests and/or opening-up."
Sub-Clause 7.7- Ownership of Plant and Materials	Insert at the end of Sub-Clause7.7: "No Plant and/or Materials that is the property of the Employer shall be removed from the Site. If it becomes necessary to: i. remove any item of such Plant from the Site for the purposes of repair; the Contractor shall give a Notice, with reasons, to the Engineer requesting consent to remove the defective or damaged item off the Site. This Notice shall clearly identify the item of defective or damaged Plant, and shall give details of : the defect or damage to be repaired; the place to which defective or damaged item of Plant is to be taken for repair; the transportation to be used (and insurance cover for such transportation) ; the proposed inspections and testing off the Site; and the planned duration required before the repaired item of plant shall be returned to The Site. The Contractor shall also provide any further details that the Engineer may reasonably require; or ii. replace any item(s) of such Plant and/or Materials , the Contractor shall give a Notice , with reasons , to the Engineer clearly identifying the item(s) of Plant and/or Materials to be replaced, and giving details of due date of delivery to the Site

	of the Replacement item(s). Where any item of Plant and/or Materials has become the property of the Employer under this Sub-Clause before it has been delivered to the Site, the Contractor shall ensure that such an item is not moved except for its delivery to the Site. The Contractor shall indemnify and hold the Employer harmless against and from the consequences of any defect in the title or encumbrances or charge (except any reasonable restriction arising from the intellectual property rights of the manufacturer or producer) of the Employer under this Sub-Clause."
Sub-Clause 7.8 – Royalties	Insert the following paragraphs at the end of this Sub-Clause: "The Contractor shall pay all royalties, rents and other payments as imposed by the local District Co-ordination Committee (DCC), or the Rural Municipality(ies), Urban Municipalities(Municipalities, Sub-Metropolitan Cities, Metropolitan Cities) and/or other relevant Government authorities that may be in force at the time, for extracting aggregates from the Site, including sand, stone/boulder, gravel, etc. from the river beds. The Contractor shall be liable for all payments of compensation, if any, levied in relation to the dumping and / or disposal of any materials, in accordance with any and all local authorities according to the Local Government Operation Act , 2076 and its Regulations with any amendments or other such laws of Nepal as are applicable."
	Insert new sub-clause 7.9 as follows:
Sub-Clause 7.9 – Sufficient Stock of Materials	"Due to the climatic and geological conditions during the monsoon season the Contractor may encounter problems with access to the site. Therefore, having regard to Nepal being landlocked, the remoteness of the site, the climatic and geological conditions, the Contractor shall at all times plan and arrange for sufficient stock of major materials, which includes, but not limited to, cement, explosives, detonators, reinforcing steel bars, rock support materials, fuel, to provide uninterrupted operations. Failure to provide sufficient stock at Site or shortage of materials shall be in no case the reasons of claim for extension of time."
Clause 8	**Commencement , Delays and Suspension,**
Sub-Clause 8.1- Commencement of Works	Delete the first paragraph and insert with following:

	"The Engineer shall give a Notice to the Contractor stating the Commencement Date 14 days before the Commencement Date."
Sub-Clause 8.3 – Programme	Add at the end of this Sub-Clause the following new paragraphs: "The description of the methods, which the Contractor intends to use for the execution of the civil works, shall be sufficient to demonstrate that the time shown in the programme for a given work is consistent with the resources that will be allocated for the same work. Failure of the Contractor to submit any programme or any revision thereof may lead to withholding of any payments due to the Contractor until the situation is rectified. Programme may be adjusted/revised to fulfill the requirement of the construction activities without modifying the milestone dates.Any revised programme submitted by the Contractor under this Sub-Clause, shall not affect or extend the time for completion for the Works. The submission of, or non-issuance of an Engineer's notice of non-compliance to, any programme or revision thereof under this Sub-Clause 8.3 [Programme] shall not in any way relieve the Contractor of any of its warranties, obligations or liabilities under or in connection with the Contract."
Sub-Clause 8.5 – Extension of Time for Completion	Insert the following paragraphs before the last paragraph of the Sub-Clause: "The Contractor shall not be entitled to any extension of Time for Completion for adverse climatic conditions, unless the contractor proves through proper statistical analysis of historical meteorological data that the climatic condition is exceptionally adverse." Replace the last paragraph with the following three paragraphs: "When delays caused by the Contractor exist in concurrence with delays caused by the Employer and/or caused by neutral causes (causes beyond the control of either party), the periods of such concurrencies shall be excluded from the Contractor's entitlement to extension of time. A concurrent delay results when delays caused by employer's risk event and /or by neutral delay event and another delay caused by a contractor's delay event occur at the same time. The granting of an extension of time for completion shall not entitle the Contractor to any additional payment. Where, in the opinion of the

	Contractor, additional costs have been incurred as a result of the cause or the event for which an extension of time for completion has been granted, such costs shall be well documented and may be claimed separately, in accordance with the provisions of Clause 20.1."
Sub-Clause 8.8 – Delay Damage	At the end of the second paragraph insert: "As set out in this Sub-Clause 8.8 [Delay Damages], the Employer's right to claim delay damages shall be without prejudice to any other right which the Employer may have under this Contract or otherwise at Law, in respect of any breach of Sub-Clause 8.2 [Time for Completion] by the Contractor." Insert the following paragraphs at the end of this Sub-Clause: "The Contractor acknowledges that the percentage of the Contract Price as delay damages as specified in Contract Data is an agreed and genuine pre-estimate of the loss and damage which the Employer may incur in the event of delay. The Contractor shall not raise by way of defense or claim, in relation to the Employer's right to deduct delay damages, any argument that the delay damages amount calculated as the percentage of the Contract Price is a penalty or otherwise unenforceable. If the Contractor's obligation to pay delay damages is found for any reason to be void, invalid or otherwise inoperative (other than through the Employer asserting that the delay damages should not be applied) so as to disentitle the Employer from claiming delay damages, the Employer shall be entitled to a claim against the Contractor for damages at Law, resulting from the Contractor's breach of its obligations under Sub-Clause 8.2 [Time for Completion], provided that the Contractor's liability for such damages shall not exceed in amount with respect to the percentage of the Contract Price as the delay damages as specified in the Contract Data."
New Sub Clause 8.14 - Bonus	The Contractor shall be paid a bonus calculated at the rate of *0.05%* of the final contract price for each day that the completion of the works is earlier than the Time of Completion pursuant to Conditions of Contract Sub Clause 8.2. The total amount of Bonus shall not exceed *10%* of the final contract price.
Clause 9	**Tests on Completion**
Sub-Clause 9.1 – Contractors Obligations	In the first paragraph between "Sub-Clause 7.4 [Testing by the Contractor]" and "after" insert:

	", Sub-Clause 4.9 [Quality Management and Compliance Verification System]" In the first paragraph between "documents" and "in" insert: "required to be provided" In the first paragraph between "with" and "Sub-Clause" insert: "the Employer's Requirements, including those referred to in" Insert the following paragraph at the end of Sub-Clause: "The Employer may wish the Employer's permanent operating and maintenance personnel to witness the operational tests and/or trial operation (including during the training of the Employer's Personnel under Sub-Clause 5.5(Training)."
Clause 11	**Defects after Taking Over**
Sub-Clause 11.3 – Extension of Defects Notification Period	Insert the following paragraph at the end of this Sub-Clause: "If any items of the Plant and/or Materials have been replaced in accordance with Sub-Clause 11.1 [Completion of Outstanding Work and Remedying Defects] during the Defects Notification Period, then that item shall be subject to an additional Defects Notification Period not exceeding 2 Yearsfrom theDefect Notifications Period stated in the Contract Data."
Sub-Clause 11.6 – Further Tests after Remedying Defects	In the second paragraph after "the Engineer" delete "may" and replace with: "shall"
Sub-Clause 11.7 – Right of Access after Taking Over	After "the Contractor shall" insert: ", subject to the Engineer's prior written approval," Delete the last paragraph of this Sub-Clause and replace it with : "Such right of access shall not be exclusive, and the Contractor shall coordinate for such access with the Employer/Engineer."
Sub-Clause 11.9 – Performance Certificate	In the second paragraph, under sub-paragraph(a) , after and delete the words " if applicable"
Clause 12	**Tests after Completion**
Sub-Clause 12.1 – Procedure for Tests after	Delete and replace the first paragraph entirely with the following;

Completion	"This Sub Clause shall be applicable if the Test After Completion is specified in the Employer's Requirements for the Contractor's Design Works."
Clause 13	**Variation and Adjustments**
Sub-Clause 13.1 – Right to Vary	Add the following paragraph at the end of this sub-clause: "Variation may include: (a) Change to the quantities of any item of work included in the contract (however, such changes do not necessarily constitute a variation) in the case of the Employer's Design Works, b) changes to the quality and other characteristics of any item of work; (c) changes to the levels, positions and/or dimensions of any part of the Works; (d) the omission of any work, unless it is to be carried out by others without the agreement of the Parties; (e) any additional work, Plant, Materials or services necessary for thePermanent Works, including any associated Tests on Completion,boreholes and other testing and exploratory work; or (f) changes to the sequence or timing of the execution of the Works. The Contractor shall not make any alteration to and/or modification of the Permanent Works, unless and until the Engineer instructs a Variation under Sub-Clause 13.3.1 [Variation by Instruction]."
Sub-Clause 13.2 – Value Engineering	Add the following paragraphs at the end of sub-clause; "If a proposal under this Sub-Clause, to which the Engineer gives his/her consent, includes a change in the design of part of the Permanent Works, then unless otherwise agreed by both Parties: (i) the Contractor shall design this part at his/her cost; and (ii) sub-paragraphs (a) to (h) of Sub-Clause 4.1 [Contractor's General Obligations] shall apply."

Sub-Clause 13.4 – Provisional Sums	Delete the second paragraph and its sub-paragraph (a) and (b) entirely. Delete the third paragraph and replace it with following: "If the Engineer instructs the Contractor to undertake an item covered by a Provisional Sum, the Contractor shall produce quotations from minimum three (03)suppliers and/or subcontractors and submit those quotations to the Engineer for consideration. The Engineer may, if he deems it necessary or desirable, revoke that instruction in whole or in part at any time before acceptance of any quotation, no payment shall be made for the extent of instruction revoked. For consideration of any quotation submitted to the Engineer by the Contractor, the Engineer may instruct the Contractor, and the Contractor shall, obtain the items from the supplier or subcontractor giving the quotation at the price and on the terms approved by the Engineer." Insert the following paragraph at the end of this Sub-Clause: "The value of the overhead charges and profit for works carried out under a Provisional Sum shall beas stated in the **Contract Data**."
Sub-Clause 13.7 – Adjustments for Changes in Costs	**Add the following paragraph before the first paragraph of this Sub-Clause;** "This Sub Clause shall not be applicable for the Contractor's design works." **Add the following paragraphs at the end of this Sub-Clause;** "The "table of adjustment data" means the completed table of adjustment data for local and foreign currencies included in the Schedules. If this Sub-Clause applies, the amounts payable to the Contractor shall be adjusted for rises or falls in the cost of labour, Goods and other inputs to the Works, by the addition or deduction of the amounts determined by the formulae prescribed in this Sub-Clause. To the extent that full compensation for any rise or fall in Costs is not covered by the provisions of this or other Clauses, the Accepted Contract Amount shall be deemed to have included amounts to cover the contingency of other rises and falls in costs.

	The adjustment to be applied to the amount otherwise payable to the Contractor, as valued in accordance with the appropriate Schedule and certified in Payment Certificates, shall be determined from formulae for each of the currencies in which the Contract Price is payable. No adjustment is to be applied to work valued on the basis of Cost or current prices. The formulae shall be of the following general type: **Pn = a + b Ln/Lo + c En/Eo + d Mn /Mo+ .....** "Pn" is the adjustment multiplier to be applied to the estimated contract value in the relevant currency of the work carried out in period "n", this period being a month unless otherwise stated in the Contract Data; "a" is a fixed coefficient, stated in the relevant table of adjustment data, representing the non-adjustable portion in contractual payments; "b", "c", "d", … are coefficients representing the estimated proportion of each cost element related to the execution of the Works, as stated in the relevant table of adjustment data; such tabulated cost elements may be indicative of resources such as labour, equipment and materials; "Ln", "En", "Mn", … are the current cost indices or reference prices for period "n", expressed in the relevant currency of payment, each of which is applicable to the relevant tabulated cost element on the date 49 days prior to the last day of the period (to which the particular Payment Certificate relates); and "Lo", "Eo", "Mo", … are the base cost indices or reference prices, expressed in the relevant currency of payment, each of which is applicable to the relevant tabulated cost element on the Base Date. In cases where the "currency of index" is not the relevant currency of payment, each index shall be converted into the relevant currency of payment at the selling rate, established by the central bank of the Country, of this relevant currency on the above date for which the index is required to be applicable. Until such time as each current cost index is available, the Engineer shall determine a provisional index for the issue of Interim Payment Certificates. When a current cost index is available, the adjustment shall be recalculated accordingly. If the Contractor fails to complete the Works within the Time for

	Completion, adjustment of prices thereafter shall be made using either (i) each index or price applicable on the date 49 days prior to the expiry of the Time for Completion of the Works, or (ii) the current index or price, whichever is more favorable to the Employer. The weightings (coefficients) for each of the factors of cost stated in the table(s) of adjustment data shall only be adjusted if they have been rendered unreasonable, unbalanced or inapplicable, as a result of Variations. **The base cost indices or prices:** The base cost indices or prices shall be those prevailing on the day 28 (twenty eight) days prior to the latest date for submission of bids. Current indices or prices shall be those prevailing 49 (Forty Nine) days prior to the period to which a particular Payment Certificate is related. If at any time the current indices are not available, provisional indices determined by the Engineer shall be used, subject to subsequent correction of the amounts paid to the contractor when the applicable indices become available. **Sources of Indices and Weightings:** The sources of indices shall be those listed in the Bidding Forms– Table of Price Adjustment data, as approved by the Engineer. Indices shall be appropriate for their purpose and shall relate to the Contractor's proposed source of supply of inputs on the basis of which his Contract shall have been computed. As the proposed basis for price adjustment, the Contractor shall have submitted with his bid the tabulation of Weightings and Source of Indices in the Bidding Forms, which shall be subject to approval by the Engineer. **Weightings**: The weightings for each of the factors of cost given in the Bidding Forms shall be adjusted if, in the opinion of the Engineer, they have been rendered unreasonable, unbalanced or inapplicable as a result of varied or additional work already executed or instructed under Clause 13.1 or for any other reason. **Subsequent Legislation:** If, after the date 30 days prior to the latest date for submission of bids for the Contract, there occur changes to any National Statute, Ordinance, Decree, or other Law or any regulation or by–law of any local or other duly constituted authority, or the introduction of any such Statute, Ordinance, Decree, Law, regulation or by–law which causes additional or reduced cost to the Contractor, other than under the preceding sub–clauses of this clause, in the execution of the Contract, such additional or reduced cost shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be added to or deducted from the Contract Price and the Engineer shall notify the Contractor accordingly, with a copy to the Employer. The total payment for adjustment for changes in cost shall be limited to 25% of the initial contract price exclusive of the Contractor's Design Works. The price adjustment shall commence

	after 12 (twelve) months from the commencement date. "
Clause 14	**Contract Price and Payment**
Sub-Clause 14.1 Contract Price	The total Contract price shall be the summation of : (i) The price for the Employer's design work including the Preliminary and General Works: the amount calculated as the product of measured quantity of the works accomplished and unit rate ; and (ii) The price for the Contractor's design works: fixed lump sum price as stated in price schedule.
Sub-Clause 14.2 – Advance Payment	Delete the entire contents of this Sub-Clause 14.2 and replace with : "Total amount of the advance payment, the number of installments and the applicable currencies and proportions shall be as stated in the Contract Data." **Sub-Clause 14.2.1**: Advance Payment Guarantee -delete the words "equal to the advance payment" from the first sentence and replace with "equal to the total amount of the advance Payment". -in the second paragraph before "the advance payment has been repaid" add the words "the total amount of". -in the third paragraph before" advance payment has not been repaid" add the words "the total amount of". -in sub-paragraph (a) before "the advance payment has been repaid" add the words "the total amount of". -in the last sentence, before "the advance payment" add the words "the first installment of". **Sub-Clause 14.2.2**: Advance Payment -in the first sentence before "the advance payment "add the words "first installment of". -delete sub-paragraph (b) and replace with: "(b) the Employer has received a copy of the Contractor's application for the first installment of the advance payment." -at the end of this Sub-Clause add the following wording. "Thereafter, the Employer shall pay each subsequent installment of the advance

	payment, which the Contractor is entitled to under the Contract, within 14 days after the Engineer has received the Contractor's application (in the form of a Statement for that installment of advance payment associated with Advance Payment Guarantee. The Employer may forfeit the Advance Payment Guarantee if the Contractor uses the advance payment for matters other than the contractual obligations." **Sub-Clause 14.2.3**: Repayment of Advance Payment -in the last sentence before "the advance payment has not been repaid" add the words "the total amount of". **Add the following paragraph at the end of this sub clause;** "In case of the repayment of the Advance Payment, if the Contractor is not able to complete the contract within the stipulated time of completion of contract, the Employer shall be entitled to claim the interest at the rate of 10 (ten) % per year of the outstanding principle amount of the Advance Payment inclusive of the outstanding principle advance payment amount."
Sub-Clause 14.3 – Application for Interim Payments	Under second paragraph replace sub-paragraph (iii) with following: "(iii) The percentage of retention shall be 5% of the certified interim payment and the limit of the retention money shall be 5% of the accepted contract amount excluding VAT."
Sub-Clause 14.4 – Schedule of Payment	Delete this Sub-Clause and replace with a new Sub-Clause 14.4 as " For the Contractor's Design Works, the Contract includes a Schedule of Payments specifying the installments after completion of individual activity for which the Contract Price will be paid. Notwithstanding with above paragraph, prior commencing to Works after the Engineer's Notice to commencement, the Contractor may submit the new Price Schedule Breakdown; subject to follow the Schedule of Payment ; for the Engineer's review and consent."
Sub-Clause 14.6 – Issue of IPC	Delete the sub-paragraph (a) of this Sub-Clause 14.6 and replace with following : "(a) the evidence (to the satisfaction of the Engineer) of those insurance policies which the Contractor is required to obtain in accordance with Clause 19 [Insurance];" **Sub-Clause 14.6.1:**Notice of interim payment

	At the end of this Sub-Clause , add the following "The Contractor's interim payment Statement shall not be accepted by the Engineer for certification of payment as per Sub-Clause 14.7 (Payments) unless the Contractor's Statement is substantiated with required supporting documents."
Sub-Clause 14.8 – Delayed Payment	Delete all the contents of Sub-Clause 14.8[Delayed Payment] and replace with the following: "If the Contractor does not receive payment in accordance with Sub-Clause 14.7 [*Timing of Payments*], the Contractor shall be entitled to receive financing charges compounded monthly on the amount unpaid during the period of the delay. This period shall be deemed to commence on the date for payment specified in Sub-Clause 14.7 (Payments). The financing charges for payments to be made in Foreign Currency shall be calculated at the rate as stated in Contract Data and shall be paid in such currency. The financing charges for payments to be made in Nepalese Rupees shall be calculated at the rate as stated in Contract Data and shall be paid in such currency. The Contractor shall be entitled to this payment without formal notice or certification, and without prejudice to any other right or remedy."
Sub-Clause 14.9 – Release of Retention Money	Delete the entire contents of Sub-Clause 14.9 and replace it with the following: "In accordance with "The Public Procurement Rules, 2064 (2007)", Rule 124, the payment of retention monies shall be as follows: The first half (50%) of the Retention Money shall be released by the Employer to the Contractor upon completion of the Defects Notification Period and the issuance of the Performance Certificate. The remaining 50% of the Retention Money shall be released by the Employer to the Contractor after the Contractor has submitted documentary evidence showing the submission by him or her of tax returns to the concerned Inland Revenue Office in the country. Notwithstanding the foregoing, in case of Joint Venture (JV), the retention money shall be released only after the submission of document showing the submission of tax returns in the Inland Revenue Office in the country."

Sub-Clause 14.15 – Currencies of Payment	Add the following paragraph at the end of this sub-clause: "Notwithstanding the foregoing, the Contract Price shall be paid in the single currency (Local Currency) only. However, for the rate of exchange to foreign currency, exchange policies and guidelines of Nepal Rastra Bank (Central Bank of Nepal) shall apply.
	Insert new Sub-Clauses 14.16 to 14.17 as follows:
New Sub-Clause 14.16 – Payment to Contractors Personnel and Subcontractors	Before making a payment to the Contractor the Engineer may require the Contractor to give the Employer aDeclaration by the Contractor that his personnel and Subcontractors who have at any time been engaged on the Works have been paid all moneys payable to them in respect of their engagement on the Works. If within 7 days after the request the Contractor fails to provide the statutory declaration, the Employer may withhold payment of moneys due to the Contractor until the Declaration is received. If the contractor provides satisfactory proof of the maximum amount which may be payable to his personnel and Subcontractors, the suspension of payment shall not apply to amounts in excess of the maximum amount."
New Sub Clause 14.17- Measurement and Evaluation	**This Sub Clause is applicable for the Employer's Design Works only.** **(i) Works to be Measured :** Whenever the Engineer requires any part of the Works to be measured on Site, he/she shall give a Notice to the Contractor of not less than 7 days, of the part to be measured and the date on which and place on Site at which the measurement will be made. Unless otherwise agreed with the Contractor, the measurement on Site shall be made on this date and the Contractor's Representative shall: (a) either attend or send another qualified representative to assist the Engineer and to endeavor to reach agreement of the measurement, and (b) supply any particulars requested by the Engineer. If the Contractor fails to attend or send a representative at the time and placestated in the Engineer's Notice (or otherwise agreed with the Contractor),the measurement made by (or on behalf of) the Engineer shall be deemed tohave been made in the Contractor's presence and the

	Contractor shall bedeemed to have accepted the measurement as accurate. Any part of the Permanent Works that is to be measured from records shall be identified in the Specification and, except as otherwise stated inthe Contract, such records shall be prepared by the Engineer. Whenever the Engineer has prepared the records for such a part, he/she shall give aNotice to the Contractor of not less than 7 days, stating the date on whichand place at which the Contractor's Representative shall attend to examineand agree the records with the Engineer. If the Contractor fails to attend orsend a representative at the time and place stated in the Engineer's Notice(or otherwise agreed with the Contractor), the Contractor shall be deemedto have accepted the records as accurate.If, for any part of the Works, the Contractor attends the measurement onSite or examines the measurement records (as the case may be) but theEngineer and the Contractor are unable to agree the measurement, thenthe Contractor shall give a Notice to the Engineer setting out the reasonswhy the Contractor considers the measurement on Site or records areinaccurate. If the Contractor does not give such a Notice to the Engineer within 14 days after attending the measurement on Site or examining themeasurement records, the Contractor shall be deemed to have acceptedthe measurement as accurate. **(ii) Method of Measurement:** The method of measurement shall be in accordance with the Bill of Quantities for the Employer's design Works . The measurement shall be made of the net actual quantity of each item of the Permanent Works and no allowance shall be made for bulking, shrinkage or waste. **(iii) Valuation of the Works:** The Engineer shall value each item of work by applying the measurement agreed or determined in accordance with Sub-Clauses 14.17(i) [Works to be Measured] and 14.17(ii) [Method of Measurement], and the appropriate rate or price for the item. For each item of work, the appropriate rate or price for the item shall be

	the rate or price specified for such item in the Bill of Quantities. Any item of work which is identified in the Bill of Quantities or other Schedule, but for which no rate or price is specified, shall be deemed to be included in other rates and prices in the Bill of Quantities or other Schedule(s). New rate or price shall be appropriate for an item of work if: (a) the item is not identified in, and no rate or price for this item is specified in, the Bill of Quantities or other Schedule and no specified rate or price is appropriate because the item of work is not of similar character, or is not executed under similar conditions, as any item in the Contract; (b) (i) the measured quantity of the item is changed by more than 10% from the quantity of this item in the Bill of Quantities or other Schedule, (ii) this change in quantity multiplied by the rate or price specified in the Bill of Quantities or other Schedule for this item exceeds 0.01% of the Accepted Contract Amount, (iii) this change in quantity directly changes the Cost per unit quantity of this item by more than 1%, and (iv) this item is not specified in the Bill of Quantities or other Schedule as a "fixed rate item", "fixed charge" or similar term referring to a rate or price which is not subject to adjustment for any change in quantity; and/or (c) the work is instructed under Clause 13 [Variations and Adjustments] and sub-paragraph (a) or (b) above applies. Each new rate or price shall be derived from any relevant rates or prices

	specified in the Bill of Quantities or other Schedule, with reasonable adjustments to take account of the matters described in sub-paragraph (a), (b) and/or (c), as applicable. If no specified rates or prices are relevant for the derivation of a new rate or price, it shall be derived from the reasonable Cost of executing the work, together with the applicable percentage for profit five percent (5%)), taking account of any other relevant matters. (iv) Omissions: Whenever the omission of any work forms part (or all) of a Variation; (a) the value of which has not otherwise been agreed; (b) the Contractor will incur (or has incurred) cost which, if the work had not been omitted, would have been deemed to be covered by a sum forming part of the Accepted Contract Amount; (c) the omission of the work will result (or has resulted) in this sum not forming part of the Contract Price; and (d) this cost is not deemed to be included in the valuation of any substituted work; then the Contractor shall, in the Contractor's proposal under sub-paragraph (c) of Sub-Clause 13.3.1 [Variation by Instruction], give details to the Engineer accordingly, with detailed supporting particulars.
Clause 15	**Termination by Employer**
Sub-Clause 15.2 – Termination for Contractor's Default	**Sub-Clause 15.2.1 :**Notice At the end of sub-paragraph (h) add "It includes situations where the Contractor or any of the Contractor's employees, agents, Subcontractors or the Contractor's Personnel gives or offers to give (directly or indirectly) to any person any bribe, gift, gratitude, commissions or other things of value as an inducement or reward for showing or for bearing to show favor or disfavor to any

	person in relation to the Contract. But it does not include lawful inducement and rewards by the Contractor to the Contractor's Personnel." **Sub-Clause 15.2.3** : <u>After Termination</u> Insert the following new sub-paragraph at the end of sub-paragraph (b) under this Sub-Clause : "(iv) all Employer-Supplied Materials and/or Employer's Equipment made available to the Contractor in accordance with Sub-Clause 2.6 (Employer-Supplied Materials and Employer's Equipment), and".
	Insert new Sub-Clause 15.8 and Sub-Clause 15.9
New Sub-Clause 15.8 – Corrupt Fraudulent , collusive, coercive or obstructive practice	If the Engineer determines that the Contractor has engaged in corrupt, fraudulent, collusive or coercive practices, in competing for or in executing the Contract, then the Employer may, after giving 14 days' notice to the Contractor, terminate the Contract immediately, and the provisions of Clause 15 shall apply as if such termination had been made under Sub-Clause 15.2 [Termination by Employer]. Should any employee of the Contractor be determined to have engaged in corrupt, fraudulent or coercive practice during the execution of the work then that employee shall be removed in accordance with Sub-Clause 6.9 [Contractor's Personnel]. For the purposes of this Sub-Clause: (a) "corrupt practice" means the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence the action of a public official in the procurement process or in the Contract execution; (b) "fraudulent practice" means a misrepresentation or omission of facts in order to influence a procurement process or the execution of the Contract; (c) "collusive practice" means a scheme or arrangement between two or more tenderers, with or without the knowledge of the Employer, designed to establish tender prices at artificial, non-competitive levels; (d) "Coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the procurement process or affect the execution of the Contract.

	(e) "obstructive practice" means: i. deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede the Employer or a Government Agency investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or ii. acts intended to materially impede the exercise of the Employer, or a Government Agency, and financier's inspection and audit rights.
New Sub-Clause 15.9 – Taking Over Contractors Equipment following Termination	(a) In the event of termination of the Contract under Sub-Clause 15.2 [Termination for Contractor's Default], the Engineer may, for the purpose of completing the Works, take-over direction of and to use all or any part of the Contractor's Equipment and property of any kind (including Intellectual Property Rights and premises belonging to the Contractor) delivered to, provided or utilized by the Contractor for the performance of the Works. (b) The Contractor must do all things and execute any documents necessary for the lawful use by the Employer of the Contractor's Equipment and other property.
Clause 16	**Suspension and Termination by Contractor**
Sub-Clause 16.2 – Termination by the Contractor	**Sub-Clause 16.2.1**: Notice At the end of sub-paragraph (i) add "It includes situations where the Employer or any of the Employer's employees, agents, or the Employer's Personnel gives or offers to give (directly or indirectly) to any person any bribe, gift, gratitude, commissions or other things of value as an inducement or reward for showing or for bearing to show favor or disfavor to any person in relation to the Contract. But it does not include lawful inducement and rewards by the Employer to the Employer's Personnel."
Sub-Clause 16.3 – Contractor's Obligations after Termination	Delete the word 'and' at the end of sub-paragraph (b) and insert new sub-paragraph (d) after (c) as follows : "and,

	(d) deliver to the Engineer all Employer-Supplied Materials and/or Employer's Equipment made available to the Contractor in accordance with Sub-Clause 2.6 (Employer-Supplied Materials and Employer's Equipment)."
Sub-Clause 16.4 - Payment on Termination	Delete the sub-paragraph (b) in its entirety.
Clause 17	**Care of the Works and Indemnities** **Insert new Sub-Clause 17.7 : Contractor's use of Employer's Facilities**
New Sub-Clause 17.7 – Contractor's Use of Employer's Facilities	The Contractor shall take full responsibility for the care of the items of the Employer's facilities and/or accommodations listed below, from the date of use and/or occupation by the Contractor until the date on which such use and /or occupation is re-vested in the Employer. (List of items and details) If any loss or damage happens to any of the above items during a time when the Contractor is responsible for its care, arising from any cause other than a cause for which the Employer is responsible or liable, the Contractor shall promptly the loss or damage at the Contractor's risk and cost.
Clause 20	**Employer's and Contractor's Claims**
Sub-Clause 20.1 – Claims	Replace the words "within a reasonable time" in the last paragraph of this Sub-Clause by "42 days".
Sub-Clause 21.1 – Constitution of the DAAB	Delete the entire text of this Sub Clause.
Sub-Clause 21.2– Failure to Appoint DAAB Member (s)	Delete the entire text of this Sub Clause.
Sub-Clause 21.3– Avoidance of Disputes	Delete the entire text of this Sub Clause.
Sub-Clause 21.4–	Delete the entire text of this Sub Clause.

Obtaining DAAB's Decision	
Sub-Clause 21.5– Amicable Settlement	Delete and replace the entire text of this Sub Clause with the following; "Where a NOD has been given under Sub-Clause 3.7.5 (Dissatisfaction with Engineer's determination) both Parties shallattempt to settle the Dispute amicably by mutual consent before the commencement of Arbitration. However, unless both Parties agree otherwise, arbitration may be commenced on or after the twenty-eighth (28th) day after the day on which this NOD was given, even if no attempt at amicable settlement has been made."
Sub-Clause 21.6– Arbitration	Add at the end of this Sub Clause the following paragraph; "Notwithstanding the foregoing, the International Arbitration in case of the Foreign Contractors and Domestic Arbitration in case of Domestic Contractors shall be conducted as specified in the Contract Data."
Sub-Clause 21.7– Failure to Comply with DAAB's Decision	Delete the entire text of this Sub Clause.
Sub-Clause 21.8– No DAAB in Place	Delete the entire text of this Sub Clause.

Section 9: Contract Forms

Table of Forms

Letter of Intent

[on letterhead paper of the Employer]

. . . . . **date**. . . . . .

Notes on Letter of Intent

The issuance of Letter of Intent is the information of the selection of the bid of the successful bidder by the Employer and for providing information to other unsuccessful bidders who participated in the bid as regards to the outcome of the procurement process. This standard form of Letter of Intent to Award should be filled in and sent to the successful Bidder only after evaluation and selection of substantially responsible lowest evaluated bid.

To: . . . . . .**name and address of the Contractor** . . . . . .

Subject: . . . . . .**Issuance of letter of intent to award the contract** . . . . . .

This is to notify you that, it is our intention to award the contract ……. **dated** …….. for execution of the . . . . . .**name of the contract and identification number, as given in the Contract Data/SCC** to you as your bid price . . . . . .**amount in figures and words in Nepalese Rupees/US$ ……** as corrected and modified in accordance with the Instructions to Bidders is hereby selected as substantially responsive lowest evaluated bid.

Authorized Signature: .....

Name: .....

Title: .....

CC:

[Insert name and address of all other Bidders, who submitted the bid]

[Notes on Letter of Intent

The issuance of Letter of Intent is the information of the selection of the bid of the successful bidder by the Employer and for providing information to other unsuccessful bidders who participated in the bid as regards to the outcome of the procurement process. This standard form of Letter of Intent to Award should be filled in and sent to the successful Bidder only after evaluation and selection of substantially responsible lowest evaluated bid

Letter of Acceptance

[on letterhead paper of the Employer]

. . . . . **date**. . . . . .

To: . . . . . .**name and address of the Contractor** . . . . . .

Subject: . . . . . .**Notification of Award**

This is to notify that your Bid dated . . . . **date** . . . . for execution of the . . . . . .**name of the contract and identification number, as given in the Contract Data/PCC** . . . . . for the Contract price of the equivalent of **[amount in figures and words in the currency……. ……..]**, as corrected in accordance with the Instructions to Bidders is hereby accepted by our Agency..

You are hereby instructed to contact this office to sign the formal contract agreement within 15 days. As per the Conditions of Contract, you are also required to submit Performance Security and **Letter of Commitment for Bank's Undertaking for Line of Credit** as specified in PCC, consisting of a Bank Guarantee in the format included in Section 9 (Contract Forms) of the Bidding Document.

The Employer shall forfeit the bid security, in case you fail to furnish the Performance Security and to appear in person or thorough a duly authorized representative to sign the contract agreement within the specified period.

Authorized Signature: .....

Name and Title of Signatory: .....

Contract Agreement

THIS AGREEMENT made the . . . . . .day of . . . . . ., ..., between . . . . . **name of the Employer**. . . . . (hereinafter "the Employer"), of the one part, and . . . . . **name of the Contractor**. . . . .(hereinafter "the Contractor"), of the other part:

WHEREAS the Employer desires that the Works known as . . . . . **name of the Contract**. . . . .should be executed by the Contractor, and has accepted a Bid by the Contractor for the execution and completion of these Works and the remedying of any defects therein,

The Employer and the Contractor agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Agreement:

    1. Contract Agreement including addenda(if any);
    2. the Letter of Acceptance/Award
    3. Letter of Technical and Price Bid
    4. the Particular Conditions Part A – Contract Data;
    5. the Particular Conditions Part B - Special Provisions
    6. these General Conditions (GCC);
    7. the Employer's Requirements including the Specifications
    8. the Drawings;
    9. Schedules;
    10. the JV Undertaking (If the Contractor is in JV);
    11. the Minutes of the Contract Negotiation (if any);
    12. other documents forming part of the Contract

3. In consideration of the payments to be made by the Employer to the Contractor as indicated in this Agreement, the Contractor hereby covenants with the Employer to design, execute and complete the Works and to remedy defects therein in conformity in all respects with the provisions of the Contract.

4. The Employer hereby covenants to pay the Contractor in consideration of the design, execution and completion of the works remedying of defects thereinand, the final contract Price at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed in accordance with the laws of . . . . . **NEPAL**. . . . .on the day, month and year indicated above.

Signed by .....
.....

for and on behalf of the Employer

in the presence of

Witness, Name, Signature, Address, Date

Signed by.....

for and on behalf the Contractor

in the presence of

Witness, Name, Signature, Address, Date

Letter of Commitment forBank's Undertaking for Line of Credit

Bank's Name, and Address of Issuing Branch or Office

(On Letter head of the Commercial bank or any Financial Institution eligible to issue Bank Guarantee as per prevailing Law)

Date:

Contract No:

Name of Contract :

To:

[Name and address of the Employer]

CREDIT COMMITTMENT No: [insert number]

We are pleased to know that [name of Contractor] (hereinafter called "the Contractor") has been awarded the Contract for the execution of the Works of **[description of works]**for above contract.

Furthermore, we understand that, according to your conditions, the Contractor's Financial Capacity i.e. Liquid Asset must be substantiated by a Letter of Commitment of Bank's Undertaking for Line of Credit.

At the request of, and arrangement with, the Contractor, we [name and address of the Bank] do hereby agree and undertake that [name and address of the Contractor] will be provided by us with a revolving line of credit, for execution of the Works viz. [insert name of the works], for an amount not less than US$ …….[in figure] (in words) for the sole purpose of the execution of the

above Contract. This Revolving Line of Credit will be maintained by us until **[Insert "Initial Contract Period"]**requiredby the Procuring Entity/Employer.

This committed line of credit shall not be terminated or cancelled without the prior written approval of Employer.

In witness whereof, authorised representative of the Bank has hereunto signed and sealed this Letter of Commitment.

Signature	Signature
Name :	Name :
Designation:	Designation:

Performance Security

.....*Bank's Name, and Address of Issuing Branch or Office*.....

Beneficiary: .....*Name and Address of Employer*.....

Date:.....

Performance Guarantee No.:.....

We have been informed that . . . . . ***nameand address of the Contractor***. . . . . (hereinafter called "the Contractor") has entered into Contract No. . . . . ***reference number of the Contract***. . . . . dated . . . . . .with you, for the execution of . . . . . ***name of contract and brief description of Works***. . . . . (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Contractor, we . . . . . ***name and address of the Bank***. . . . . hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of . . . . . ***name of the currency and amount in figures****. . . . . *(. . . . . **amount in words**. . . . .) such sum being payable in US$, upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation(s) under the

Contract, without your needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire, no later than the . . . . . Day of . . . . . , ... **, and any demand for payment under it must be received by us at this office on or before that date.

. . . . . .
Seal of Bank and Signature(s)

Note: All italicized text is for guidance on how to prepare this demand guarantee and shall be deleted from the final document.

*** The Guarantor shall insert an amount representing the percentage of the Contract Price specified in the Contract in US$.**

**** Insert the date thirty days after the end of Defect Notification Period. The Employer should note that in the event of an extension of the time for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months], in response to the Employer's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee".**

Advance Payment Security

.....*Bank's Name, and Address of Issuing Branch or Office*.....

Beneficiary: .....*Name and Address of Employer*.....

Date:.....

Advance Payment Guarantee No.:.....

We have been informed that . . . . . ***name and addressof the Contractor***. . . . . (hereinafter called "the Contractor") has entered into Contract No. . . . . ***reference number of the Contract***. . . . . dated . . . . . .with you, for the execution of . . . . . ***name of contract and brief description of Works***. . . . . (hereinafter called "the Contract").

Furthermore, we understand that, according to the Conditions of the Contract, an advance payment in the sum of. . . ***name of the currency and amount in figures****. . . . . *(*. . . . . ***amount in words***. . . . .) is to be made against an advance payment guarantee.

At the request of the Contractor, we . . . . . ***name and addressof the Bank***. . . . . hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of . . . . . ***name of the currency and amount in figures****. . . . . *(*. . . . . ***amount in words***. . . . . *)* upon receipt by us of your first demand in writing

accompanied by a written statement stating that the Contractor is in breach of its obligation under the Contract because the Contractor used the advance payment for purposes other than the costs of execution of the Worksand/ or has failed to repay the Advance Payment as specified in the Contract.

It is a condition for any claim and payment under this guarantee to be made that the advance payment referred to above must have been received by the Contractor on its account number . . . . . ***Contractor's account number***. . . . . *at* . . . . . ***name and address of the Bank***. . . . . .

The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Contractor as indicated in copies of payment certificates which shall be presented to us. This guarantee shall expire, at the latest, upon our receipt of a copy of the interim payment certificate indicating that eighty (80) percent of the Contract Price has been certified for payment, or on the . . . day of . . . . . , ...**, whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

. . . . . .

Seal of Bank and Signature(s)

Note: All italicized text is for guidance on how to prepare this demand guarantee and shall be deleted from the final document.

*** The Guarantor shall insert an amount representing the amount of the advance payment in US$ of the advance payment as specified in the Contract.**

**** <u>Insert the date Thirty days after the expected completion date</u>. The Employer should note that in the event of an extension of the time for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months], in response to the Employer's written request for such extension, such request to be presented to the Guarantor before t guarantee".**

BIDDING DOCUMENT

PRICE BID

PROCUREMENT OF WORKS

International Competitive Bidding (ICB)

Two Envelope Bidding Procedure

Procurement of

Kathmandu- Terai/Madesh Fast Track (Expressway) Road Project

Construction of Double Lane Dual Carriageway Standard Expressway Road, Bridge and Allied Works

Ch: 57+400 to Ch. 65+160

Issued on:….2021

Bid Document issued to: To All Eligible National and Foreign Bidders

Contract Identification No: KTFT/ICB/WORKS/R&B/078/079/4

Project Name: Kathmandu- Terai/Madesh Fast Track (Expressway) Road Project

Office Name:Kathmandu- Terai/Madesh Fast Track (Expressway) Road Project (KTFT)

Office Address:Bhadrakali, Kathmandu, Nepal

Financing Agency: Government of Nepal

Table of Contents

1. Letter of Price Bid

The Bidder must accomplish the Letter of Price Bid in its letterhead clearly showing the Bidder's complete name and address.

Date: .....

Name of the contract: .....

Invitation for Bid No.: .....

To: ……....

We, the undersigned, declare that:

(a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB) Clause 8;
(b) We offer to execute in conformity with the Bidding Documents the following Works:
(c) The total price of our Bid, excluding any discounts offered in item (d) below is:
(d) The discounts offered and the methodology for their application are:
(e) Our bid shall be valid for a period of ***120 (One Hundred Twenty)*** days from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;
(f) If our bid is accepted, we commit to obtain a performance security in accordance with the Bidding Document;
(g) We understand that this bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed;
(h) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive;
(i) We agree to permit the Employer/DP or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by the Employer; and
(j) If awarded the contract, the person named below shall act as our Representative:

Name: .....

In the capacity of .....

Signed ……...

Duly authorized to sign the Bid for and on behalf of ……

Date ……..

2. Table of Price Adjustment Data

(Applicable to the Employer's Design Works only)

[To be used if Price Adjustment if applicable as per GCC 13.7]

Code	Index Description	Source of Index*	Base Value and Date	Employer's Proposed Weighting Range (coefficient)	Bidder's Proposed Weighting (coefficient)**
1	2	3	4	5	6
	Non - adjustable (A)			0.15	0.15
	Labor (b)			0.05-0.15	
	Materials (c)			0.55-0.65	
	Equipment usage (d)			0.10-0.20	
		Total		**1.00**	**1.00**

*Normally following source of index shall apply. Public Entity shall choose applicable Index for each item.

(a) Labor: "National Salary and Wage Rate Index"- "Construction Labor" of Nepal Rastra Bank

or

rate fixed by District Rate Fixation Committee

(b)Material:"National Wholesale Price Index" - Construction Materials" of Nepal Rastra Bank

(c) Equipment usage:

"National Wholesale Price Index" - "Machinery and Equipment " of Nepal Rastra Bank

or

"Fuel" Price fixed by Nepal Oil Corporation.

** Bidders proposed weightings should be within the range specified by the Employer in column - 5

3. Schedule of Payment Currencies

For .....*insert name of Section of the Works*.....

Separate tables may be required if the various sections of the Works (or of the Bill of Quantities) will have local currency requirements. **[Insert the names of each Section of the Works]**.

	A	B	C	D
Name of Payment Currency	**Amount of Currency**	**Rate of Exchange to Local Currency**	**Local Currency Equivalent C = A x B**	**Percentage of Net Bid Price (NBP) 100xC / NBP**
Local currency		**1.00**		
Foreign Currency US Dollar (US$)				
Net Bid Price				**100.00**
Provisional Sums Expressed in Local Currency		**1.00**		
BID PRICE				

Note:

- The rates of exchange shall be the selling rates 30 days prior to the deadline for submission of bids published by the source specified in BDS 15.
- The Bidder may fill separate table for the Employer's Design Works and the Contractor's Design Works.

4. Tables of Adjustment Data

(Not Applicable)

Table A - Local Currency

Index Code	Index Description	Source of Index	Base Value and Date	Bidder's Local Currency Amount	Weighting range (in %) to be applied	Bidder's Proposed Weighting
To be entered by the Employer	Nonadjustable labor fuel Steel Cement Bitumen - -	—	—	—	15 - - - - -	0.15 (fixed)
			Total		**1.00**	**1.00**

Table B - Foreign Currency

Name of Currency: .....

If the Bidder wishes to quote in more than one foreign currency, this table should be repeated for each foreign currency.

Index Code	Index Description	Source of Index	Base Value and Date	Bidder's Currency in Type/Amount	Equivalent in FC1	Bidder's Proposed Weighting
To be entered by the Employer	**Nonadjustable**	—	—	—		A: _____ B: _____ C: _____ D: _____ E: _____
				Total		**1.00**

Note:

As per GCC 1.1, "Base Date" means the date 30 days prior to the latest date for submission and completion of the tender

Section 6:- Preamble of Bill of Quantities/ Schedule of Prices

Preamble of Bill of Quantities (For the Employer's Design Works including Preliminary and General Works)

General

1. The Bill of Quantities shall be read in conjunction with the Instructions to Bidders, General and Particular Conditions of Contract, Technical Specifications, and Drawings.

2. The quantities given in the Bill of Quantities are estimated and provisional, and are given to provide a common basis for bidding. The basis of payment will be the actual quantities of work ordered and carried out, measured and verified by the Engineer and valued at the rates and prices in the priced Bill of Quantities, where applicable, and otherwise at such rates and prices as the Engineer may fix within the terms of the Contract.

3. For any item for which measurement is based on records made before or during construction the records shall be prepared and agreed between the Engineer and the Contractor. Should the Contractor carry out such work without the prior agreement of the Engineer, the Engineer may request the Contractor to carry out investigations to confirm the extent of the work and the quantity of work certified for payment shall be solely at the Engineer's discretion. The cost of any such investigation shall be borne by the Contractor.

4. The rates and prices in the priced Bill of Quantities shall, except as otherwise provided under the Contract, include all construction equipment, labor, supervision, materials, erection, maintenance, insurance, profit, taxes, and duties, together with all general risks, liabilities, and obligations set out or implied in the Contract.

5. A rate or price shall be entered against each item in the priced Bill of Quantities, whether quantities are stated or not. The cost of items against which the Contractor has failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities.

6. The whole cost of complying with the provisions of the Contract shall be included in the Items provided in the priced Bill of Quantities, and where no Items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related Items of Work.

7. General directions and descriptions of work and materials are not necessarily repeated nor summarized in the Bill of Quantities. References to the relevant sections of the Contract documentation shall be made before entering prices against each item in the priced Bill of Quantities.

8. The method of measurement of completed work for payment shall be in accordance with **Standard Specifications for Road and Bridge Works–2073, published by Department of Roads, Ministry Physical Planning and Infrastructure or its latest version**.

9. Arithmetic errors will be corrected by the Engineer as follows:

   (a) if there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Engineer there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected.

   (b) if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and

   (c) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic errors, in which case the amount in figures shall prevail subject to (a) and (b) above.

Daywork

Work shall not be executed on a daywork basis except by written order of the Engineer. Bidders shall enter basic rates for daywork items in the Schedules, which rates shall apply to any quantity of daywork ordered by the Engineer. Nominal quantities have

been indicated against each item of daywork, and the extended total for Daywork shall be carried forward as a Provisional Sum to the Summary Total Bid Amount. Unless otherwise stated, payments for daywork shall be subject to price adjustment in accordance with the provisions in the Conditions of Contract.The currency of bid and payment for the daywork shall be as per the contract for the BOQ items of works.

Daywork Labor

(i) In calculating payments due to the Contractor for the execution of daywork, the hours for labor will be reckoned from the time of arrival of the labor at the job site to execute the particular item of daywork to the time of return to the original place of departure, but excluding meal breaks and rest periods. Only the time of classes of labor directly doing work ordered by the Engineer and for which they are competent to perform will be measured. The time of gangers (charge hands) actually doing work with the gangs will also be measured but not the time of foremen or other supervisory personnel.

(ii) The Contractor shall be entitled to payment in respect of the total time that labor is employed on daywork, calculated at the basis rates entered by him in the Schedule of Daywork Rates for labor. The rates for labor shall be deemed to cover all costs to the Contractor including (but not limited to) the amount of wages paid to such labor, transportation time, overtime, subsistence allowances, and any sums paid to or on behalf of such labor for social benefits in accordance with law of Nepal, as well as Contractor's profit, overheads, superintendence, liabilities and insurance and allowance to labor, timekeeping and clerical and office work, the use of consumable stores water, lighting and power; the use and repair of stagings, scaffolding workshops and stores portable power tools, manual plant and tools; supervision by the Contractor's staff, foremen and other supervisory personnel; and charges incidental to the foregoing.

Daywork Materials

The Contractor shall be entitled to payment in respect of materials used for daywork (except for materials for which the cost is included in the percentage addition to labor costs as detailed heretofore), at the rates entered by him in the Schedule of Daywork Rates for Materials and shall be deemed to include overhead charges and profit as follows;

(a) the rates for materials shall be calculated on the basis of the invoiced price, freight, insurance, handling expenses, damage, losses, etc., and shall provide for delivery to store for stockpiling at the Site.

(b) the cost of hauling materials for use on work ordered to be carried out as daywork from the store or stockpile on the Site to the place where it is to be used will be paid in accordance with the terms for Labor and Constructional Plant in this Schedule.

Daywork Contractor's Equipment

(i) The Contractor shall be entitled to payments in respect of Contractor's Equipment already on Site and employed on daywork at the basic rental rates entered by him in the Schedule of Daywork Rates for Contractor's Equipment. The said rates shall be deemed to include due and complete allowance for depreciation, interest, indemnity and insurance, repairs, maintenance, supplies, fuel, lubricants, and other consumable, and all overhead profit and administrative costs related to the use of such equipment. The cost of drivers, operators and assistants will be paid for separately as described under the section on Daywork Labor.

(ii) In calculating the payment due to the Contractor's Equipment employed on daywork, only the actual number of working hours will be eligible for payment, except that where applicable and agreed with the Engineer, the traveling time from the part of the Site where the Construction Plant was located when ordered by the Engineer to be employed on daywork and the time for return journey thereto shall be included for payment.

Provisional Sums

Provisional Sums included and so designated in the Bill of Quantitiesshall be expended in whole or in part at the direction and discretion of the Engineer in accordance with the Conditions of Contract.

Preamble of Schedule of Prices (For the Contractor's Design Works)

1. General

The Schedule of Prices, shall be read in conjunction with the Conditions of Contract, the Employer's Requirements (the scope of Works, Technical Specifications and the Drawings) for details of the description, performance, quality and strength of materials and the workmanship, conditions, obligations and liabilities generally which shall be complied with in carrying out the Contract. This Schedule shall also be read in conjunction with the Instructions to Bidders, the Data for Bidders, the Bid Forms, the Data Sheets (if any) and any Addenda that may be issued at a laterdate.

a. The brief descriptions of the items of work given in this Schedule are purely for the purpose of Payment and shall in no way modify or supersede the detailed descriptions of the work given in the Employer's Requirement and Technical Specification and elsewhere in the BidDocument.

b. The cost of providing materials, executing the work as shown and described on the Drawings and in the Employer's Requirements/ Specifications, complying with all conditions, obligations and liabilities described in the Conditions of Contract, Employer's Requirements/Specifications and this Schedule, whether or not the aforesaid are expressly stated in the Bidding document, and all taxes, royalties, overhead charges and profit shall be deemed to be included in the bid.

c. All Prices in the Price Schedule shall be for work complete in every

respect. The Prices shall therefore include, but not be limited to, all labour, materials, plant equipment and supervision to execute the item as required and shall include for carriage, handling, cutting and waste, the preparation of drawings where required, the storage, protection and completion of the work, testing, allincidentalchargesandexpenseswhatsoever, overheadsandestablishmentchargesas applicable and Contractor's profit for the completion of works in a satisfactory manner to the Employer/Engineer and as shown on drawings, specifications and Biddocuments.

d. All Prices in the Price Schedule shall include submission of work Programme, QMS, HSE Manual, EMAP, Monitoring and control procedures, work methodologies, project progress report, project completion report etc.

e. If any item in this Schedule is not priced by the Bidder, it will be deemed to have been priced as nil.

2. ProvisionalSums

Amounts allocated under Provisional Sums may be expended in whole, in part or not at all as per the instructions of the Engineer.

a. The total sum paid to the Contractor shall include only such amounts, for the work, supplies or services to which the Provisional Sum relates, as the Engineer shall have instructed.

b. The Provisional sum for General Item, International Consultant for KTFT, Human Resources Development, Environmental Mitigation and other associated works shallbe used for local project support programs like water supply, education, road & track improvement, health, electrification, community support etc.

3. TheBiddertosubmitdetailsofwork

a. The successful bidder (Contractor) shall submit thedetails of works/quantities with anticipated cost to be carried out under each sub item of works mentioned in the Schedule of Prices and the Schedule ofPayment.

Bill of Quantitiesand Schedule of Prices

(Provided Separately Bound)

Schedule of Payment (For the Works Designed by the Contractor with lump Sum Prices)

PART2: SCHEDULE OF PAYMENT

Project Name: Kathmandu-Terai/Madhesh Fast Track(Expressway) Project (KTFT Road)

ICB Contract ID: KTFT/ICB/WORKS/R&B/078/079/4

Contract Package : -4

Schedule of Price Item No.	Particulars (as per the Schedule of Prices)	Quantity Payment Percentage Corresponding to the Relevant Item of Schedule of Prices	Remarks
1.	Conduct detailed survey, geo-physical and geo-technical investigation, hydrological investigation and preparation of detailed design and construction drawings for the Contractor's Design Works comprising Bridges (12 Nos. of Twin Bridges& 2 Nos. of VOP single bridges), Expressway Road, Slope Protection/Stabilization, River Trainingand Associated Works (From Ch. 59+880 to Ch. 59+900 and Ch.	i) 40% upon completion of detailed survey, geo-physical and geo-technical investigation, hydrological investigation and submission of the relevant particulars to the Engineer. ii) 50% upon completion of detailed design and Construction drawings for the Bridges, Expressway road including slope protection work and associated works and approved by the Engineer. iii) 10% upon the completion of as-builtdrawings and O & M Manual for the Contractor's Design Works and	

PART2: SCHEDULE OF PAYMENT

Project Name: Kathmandu-Terai/Madhesh Fast Track(Expressway) Project (KTFT Road)

ICB Contract ID: KTFT/ICB/WORKS/R&B/078/079/4

Contract Package : -4

Schedule of Price Item No.	Particulars (as per the Schedule of Prices)	Quantity Payment Percentage Corresponding to the Relevant Item of Schedule of Prices	Remarks
	63+390 to Ch. 64+030)as per the Employer's Requirement and Conditions of Contract.	approved by the Engineer.	
2	Construction of foundations, sub-structures (Pier and Abutments), super structures, protection works; approach slab, wing/return walls, Asphalt overlay, Health monitoring system, including utility works e.g. electrical and lighting works, optical fiber works, ; ancillary. for double lane bridges(twin)all complete as per the employer's requirement and as per the Employer's Requirement and condition of contract for the Bridges and	i) 25% for the construction of Bridge Foundations: payable on prorate basis upon the Engineer's Approval. ii) 10% for the construction of Bridge Substructures: payable on prorate basis upon the Engineer's Approval. iii) 40% for the construction Bridge Super-structures including health monitoring system: payable on prorate basis upon the Engineer's Approval. iv) 5% for the protection of Bridge Piers and Abutments:	

PART2: SCHEDULE OF PAYMENT

Project Name: Kathmandu-Terai/Madhesh Fast Track(Expressway) Project (KTFT Road)

ICB Contract ID: KTFT/ICB/WORKS/R&B/078/079/4

Contract Package : -4

Schedule of Price Item No.	Particulars (as per the Schedule of Prices)	Quantity Payment Percentage Corresponding to the Relevant Item of Schedule of Prices	Remarks
	associated works as outlined below; i. (a) CH 57+535 to CH 57+575, approx. 40 m length (Kathmandu) (b) CH 57+545 to CH 57+585, approx. 40m length (Terai) ii. (a) CH 57+876 to CH 57+911, approx. 35m length (Kathmandu) (b) CH 57+856 to CH 57891, approx. 35m length (Terai) iii. (a) CH 58+400 to CH 58+490, approx.90 m length (Kathmandu) (b) CH 58+410 to CH 58+500,	payable on prorate basis upon the Engineer's Approval. v) 10% for the construction of Bridge approaches, installation of barriers and laying pavement wearing course and finishing of the Bridges: payable on prorate basis upon the Engineer's Approval. vi) 10% for final load test and health monitoring system of the completed Bridges payable upon approval and acceptance by the Engineer.	

PART2: SCHEDULE OF PAYMENT

Project Name: Kathmandu-Terai/Madhesh Fast Track(Expressway) Project (KTFT Road)

ICB Contract ID: KTFT/ICB/WORKS/R&B/078/079/4

Contract Package : -4

Schedule of Price Item No.	Particulars (as per the Schedule of Prices)	Quantity Payment Percentage Corresponding to the Relevant Item of Schedule of Prices	Remarks
	approx.90 m length (Terai) iv. (a) CH 59+080 to CH 59+140, approx.60 m length (Kathmandu) (b) CH 59+100 to CH 59+160, approx.60 m length (Terai) v. (a) CH 59+820 to CH 59+880, approx.60 m length (Kathmandu) (b) CH 59+820 to CH 59+880, approx.60 m length (Terai) vi. (a) CH 59+900 to CH 60+150, approx. 250m length (Kathmandu). (b) CH 59+901 to CH 60+151,		

PART2: SCHEDULE OF PAYMENT

Project Name: Kathmandu-Terai/Madhesh Fast Track(Expressway) Project (KTFT Road)

ICB Contract ID: KTFT/ICB/WORKS/R&B/078/079/4

Contract Package : -4

Schedule of Price Item No.	Particulars (as per the Schedule of Prices)	Quantity Payment Percentage Corresponding to the Relevant Item of Schedule of Prices	Remarks
	approx. 250m length (Terai). vii. (a) CH 60+249 to CH 60+439 approx. 190 m length (Kathmandu) (b) CH 60+251 to CH 60+441 approx. 190 m length (Terai) viii. (a) CH 60+779 to CH 61+049approx. 270 m length (Kathmandu) (b) CH 60+781 to CH 61+051approx. 270 m length (Terai) ix. (a) CH 61+985 to CH 62+305		

PART2: SCHEDULE OF PAYMENT

Project Name: Kathmandu-Terai/Madhesh Fast Track(Expressway) Project (KTFT Road)

ICB Contract ID: KTFT/ICB/WORKS/R&B/078/079/4

Contract Package : -4

Schedule of Price Item No.	Particulars (as per the Schedule of Prices)	Quantity Payment Percentage Corresponding to the Relevant Item of Schedule of Prices	Remarks
	approx. 320 m length (Kathmandu) (b) CH 61+976 to CH 62+296 approx. 320 m length (Terai) x. (a)CH 62+592 to CH 63+017, approx. 425m length (Kathmandu) (PSC Girder + PSC Box (Extradose)/ICONIC Bridge) (b)CH 62+598 to CH 63+023, approx. 425m length (Terai) (PSC Girder + PSC Box (Extradose)/ICONIC Bridge) xi. (a)CH 63+136 to CH 63+386,		

PART2: SCHEDULE OF PAYMENT

Project Name: Kathmandu-Terai/Madhesh Fast Track(Expressway) Project (KTFT Road)

ICB Contract ID: KTFT/ICB/WORKS/R&B/078/079/4

Contract Package : -4

Schedule of Price Item No.	Particulars (as per the Schedule of Prices)	Quantity Payment Percentage Corresponding to the Relevant Item of Schedule of Prices	Remarks
	approx. 250m length (Kathmandu) (b)CH 63+144 to CH 63+394 approx. 250m length (Terai) xii. (a) CH 64+024 to CH 64+064, approx. 40m length (Kathmandu) (b)CH 64+036 to CH 64+076 approx. 40m length (Terai) xiii. CH 58+150, approx. 40m length (VOP) xiv. CH 58+600, approx.. 40m Length (VOP)		

PART2: SCHEDULE OF PAYMENT

Project Name: Kathmandu-Terai/Madhesh Fast Track(Expressway) Project (KTFT Road)

ICB Contract ID: KTFT/ICB/WORKS/R&B/078/079/4

Contract Package : -4

Schedule of Price Item No.	Particulars (as per the Schedule of Prices)	Quantity Payment Percentage Corresponding to the Relevant Item of Schedule of Prices	Remarks
	Note: ***Width of each bridge is 11.8 m as per standard and as per the indicative drawings. The Bridge width may increase at the curved sections for extra widening.** ***The length and height of the Bridges may vary during design as per design requirements.**		
3	Construction of Expressway Road, Slope Protection/Stabilization,River Trainingand Associated Works (From Ch. 59+880 to Ch. 59+900 and Ch.	i) 5% for thesite clearing, earthwork in cutting and filling for the expressway road: payable on prorate basis upon the Engineer's Approval.	

PART2: SCHEDULE OF PAYMENT

Project Name: Kathmandu-Terai/Madhesh Fast Track(Expressway) Project (KTFT Road)

ICB Contract ID: KTFT/ICB/WORKS/R&B/078/079/4

Contract Package : -4

Schedule of Price Item No.	Particulars (as per the Schedule of Prices)	Quantity Payment Percentage Corresponding to the Relevant Item of Schedule of Prices	Remarks
	63+390 to Ch. 64+030) includingSide Drain, Cross Drainage, Stone Masonry Wall, Cantilever RCC wall for Hill side and Valley Side including piling foundation,, Bio-Engineering, Electrical work including optical fiber and other associated worksas per the Employer's Requirement and Conditions of Contract.	ii) 45% for the construction of slope protection/stabilization, bioengineering, river training, side and cross drainageand associated works: payable on prorate basis upon the Engineer's Approval. iii) 30% for the construction of asphalt concrete pavement and DBM including sub-grade, sub base, base etc:payable on prorate basis upon the Engineer's Approval. iv) 10% for theinstallation of utility services including electricity, drainage, water supply, optical fiber etc.: payable on prorate basis upon the Engineer's Approval. v) 5% upon completion of road signs, road markings, barriers, gates, fence, paint on exposed concrete surfaces	

PART2: SCHEDULE OF PAYMENT

Project Name: Kathmandu-Terai/Madhesh Fast Track(Expressway) Project (KTFT Road)

ICB Contract ID: KTFT/ICB/WORKS/R&B/078/079/4

Contract Package : -4

Schedule of Price Item No.	Particulars (as per the Schedule of Prices)	Quantity Payment Percentage Corresponding to the Relevant Item of Schedule of Prices	Remarks
		etc. and approved by the Engineer. vi) 5% upon completion of testing and commissioning, approval and acceptance by the Engineer.	

Bidding Document for Procurement of

Construction of Double Lane Dual Carriageway Standard Expressway Road and Bridge Works

CH 57+400 to CH 65+160

Part II: Requirements

Section 5. Employer's Requirements

ICB Contract ID: KTFT/ICB/WORKS/R&B/078/079/4

Project Name: Kathmandu- Terai/Madhesh Fast Track (Expressway) Road Project

Office Name: Kathmandu- Terai/Madhesh Fast Track (Expressway) Road Project (KTFT)

Office Address: Bhadrakali, Kathmandu, Nepal

Financing Agency: Government of Nepal

Section 6. Works Requirements.

This section comprises the scope of works, design criteria, technical requirements, specifications, supplementary information, construction requirements etc. for the proposed work Contract.

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List of Tables

1 Project Summary

Nepal is a predominantly mountainous country situated between India and China as a landlocked country with limited navigable watercourses, Nepal has to rely mostly on road transport for moving passenger and freight traffic. Road network development is challenging and expensive due to terrain conditions characterized by fragile mountains, often very steep and crossed by numerous rivers of different sizes, hydrological and hydraulic characteristics. This has resulted in slow and inequitable distribution of road lengths across the country. Therefore, road density is low and a number of remote regions in the country disconnected to the national road network.

Government of Nepal (GoN) has allocated funds from its own resources towards the cost of construction of 72.529 kilometers of Kathmandu Terai/Madhesh Fast Track (Expressway) (KTFT). The Nepali Army is the implementing agency on behalf of the GON. The Nepali Army has engaged JV of M/S Yooshin Engineering Corporation, Korea - Korea Expressway Corporation, Korea - Pyunghwa Engineering Consultants Ltd. Korea In Association with Garima International Design Associates Nepal Pvt. Ltd. (GIDAN), Nepal and SITARA Consult Pvt. Ltd, Nepal) as a Design and Supervision Consultant (DSC).

The project road runs along the Bagmati river and Lal Bakaiya river corridor which originates at Sano Kokhana and travels through Naikhandi, Damsintar, Malta, Lanedanda, Ranisera, Rajdamar, Chhatiwan and reaches to Nijgadh where it connects with the Mahendra Highway. The total length of the expressway is 72+529.46 km whereas the existing road length is 246 km via Nijgadh-Hetauda-Narayangadh-Mungling-Kathmandu. This project after completion expects to shorten the travelling distance from Kathmandu to Nijgadh by 173.50 km and save travelling time by more than seven hours.

The GON has declared the KTFT as a national pride project. The expressway categorized as per the standard of the Asian Highway and is aiming at a high-class connection between Kathmandu and Terai with high traffic volume. The expressway alignment starts from Khokana and ends at Nijgadh. The expressway consists of 4 Lane including 3-4m wide median with 50m to 100m right of way (RoW). Particularly, RoW of Ch. 0+000-9+000 is 50m and RoW of Ch. 9+000-72+529.46 is 100m. This contract starts at Ch. 57+400 and ends at Ch. 65+160 as presented in figure below.

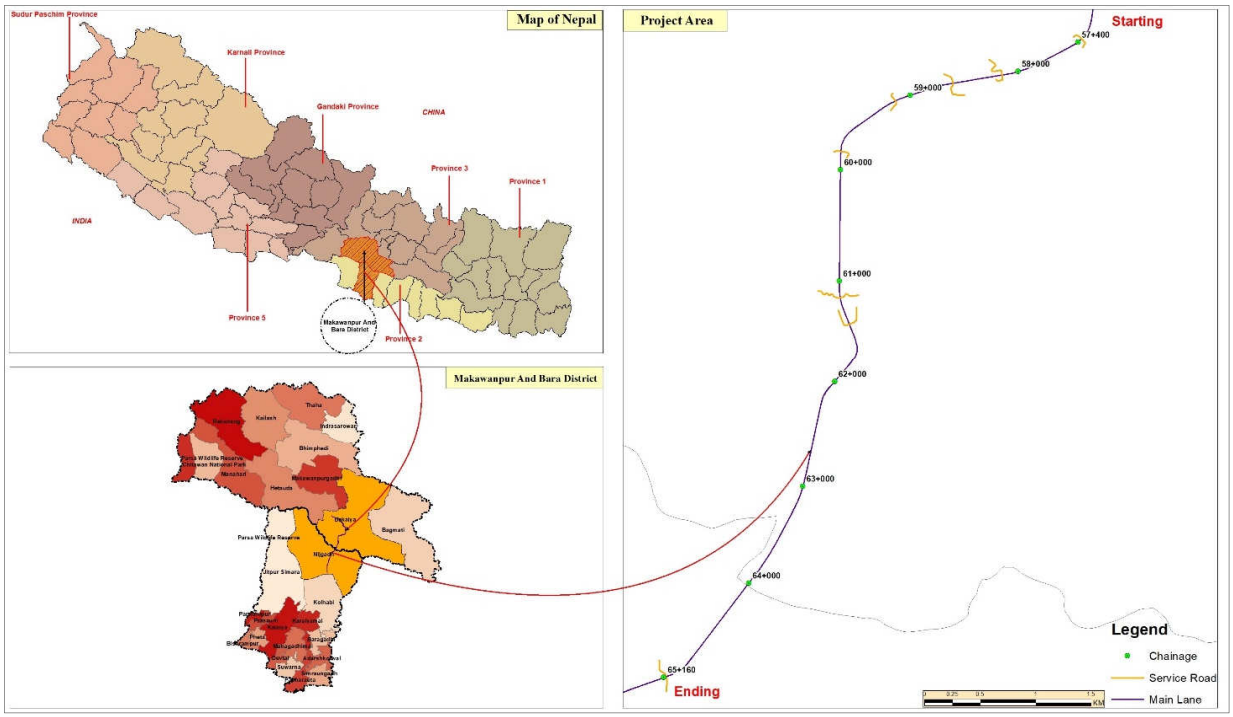


Figure 1.1 Location Map

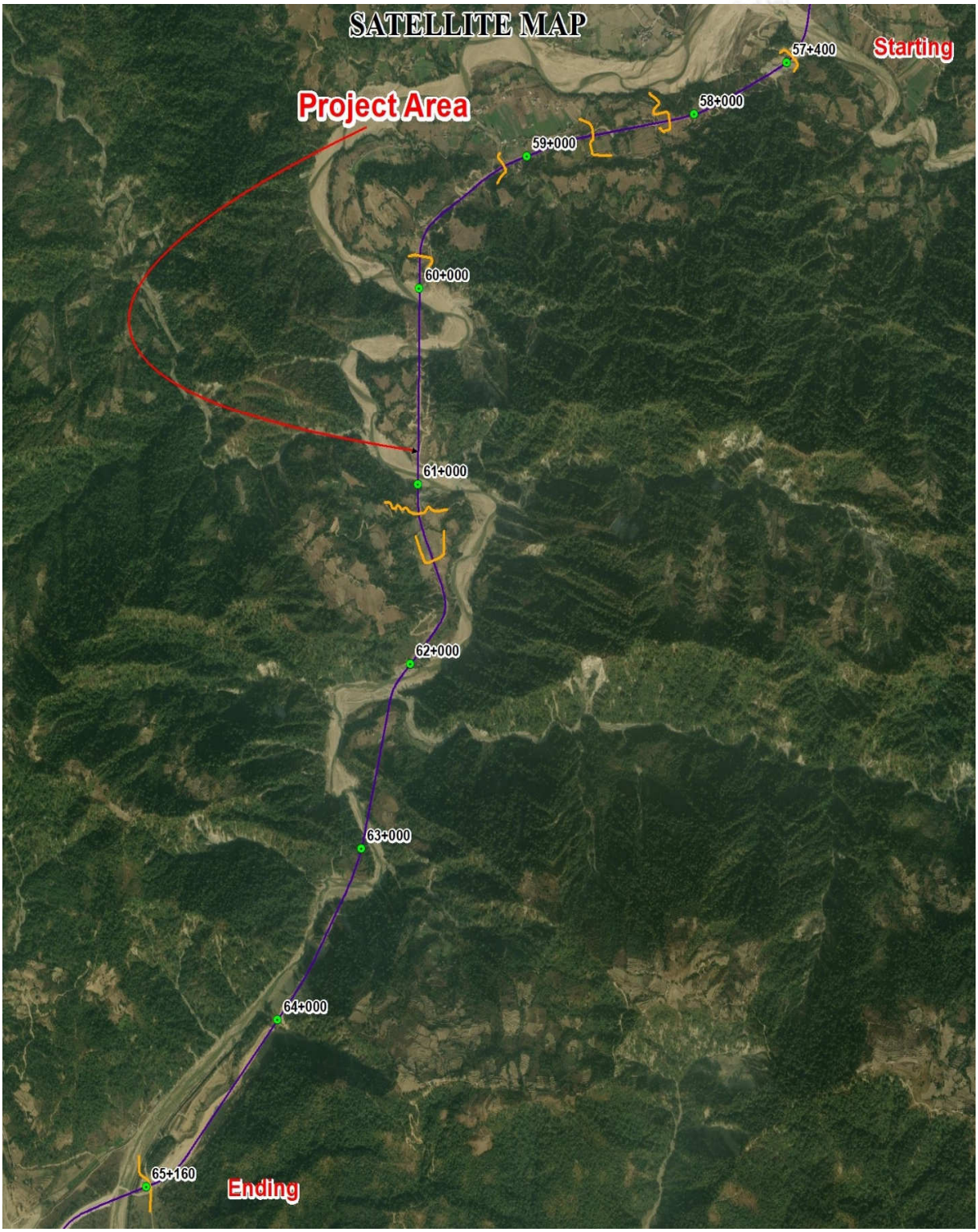
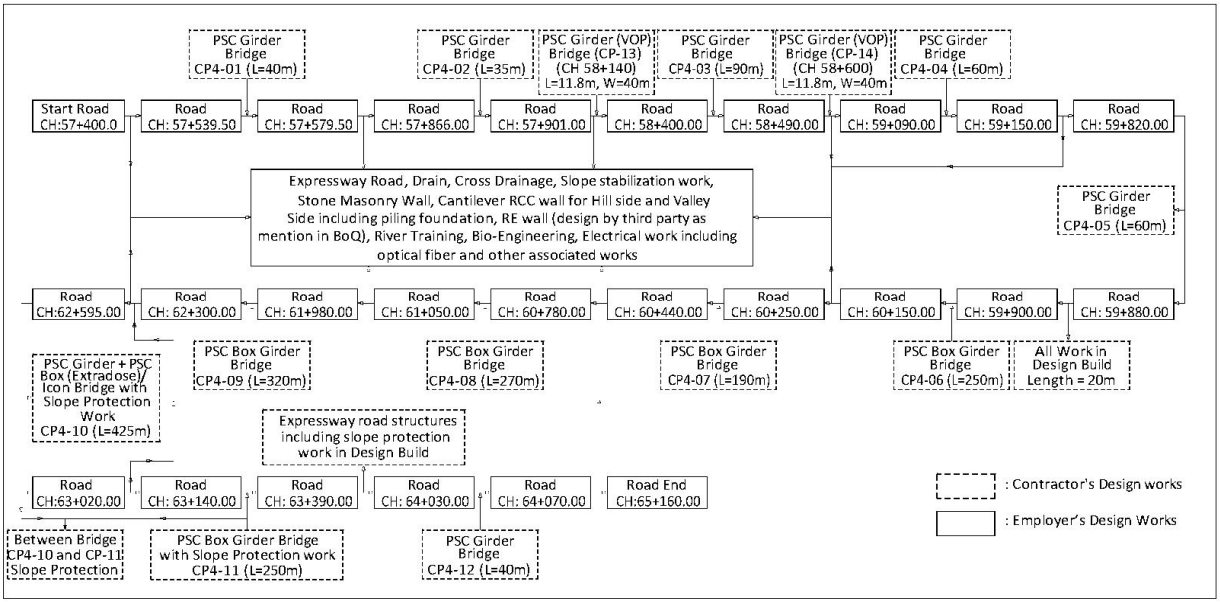


Figure 1.2 Satellite Map

2 PROJECT SITE DESCRIPTION



2.1 General

This contract work starts at Ch. 57+400 (X=619868.4511 Y=3020071.6952) and ends at Ch. 65+160 (X=616134.2499 Y=3014356.0239). The total length of this contract is 7.760 km. This contract area lies in hilly zone. The expressway road alignment passes along Bakaiya river and crosses other minor rivers which flow during rainy season only. An earthen road from Nijgadh town of East-West national highway links the expressway near Bagdev Nepali Army Basecamp, which may be used as an access road to transport construction material from Hetauda through Nijgadh and to the project site. The access road is approximately 8 km long with average width 4m from the East-West National Highway and is presented in figure.

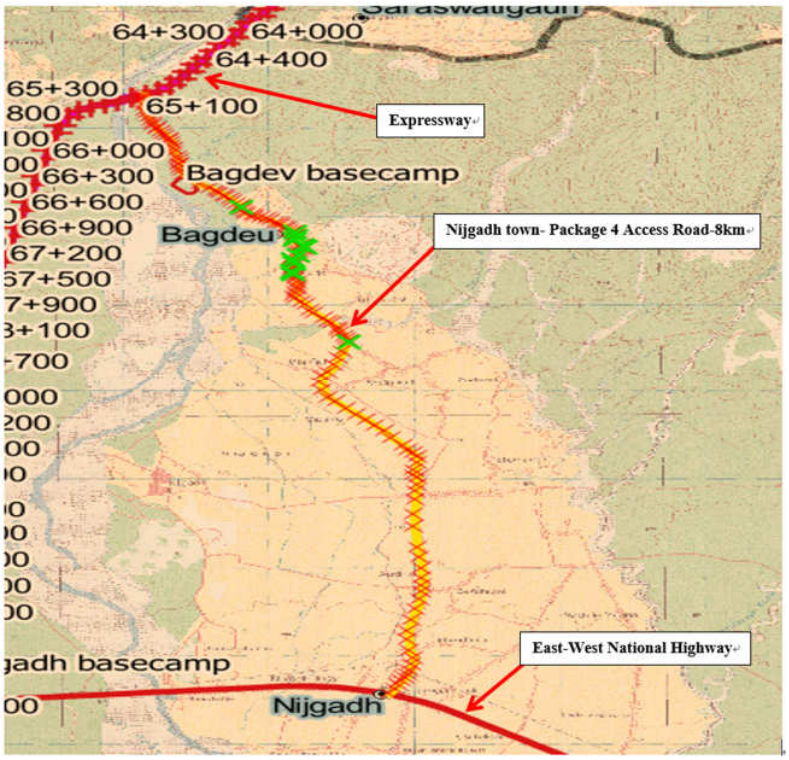


Figure 0.1 : Proposed access road

Permanent and temporary benchmarks (BM) had been established for reference along the expressway alignment to carry out the design and construction survey. A pair of BMs had been established near major bridges for reference. The locations of the BMs are shown in following table.

Table 0-1: Location of Benchmarks

SN	Name	Easting	Northing	Reduced Level	Remarks/Reference
Contract Package-4					
1	_BG1	617112.7	3015521	260.8121	Tree
2	_BG2	617151.4	3015584	259.5358	Stone/Tree
3	_BG3	617257.5	3015733	249.5844	Tree
4	_BG4	617362.7	3015767	222.0635	Tree
5	_BG5	617449.7	3015917	206.9079	Stone/Tree
6	_BG6	617542.6	3015983	208.0578	Stone/Tree
7	_BG7	617344.1	3016443	213.0424	Stone/Tree
8	_BG7B	617399.8	3016378	220.1166	Tree
9	_BG8	617500.8	3016812	220.1532	Stone/Tree
10	_BG9	617702.2	3017030	256.2583	Suspension bridge
11	_BG10	617775.9	3017822	322.4713	Stone/Tree
12	_BG11	617690.0	3018120	314.5862	House/Tree
13	_BG12	617888.0	3018904	294.6657	Stone/Tree
14	_BG13	617704.6	3019004	317.0446	House
15	_BG14	617719.6	3019234	298.0697	Tree
16	_BG15	618248.5	3019593	258.3363	Concrete
17	_BG16	618635.1	3019650	282.7921	Tree
18	_BG17	619382.8	3019864	289.8932	Concrete pole/Tree
19	_BG18	620068.0	3020527	267.1798	House
20	_BG19	620020.5	3020601	266.1947	Stone/Tree
21	_BG20	619979.5	3021987	268.9009	Stone/Tree
22	_BG21	619934.2	3022062	265.0971	Stone/Tree
23	_BG22	619610.4	3022146	257.3262	House/Stone
24	_BG23	619444.0	3022270	260.8121	Tree
25	_BG24	619900.7	3021834	263.4233	House/Stone

2.2 As Built Work Status

The construction works of following structures have been completed earlier by KTFT. These structures to be considered, designed at these chainages and strengthened during construction of this package.

Table 0-2: As built structure details

SN	Description	Chainage	Length	Remarks
1	Masonry wall	58+710	70	Right side
2	Masonry wall	58+790	100	Right side
3	Masonry wall	58+900	160	Right side

In addition to above, Earthworks in excavation and filling for Expressway is completed most of the section. All remaining works to be completed by the contractor as per the Bill of Quantities, schedule of prices, specifications and drawings.

2.3 Site Clearance:

Track opening works for Contract Package-4 is partially completed from Ch. 57+400-60+000. Site clearance may be required at the virgin areas where no track was opened and to acquire the right of way of the Expressway.

2.4 Existing Features/ Utilities

The following main features/utilities exists along Contract Package-4.

Rivers: Three major water courses are found along package-4. Among them Bakaiya river is perennial river with seven (7) times crossing the expressway alignment and remaining 2 rivers (Andheri and Mohari rivers) flow during rainy season only.

Agricultural Land: Approximately 24.4 hector agricultural land are found in package- 4 along the expressway alignment.

Village/Settlement: There are 4 villages along the expressway in package-4 namely Junel, Andheri, Mamchha, Aapdamar.

Social, Economic and Cultural Status: Social, economic and cultural status of the area is complex. The villages are living as a mix society along the alignment with different ethnicity, religion, education, occupation and different income level. In total 232 HHs and total population 1230 are found along the alignment with majority of females (55%) and males (45%). Similarly, Tamang (30%), Newar (27%) and Brahmin (11%) are found majority in the area. Hindus (67%) are found majority in the project site followed by Buddhist (16%) and remaining others. Literacy rate (85%) is found quite good in the project area. Agriculture (25%) and wedge labour (39%) are main occupation of local people in the project area. Main source of income is found wedge labour (29%) which is followed by agriculture (28%) and service (15%) and business (14%).

Electricity, Communication facility (Telephone), Water Supply and Hygiene: The facility for the Electricity and Communication (Telephone) are available at the settlements beside expressway corridor. The local government is providing water supply system in the at the settlements beside expressway corridor. Almost 42% of households had a public tap and around 30% people are dependent on private taps.

Similarly, about 54% of households have good toilet facility and 10% people have ordinary toilets.

2.5 Construction Materials

The potential sources of construction materials are Lal Khola (river), Bakaiya river and Juina river for this contract work. The required construction material shall be entirely managed by contractor complying environmental and social impacts. The contractor shall have to obtain local authority approval and pay local taxes and royalty as per GoN rules and regulations.

2.6 Environmentally Protected zone / Wildlife Zone

No environmentally protected/wildlife zone exists along Contract Package-4.

2.7 Physical Hazard

Medium to low level of physical hazard (flood, earthquake, wind velocity) occurs in Contract Package-4 zone.

2.8 Disposal of Excavated and /or excess materials:

Disposal of excavated material shall strictly follow the guidelines mentioned in the document and shall be dumped at designated locations follow approved disposal management plan as per specifications and Employer's instructions/ approval.

3 Preliminary and General Works

3.1 Scope of Preliminary and General Works

The Contractor during implementation of the contract for the construction of expressway road works, slope protection works, river training works etc. and the design build and construction of the Bridges, Slope Protection works shall perform the following works but not limited to:

1. Submission and maintaining of performance security and Advance Payment Security
2. Submission and maintaining of insurance policies
3. Submission of the Contract Management Organization/Organogram
4. Establishment of Contractor's Camp including fencing with all facilities including utility services to all the Contractor's personnel
5. Mobilization of required manpower and equipment
6. Submission of Detailed Work program and schedules

7. Submission of Health and Safety Manual, implementation of H&S system during the contract implementation period
8. Submission of Quality management system (QMS) including Quality Assurance Plan (QAP) and its implementation
9. Submission of Environmental Management Action Plan and its implementation
10. Establishment of Material Testing Laboratory (MTL) including installation of it's all testing equipment required for the works, accessories and facilities with regular maintenance
11. Fixation of Project Information Board at the project site as per specification
12. Regular maintenance of existing access roads and making of new access roads if required
13. Obtaining necessary statutory approvals from concerned authorities
14. Keeping the workers' camps, lay down area, workshops etc., clean and tidy
15. Pay the workers and provide other facilities as per Country's Laborer Law
16. Making aware the Contractor's workers about the local tax payment requirements
17. Payment of tax and royalties as per prevailing law of the land
18. Submission of Design as required, Shop/working drawing for review and approval before commencement of work
19. Protection of the whole Construction Site during Contract Implementation period
20. Fixing of location of quarry sites and obtaining of approval from the Engineer/the Engineer's representative.
21. Submission of sample of Construction materials as per required frequency for approval before delivery at sites
22. Submission of construction methodologies
23. Conducting test of materials and workmanship as per QMS/QAP
24. Submission of Request for Works for the Engineer's approval before subsequent works are started
25. Obtaining the Engineer's approval for the sub-contractors if any
26. Regular supervision of the Construction works
27. Submission of daily, weekly and monthly progress reports as stipulated in the Contract document
28. Establishment of Communication strategy with all the stakeholders.
29. Participation in progress review meetings with weekly and monthly progress reports
30. Respecting local cultural and social values
31. Proper arrangement of traffic movement and traffic diversion at sites
32. Avoidance of interference with the existing public roads and utility services
33. Submission of training manual prior to start training if applicable
34. Conducting training to the Employer's personnel as per the contract and training manual
35. Submission of as built records for Engineer's review and approval
36. Submission of operation and maintenance (O & M) manual for Engineer's review and approval
37. Submission of Final completion statement and project close-out report
38. Rectification of defects after taking over during Defects Notification Period (DNP)
39. Other as per Employer's requirements and these conditions of Contract

3.2 Specific Requirements for the Preliminary and General Works

The Contractor shall carry out the preliminary and general works for the management and successful completion of the contract works. These works shall confirm to the Specifications, conditions of Contract and the specific requirements provided here below. The details of payable items under the Preliminary and General Works are provided in the Bill of Quantities. Any item not provided in the Bill of Quantities shall be deemed included in the other items of the Bill of Quantities and Schedule of Prices corresponding to the Employer's design works and the Contractor's design works respectively.

3.2.1 Temporary Works

The Contractor's facilities, warehouse, fuel storage area, parking area, access road to construction site, temporary road signs to guide the construction vehicles, and other temporary works required to execute the permanent works is completely the Contractor responsibility. Plan and install enough storage area for

material, equipment, utilities and facilities required during construction is the sole responsibility of the Contractor. Within a reasonable time (and in any case not less than twenty-one (21) calendar days) before he intends to commence construction of any of the Temporary Works the Contractor shall submit full particulars, including drawings, of the same for the approval of the Engineer. The submission to and approval by the Engineer of any such particulars shall not relieve the Contractor of his responsibility for the sufficiency of the Temporary Works or of his other duties and responsibilities under the Contract. The Contractor shall make safe and reinstate all areas affected by Temporary Works when they are removed.

3.2.2 Site Establishment

Site establishment shall be the sole responsibility of the Contractor including providing the water supply, sewage system and Electrification, fire hazard and mitigation measure. The Camp Set out by the contractor shall be spacious for dwelling and parking facilities. The Contractor responsibly shall obtain the related permissions and approval from the Engineer or local bodies to construct the camp.

3.2.2.1 The Contractor's Accommodation

The Contractor shall erect, construct, maintain and subsequently remove all temporary offices, sanitary conveniences, stores, workshops, compounds, parking areas and the like as are necessary to ensure that he is able to execute the Contract efficiently. The sitting and layout of the Contractor's accommodation shall be to the general approval of the Engineer. No labor camps shall be permitted within the boundaries of the Permanent Works Sites and accordingly the Contractor shall not establish any camp or temporary living accommodation for his staff within or adjacent to the Works Site, and shall clear any unauthorized squatters or unofficial camps from the site. All costs of land required for the above Contractor's accommodation, infrastructure & parking area to facilitate construction shall be borne by the Contractor's own costs.

3.2.2.2 Water Supply

The Contractor shall provide at his own cost, the potable water for drinking, washing, sanitation and general cleaning for his employees. In addition, the contractor shall provide water for the purposes of the construction, testing and commissioning of the Works.

3.2.2.3 Electricity Supply

The Contractor shall install, operate, maintain and pay for electricity at his own cost for their use of all offices, stores, laboratories, temporary buildings and construction of the Works.

3.2.2.4 Materials Testing Laboratory (MTL) facilities

The Contractor shall have a designated laboratory to carry out testing of all construction works and materials for quality control and assurance. The Contractor shall have competent technicians in charge of testing required for verifying the compliance of all construction materials as mentioned in Appendix 1: Laboratory Equipment.

3.2.3 Contractor's documents

The Contractor shall prepare and submit for review to the Engineer, the detailed initial/baseline program, methodology of works, inspection and test plan, Quality / Management system, Health and Safety manual and Environment Management Plan and other required documents before the commencement of the construction works. The contractor shall submit daily, weekly and monthly progress reports in formats as approved by the Engineer, updated program of work, performance reports etc., during the implementation phase and as built records and drawings, Operation and Maintenance Manual, statement of completion and close out report at the post implementation stage as per the contract.

3.2.3.1 Detailed Program of Works:

The initial/baseline program of work shall include necessary investigations, design and construction and the Contractor shall submit the program before commencement of the works. This program shall be in the agreed scheduling method prepared through software and shall include proper logic links between the activities. A

soft copy shall be submitted along with other supporting documents for the Engineer's review. Detailed programs shall be submitted during the contract period to macro format versions of the baseline program for review and acceptance by Engineer.

3.2.3.2 Progress Reports and Meetings:

The Contractor shall submit to the Engineer within the first week of each month a progress report in a format approved by the Engineer, indicating actual progress at the end of the preceding month, which will form the basis of the Contractor's performance; compared with the Contractor's program for the Works.

At regular intervals as mutually agreed, the Engineer shall arrange meetings in his office or at the Contractor's office or at the Site, as deemed necessary for the purpose of monitoring and appraisal of the Contract performance. Authorized and responsible representatives of the Contractor such as Contractor's Representative / Construction Manager shall attend such meetings. The Contractor shall arrange monthly for color digital photographs to be taken for showing the progress of the Works as instructed by the Engineer and shall provide the Engineer with one (1) set of prints and a digital copy of each photograph. The prints shall be on matt paper un-mounted and of a size not less than 165mm x 215mm. The Contractor shall hand-over all prints to the Engineer. The Contractor shall ensure that he will not make any electronic copy or print of the photographs without permission of the Engineer. The Contractor shall also ensure that no unauthorized photography is allowed on site. The Contractor shall allow the Employer and or his personnel to take the photographs on site.

3.2.3.3 Methodology of works

The Contractor shall submit Methodology of works at least seven (07) days prior to commencement of the relevant activity for the Engineer's review and approval. Method statements for temporary and permanent works shall include, but not be limited to:

- Preparatory works if any
- Resources (Manpower and Equipment) required,
- Safety hazards and precautionary measures,
- Quality control measures and critical quality assurance,
- Methodology of works,
- Attachments: Inspection and testing Plan, Task Risk Assessment, Approved Shop Drawing

3.2.3.4 Inspection and Testing Plan (ITP)

Inspection and Testing Plan shall be submitted at least Fourteen (14) days prior to the commencement of the works for the Engineer's review. The ITP includes.

- Schedule of activities,
- Details of Inspection and Tests,
- Inspection or test frequency,
- Inspection or test standards,
- Compliance requirements, etc.

3.2.3.5 Operation and Maintenance Manual

The Contractor shall provide operation and maintenance (O & M) manuals for the operation of bridges if required including structural health monitoring system. The manual shall be reviewed by the Engineer and upon acceptance, shall be the property of the Employer. The Contractor within 56 (fifty-six) days of commencement date shall submit to the Engineer for review two complete draft sets of Operation and Maintenance Manuals and As-built reports & drawings. The Engineer will assess the suitability of the draft

manuals and shall notify within 14 (fourteen) days of receipt of the manuals. The Engineer shall notify the Contractor in writing either on the approval of such manual with or without minor comments or for re-submission of the manual; subject to incorporation of comments and suggestion made by the Employer/the Engineer. Within fourteen (14) days of receipt of any such comments and/or suggestions, the Contractor shall resubmit the manuals. Submission of the draft manuals and draft as-built drawings shall be a pre-condition to the issue of a Completion Certificate. Following approval to the draft manuals and drawings, the Contractor shall submit five (5) copies with one electronic copy of the final approved manuals to the Engineer.

3.2.3.6 As-Built Records and Drawings

As-built drawings shall cover the works as completed, incorporating all modifications carried out during and after testing at the Contractor's works and all modifications done. The Contractor shall submit these drawings to the Engineer for review and approval.

The drawings shall be arranged in sets comprising dyeline positive transparencies (on plastic film) and prints bound in albums of approved size. Where drawings have been produced electronically, one (1) original print and a CD copy shall be provided for each drawing in place of transparencies. CD copies shall be compatible with latest version of AutoCAD.

The record drawings shall be handed over to the Engineer (by delivery to addresses directed) with the following provisions:

- One (1) set to the Engineer comprising two (2) copies of each of the prints
- One (1) set for the Engineer to deliver to the local Operational Staff comprising one (1) transparency and two (2) copies of each of the prints
- One (1) set for retention by the Employer comprising one (1) transparency and one (1) of each of the prints.
- One (1) set to be handed over to NEPALI ARMY, KTFT, fully laminated

The drawings shall be submitted to the Engineer within two (2) months after the issuance of the Contract Completion Certificate. In the event of the Contractor makes any modifications to the Works after submitting the record drawings, the Contractor shall provide amended/modified drawings in the same numbers as stated above.

3.2.4 Contractor's personnel

The Contractor shall employ the minimum key personnel for the design and construction of the proposed works, as outlined as below. The contractor shall be solely responsible for the employment of required number of personnel for timely completion of the contract.

Table 3-1: Contractor's Key Personnel Qualification

S.N.	Position	No.	Minimum Qualification	Total Work Experience [Years]	Experience in Similar Works [years]
For the Contractor's Design Works (for Design Part only)					
1.	Bridge Engineer (Design)	2	Master's Degree in Bridge / Structural Engineering	15	Seven Years of experience in the related field and shall have experience of Design Works of Two Bridges of Minimum 300m Length and ≥30m of Pier height.
2.	Highway Engineer (Design)	1	Master's Degree in Highway / Transportation Engineering	15	Seven Years of experience in the related field and shall have experience of Design of Highway/Expressway including Inter-change of at least one Highway/Expressway project.

S.N.	Position	No.	Minimum Qualification	Total Work Experience [Years]	Experience in Similar Works [years]
3.	Highway Engineer (Pavement Design)	1	Master's Degree in Highway / Transportation Engineering	15	Seven Years of experience in the related field and shall have experience of Design of Road/Highway/Expressway pavement of at least one Highway/Expressway project.
4.	Geotechnical Engineer	2	Master's Degree in Geotechnical Engineering	15	Five Years of experience in the related field and shall have experience in Geotechnical report of Open and Deep/Pile Foundations for at least one multi span Bridge. Seven Years of experience in the related field and shall have experience in design of Slope stability works in at least one Highway/Expressway Project.
5.	Geologist	2	Master's Degree in Geology	15	Five Years of experience in the related field and shall have experience in geological investigation on slope, highway, bridge
6.	Hydrologist	1	Master's Degree in Hydrology/Water Resources	15	Five Years of experience in the related field and shall have experience in Hydrological analysis report of at least one multi span Bridge.
For the Construction of all works					
7.	Project Manger	1	Bachelor's Degree in Civil Engineering	20	Ten years of experience in the related field as a Project Manager or Contract Manager or Equivalent and shall have experience of at least one Bridge of Highway/Expressway and one 30m pier Height Bridge of 300m length.
8.	Deputy Project Manager/Contracts Manager	1	Bachelor's Degree in Civil Engineering	15	Seven Years of experience in the related field as a deputy Project Manager or Deputy Contract manager or equivalent and shall have experience of at least one Bridge or Highway/Expressway on contract.
9.	Quality Manager	1	Bachelor's Degree in Civil Engineering	15	Seven Years of experience in the related field and shall have experience in supervision of at least one Highway/Expressway Project.
10.	Health, Safety and Environment Protection Engineer	1	Bachelor's Degree in Civil / Environment Engineering	12	Five Years of experience in the related field and shall have experience in supervision of at least one Highway Project

S.N.	Position	No.	Minimum Qualification	Total Work Experience [Years]	Experience in Similar Works [years]
11.	Highway Engineer (Supervision)	2	Bachelor's Degree in Civil Engineering	12	Five Years of experience in the related field and shall have experience in supervision of at least one Highway/Expressway Project.
12.	Bridge Engineer (Supervision)	3	Master's Degree in Structural / Bridge Engineering	15	Seven Years of experience in the related field and shall have experience in Supervision Bridge Works of Highway/Expressway Project.
13.	Geotechnical Engineer	2	Master's Degree in Geotechnical Engineering	15	Five Years of experience in the related field and shall have experience in supervision of Slope stability works in at least one Highway/Expressway Project.
14.	Geologist	2	Master's degree in Geology	15	Five Years of experience in the related field and shall have experience in geological investigation on slope, highway and bridge foundation.

3.2.5 Contractor's equipment

The Contractor shall deploy his/her owned or leased key vehicles/equipment during the construction period as outlined below. The contractor shall be solely responsible for deployment of required equipment for timely completion of the contract. All the equipment provided by the Contractor for the execution of work shall be in working conditions meeting the requirements of Transport Management Law, Nepal and Traffic Rule, Nepal.

Table 3-2: List of Equipment

No.	Equipment (Type and Minimum Capacity)	Minimum Quantity (Nos.)	Remarks
1.	Hydraulic Excavator - ≥1.1 cum rock bucket	5	
2.	Loader- ≥3 Cubic Meter	5	
3.	Concrete mixing station (Fully computerized Automatic Batching Plant) Min. production capacity of - ≥60cum/h	1	
4.	Concrete transit Mixer Truck - >6cum	4	
5.	Mobile Crane - ≥50Ton	2	
6.	Pile Driving/Boring Machine - ≥1.20m diameter with Tremie, Funnel all complete	1	
7.	Dump Trucks/Dumpers - ≥25t capacity	15	
8.	Generator - ≥200KVA	1	
9.	Motor Graders with Blade width≥3.75m	4	
10.	Asphalt Batching Plant≥60Ton/h Capacity	1	
11.	Asphalt paver Machine with paving width≥3.75m and having Sensor for level control	1	
12.	Pneumatic Roller≥10Ton Capacity	3	
13.	Vibratory Steel Roller≥12Ton Capacity	2	

14.	Water Tanker ≥ 6000liters capacity	2	
15.	Bitumen Distributor≥3000 liters capacity	1	
16.	Concrete Pump Car≥80m^3/h	1	
17.	Cargo Crane Truck≥200T capacity	1	
18	Cargo Trolley Truck -≥ 40 Ton-≥ 40 m Long	2	

3.2.6 Environmental Safeguards

The Contractor shall carry out all the construction work satisfying the environmental and social safeguards measures as mentioned in the Table 3-3 for design and preconstruction and construction stages. The Contractor shall also be responsible to manage and maintain Occupational Health and Safety Administration (OHSA) regulations and system to safeguard the Environment and Health of the crew working in the project as guided by the OHS manual. The contractor shall also prepare Geohazard Management Plan for Earthquake, Landslide and Ground Deformation, if any.

Table 3-3: Environmental Management Action Plan (EMAP)

Environmental Concern	Objectives	Mitigation Measures Recommended	Timing to Implement Mitigation Measure	Locations to Implement Mitigation Measure	Resp. imp. Mitigation Measure	Resp mon. Mitigation Measure
DESIGN and - PRECONSTRUCTIN STAGE						
1. Social Impacts and Resettlement	To ensure that the adverse impacts due to the property acquisition and resettlement are mitigated according to the RAP.	**To be completed prior to commencement of construction** 1. Social preparation of the APs to be completed prior to commencement of construction. 2. Acquisition of lands completed to minimize the uncertainty of people. 3. Completed implementation of RP and LAS to provide compensation and assistance to the APs. 4. Alternative land is given together with sufficient compensation to enable families to build & move to new houses as preferred. 5. All the payments/entitlements are paid according to the entitlement matrix, which was prepared according to the RP. 6. All the impacts identified by the EIA were incorporated into the RP and relevant entitlements included into the entitlement matrix.	Before the removal of houses and other structures, the APs to be given sufficient time with compensation money and assistance to resettle satisfactorily.	Targeted APs and families according to the CDC. The CDC and The Project Staff will prepare an Inventory of Losses (IOL).	KTFT	KTFT and External Monitors
2. Hydrological Impacts	To minimize hydrological and drainage impacts during construction.	1. Prepare detailed drainage report during DDS. Design of adequate major and minor drainage facilities will be completed and approved by KTFT in the DDS prior to construction. 2. Assess expected hydrologic flow in all areas where it is sensitive, such as for irrigated terraced lands taking into account changes due to climate change as predicted by accredited sources such as OECD. 3. Ensure surface flows are controlled and facilitated through early re-provision of irrigation with appropriate drainage structures in the road base including bridges and culverts. 4. Redistribution of sheet flows to be provided in the design for identified significant impact areas. 5. The main road, bridges and drainage structures over various water bodies in all the river basins (e.g. Bakaiya River) to be designed to maintain pre-project flows and ecological conditions and river water quality. 6. Prepare Drainage Management Plan, to be completed and approved by KTFT in the DDS at least one month prior to construction.	Before the commencement of construction activities/ during detailed designing stage.	Considered locations to be identified in the Detailed Drainage Report.	Contractor	MoDE/KTFT

Environmental Concern	Objectives	Mitigation Measures Recommended	Timing to Implement Mitigation Measure	Locations to Implement Mitigation Measure	Resp. imp. Mitigation Measure	Resp mon. Mitigation Measure
3. Temporary drainage and erosion control	1. Prevent runoff and control erosion.	1. Identify locations for Erosion Control and Temporary Drainage along all earthworks and at all culverts and crossing structures. 2. Agree detailed EC and TD plan with MoD / KTFT cell at least one month prior to construction.	1. During first month after contract is signed but before construction and agree in contract negotiations.	All stream and river crossings and all alignments where slopes indicate erosion will be a problem based on observation.	Contractor	MoD/KTFT
4. Planning construction camps and materials management	To plan to minimize the effect of the work camps on the surrounding environment and residents in the area.	1. Plan sites for worker camps and back up areas for stockpiling materials and equipment in advance. 2. Consult local community and locate to use waste/barren land and nonagricultural plots. 3. Agree use of land before construction commences reconfirmed by the contractor and agreed KTFT at least one month prior to construction.	1. During first month after contract is signed but before construction and agree in contract negotiations.	Locations decided by KTFT in consultation with community and the contractor.	Contractor	MoD/KTFT
5. Planning handling, transportation and storage of construction materials	To minimize contamination of the surroundings (due to implementation of works, asphalt, concrete and aggregates crushing plants)	1. Avoid and or minimize adverse environmental impacts arising out of construction material exploitation in line with MOFE guidelines/ conditions / recommendations. 2. Compile Materials Management Plan one month before commencement of construction and update monthly and include in progress report. 3. Include conditions for selecting borrow sites, timing and use of roads, maintenance of vehicles, selection of sites for material storage, rock blasting and aggregate production, handling hazardous or dangerous materials such as oil, explosives and toxic chemicals.	Update monthly	1. List of borrow areas is to be prepared one month prior to KTFT construction 2. A list of routes of transport of construction material is to be prepared for the contract and agreed one month prior to KTFT construction. 3. A map of locations of storage is prepared by the contractor.	Contractor	MoD /KTFT
6. Spoil disposal	To minimize the environmental impacts arising from generation of spoil waste, reuse where possible and provide adequate disposal options for unsuitable soils.	1. Compile Waste Management Plan. 2. Investigating the environmental conditions of the disposal sites and recommendation of most suitable and safest sites. 3. Investigating whether the waste can be reused in the project or by other interested parties in the vicinity. (landfilling, local road reconstruction, earth berms, amenity planting at intersections – other future public projects. 4. Identify sufficient locations for disposal of best updated estimate.	1. UPDATE Once a month	Spoil Disposal Locations	Contractor	MoD /KTFT
7. Traffic Condition	Plan to minimize disturbance of traffic	1. Avoiding blocking existing roads and other access near the works route during construction.	During preconstruction no later than one month after contract award.	Important locations	Contractor	MoD /KTFT

Environmental Concern	Objectives	Mitigation Measures Recommended	Timing to Implement Mitigation Measure	Locations to Implement Mitigation Measure	Resp. imp. Mitigation Measure	Resp mon. Mitigation Measure
		2. Design provisional Temporary Pedestrian and Traffic Management Plan for updating by the contractors one month prior to start of works in any given sector.				
8. Protecting wildlife	Avoid impacts on threatened birds and other animals	1. Prevent encroachment into the forests outside the ROW. 2. Do not clear ground vegetation outside the ROW. 3. Enforce a ban poaching in the areas adjacent to the ROW for the duration of construction. 4. Contractor to provide worker canteens with ample alternative supplies of meat and other food sources to avoid the need for poaching in forests. 5. Ban the supply of poached animals to worker canteens for food. 6. Conduct regular spot checks that worker canteens do not serve poached meat	Method statement during contractor selection, prior to contract signing.	Forest Areas	Contractor	MoD /KTFT
CONSTRUCTION STAGE						
1. Orientation for Contractor, and Workers	To ensure that the Contractor, subcontractors and workers understand and have the capacity to ensure that the environmental requirements for mitigation measures are implemented.	1. Conducting special briefing and / or on-site training for the contractors and workers on the environmental requirement of the project. Record attendance and achievement. 2. Conducting special briefing and training for contractor on the environmental requirement of the project. Record attendance and achievement. 3. Agreement on critical areas to be considered and necessary mitigation measures, among all parties who are involved in project activities. 4. Periodic progress review sessions to be conducted every six months	1. Induction for all site agents and above before commencement of work. 2. At early stages of construction for all construction employees as far as reasonably practicable.	All staff members in all categories. Monthly induction until contractors comply / improve	KTFT/Contractor	MoD/KTFT
2. Plans to control environmental and associated impacts	Avoid impacts from unplanned activities by penalizing contractors for not committing to properly planning works.	1. Drainage plan, 2. Temporary pedestrian and traffic management plan, 3. Erosion control and temporary drainage plan, 4. Materials management plan, 5. Waste management plan, 6. Noise and dust control plan, 7. Safety Plan, 8. Agreed Bioengineering and Slope Stabilization plan	Deliverable in final form to KTFT one month before construction commences for any given stretch.	All of KTFT alignment.	Contractor	KTFT/MoD
3. Hydrology Drainage and Irrigation	To ensure the proper hydrology and implementation of drainage for the project	1. Drainage Management Plan (DMP) to provision proper drainage systems at all construction sites, material exploitation, and storage sites prior to their use.	DMP to be approved by KTFT one month prior to a commencement of construction. Proper timetable prepared in	A list of locations to be provided with the detailed designs.	1. Contractor. (KTFT Cell to actively supervise and enforce.	MoD/KTFT

Environmental Concern	Objectives	Mitigation Measures Recommended	Timing to Implement Mitigation Measure	Locations to Implement Mitigation Measure	Resp. imp. Mitigation Measure	Resp mon. Mitigation Measure
	and protect irrigation systems.	2. Review the detailed designs for cross-drainage structures provided with the tender and assess and agree with KTFT if redesign is required. 3. Review the irrigation systems and irrigation structures potentially affected by construction of the KTFT. 4. Provide and maintain alternative temporary irrigation structures for the construction phase. 5. Re-provision irrigation structures disturbed by construction and agreed with. Appropriate drains will be constructed so that the outfalls of the surface run-off from the carriageway are diverted away from the SRs. 6. Re-provisioned irrigation channels capable to supply all the fields previously supplied with the volume of water supplied before the construction of the KTFT. 7. Measures to ensure that newly installed storm drains and highway drainage systems are periodically cleared to maintain storm water flow.	consideration with the climatic conditions of each area, the different construction activities mentioned here to be guided.		2. Relevant at all locations in the Drainage Management Plan.	
4. Soil Erosion / Surface Run-off	To prevent adverse water quality impacts due to negligence and ensure unavoidable impacts are managed effectively. To minimize soil and rock erosion due to the construction activities	1. Erosion Control and Temporary Drainage Plan one month before commencement of works. 2. Minimizing the removal of vegetative cover as much as possible and providing for immediate restoration where construction sites have been cleared of such areas. Proper installation of TD and EC before works within 100m of water bodies. 3. Meaningful water quality monitoring up and downstream at all bridges during construction. Rapid reporting and feedback to SC 4. Back-fill should be compacted properly in accordance with design standards and graded to original contours where possible. 5. Cut areas should be treated against flow acceleration while filled areas should be carefully designed to avoid improper drainage. 6. Stockpiles should not be formed within such distances behind excavated or natural slopes that would reduce the stability of the slopes. 7. In the short-term, either temporary or permanent drainage works shall protect all areas susceptible to erosion.	All times. Dependent on weather forecast monitoring and rainfall because the area can be subject to un-seasonal heavy rain plan before and during construction (cut and fill, land reclamation etc.) while considering the climatic conditions.	1. All locations based on potential problems as advised by authorities review monthly. 2. A List of sensitive areas during construction prepared by the KTFT in consideration with the cut and fill, land reclamation, borrow areas etc. 3. Locations of all culverts, cross structures, and bridges.	1. contractor (KTFT Cell to actively supervise and enforce. 2. Relevant at all locations in the EC and TD Plan.	MoD

Environmental Concern	Objectives	Mitigation Measures Recommended	Timing to Implement Mitigation Measure	Locations to Implement Mitigation Measure	Resp. imp. Mitigation Measure	Resp mon. Mitigation Measure
		8. Measures shall be taken to prevent ponding of surface water and scouring of slopes. Newly eroded channels shall be backfilled and restored to natural contours. 9. The contractor should arrange to adopt suitable measures to minimize soil erosion during the construction period. The contractor should consult the local authorities in the area before deciding on mitigation measures. 10. Surface protection measures such as turf and other bioengineering to be carried out as early as possible. The protection shall be applied in completed portions of surfaces, if such is possible without waiting for the entire section to be completed. 11. Clearing of green surface cover to be minimized during site clearing. 12. Monitor weather and consider of weather conditions when particular construction activities such as cut operations are undertaken. 13. Use of bioengineering / landscaping and slope stabilization early in the construction process as an integrated component of construction activity 14. Erosion Control and Temporary Drainage plan one month before commencement of works.				
5. Water quality	1. To prevent adverse water quality impacts due to negligence and ensure unavoidable impacts are managed effectively. 2. Ensure adverse impacts on water quality caused by construction activities are minimized.	1. Proper construction of TD and EC measures, maintenance and management including training of operators and other workers to avoid pollution of water bodies by the considerate operation of construction machinery and equipment. 2. Storage of lubricants, fuels and other hydrocarbons in self-contained dedicated enclosures >50m away from water bodies. 3. No stockpiles next to water bodies. 4. Proper disposal of solid waste from construction activities & worker camps. 5. Cover construction material and spoil stockpiles with a suitable material to reduce material loss and sedimentation. 6. Stripped surface materials not stored where will disrupt natural drainage. 7. Borrow sites should not be close to sources of drinking water.	Prior to construction, 50m from water bodies Timing will depend on the construction timetable	Relevant locations are construction within 50m of rivers.	Contractor	MoD

Environmental Concern	Objectives	Mitigation Measures Recommended	Timing to Implement Mitigation Measure	Locations to Implement Mitigation Measure	Resp. imp. Mitigation Measure	Resp mon. Mitigation Measure
6. Water Resources	To minimize impacts on local water supply caused by construction activities are minimized.	1. Availability of water will be assessed to evaluate the impact on community resources. 2. Project water will be obtained without depleting local village supplies. 3. Camps will be located at least 100m away from the nearest local settlement. 4. The contractors will be required to maintain close liaison with local communities to ensure that any potential conflicts related to common resource utilization for project purposes are resolved quickly. 5. Guidelines will be established to minimize the wastage of water during construction operations and at campsites.	Prior to construction, at all local water supply resources. Timing will depend on the construction timetable.	Relevant locations are all local water supply resources and rivers.	Contractor	MoD/KTFT
7. Cut and fill materials management	To reuse cut materials and reduce need for extraction of raw materials.	1. Update and implement Materials Management Plan drafted in preconstruction phase. 2. Contractor to agree in advance storage and disposal sites for surplus with KTFT and the local authorities. 3. Contractor will estimate the construction materials required and make preliminary schedules of works to facilitate the timely production of materials to avoid stockpiling. 4. Suitable cuttings from the project will be crushed and graded and reused to avoid unnecessary extraction of materials in future. 5. Contractor will be informed to produce and update regularly a Materials Management Plan 6. Surplus material should be stockpiled at locations agreed with local authorities for use on other local district or national projects.	Prior to construction. Update monthly.	All KTFT alignment	Contractor	MoD/ KTFT
8. Spoil disposal and construction waste disposal	To minimize the environmental impacts arising from generation of spoil waste, reuse where possible and provide adequate disposal options for unsuitable soils.	1. Implement Waste Management Plan. 2. Confirm conditions and safety of proposed disposal sites. 3. Confirm amounts of surplus rock-based materials that can be reused in the project or by other interested parties for public projects. 4. Confirm sufficient locations in the contract for disposal of best updated estimate. 5. Used oil and lubricants shall be recovered and reused or removed from the site in full compliance with the national and local regulations.	1. Before construction commences. 2. UPDATE Once a month	Locations approved by KTFT / local authority.	Contractor	MoD/KTFT

Environmental Concern	Objectives	Mitigation Measures Recommended	Timing to Implement Mitigation Measure	Locations to Implement Mitigation Measure	Resp. imp. Mitigation Measure	Resp mon. Mitigation Measure
		6. Waste oil must not be burned. – Oil and solid waste disposal location to be agreed with KTFT and local authority. 7. Open burning is contrary to good environmental practice and will not be allowed				
9. Noise	To minimize noise level increases and ground vibrations during construction operations.	1. Install, maintain and monitor all requisite mitigation as per contract all heavy equipment and machinery shall be fitted with acoustic insulation. 2. The operation of heavy equipment shall be conducted in daylight hours. 3. Hammer-type pile driving operations shall be avoided during nighttime. 4. Construction equipment, which generates excessive noise, shall be enclosed. Well-maintained haulage trucks will be used with speed controls. 5. Contractor shall take adequate measures to minimize noise nuisance in the vicinity of construction sites by way of adopting available acoustic methods. 6. Contractor may obtain guidelines for noise reduction from ISO/TR11688- 1:1995 (E), which enumerates methods by which air-borne, liquid – borne and structure-borne noise sources may be curtailed with suitable design criteria.	Maximum allowable noise levels are 70dB (A) LEQ.	1. Strong follow up from KTFT Cell required to update locations monthly. 2. Potential noise impact locations will be within 100m near all settlements and towns.	Contractor should maintain the accepted standards. KTFT cell will monitor relevant activities.	MoD/KTFT
10. Air quality	To minimize effectively and avoid complaints due to the airborne particulate matter released to the atmosphere.	1. Control all dusty materials at source. 2. All heavy equipment and machinery shall be fitted to minimize particulate emissions. 3. Stockpiled soil and sand shall be slightly wetted before loading, particularly in windy conditions. 4. Fuel-efficient and well-maintained haulage trucks shall be employed to minimize exhaust emissions. 5. Vehicles transporting soil, sand and other construction materials shall be covered. Limitations to speeds of such vehicles necessary. Transport through densely populated area should be avoided. 6. Spray bare ground areas with water. 7. Concrete and rock crusher activities to be controlled. Plants should be >100m and should be downwind of sensitive receptors such as villages, schools and hospitals) if upwind should be >500m from SRs.	1. Dust control planning will be a line item in the approval of setting up dust producing activities. 2. A schedule of spraying water to be revised monthly	1. A list of locations to be prepared by the Contractor 1 month prior to commencement of construction. 2. Most villages and hamlets are sensitive locations. 3. All concrete plant and any rock crushing plant.	The Contractor should maintain the accepted standards. KTFT will supervise relevant activities.	MoD/KTFT
11. Bitumen usage	Avoid air pollution and traffic obstacles	1. Asphalt hot-mix plants should be >100m and should be downwind of sensitive receptors) if upwind should be >500m from SRs.	Instruct before works commence and	Throughout all KTFT.	Contractor	MoD/KTFT

Environmental Concern	Objectives	Mitigation Measures Recommended	Timing to Implement Mitigation Measure	Locations to Implement Mitigation Measure	Resp. imp. Mitigation Measure	Resp mon. Mitigation Measure
		2. Bitumen should not be used as fuel. 3. Fuel wood should not be for bitumen heating. 4. Bitumen drums should be stored in a dedicated area, not scattered along the HRRIP road works.	throughout all construction works.			
12. Soil Contamination	Avoid soil contamination	Contractors to instruct and train workforce in the storage and handling of materials and chemicals that can potentially cause soil contamination. Accidentally spills on open ground including the top 2cm of any contaminated soil shall be disposed of as chemical waste to a disposal site acceptable to the local authority / community.	Instruct before works commence and throughout all construction works.	Throughout all KTFT.	Contractor	MoD/KTFT
13. Work Camp Location and Operation	To ensure that the operation of work camps does not adversely affect the surrounding environment and residents in the area.	1. Confirm location of work camps in consultation with KTFT and local authorities. Location subject to approval by the KTFT. If possible, camps shall not be located near settlements or near drinking water supply intakes. 2. Cutting of trees shall be avoided and removal of vegetation shall be minimized. 3. Water and sanitary facilities shall be provided for workers and employees. 4. Solid waste and sewage shall be managed according to the national and local regulations. As a rule, solid waste must not be dumped, buried or burned at or near the project site, but shall be disposed of to the nearest site approved by the local authority. 5. The Contractor shall organize and maintain a waste separation, collection and transport system. Construction camps will be established in areas with adequate natural drainage channels in order to facilitate flow of the treated effluents. 6. Portable lavatories or at least pit latrines will be installed and open defecation shall be discouraged and prevented by keeping lavatory facilities clean at all times. 7. Wastewater effluent from contractors' workshops and equipment washing yards will be passed through gravel/sand beds to remove oil/grease contaminants before discharging it into natural streams. Oil and grease residues shall be stored in drums awaiting disposal in line with the agreed waste management plan.	UPDATE Once a month	Location Map is prepared by the Contractor in tender/ bid documentation.	Contractor	MoD/KTFT

Environmental Concern	Objectives	Mitigation Measures Recommended	Timing to Implement Mitigation Measure	Locations to Implement Mitigation Measure	Resp. imp. Mitigation Measure	Resp mon. Mitigation Measure
		8. The Contractor shall document that all liquid and solid hazardous and nonhazardous waste are separated, collected and disposed of according to the given requirements and regulations. 9. At the conclusion of the project, all debris and waste shall be removed. All temporary structures, including office buildings, shelters and toilets shall be removed. 10. Exposed areas shall be planted with suitable vegetation. 11. The KTFT Cell shall inspect and report that the camp has been vacated and restored to pre-project conditions as far as is reasonably practicable.				
14. Encroachment, Landscape and Physical Disfiguration	To avoid several negative impacts due to removal of vegetation.	1. Clearing of green surface cover for construction, for borrow or for development, cutting trees and other important vegetation during construction should be minimized. 2. Install bioengineering as soon as practicable after earthworks are completed. 3. Landscaping of intersections and road verges. 4. At conclusion of the project, all debris and waste shall be removed. 5. All temporary structures, including shelters and toilets shall be removed.	During construction of relevant activities	A list of locations for bioengineering will be drawn up by the Contractor 1 month before commencement of work.	Contractor and KTFT	MoD
15. Temporary traffic management.	Avoid community severance and minimize nuisances from works traffic.	1. Contractor should discuss and agree with local bodies and organize temporary means of access to avoid such short-term negative construction impacts on footpaths and tracks from construction works. 2. The Temporary Pedestrian and Traffic Management Plan will be updated as necessary and include 3. Road availability and minimizing interference with pedestrians and traffic. 4. Establishment of acceptable working hours and constraints. 5. Agreement on the time scale and traffic flow/delay requirements. 6. Programming issues including the time of year and available resources. 7. Discussion of the KTFT / inspection/monitoring role. 8. Establishment of complaints management system for duration of the works. 9. Agreement on publicity/public consultation requirements (advance signs and publicity etc.).	Before commencement of construction activities	TPTMP to cover all roads and paths crossing the KTFT.	Contractor/KTFT	MoD

Environmental Concern	Objectives	Mitigation Measures Recommended	Timing to Implement Mitigation Measure	Locations to Implement Mitigation Measure	Resp. imp. Mitigation Measure	Resp mon. Mitigation Measure
		10. Installation of traffic warning signs and enforcing traffic regulations during transportation of materials and equipment and machinery. Conditions of roads and bridges to be considered. 11. Conducting awareness programs on safety and proper traffic behavior in densely populated areas near the construction sites. 12. Assigning pedestrian traffic control personnel.				
16. Minimize Impact on Rivers	To ensure that damage to rivers and wet ecosystem is minimized during construction.	1. Avoid use of river bed for access roads as far as possible. 2. Prevent disposal of wash water, solid waste & discarded packing in rivers. 3. Do not allow washing of vehicles in rivers and tributary streams. 4. Prevent piling up of loose material near rivers. In addition, these materials should not be tipped or stockpiled near rivers or streams or irrigation channels. 5. Remainders from concrete batches should not be dumped but removed with other spoil to avoid seepage to waste bodies. 6. Avoid temporary structures or stockpiling near rivers and irrigation channels. 7. Reestablish condition and water quality after construction.	During and immediately after construction for 1 year.	The rivers and adjoining tributaries e.g. Bakaiya River) to be restored to pre-project flows and ecological conditions and water quality.	Contractor	Independent experienced laboratory/KTFT
17. Disease vectors	Minimize health risks due to mosquitoes and other water borne diseases	1. Discourage mosquitoes by reporting and removing any standing water. 2. Temporary and permanent drainage facilities shall be designed to facilitate the rapid removal of surface water from all areas and prevent the accumulation of surface water ponds.	During construction.	All areas of KTFT alignment.	Contractor	KTFT
18. Safety Precautions for Workers	To ensure physical safety of workers	1. Submit Safety Plan one month before commencement of construction. 2. Providing adequate warning signs. 3. Providing every worker with skull guard or hard hat and safety shoes. 4. Establish all relevant safety measures as required by law and good engineering practices. 5. The contractor shall instruct his workers in health and safety matters and require the workers to use the provided safety equipment.	During construction	All areas of KTFT alignment.	Contractor	MoD/KTFT

Environmental Concern	Objectives	Mitigation Measures Recommended	Timing to Implement Mitigation Measure	Locations to Implement Mitigation Measure	Resp. imp. Mitigation Measure	Resp mon. Mitigation Measure
19. Social Impacts	1. To engage local workforce and community in the KTFT Project. 2. To secure a significantly large proportion of construction labour force locally. 3. To secure a proportion of clerical and service labour force from well-educated local people including women. 4. To encourage local support for the project. 5. To ensure minimum impacts to people living close to the ROW.	1. Use local labour as far as possible for manual work. 2. Use local educated people for clerical and office work where possible. 3. Encourage monitoring of the project by local village groups. 4. Claims/complaints of the people on construction nuisance/damages close to ROW to be considered and responded to promptly by the Contractor and monitored by KTFT. 5. Quarterly meetings with local bodies for liaison purposes to monitor complaints.	Claims of APs to be solved as soon as possible Necessary evacuations to be done as when necessary	All local bodies. A list of current construction areas to be updated by the Contractor monthly and displayed at local body offices. Special attention to locations of irrigation systems, irrigated terraces and lands damaged due to flood or landslide.	Contractor	MoD/KTFT

Note: CDC = Compensation Determining Committee. DDS=Detailed Design Stage. MOFE=Ministry of Forestry and Environment, EIA=Environmental Impact Assessment. EMAP= Environmental Management Action Plan = Environmental Management Plan, SPM= Suspended Particulate Matter, KTFT= Kathmandu – Terai/Madhesh (Expressway) Fast Track Road Project. TD = Temporary Drainage. EC = Erosion Control. NGO = non-government organization. AP = Affected Person. RP = Resettlement Plan. LAS = Land Acquisition Survey. IOL = Inventory of Loss. ROW = Right of Way. SR = Sensitive Receiver. SC = Supervision Consultant.

3.2.7 Social Safeguard Measures

The Contractor shall ensure that the following Social Safeguards measures are taken into account and followed; during pricing of Contractor's bid, construction period and during Defect Notification Period; whenever carrying out any rectification works:

3.2.7.1 Public Safety

Undertake other applicable Community and Occupational Health and Safety Measures as per the Environment, Health, Hygiene and Safety guidelines. When work is to be carried out in public areas such as roads, pedestrian walkways, playgrounds etc., the Contractor shall use barricade tape to prevent entry to such working areas and also erect suitable warning signs for the benefit of public use.

The Contractor's workshops, material storage areas and other working areas shall be fenced off from public. The Contractor should ensure that heavy machinery and material hauling vehicles do not unduly obstruct private accesses, public roads. If any damages occur to the utility lines / house connections (water supply, electricity, telecom, wastewater lines, etc.) due to the construction works, the Contractor should take immediate actions with relevant service providers to restore such utility lines/house connections. If any adverse impact occurs to the existing ground water sources (tube wells, shallow wells, etc.) due to project implementation, the Contractor should take immediate necessary actions to rectify the issues.

The Contractor shall make all necessary arrangements to ensure that public in the surrounding areas are not in convenience by dust and noise due to construction work. The Contractor shall bear the compensation cost of any impact on a structure or land due to negligent movement of machinery during construction or establishment of construction plant, as per standard contract provision.

3.2.7.2 Disturbance to the Livelihood Activities

The Contactor shall make necessary arrangements to provide access for continuing trade/ business or any other livelihood activities. The Contractor shall make necessary alternative arrangements for the vendors (mobile vendors, expressway (highway) vendors, etc.) who will be affected due to the construction works, material storage, construction machinery or equipment mobility. The Contractor shall display proper signboards / directions for the road users such as passengers, vendors and customers.

3.2.7.3 Relevant Labor Laws

The Contractor shall adhere to relevant labor laws of Nepal (meeting minimum wages, equal wages for male and female workers, prevention of child labor, prevention of harassment of women workers etc.), minimize the need for labor camps as far as practically possible by recruiting local labor and maintain health and sanitation within labor camps. The Contractor shall maintain protocol among his work teams and raise awareness on risk taking behaviors for COVID-19 including sexually transmitted diseases.

3.2.7.4 Process of Grievance Redress Mechanism

The Contractor shall follow the process of Grievance Redressing Mechanism. The Contractor shall arrange a proper awareness program to site officers and laborers about the Grievance Redressing Mechanism.

The Contractor shall distribute a Grievance Redressing Mechanism leaflet among the Project Affected Persons (PAPs) and the general public with details of grievance redress procedures.

The Contractor shall establish suggestions boxes in the construction area. The Contractor shall display the relevant contact numbers within the site office: telephone numbers of the Project Management Unit (NEPALI ARMY, KTFT), and other related stakeholders to facilitate contractibility.

3.2.8 Health and Safety

3.2.8.1 Safety Responsibility

The Contractor shall be solely responsible for the safe conduct of the Works. He shall ensure that all operations are carried out safely and that any person he makes responsible for the safe conduct of any part of the operations carries out his duties in a proper manner. The Contractor shall be responsible for "Occupational, Health and Safety Management" with the dedicated team of registered doctor for emergency safety work including 24 hrs. at the designated site office with required first aid facilities as well as for further treatment facilities as per prevailing government rules if required.

3.2.8.2 Contractor's Safety Procedures

Before commencing work on any site, the Contractor shall prepare a site safety plan for that site for approval by the Engineer. The Contractor and all persons engaged on work for this Contract shall be required to comply with the safety plan. A copy of the safety plan shall be supplied to the Contractor's Representative at that site, and it shall be the Contractor's Representative's responsibility to ensure that all persons under his control read and follow the safety plan.

The Contractor shall also institute a safety-training program on site upon commencing work to train all the workers in environmental, health and safety matters, including accident prevention, safe equipment handling practices in accordance with labor laws and their maintenance and upkeep. Detailed procedures and plans of action shall be laid out to combat emergency situations, including the location and proper use of the emergency equipment, procedures for raising alarm and proper response actions for each foreseeable emergency situation. The Contractor shall ensure that all personnel working on the site use PPE, including enclosed footwear, and protective headgear, and where appropriate protective goggles, gloves, steel-capped boots and such other items.

The Contractor shall institute safety procedures for work in confined spaces as follows:

Checking all confined spaces (such as, tanks, sumps, vessels, sewers, excavations) for toxic, flammable or explosive gases, or lack of oxygen, and ventilation of these spaces as required before entry and during occupancy. The Contractor shall ensure of adequate ventilation systems or air-supplied respirators for work in underground and confined work areas. The Contractor shall station of observers or assistants outside of confined spaces to watch over the safety of personnel working inside these areas.

3.2.8.3 Fire Hazard (Naked Lights)

No naked light, wire/cable shall be used by the Contractor on or about the Site and in the open air without the permission of the Engineer. If it requires to do so as per site condition then written instruction should get from client electrical engineer and have to use the naked light, wire/cables and by using this it may cause a fire hazard, and the Contractor shall take such additional precautions and provide such additional fire-fighting equipment (including breathing apparatus) with contractor own cost. The term "naked light" shall be deemed to include electric arcs and oxy-acetylene or other flames used in welding or cutting metals

3.2.8.4 Work in the Vicinity of Electrical Equipment

Any permanent fencing or other safeguards required to be erected around electrical equipment shall be completed as far as practicable before connection is made to the electricity supply, but where this is not practicable the Engineer may permit the use of temporary fencing or other safeguards. If work in the vicinity of electrical equipment is to be carried out after connection has been made to the electricity supply the Contractor shall put into operation a "Permit to Work" system to the approval of the Engineer.

3.2.8.5 Portable Electrical Equipment

Any person using portable electric tools or equipment is classified as a "Duty Holder" and must

therefore be "Competent" and appointed in writing. All handheld portable tools must operate at a voltage not exceeding 220 volts AC and the source of the voltage must be center tapped to earth. This does not apply to domestic cleaners etc. and to Class 2 domestic appliances, and approved test equipment. All hand lamps must operate at a voltage not exceeding 220 volts AC between conductors and be fed from a circuit which is isolated from the supply mains and from earth by means such as an isolating transformer. Before any new portable electric tool is put into service, it must be examined, tested and certified safe for use by an authorized person. This includes any equipment that may be hired by the Contractor from a specialized tool hire company.

Where portable electric tools remain on site for an extended period, they must be inspected on each occasion before use, and they must be tested and marked accordingly at no more than three monthly intervals. Prior notice shall be given of the intention to use transportable equipment on supplies exceeding 220 volts and the use of such equipment shall be at the discretion of the Employer. Only electrically trained personnel shall install temporary generators for supplying fixed or temporary installations. Electrical welding equipment shall not be connected to the site electricity supply and the Contractor shall provide all of the necessary portable generating equipment as may be required to carry out such electrical welding for the Works.

3.2.8.6 Electrical/ Mechanical Test Equipment

All test equipment used by the Contractor at the Contract Works Site to test the electrical and mechanical work shall be such that the use of the equipment shall not endanger the life of those using the equipment, and the test equipment shall be provided with clear instructions for the safe usage of such test equipment on or near to electrical systems, equipment and conductors.

3.2.8.7 Accident Reporting

All accidents shall be notified to the Engineer as soon as possible after their occurrence. The Contractor shall maintain a daily record for the Health and Safety provision for Pan.

3.2.8.8 Construction Safety Standards

The Contractor shall carry out all construction installation and commissioning activities in accordance with good safe working practices. In particular, the Contractor shall comply with the requirements of the Specification and the relevant Nepal Standards/ equivalent other standards as per conditions of contract and employer's requirements.

3.2.8.9 COVID-19 Safety Standards

The contractor shall be solely responsible for safety management to avoid COVID-19 as per government protocol. The contractor shall also be responsible for management of safety kits such as PPE, face masks and sanitizer etc.

3.2.9 Quality Management System

The Contractor shall ensure that all actions/activities are taken to build with quality assurance (QA) in the planning, management and execution of works the quality assurance shall cover all stages of work such as setting out, selection of materials, selection of construction methods, selection of equipment and plant, employment of personnel and supervisory staff, quality control testing, etc.

The QA program shall cover not limited to followings:

- Organization and management responsibility
- Document and data control
- Construction program
- Method statement
- Process control

- Working Inspection, Testing and documentary procedures
- Arrangement for smooth safe traffic flow during construction and maintenance
- Control and documentation of purchasing and handling of materials
- Maintenance of records for non- conformity and timely corrective actions
- Internal quality audit
- Training to staff
- Environment Management Action Plan (EMAP)

The Contractor shall submit evidence that the Equipment to be supplied from outside Nepal will be designed, manufactured and delivered to the requirements of ISO 9002 -Quality Systems - Model for Quality Assurance in Production, Installation and Servicing (or ISO 9001), and in accordance with the Employer's Requirements, including Schedules.

This evidence shall be in the form of the following:

A certificate issued by an independent, internationally recognized Third Party Accreditation Agency that the proposed manufacturer of the equipment and materials operates quality assurance systems, which conform to the requirements of ISO 9001 or 9002. The certificate shall clearly show the name of the certifying agency, the certificate number and the products or facilities certified. To be accepted as an internationally recognized independent third-party accreditation agency, the agency must have performed accreditation work of a similar nature in a minimum of two countries. As evidence of this, copies of relevant certificates issued by the agency or a statement from the agency or from an ISO Member Body, showing how the agency meets this criterion shall be provided.

The Quality Plan shall include the following as appropriate:

- Design of equipment necessary for execution of the Contract.
- Procurement of equipment, components and raw material.
- Calibration of test equipment.
- Sampling, destructive/non-destructive testing, frequencies of sampling and testing.
- Inspection procedures; rectification of non-conformities.
- Record systems.
- Inventory control, packing.
- Proposed production, transportation, delivery and installation program.

3.2.9.1 Quality Control

The Contractor shall develop an Inspection and Test Plan for all construction activities and submit to the Engineer for approval before commencement of the construction including material inspection and re-inspection applied to the subject of engineering, calibration of measuring and testing equipment, storage of materials, identification and traceability of materials, control of construction process, reporting and processing of unqualified products, quality training, etc.

The contractor shall have its own system for quality assurance to demonstrate compliance with the requirements of the Contract. It is up to the Contractor to demonstrate that he has complied with the Specifications – the Engineer is entitled to audit any aspect of the system. Contractor shall submit procedure and compliance documents to the Consultant for information before each section of the work is commenced.

Nevertheless, the Engineer is entitled to audit any part of the Contractor's work. Audit means to witness, oversight or verify whatever the Contractor is doing, and examine any of the Contractor's records. Also, per Specification Section 503, the Engineer's staff can examine, inspect, measure and test the materials and workmanship. The Engineer will use his forms to undertake and record these tasks. The Contractor is required to give notice to the Engineer whenever any work is to be covered up – after which the Engineer may examine, inspect, measure or test without unreasonable delay.

3.2.9.2 Sampling and testing of Materials

The Contractor shall submit to the Engineer as he may require samples of all materials and goods, which he proposes to use or employ in or for the Works. Such samples, if approved, shall be retained by the Engineer and no materials or goods of which samples have been submitted, shall be used in the permanent Works unless and until such samples shall have been approved in writing by the Engineer.

It shall be the Contractor's responsibility to ascertain from the Engineer which materials and articles are required for testing, and to ensure that they are submitted, sufficiently far in advance as to avoid delay in the Works.

The routine monitoring of aggregates, cement, steel, etc., site quality control, and specimen and sample manufacture and curing has to be ensured by contractor. Prior to concreting, slump test should be done and if failing, concrete will be rejected. Sufficient cubes should be cast for testing at 7 days, 28 days; and to be retained for future use as stipulated by The Engineer.

When ready mix concrete is used it has to be from a reputed manufacturer approved by the Engineer. The ready-mix plant should have automation for ensuring the use of designed mixes, recording and printing, and should have the facility for testing aggregates, moisture content cube testing and competence for doing mixed designs. All test certificates and records/ printouts from the plant shall be made available to the Engineer.

All costs for testing and getting items transported to laboratory and for obtaining test certificates shall be borne by the Contractor. In addition, the Contractor shall be responsible for transporting samples for testing from sites to the laboratories. The Contractor shall assign competent technicians to work in the laboratory under the direction of the Engineer.

3.2.10 Other General Requirements

3.2.10.1 Working Hours/Night work

Site working hours shall be 42 hrs within a week. Working apart from these hours shall only be carried out by prior arrangement and consent of the Engineer.

3.2.10.2 Site Land for Construction

The Employer shall give the Contractor possession of the area of the Permanent Works and such other areas shown on the bidding document drawings as being available for the Contractor's use. Such possession may not be exclusive to the Contractor. The Contractor shall make his own arrangements for any other land required by him. The Contractor shall not use the Site for any purpose other than for carrying out the work required under this Contract.

3.2.10.3 Access to the Site

The Employer shall provide the service track to the Contractor for the implementation at the beginning /of the construction work. But the required maintenance and operation of the service track is the responsibility of the Contractor including the widening of service track as and when required. The Contractor shall arrange for, construct, maintain and afterwards hand over to the Employer on completion of the Contract (or, if directed by the Engineer remove and reinstate) any temporary

access required for and in connection with the execution of the Works. Reinstatement shall include restoring the area of the access route to at least to the degree of safety, stability and drainage that prevailed before the Contractor entered the Site. Where operations are carried out on securely fenced lands/ premises belonging to or under the control of the Employer, the Contractor shall ensure that the Employer's current security regulations are maintained. The Contractor shall ensure that all workers leave the site on conclusion of their duties each day.

3.2.10.4 Site to be Kept Tidy

Throughout the progress of his work, the Contractor shall keep the Site and all working areas in a tidy and worker like condition and free from rubbish and waste materials. Any Temporary Works, Constructional equipment, materials or other things which for the time being are not required for use by the Contractor may with the consent of the Engineer be removed from the site to an approved location, but otherwise shall be properly and securely kept/ parked within the site subject to the consent of the Engineer.

3.2.10.5 Permit to Work System

The Employer may operate a Permit to Work system which the Contractor shall comply with throughout the Contract. Any part of the site that is designated by the Employer as a 'Restricted Working Area' may not be entered without a 'Permit to Work'.

The Contractor shall not allow any of his employees or sub-contractors to enter such an area until a permit has been issued. When the Contractor requires such a permit he shall give seven (7) days' notice to the Engineer, who shall arrange for one to be issued. When the Contractor receives such a permit he shall comply with any precautionary requirements that may be specified in it and shall hold the permit until the end of the period covered and then return it to the Issuing Officer. Compliance with the requirements of the permit shall not absolve the Contractor from any responsibilities under this Contract. Where the equipment in the restricted area can be put entirely out of use one permit shall usually cover the whole continuous period that the Contractor requires, but otherwise a new permit will be required each day.

Prior to carrying out any excavation work the Contractor shall apprise the Engineer of the proposed location of the excavation and shall confirm that the positions of all known services affecting the proposed excavation have been noted. In addition, the Contractor shall carry out a sweep with an approved detector and shall mark all known services on the ground. Excavation shall not commence without a "Permit to Excavate" issued by the Engineer.

3.2.10.6 Transport, Delivery and Storage of Equipment

The Contractor shall be responsible for making all arrangements necessary for the transportation of equipment to site, including investigation of the route for bridge clearances, loading limitations and the like. The Contractor shall ensure that all assemblies and sub-assemblies delivered to the site are of size and weight suitable for access to the place of installation/usage. The Contractor shall provide all labor and lifting facilities for off-loading of equipment at site. No delivery shall be made without the prior permission of the Engineer, which must be sought in writing at least seven (7) days before the intended delivery date. Delivery shall normally be to the designated storage area on site, or may be directed to the point of erection with the agreement of the Engineer.

The Contractor shall be responsible for reception at the designated storage area, offloading including all verification that equipment delivered conforms to delivery inventories, ensuring that stored equipment is adequately protected against deterioration from any cause and subsequent removal from the storage area and offloading at the point of erection including all transport. It is the sole responsibility of the Contractor to maintain protection of the construction equipment until Completion Certificate has been issued. The Contractor shall, at his own expense, provide for storage of all construction equipment brought to the site for the purposes of the Contract and its adequate

protection and preservation against loss, deterioration or damage however to be caused, both at his works and on site, where it is required for his approved erection program, his convenience or the requirements of the overall contract program.

3.2.10.7 Redundant Equipment

Redundant equipment removed during the Works shall remain the property of the Employer and shall be moved by the Contractor to a storage area to be allocated on the site.

3.2.10.8 Reinstatement of Roads

Where the Works involve construction in or across public roads, the Contractor shall undertake, at his own cost, the temporary and permanent reinstatement of all such roads affected. The temporary and permanent reinstatement shall be in accordance with the specifications and requirements of the Department of Road (DoR) Nepal or other related authority responsible or concerned.

3.2.10.9 Liaison with Others

The Contractor shall be responsible for liaison with all relevant authorities including but not limited to Nepali Army, other related authorities, local municipalities and ministries and for obtaining all approvals and consents necessary for executing the Works. The Contractor shall, in consultation with the Engineer, arrange his construction program so as to minimize inconvenience to the Employer, other government departments, other contractors and the public.

3.2.10.10 Amenities to be preserved

The Contractor shall cause the least possible interference with existing amenities and facilities, whether natural or manmade. No trees shall be felled except as authorized by the Employer and clearance of the Site shall generally be kept to the minimum necessary for the Works and Temporary Works. Before starting work on any site, the Contractor shall divert around the perimeter of the site any minor watercourses crossing the site which are necessary for the continuation of agriculture outsides the boundaries of the site. The Contractor shall at all times ensure that he does not cause any damage to or pollution of any existing installations and he shall take positive steps to minimize any inconvenience to the inhabitants of local communities. He shall at all times respect local traditions, religious sites and periods and the life style of the people, and shall deal promptly with any complaints by owners or occupiers.

3.2.10.11 Hoarding Board

The Contractor shall not, except with the written authority of the Employer, exhibit or permit to be exhibited on the site any hoarding board. The content and form of any such advertisement may also be subject to the approval of the Employer before it is put up and it shall be removed if the Employer so instructs.

3.2.10.12 Works to be kept Clear of Water

The Contractor shall keep the works well drained until the Engineer certifies that the whole of the Works is substantially complete and shall ensure that so far as is practicable all work is carried out in the dry. Excavated areas shall be kept well drained and free from standing water.

The Contractor shall construct, operate and maintain all temporary dams/caissons, watercourses and other works of all kinds, including pumping and well-point dewatering plant, which may be necessary to exclude water from the Works while construction is in progress. Such temporary works and plant shall not be removed without the approval of the Engineer. Notwithstanding any approval by the Engineer of the Contractor's arrangements for the exclusion of water, the Contractor shall be responsible for the sufficiency thereof and for keeping the Works safe at all times particularly during any floods and for making good at his own expense any damage to the Works including any that may be attributable to floods. Any loss of production or additional costs of any kind that may result from flooding shall be at the Contractor's own risk.

3.2.10.13 Disposal of excess materials

Disposal of excavated material shall strictly follow the guidelines mentioned in the document and shall be dumped at designated locations following approved disposal management plan as per specifications and Engineer's instructions/ approval. The Environmental policy measures and guidelines shall be strictly adhered to in the excavated material deposal.

The excavated material from the Construction work (in excess of the used in the site) shall be the property of the Employer. Excess excavated material shall be transported up to the required destinations as per the directions of the Employer and in compliance with the environmental and safety regulations. The Contractor shall pay attention to maintain the sanctity of the historical importance places, with due honor of local traditions, customs, rites, rituals and best practices. Excess material and waste generated during construction shall be managed and disposed in accordance with relevant local laws and regulations of Government of Nepal.

3.2.10.14 Utility Services for Work

Temporary power supply and other utility services for the construction work shall be the responsibility of the Contractor. The Contractor shall install power transformer and required accessories if required by own cost.

3.2.10.15 Interference with other contractors

The Contractor shall closely liaise with the Engineer to ascertain new construction development activities in the vicinity, which could affect the work carried out under this Contract. The Contractor shall co-operate and shall not interfere unnecessarily the other contractors' work.

3.2.10.16 Public Utility

During execution of temporary and permanent works, the Contractor shall pay attention on existing public utilities such as water sources, electricity power lines, telephone, TV cable, drainages etc. The contractor shall be responsible for the keeping safe and restoration of the public utilities if damaged during the execution of the work.

3.2.10.17 Quarry Materials

The management of local construction material source for the construction shall be the responsibility of the Contractor. The Employer shall not be responsible for facilitation and quarry site management works.

3.2.10.18 Assistance to the Employer and Employer's Personnel

The Contractor shall provide every assistance to the Employer and Employer's Personnel in carrying out their duties and shall provide a sufficient supply of measuring tapes, hammers, ranging rods, survey books, pegs, poles, paint, lines, tools, instruments, spirit levels and other materials, meters, gauges and small tools for testing and checking and setting out tolerances of the Works and the erection testing, commissioning and maintenance of the Works.

The Contractor shall also provide for the Employer and his staff such waterproof clothing, safety jackets and helmets, rubber boots, torches and the like as may reasonably be required by them. These articles shall remain the property of the Contractor, and they shall be repaired or replaced by him as necessitated by fair wear and tear.

3.2.10.19 Insurance Policies

The Contractor shall effect and maintain Contractor's All Risk (CAR) policy covering all construction related risks.

3.2.10.20 Facilities for the Site Office & Camp

Site office & camp shall be established for the contractor's site office & Engineer's staff at the locations

in 3000 sq. feet. and approved by the Engineer at the time of mobilization. The Contractor shall provide, furnish, equip and maintain, for the required period, site offices for the sole use of the Technical staff of both parties and also Engineer's resident site staff. The offices shall be located adjacent to the Contractor's site offices & camp, and the Contractor shall make available to the Engineer all services provided for his own offices including road access, fencing, hard standing, water, power, telephone and sewerage, subject to the provisions of this section of the Specifications. If Contractor requires for his purposes subsidiary offices (which may be moved and re-located during the contract) close to construction activities, he will provide suitable subsidiary offices for the Engineer. Basic construction details and dimensions shall generally conform to local building standard or as approved by the Engineer.

The site office may be mobile, semi-mobile or hired permanent building forming a single block / 2 Flat. Each site office shall have an internal area of at least 50 m2, a ceiling height of at least 3 m and shall have at least, 2 office rooms, kitchen, lobby and 2 toilets. The layout of the site office and the sizes of the individual rooms shall be agreed upon between the Engineer and the Contractor. The Contractor shall submit proposals for the site office within 14 days of the issue of the Notice to Commence. Each office room shall be weather proof, shall have a floor that is at least 150 mm above the ground, and shall be provided with a ceiling and a lining to the walls, or equivalent insulation, with an acceptable type of door with a secure lock, and two opening windows of glazed area at least 15% of the floor area. Each office room shall be well ventilated and shall be so insulated as to provide comfortable working conditions.

The window frames shall be close fitting and protected by fly screens. Sunblind's shall be provided. A continuous supply of cold water under adequate pressure shall be maintained, either from the public supply or from another source of equivalent standard and shall have drinking water quality. If water has to be provided by tankers to the site office, 2 (two) storage tanks (1 ground tank of 2 m3 and 1 roof tank of 1 m3 capacity including booster pump) shall be provided and connected to the piping of the site office. A suitable drainage system with septic tank or otherwise shall be provided. Each site office shall be provided with electric fans, air conditions, heating facilities and fluorescent lighting and shall have at least 3 no. 13 Amp power sockets in all office rooms. The contractor shall provide and maintain a not less than 5 kVA working conditioned backup generator. The generator shall not make noise more than 85 decibels (dB).

Each site office shall have a telephone connected to the public system and broadband internet. The telephone and internet shall be available for use by the user at all times. The site office shall be fully furnished to the satisfaction and approval by the Engineer.

The Contractor shall provide the office logistic as required and as instructed by engineer i.e. Laptop, computer, printer and photocopy, etc.

Each building shall be ready for occupying and all the equipment provided within 14 days after Commencement of Works.

Each site office and equipment shall become the property of the Contractor upon completion of the Contract and shall be removed from the Site.

The Contractor shall supply and erect, at approved locations, name boards in Nepali and English approved by the Engineer, giving a description of the Project as well as names and titles of the Employer, Engineer and Contractor as ordered or as shown on the Drawings. The Contractor shall keep the name boards in good repair for the duration of the Contract and shall remove them on completion of the Contract.

Services to the Engineer

The Contractor shall be responsible for the proper maintenance of the above listed offices during the Contract period. He shall keep the offices and toilets clean and shall provide cleaning staff for this

purpose throughout the Contract period.

The Contractor shall regularly, and when required, clean, repair, and maintain the Contractor's site office & camp, shall carry out emptying of the septic tanks and supply water to the water tanks. The Contractor shall pay all electricity, water and telephone charges, relating to the Contractor's site office & camp, including connection and disconnection fees and rental charges. The Facilities for the Contractor's site office & camp shall provide, maintain, operate, use of skill & non-skill workers and all complete work through contractor and the cost has been included in BoQ.

4 The Employer's Design Works

4.1 Scope

The construction of Expressway Road, Service Road, Drain, Cross Drainage, Vehicle Under Pass (VUP), Slope stabilization work, Stone Masonry Wall, Cantilever RCC wall for Hill side and Valley Side including piling foundation, RE wall (investigation and design by third party as mention in BoQ), River Training, Bio-Engineering, Electrical work including optical fiber and other associated works (designated as the Employer's Design Works) shall be carried out and based on the drawings and specifications. The detailed scope of these Employer's Design Works consists of, but not limited to the following works:

1. Construction of Expressway Road: Approx. 5.665 km asphalt concrete road in between Ch. 57+400 and 65+160 excluding bridges.
2. Number of carriageway=2, Lane width=2x2x3.75m, Shoulder width 3.0m both side and median width 3-4 m;
3. Concrete Road kerbs.
4. Road furniture: Road markings, road signs, Km posts, Metallic guard rails, delineators etc.
5. Drainage works: Masonry or Concrete side drains, spillways and RCC culverts
6. Retaining structures: Masonry or concrete retaining walls
7. Utility works: Street lighting, optical fiber ducts, road-crossing future ducts, substations etc.
8. Slope protection works: Soil nailing, Rock bolting, turfing, stone riprap, geo-grid, etc.
9. Fencing: Chain link fence with gates
10. Vehicle underpass (VUP)
11. Earthwork in excavation for road subgrade, structures, drainage works, box culverts etc. including disposal of excess material
12. Earthwork in filling for road embankment, median, structural filling etc.
13. Clearing site: removal of trees, bushes, rocks, etc.
14. River Training Works
15. Slope Stabilization Works
16. Others as per Bill of Quantities (BOQ) and required as per the Contractual provisions.
17. Due to Drawing production constraint only written dimensions to be followed.

Detailed quantities of above work are presented in Bill of Quantities (BoQ).

4.2 Specific Requirements of the Employer's Design Works

The Contractor shall carry out the Employer's Design works, such as Expressway Road, Slope Protection, River Training, and associated Works in accordance with design, drawings and specification provided by the Employer. The detailed quantities of these works are provided in the Bill of Quantities (BOQ).

The requirement specified in Preliminary and General Works shall be applicable to these works in addition to the following specific requirements.

4.2.1 Construction Drawings

The Employer shall supply the construction drawings to the contractor within reasonable time before the commencement of the works. The Contractor shall prepare and submit working drawings/shop drawing for the Engineer's review and approval. The working drawings shall be prepared based on the Construction Drawings provided by the Employer. No works shall commence without the approved working drawings.

4.2.2 Contract Price

The Contract Price shall be agreed or determined by Evaluation and subject to adjustment as per the Contract.

4.2.3 Measurement and payment

The Employer shall make payment to the Contractor in accordance with the measured quantities of work done and their respective unit rate as per the Contract Agreement.

5 The Contractor's Design works

5.1 Scope

The Design and Build / Construct work consists of Bridges, Vehicle over pass (VOP), Expressway Road, Drain, Cross Drainage, Slope stabilization work, Stone Masonry Wall, Cantilever RCC wall for Hill side and Valley Side including piling foundation, foundation protection, River Training, Bio-Engineering, Electrical work including optical fiber installation and other associated works including planning, topographical surveying, geological, geophysical & geotechnical investigations, hydrological study, preliminary and detail design works and approval, construction and 5 years defects notifications period with preparation of maintenance manual & implementation during defects notifications period for specified works. The detailed scope of the Contractor's Design and Build (Construct) Work are listed hereafter but not limited to;

5.1.1 Bridge Works

The Design Build work for the Bridges comprises, but not limited the following:

1. Site preparation / surface preparation i.e. levelling, trimming removal of boulders and other structure if any all complete.
2. Geotechnical / Geological / Geophysical investigation as per IRC Code of each foundation and detailed design of bridges, and associated works
3. Earthwork in excavation for Bridges foundations, etc. including disposal of excess material.
4. Earthwork in filling for bridge embankment, structural filling.
5. Construction of 5@35m span Twin Bridges plus 65+120+65 of Iconic Single Bridge having 26.8m wide superstructure and 11 number of Twin Bridges comprising at least as per the followings conceptual design:
   a. PSC Box Girder, PSC Extradose, PSC Girder deck, medians etc.
   Note: In between the CP4-05A & CP-05B and CP4-06A & CP4-06B gap is 20m (CH 59+880 to CH 59+900). So, if the starting and ending points of adjacent 2(two) bridges are close, the contractor can design each of the 2(two) bridges as one continuous bridge.
   b. RC Piers, abutments with 8-meter-long (minimum) return walls, wing walls etc. with deep foundations and foundations protection.
   c. 6m long 500mm thick Approach slabs at both approaches of the bridges and including crash barriers at both sides of the bridges.
   d. Bearings, Expansion joints etc.
6. Construction of PSC Girder (VOP) of 40m span, 11.8m width at CH 58+150 and PSC Girder (VOP) of 40m span, 11.8m width at CH 58+600.

7. Painting of exposed concrete surfaces using two coats of suitable epoxy painting over suitable primer and waterproofing
8. Traffic signs, road marking, cat eyes and informative signs
9. Utility works: Street lighting work & cabling, optical fiber ducts etc.
10. Slope protection works for bridge approaches and abutments, turfing, stone riprap, etc. up to the approach slab end.
11. Permanent Structural Health Monitoring (SHM) should be installed in the special bridges. It includes data acquisition system, continuous power supply, data transmission, data storage & mining, data processing, data interpolation and associated software with interconnection with station. All the data should be instantaneous (Synchronized) transferred to toll Plaza at Budhene interchange by the means of optical fiber.
12. Due to Drawing production, constraint only written dimensions to be follow.

Table 5-1: Details of bridge location and size, excluding Approach Slabs at either approaches

S.N.	Bridge Number	Chainage	Length (m)	Description
1	BR.CP4-01-A (Terai)	57+545 to 57+585	40	PSC Girder
2	BR.CP4-01-B (Kathmandu)	57+535 to 57+575	40	PSC Girder
3	BR.CP4-02-A (Terai)	57+876 to 57+911	35	PSC Girder
4	BR.CP4-02-B (Kathmandu)	57+856 to 57+891	35	PSC Girder
5	BR.CP4-03-A (Terai)	58+410 to 58+500	90;3@30	PSC Girder
6	BR.CP4-03-B (Kathmandu)	58+400 to 58+490	90;3@30	PSC Girder
7	BR.CP4-04-A (Terai)	59+100 to 59+160	60;2@30	PSC Girder
8	BR.CP4-04-B (Kathmandu)	59+080 to 59+140	60;2@30	PSC Girder
9	BR.CP4-05-A (Terai)	59+820 to 59+880	60;2@30	PSC Girder
10	BR.CP4-05-B (Kathmandu)	59+820 to 59+880	60;2@30	PSC Girder
11	BR.CP4-06-A (Terai)	59+901 to 60+151	65+120+65=250	PSC Box Girder
12	BR.CP4-06-B (Kathmandu)	59+900 to 60+150	65+120+65=250	PSC Box Girder
13	BR.CP4-07-A (Terai)	60+251 to 60+441	50+90+50=190	PSC Box Girder
14	BR.CP4-07-B (Kathmandu)	60+249 to 60+439	50+90+50=190	PSC Box Girder
15	BR.CP4-08-A (Terai)	60+781 to 61+051	70+130+70=270	PSC Box Girder
16	BR.CP4-08-B (Kathmandu)	60+779 to 61+049	70+130+70=270	PSC Box Girder

S.N.	Bridge Number	Chainage	Length (m)	Description
17	BR.CP4-09-A (Terai)	61+976 to 62+296	55+2@105+55=320	PSC Box Girder
18	BR.CP4-09-B (Kathmandu)	61+985 to 62+305	55+2@105+55=320	PSC Box Girder
19	BR.CP4-10-A (Terai)	62+598 to 63+023	5@35+65+120+65=425	PSC Girder + PSC Box (Extradose)/ICONIC Bridge
20	BR.CP4-10-B (Kathmandu)	62+592 to 63+017	5@35+65+120+65=425	PSC Girder + PSC Box (Extradose)/ICONIC Bridge
21	BR.CP4-11-A (Terai)	63+144 to 63+394	65+120+65=250	PSC Box Girder
12	BR.CP4-11-B (Kathmandu)	63+136 to 63+386	65+120+65=250	PSC Box Girder
13	BR.CP4-12-A (Terai)	64+036 to 64+076	40	PSC Girder
14	BR.CP4-12- B (Kathmandu)	64+024 to 64+064	40	PSC Girder
15	BR.CP4-13	58+150	40	PSC Girder(VOP)
16	BR.CP4-14	58+600	40	PSC Girder(VOP)

Note: 1. If the length of the bridges decreases from the proposed length, the price of the bridges shall be reduced in the proportion to the length on quoted price on prorate basis, but no extra payment shall be made for the increased bridge length to any extent during the design and construction

2. The conceptual drawing and plan arrangement is included in Volume IV: Reference Drawings.

3. Geometry of the Expressway and Bridges is presented in reference drawings.

4. Span arrangement, type and height of the bridges can be changed except PSC Box (Extradose)/ ICONIC bridge.

5. Exposure visit in development countries for the ICONIC Bridge with Client and Consultant Expert (Highway and Bridge Engineer) (minimum 3+3 persons) before conceptual design final.

5.1.2 Expressway Road and Slope Stabilization Works

The Design and Build works for the Expressway Road (CH 59+880 to CH 59+900 and CH 63+390 to CH 64+030) including Drain, Cross Drainage, Slope stabilization work, River Training, Bioengineering, Electrical work including optical fiber and other associated works but not limited the following:

1. Desk study, detail survey, site pre-investigation, inventory survey etc.
2. Site preparation / surface preparation i.e. levelling, trimming removal of filling materials, boulders and other structure if any all complete.
3. Geotechnical investigation as per IRC Code of each Spot of proposed structures and detailed design of sub-structures including analysis of slope protection and modelling.
4. Earthwork in excavation including disposal of excess material where the spot for disposal is identified at the construction time.
5. Construction and design of Expressway road including river training, bio-engineering, electric work including optical fiber, drains, cross drainage, etc. to a high level of technical competence and shall be based on proven methods, materials and technology. All structures shall be designed in accordance with accepted engineering practice, relevant codes and incorporate safety in design principles by adopting following parameters but not limited to:
   -traffic analysis

-Horizontal alignment and vertical alignment (as per employee design or applicable to change but effect should be minimizing for employee design)
-hydrological investigations
-geotechnical investigations
-geological and geophysical investigations
-social and environmental impacts, -etc.

6. Construction of different numbers of slope comprising at least as per the following design:

a. Slope protection works: Rock bolting, rock anchoring, soil nailing, permanent ground anchors with bearing system structure, Bio-engineering, RCC Wall, River training etc.

b. Earthwork in excavation for slope, slope reinforcement, drainage works for slope stabilization

c. Slope Monitoring work (Supply, install and measuring work)

Table 5-2: Details of Slope Site Condition

S.N.	Particulars	Area (m^2)	Remarks
1.	Bridge with Slope Protection Work		
1.1	CP4-10	26888.97	
1.2	CP4-10, CP4-11 and In between CP4-10 & CP4-11	21432.31	
1.3	CP4-11	9931.80	
2	Expressway road including slope protection	190450.10	Out of 221060.10 m^2 (CH 63+390 to CH 64+030)
	Total	**248703.18**	

Note:
1. If the area of the slope protection works decreases from the proposed area, the price of the slope protection work shall be reduced in the proportion to the quoted price, but no extra payment shall be made for the increased slope protection work area to any extent during the design and construction.
2. The conceptual drawing and plan arrangement is included in Volume IV: Reference Drawings.
3. The design of slope by the Contractor should be within the approved land acquisition area. If the design slope exceeded the acquired area, the contractor must obtain the Client's approval in advance.

5.2 Specific Requirements for the Contractor's Design Works

The Contractor shall design the Bridges/ Slope stabilization Works and prepare the respective drawings as per the Employer's Requirements. The Contractor shall conduct necessary survey, detailed investigation and Hydrological survey, Natural hazards (Rainfall, Earthquake, etc.) study, and design in addition to the information provided by the Employer. The Contractor shall scrutinize the Employer's Requirement for these works, set out the works as per the site data and items of reference provided by the Employer. The contractor shall prepare the conceptual design drawings and get Employer's approval on the Contractor's conceptual design. The contractor shall carry out detailed survey & design and prepare drawings and get approval from the Employer. The Contractor shall carry out the construction works as per the approved design drawings.

The requirement specified in Preliminary and General Works shall be applicable to these works in addition to the following specific requirements;

5.2.1 Design Obligation

The Contractor shall design, execute and maintain the Works in accordance with this Employer's Requirements. The Contractor's design process shall include topographical survey, geotechnical investigations, water quality survey, hydrological study and analysis of flood level as per the specified

codal provision, Geological Slope Mapping, Natural hazards (Rainfall, Earthquake, etc.) for the conceptual designs, schematics, detailed designs, preparation of the working drawings and all other studies, investigations, analysis, calculations necessary to achieve compliance with the Employer's Requirements. In this process, the Contractor has to take into consideration of the existing data, amenities utilities on ground and to plan and shift as per the requirement for the shifting of these utilities and amenities (if necessary).

The Contractor shall submit to the Employer the documents comprising the Contractor's design of the Works, drawings including a comprehensive design report, in electronic as well as hard copy ten (10) format for the Engineer's review and approval. The software contracts used in the designs shall be compatible with available software (the software should be to international standard) with the authority and/ or accepted by the Employer. One copy of each software used during design shall be provided to the Engineer for the design check. The Contractor in carrying out the construction works shall use only Construction Documents including drawings as approved by the Engineer. The Contractor shall neither use for other than this contract nor publish the design details/data without written permission of the Engineer.

5.2.2 Design Personnel

The Contractor shall engage suitably qualified and experienced design personnel/expert/consultant acceptable to the Employer for the design works. The design/expert/consultant personnel shall be available during the design approval and execution of the works for clarification if any. The design personnel/expert/consultant specified in the Employer's Personnel Section above are minimum required and the Contractor shall deploy sufficient number of qualified design professionals to complete the design works in time.

5.2.3 Design Procedure and Program

The Contractor shall submit the Design Procedure with program to the Engineer and shall clearly indicate the submission date of design documents providing appropriate review period. The program shall allow 21 days for Engineer's review of the submissions by the Contractor. The program also shall include reasonable period that the Contractor shall prepare re-submissions of items after reviewing comments from the Engineer and transmit documents to be re-submitted. The design program shall be compatible with overall construction program and milestones if any.

5.2.4 Detailed Design and Documents

The design shall be based on the Employer's requirements performance and standard specification requirement (Functional Requirement). No variations to the approved design shall be permitted, except with the specific written consent of the Employer.

The Contractor shall submit the following information for review and approval:

General Design Information - this shall incorporate an augmentation of information provided in the preliminary design as appropriate, with design report.
Civil and Structural Works Drawings - Civil and Structural works drawings shall include but not be limited to:

- Setting out drawings with reference coordinates.
- Layout drawings and sectional views.
- Civil works and structural drawings.
- Ancillary and temporary works (shafts etc.) drawings.
- Architectural and builder's work drawings.
- Drainage and other disposal systems drawings.
- Co-ordination drawings.
- Reinforcement and bar bending schedules.
- Any other drawings required to cover work included under bridge works.

- Slope Reinforcement drawing
- Reinforcement detail drawing
- Monitoring system detail drawing
- Bio-engineering (for slope protection) detail drawing
- Construction Method (including, reinforcement equipment list and earthwork, reinforcement process)

5.2.4.1 Document Format

Designs and Construction drawings submitted by the Contractor for review shall include but not limited to:

- Contents List and Summary.
- References including specification requirements, design codes of practice, manuals and supporting documents used, numbers and titles of drawings which are based on the design.
- Criteria, parameters, software and methods used. Test procedures, analysis and results.
- Calculations and Schedules.
- Qualitative description and comments on results.
- Any other relevant information required by the Engineer.

Designs calculations and documents shall be presented on A4 size paper with every page numbered and bound in order between a transparent front cover and stiff back using undeletable ink. The title of the submission shall be given on the front sheet beneath the title of Contract, Contractor's name, title of works location, author's reference, date, Contractor's signature, and any other relevant information. Drawings submitted as part of the design or document shall be presented on A3 size paper (unless otherwise requested by the Engineer to submit on A1 size paper) folded into pockets at the back using undeletable ink. The Contractor shall bind in as appendices to the designs and documents English language copies or photocopies of any standard, code of practice, manual or other reference referred to in the designs and documents which have not otherwise been submitted.

5.2.4.2 Drawing Format

Drawings submitted by the Contractor for review shall be based on previously submitted designs or documents. Interrelated drawings shall be submitted at the same time in a complete and self-sufficient set. Copies shall be collated into ordered bundles each with a list of contents. All drawings provided by the Contractor shall be in the form of good quality reproductions and shall conform to the requirements of the relevant British Standard, or equivalent, in respect of drawing size, presentation and use of symbols.

Drawings shall be no smaller than A4 and no larger than A1. All dimensions used on drawings shall be in metric units and all drawings shall be to scale acceptable by both parties, and shall include a graphical scale to aid the use of photographic reproductions.

Drawings shall be complete with:

- Title block approved by the Engineer.
- Drawing codification with revision number & related details. Legends with all details.
- Comprehensive notes describing all aspects, including revision, modifications made.
- Separate descriptive information for sub-assemblies, major components, foundation, fixing details etc.

- Sections, elevations, plan layout information.

5.2.4.3 Numbering and Titling

The Contractor shall use a reference numbering system for designs notes, report, drawings and documents so that each number used is unique. The numbering and title information on design notes, reports, drawings and documents shall be designed so that management, transmittal and communication of drawings can be carried out expeditiously using a computer aided data base system.

All drawings shall bear the following information in a standard title block:

Employer's name, address and logo. Contractor's name, address and logo. Contract Title.

- Contract Number.
- Drawing Title, including names of facility and site. A unique Drawing Number.
- Revision Schedule.
- Name and signature of Originator, Reviewer and Approver of the drawing, Scale, Date.

The Contractor shall maintain a document/ drawing register listing all documents/ drawings prepared as part of the Contract. The document / drawing register shall incorporate a revision number. Wherever a change is made to the document / drawing the revision number, the date of the change, full details of the change and person responsible for the change shall be recorded on the register.

The revised document / drawing shall be submitted with complete details after rectifying all the discrepancies observed in the initial document, together with the revised reference number and brief description.

5.2.4.4 Number of Copies

The Contractor shall submit to the Engineer for review ten (10) hard copies as well as electronic copies of all submissions along with each the software used. Only one (1) hard-copy will be returned to the Contractor. Following acceptance of the documents by the Engineer, the Contractor shall submit to the Employer five (5) copies of all accepted documents and drawings with the date of the Employer's acceptance marked on the original.

5.2.4.5 Review of Submissions

Acceptance by the Employer of any drawing or revision, structural design, method of work or any information regarding materials and equipment the Contractor proposes to supply, shall not relieve the Contractor of his responsibility for any errors or omissions therein, and shall not be regarded as an assumption of risks or liability by the Employer.

The Contractor shall have no claim under the Contract on account of the failure or partial failure or inefficiency of any design, plan or method of work or material and equipment so accepted. Such acceptance shall be considered to mean that the Employer has no objection to the Contractor using, upon his own full responsibility, the design, plan or method of work proposed or furnishing the materials and equipment proposed.

5.2.4.6 Quality assurance plan for Design and Build and Unit Rate works

The QA/QC Manual established by this project includes quality assurance plan and quality control plan, covering organization and responsibilities, quality inspection plan, quality control procedures, design quality control, construction quality control, quality document control, training, etc. It defines the policies and objectives and its quality commitment during the execution of Kathmandu Terai Fast Track Road Project. The QA/QC also defines the quality assurance and control procedures used by all functional areas from consultant to fulfil the quality objectives and its contractual obligations towards the Client. The QAQC applies to all activities affecting the project quality including engineering and construction of the project. QAQC manual shall apply to all quality-related activities for the execution

of the Contract with Client/engineer to engineering, procurement and construction, warranty of Kathmandu Terai Fast Track Road Project.

The purpose of this manual is to establish the necessary standards for construction supervision methods and procedures to carry out on-site construction work and supervision service effectively. Standard Specifications for Road and Bridge works, published by the Department of Roads shall be one of the documents for quality control and quality assurance.

5.2.5 Final Design Report

The Contractor shall submit detail design report with step by step design calculations (both Hard & Soft copy) incorporating all suggestions and including all necessary topographic, hydraulic, structural, geotechnical, and calculations early in the design stage. The Contractor shall submit a final design report prior to the commencement of works. The final report shall be based on the preliminary design, conceptual design report and contain any necessary updated or augmented information.

5.2.6 Errors in Documents

The Contractor shall scrutinize the Employer's Requirement, site data and item of reference and give notice to the Employer if found any error, fault or defects in the Employer's Requirements, site data or the item of reference.

5.2.7 Contract Price

The Contract Price shall be the accepted lump sum contract amount as per the Contract Agreement shall not be adjusted for the change in cost.

5.2.8 Measurement and payment

The Contractor shall be paid based on the Payment Schedule provided in this contract to the proportion of work completed by the Contractor.

5.3 Design Criteria and Design Restrictions

The design criteria and restrictions are applicable for the Design and Build (contractor design) works only.

5.3.1 Expressway Road

Expressway road design shall confirm to a high level of technical competence and shall be based on proven methods, materials and technology. All sub-structures of expressway road shall be designed in accordance with accepted engineering practice, relevant codes and incorporate safety in design principles. Structures shall be designed integrating the following parameters, but not limited to:

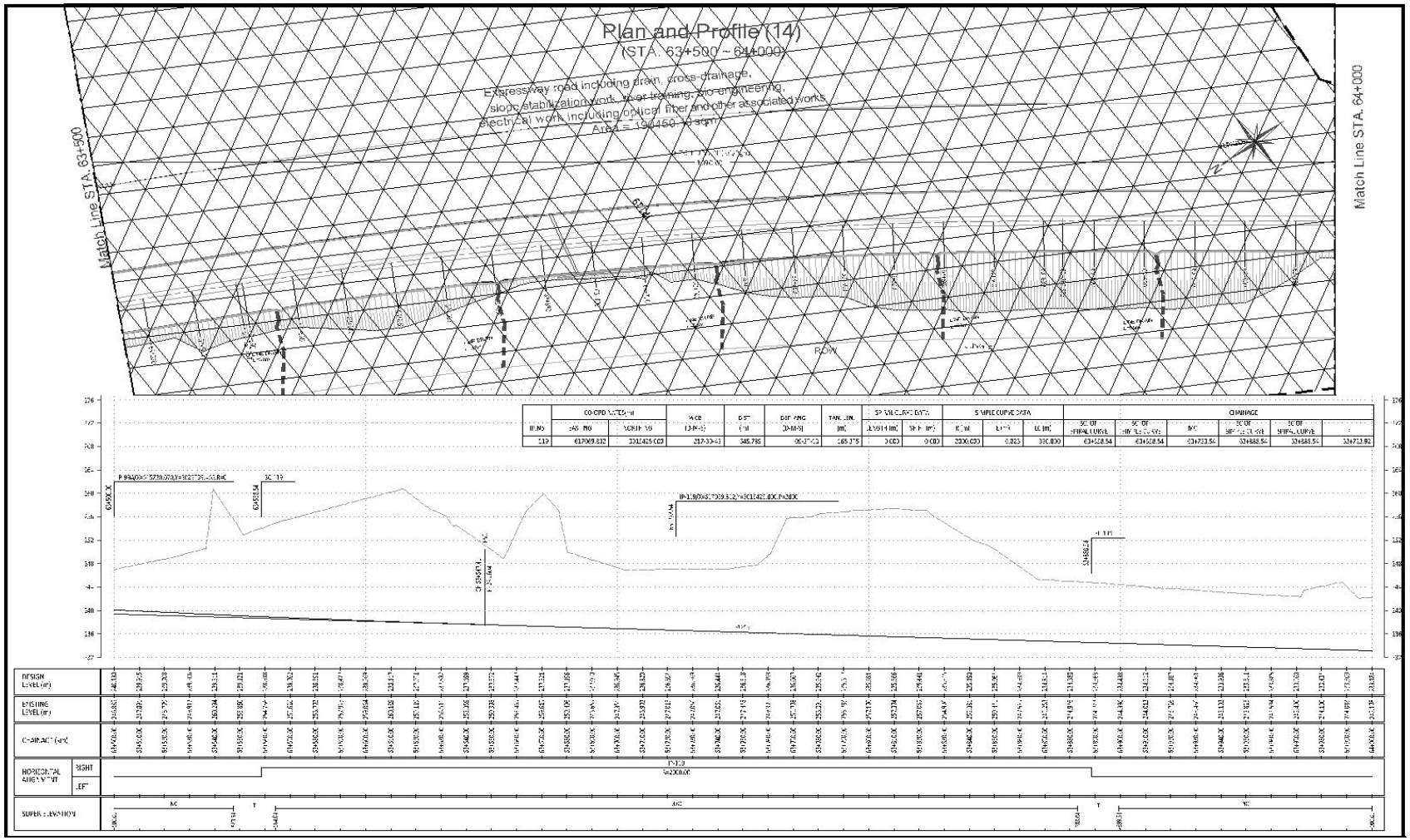
- traffic analysis
- horizontal and vertical alignments
- geotechnical investigations
- geological and geophysical Investigations
- hydrological investigations, and
- environmental impacts.

5.3.1.1 Technical Requirement

The contractor shall refer to Nepal designated design standards (as per table hereafter) that match with economic design and maintenance costs to keep construction and future maintenance costs as low as possible without jeopardizing road safety. Standardization will eliminate the risk of complex

construction methods and there with lower the risk profiles of the contractors. The Contractor shall design and build the works as per IRC standard or Korean standard or AASTHO standard.

5.3.1.2 Plan and Profile



5.3.1.3 Design Standard

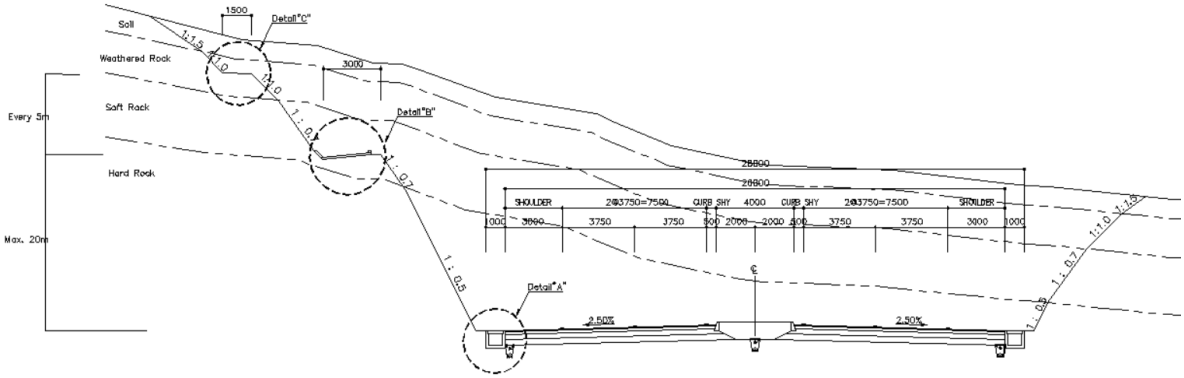
The standard of the Expressway is shown in the table below, a design should be made in consideration of the site condition.

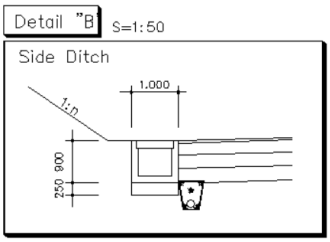
Table 5-2: Design Standard of Expressway components

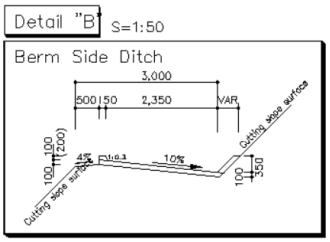
Station (STA.)		Length (Km)	Adopted Design Speed (Km/h)	Road width (m)	Remarks
From	To				
63+390	64+030	0.64	80	27.0	Main Road

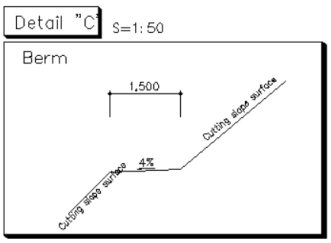
5.3.1.4 Typical Cross-section

-Main Road









5.3.1.5 Shoulders & Cross fall

Paved Shoulder: As per Asian Highway standards / Nepal road standard a Granular shoulder of 3.0 to 2.5m is recommended and a shoulder with asphalt concrete pavement of 2.5m for Mountainous / Steep Terrain shall be adopted on both sides.

Pavement Camber (Cross fall): Considering the surface (asphalt concrete) Camber has been proposed 2.5 % for the main carriageway as well as for the Paved shoulder.

5.3.1.6 Pavement

a. Design Standard

Flexible Pavement Design: Flexible Pavement Design shall be carried out in accordance with the Pavement Design Guideline, MOPIT, GON which is based on IRC 37 "Guidelines for the Design of Flexible Pavements" and AASHTO pavement design methods.

Rigid Pavement Design: IRC 58-2011 "Guidelines for the Design of Plain Jointed Rigid Pavements for Highways" is used for small road length. Continuous Reinforced Concrete Rigid Pavement shall be used for long rigid pavement.

b. Design Life

The design life of the pavement shall be taken as 20 years.

Base Year - 2021

c. Design Life for Base and Sub-Base

The base and sub-base courses of the new pavement shall be designed for the full design life i.e., the design year of 2046.

d. Design Life for Bituminous Surface

The life of the Bituminous Surface shall be designed for a maximum design period of 10 years and as necessary a bituminous overlay shall be carried out for the strengthening of the pavement life to its full life i.e. 20 years.

e. Finalize the Design of Pavement Structures

These projected loadings, modified, if necessary, together with field test results, pit, sampling, testing and DCP investigation will be combined to finalize a cost effective pavement design based on the preliminary pavement design. Design of sub-grade, sub-base, base and asphalt layers shall be done in homogenous sections taking into account changes in sub-surface conditions and pavement loading alterations.

The pavement shall be designed for a 10-year life, with provision for overlays during or at the end of the original life period to extend the life to 20 years. Care shall be taken to maximize the use of existing pavement layers; removal of existing pavement layers would only be considered in the case of strength deficiency.

Table 5-3: Design Life Standards

Design Parameter		Minimum Value
A	Road Pavement:	
	- Cement Concrete Pavement	+20 years
	- Asphalt Concrete Pavement	+10 years
B	Wearing Surface/Overlay	+10 years

5.3.1.7 Road Signs & Road Marking

Road signs shall be adopted according to Nepal Traffic Signs Manual and as per safety requirement Road markings are proposed for center and edge lines, merging and diverging of road using reflective hot thermoplastic paints.

5.3.1.8 Drainage

In order to manage the water on the roads, cross drainage structures and roadside ditches (RCC Closed) have been proposed for drainage. Discharge of the drains for the various sections shall be the nearest proposed culvert/bridge locations.

It is critical to ensure the proper removal of storm water from the road structure, to maintain integrity and ensure longevity.

1. Collect and control of water flows onto the road from cut and natural slopes above the road.
2. Proper control of runoff, so that erosion and scour are prevented. It is important that in the wider vicinity of the works there shall be no negative effects on the natural drainage system from construction the works.

Investigations by the hydrologist/drainage specialist, combined with the topographic survey and informed

by observations of performance of existing side drainage features, shall ensure appropriate design of the cross-sectional shape, lined type and the location requirement of the side drains as well as the need for and capacity of collector cross-drains, including input/output structures and entrance/exit aprons/chutes.

Once the detailed design has been finalized all details shall be incorporated in the detailed design drawings.

Roadside drainages are designed to manage storm water on road surface connecting nearest cross drainages. Similarly, cross drainage structures are designed to manage rainwater as per site condition and with reference to standard design.

5.3.2 Bridge Design Criteria

All permanent road bridges in Nepal shall be designed as per IRC loadings and relevant IRC Codes. All design shall be carried out in accordance with IRC standards for bridges unless otherwise specified in this document. In line with this, PSC Girder Bridge, Balanced cantilever, Extrados Cable stayed bridge are preferred one for Major Bridges and for Rigid Frame Bridge (for minor Bridge) PSC/ RCC types would be preferred type under Design and Build. No Steel Bridge is preferred.

5.3.2.1 Scope of Design

The Scope of Design Covers planning, Survey, Design, Construction and maintenance of the Bridge system mentioned in Bill of Quantities. The Scope of design shall be preferably equivalent or better than the Employer's Conceptual Engineering Design (CED). Within the Design criteria and preferred type of bridge the Contractor can opt suitable type of bridge and span arrangement which is subject to approval from the Engineer. The Detail Design at least should comply all criteria of IRC code; in absence or the topics that are not covered reference of AASTHO or Euro code would be acceptable. It is to comply the minimum configuration /survey, detail investigation of sub soil and hydrological conditions, loading, site specific Seismic design of bridge and testing, performance standard etc. Design life of bridgeworks and ancillary retaining walls, except for the sub-elements (Minor non-structure), shall be designed and detailed to ensure an operational design life of 100 years, without major repair requirements.

5.3.2.2 Design Criteria and Standard

The Employer Standard and Required / Compliance Specification document provides guidance and requirements for the design / construction of bridges and associated civil engineering work throughout the Expressway. It defines design principles and best practice to be applied to construction of the bridges in accordance with IRC loading. The design approach defined here embraces the IRC vision and reflects the project's commitment to secure design, construction and operation as per minimum requirement. The scope of design and construction work considered here encompasses the majority of civil engineering structures within the contract. The following codes provides the basic requirement to be meet with:

BRIDGE DESIGN CODES: The code shall be followed generally by IRC whenever IRC not available, the contractors should follow international codes (i.e. AASTHO, EURO codes etc.)

i. IRC: 5-2015 Standard Specification and Code of Practice for Road Bridges
ii. IRC: 6-2017 Standard Specification and Code of Practice for Road Bridges
iii. IRC: 112-2011 Code of Practice for Concrete Road Bridges
iv. IRC: 22-2015 Standard Specifications and Code of Practice for Road Bridges
v. IRC: 24-2010 Standard Specifications and Code of Practice for Road Bridges, Steel Road Bridges (Limit States Method).
vi. IRC: 78-2014 Standard Specifications and Code of Practice for Road Bridges
vii. IRC: 83-2015 Standard Specifications and Code of Practice for Road Bridges (Part – I)
IRC: 83-2018 Standard Specifications and Code of Practice for Road Bridges (Part – II)
viii. IRC: 83-2018 Standard Specifications and Code of Practice for Road Bridges (Part – III)
ix. IRC: 83-2014 Standard Specifications and Code of Practice for Road Bridges (Part – IV)
x. IRC: 45-1972 Recommendation for estimating the resistance of soil below the maximum scour level in the design of well foundation of bridges

xi. IRC: 87-2011 Guidelines for Formwork, False work and Temporary Structures
xii. IRC: 89-1997 Guidelines for Design and Construction of River Training & Control Works for Road Bridges
xiii. IRC: SP 33-1989 Guidelines on supplemental measures for design, detailing and durability of important bridge structures
xiv. IRC: SP 65-2018 Guidelines for Design and Construction of Segmental Bridges
xv. IRC: SP 66-2016 Guidelines for Design of Continuous Bridges
xvi. IRC: SP 67-2005 Guidelines for Use of External and Unbonded. Prestressing Tendons in Bridge Structures
xvii. IRC: SP 70-2016 Guidelines for Use of High-Performance Concrete in Bridges (Including Self Compacting Concrete in Bridges)
xviii. IRC: SP 71-2018 Guidelines for Design and Construction of Precast Pretensioned Girder for Bridges
xix. IRC: SP 23-1983 Vertical Curves for Highways
xx. IRC: SP 64-2016 Guidelines for analysis and design of cast in place voided slab structure
xxi. IRC: SP:114-2018 Guidelines for Seismic Design of Road Bridges
xxii. IRC: SP: 115-2018 Guidelines for Design of Integral Bridges
xxiii. IS: 2911-2010 Code of Practice for Design and Construction of Pile Foundations
xxiv. IS: 13920-2016 Ductile detailing of Reinforced Concrete Structures subjected Seismic Forces – Code of Practice
xxv. IS: 13920-2016 Ductile detailing of Reinforced Concrete Structures subjected Seismic Forces – Code of Practice

5.3.2.3 Design Life of Bridge Structures.

The minimum design life of the Project shall be as follows:

Table 5-4: Design life of Expressway components

Design Parameter		Minimum Value
A	Bridge	100 years
B	Bearings / Movement Joint	50 years
C	Drainage system	20 years
D	Road Pavement:	
	- Cement concrete pavement	20 years
	- Asphalt concrete pavement	10 years
E	Wearing surface/Overlay	10 years

5.3.2.4 Technical Requirement

It is to meet the Minimum Performance Standards and Specifications (MPSS), which is at least:
Establish and meet the minimum requirements that the Contractor must comply since from survey, geotechnical/ sub surface investigation, detail engineering design Construction and maintenance of the bridges upto the defect notifications period as specified in contract data. The attached conceptual drawings in route to Kathmandu Terai Fast Track (KTFT) is to refer for generic conceptual requirement.

Scope of Construction: The Contractor shall undertake the construction of the Project in accordance with the certified/approved DED by Employer. While doing so, it is the sole Contractor responsibility to complying with the Standard Specifications of Highway and Bridges of Nepal, it is to create certainty of the physical construction of the designed bridges as per General Requirements/MPSS up to the specified duration. The contractor is to meet minimum requirements which are the outcome of integrated effort since from detail Engineering Survey, geotechnical/ geological investigation, Preliminary and Detail design, clearances, environmental protection, aesthetics, economical, durable, constructible, maintainable for vehicular movement as well as for utility service passage too. It is to ensure Minimum requirements for traffic safety as referenced. Minimum requirements for drainage facilities and self- protecting measures against erosion, sliding water, ice, and water-borne salts (if any) in worst

possible cases or combination of cases that the structure subjects in its life span.

5.3.2.5 Survey and Investigation work

The Contractor shall carry out the following the detailed survey and investigations suitable for bridge under the MPSS requirement. This does not limit the necessary survey and investigation that warrants for the particular type of bridge.

Topographic survey

The Engineer shall provide reference basic topographic survey data/ thereof drawing which was carried out just in 2021. The Contractor shall carry out detail survey work to update and validate plan, profile and cross section @10m intervals cross section for at least up to 500 m upstream and 500 m downstream of the main crossing and auxiliary crossing as instructed by the Engineer. The acquired coordinates shall be converted into coordinates of Modified Universal Transverse Mercator (MUTM) projection system. These converted coordinates shall be used for the survey and mapping of road/ bridge alignment.

Geological & Geotechnical Investigation

The existing geological and geotechnical investigation report is provided as reference materials in the supplementary information chapter. However, the contractor shall conduct geological, geophysical and geotechnical investigation works as per IS, IRC and international standard codes and prepare and submit the report separately. It is the Contractor's responsibility to determine to undertake adequate investigations and studies to justify the proposed design and verify site conditions.

Bridge Geometry, Super Elevation, Radius of Curve and Bridge Ancillary Structure ie Approach Slab and return wall/wing wall

The Bridge Geometry including extra widening in curve bridge super elevation, skewness and radius of Curve shall satisfy the design speed of 120 km/ hr. In addition, it is to provide at least 6m length RCC approach slab on either side of bridge and sufficient length/height of RCC wing and return walls, Bio-engineering work on slopped portion including proper drainage management.

5.3.2.6 Requirements of Bridge Design

Structural design shall conform to a high level of technical competence and shall be based on proven methods, materials and technology. The structures shall be designed in accordance with accepted engineering practice, relevant codes and incorporate safety in design principles. The structures shall be designed collaboratively and integrate the various inputs of all involved disciplines including:

- Detailed topographic survey
- Geotechnical/Geological/ Geophysical investigations tailored to fit proposed type of bridge as per relevant IS code or AASHTO.
- Geotechnical investigation reports
- Geological/ Geotechnical and geophysical Investigations to match bridge design requirement for bridge located in nearby active fault zone/Seismic zone V
- Hydraulic survey and study reports, and
- Environmental protection works and bio engineering works.
- Slope protection (up to the Design and Built portion)
- Abutment and pier protection works
- Specifications
- Quantity estimate and Drawings

Plan of land acquisition

The Employer has already acquired land for 50m from center line to right and left side. The Contractor shall verify land acquisition and have to submit the plan of land acquisition in case of changing alignment or to build additional bridge/slope structure and its components. The design of slope's land acquisition by contractor should be less than Detail slope site condition. If the one is exceeded than Detail slope, the contractor must obtain the Client's approval in advance.

Hydrological Investigation

A comprehensive outline of hydrological investigations for collecting the necessary field data and hydrological analysis can be collected from Department of Hydrology and Meteorology (DHM), Nepal for 100 years return period using the flood frequency analysis.

Hydraulic Analysis

The Contractor shall perform hydrology, hydraulic survey for bridge and river training plan for high quality design.

Design Flood Frequency

A frequency of 1/100 years is adopted for bridges; For special bridges a frequency of 1/200 years is recommended

Hydraulic Analysis of the River is to clearly mark:

- design High Flood Level (HFL),
- hydraulic gradient,
- free board,
- side slopes,
- top width etc.

Hydraulic analysis shall be performed to compute the hydraulic parameters in the geometrical shape of cross section from survey data and design flood discharge.

Design HFL

- The design HFL obtained from gauge stage discharge curve.
- The design HFL so obtained should be verified on the basis of observed cross-sections, slopes and velocity of the river
- The design HFL also be obtained from flood frequency analysis for corresponding return period

Free board

- The top of the embankment fixed that no danger of overtopping,
- Unexpected rise in water level, sudden change in river course, aggradations or degradation of riverbed.

  $FB=0.1*Q^{0.3}+0.008v^2$

  Where,

  Q= Design discharge, m^3/s

  V= approach velocity, m/s

  FB= Free board, m
- Free Board adopted in design shall also comply Nepal Bridge Standard – 2067

Pier Abutment Protection:

Protection of abutment and piers are integral part of Design and Build part of the bridges and the contractor shall ensure the design of these protection works

5.3.2.7 Bridge Structure design:

For structural verifications, by means of a proper static cum dynamic model the following shall be verified for the all major structural elements according to IS code: ULS (Ultimate limit states) - Bending moments (interaction domain MN); - Shear load. SLS (Serviceability limit states) - deformations; - cracking. Structural and geotechnical verifications (STR/GEO) must be provided for the foundation of all structures.

Computer Calculations:

The Contractor shall use industry standard software for the modelling, analysis and drawing of the design. Calculations prepared with appropriate Computer Programs shall have the following information attached, without limitations: - name of the program and the version number; - description of the program with general assumptions and limitations; basis of calculation and a description of the calculation process with any approximations or simplification being used; - rules for notation; - details of input loads, their method of derivation and quantity and load combinations used.

The results from any computer calculations shall include the following information, without limitations - name of the structure and computer program with version number; - list of contents; - page number; - data input; - graphic representation of the calculation model Output data shall be provided under Engineer's request. Supplement calculations prepared with computer programs if necessary with checks done by manual calculation.

Detailed Design Drawings:

The Contractor shall prepare all detailed design drawings and submit to the Engineer for review and approval.

5.3.2.8 Materials

All materials, workmanship to be used in the project shall conform to the Nepal standard specifications for road and bridges works-2073, relevant IRC specification to the extent not covered by specification for road and bridges works-2073. Despite, the generic and minimum strength would be as following:

a) Concrete

Minimum cube strength of all concrete grades shall be as follows:

Table 5-5: Required strength of Concrete

Location	Minimum Grade for concrete (MPa)
Concrete for bored piles	40
Pile caps	40
Abutments	35
Piers	40
RC Slab	35
PC Beam Girder	40
PC Box Girder	50
Pylon/Tower	50
Barrier	35

b) Reinforcement Steel

All reinforcing steel bars shall be High Yield Strength Deformed type and Cold Twisted Deformed Bar/ Thermo Mechanically Treated, having specified minimum 0.2 per cent proof stress of 500 MPa conforming to IS:1786.

5.3.2.9 Requirement of Design reports and list of drawings:

The Design report shall include

1. Location plan/vicinity map
2. General Notes on Design Parameters and construction Procedures
3. General plan and elevation
4. Details of superstructure
5. Detail of bearing and Expansion joints
6. Details of piers and abutments
7. Details of foundations
8. Details of abutment and pier protection works
9. Detail of temporary structure such as: crane way, cofferdam etc.
10. Summary of quantities
11. Detail lighting facilities
12. Utility provision

5.3.2.10 Shoulders & Cross fall

Paved Shoulder: As per Asian Highway standards / Nepal road standard a Granular shoulder of 3.0 to 2.5m is recommended and a shoulder with asphalt concrete pavement of 2.5m for Mountainous / Steep Terrain shall be adopted on both sides.

Pavement Camber (Cross fall): Considering the surface (asphalt concrete) Camber has been proposed 2.5 % for the main carriageway as well as for the Paved shoulder.

5.3.2.11 Pavement

f. Design Standard

Flexible Pavement Design: Flexible Pavement Design shall be carried out in accordance with the Pavement Design Guideline, MOPIT, GON which is based on IRC 37 "Guidelines for the Design of Flexible Pavements" and AASHTO pavement design methods.

Rigid Pavement Design: IRC 58-2011 "Guidelines for the Design of Plain Jointed Rigid Pavements for Highways" is used for small road length. Continuous Reinforced Concrete Rigid Pavement shall be used for long rigid pavement.

g. Design Life

The design life of the pavement shall be taken as 20 years.

Base Year - 2021

h. Design Life for Base and Sub-Base

The base and sub-base courses of the new pavement shall be designed for the full design life i.e., the design year of 2046.

i. Design Life for Bituminous Surface

The life of the Bituminous Surface shall be designed for a maximum design period of 10 years and as necessary a bituminous overlay shall be carried out for the strengthening of the pavement life to its full life i.e. 20 years.

j. Finalize the Design of Pavement Structures

These projected loadings, modified, if necessary, together with field test results, pit, sampling, testing and

DCP investigation will be combined to finalize a cost effective pavement design based on the preliminary pavement design. Design of sub-grade, sub-base, base and asphalt layers shall be done in homogenous sections taking into account changes in sub-surface conditions and pavement loading alterations.

The pavement shall be designed for a 10-year life, with provision for overlays during or at the end of the original life period to extend the life to 20 years. Care shall be taken to maximize the use of existing pavement layers; removal of existing pavement layers would only be considered in the case of strength deficiency.

Table 5-6: Design Life Standards

Design Parameter		Minimum Value
A	Road Pavement:	
	- Cement Concrete Pavement	+20 years
	- Asphalt Concrete Pavement	+10 years
B	Wearing Surface/Overlay	+10 years

5.3.2.12 Road Signs & Road Marking

Road signs shall be adopted according to Nepal Traffic Signs Manual and as per safety requirement Road markings are proposed for center and edge lines, merging and diverging of road using reflective hot thermoplastic paints.

5.3.2.13 Drainage

In order to manage the water on the roads, cross drainage structures and roadside ditches (RCC Closed) have been proposed for drainage. Discharge of the drains for the various sections shall be the nearest proposed culvert/bridge locations.

It is critical to ensure the proper removal of storm water from the road structure, to maintain integrity and ensure longevity.

3. Collect and control of water flows onto the road from cut and natural slopes above the road.
4. Proper control of runoff, so that erosion and scour are prevented. It is important that in the wider vicinity of the works there shall be no negative effects on the natural drainage system from construction the works.

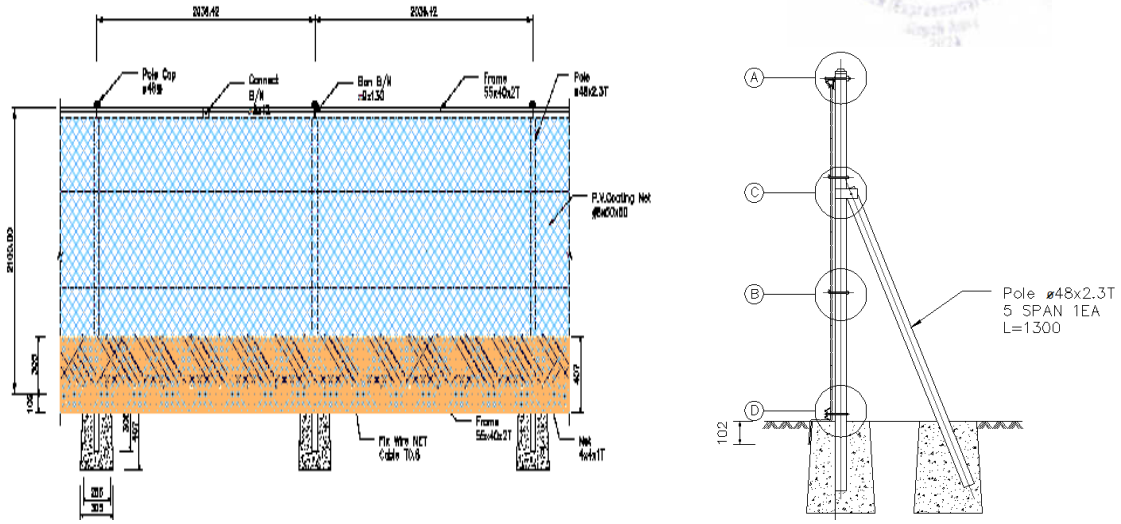
Investigations by the hydrologist/drainage specialist, combined with the topographic survey and informed by observations of performance of existing side drainage features, shall ensure appropriate design of the cross-sectional shape, lined type and the location requirement of the side drains as well as the need for and capacity of collector cross-drains, including input/output structures and entrance/exit aprons/chutes.

Once the detailed design has been finalized all details shall be incorporated in the detailed design drawings.

Roadside drainages are designed to manage storm water on road surface connecting nearest cross drainages. Similarly, cross drainage structures are designed to manage rainwater as per site condition and with reference to standard design.

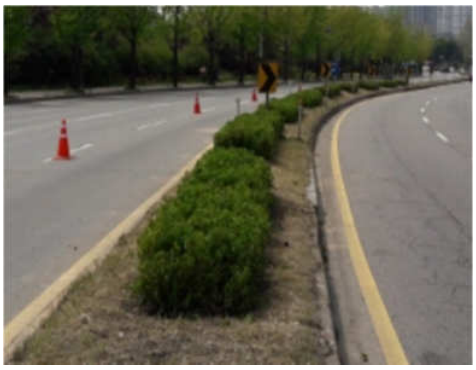
5.3.3 Fencing and Gate

It shall be planned to construct the expressway access control for people and animal with heavily galvanized netting mild steel wire with hexagonal mesh. The sample and section of fencing works are presented below.



5.3.4 Median Barrier

4 m wide central median barrier shall be designed with plantation expressway. The median shall have kerb guard at both sides and best aesthetic green plants having maximum height of 4m at center with good quality grass turf within kerb at top of median. The median shall have proper drainage system.



5.3.5 Design Criteria for Light and Electrical Utilities

The major objective of the road safety traffic engineering measures is to provide safe and efficient movement along the expressway including bridge sections. The road safety measures shall be provided for the convenient and comfortable driving and selection of safer speed as well as the carriageway. The road and traffic safety measures shall be matched with the major elements of the cross-section of roads and bridges and driver's perception.

The Design of expressway and bridges including the approach road-sections shall contain road safety measures including the traffic control devices as per the appropriate design standards, guidelines and best practices in the country as well as in the region. The application of these standard documents shall be of latest version. The Contractor shall incorporate the entire safety deficiencies pointed out by Engineer. The traffic management plan during the construction period and the proper operation plan shall be prepared as the part of the completion report. Proper illumination shall be designed and provided at the bridges and roads approaches. In conclusion, the safety and efficiency of traffic operations shall be taken as the prime concern for the entire stages of the project.

5.3.5.1 Bridge and Expressway

Supplying and laying of underground electrical cables 4" HDP pipe of 10 kg pressure by making inspection chamber at interval of 30 meter and in every bend in bridge and road section have to lay the cable on hot

dip galvanized GI perforated tray of suitable size.

The LT cables shall be PVC armoured cables with copper conductor, confirming to IS 1554 (part 1)1988 & IS7098 Part-II amended up to date of make CCI / universal / Polycot / uncial or equivalent as per universal standard specification.

The contractor shall be set up light & electrical utilities in Road and bridges.

5.3.5.2 Description

This works shall include the following:

- Supplying, construction and installation of the High Lighting System (HLS)
- Ancillary Works and Testing

The expressway (highway) light system consists of the specified electrical hardware, mast arm poles, and jointing in bridge components or at any other hard surface such Railings, concreting, erecting poles to lines and levels and curing the concrete and re-instatement of the surface to its original condition and disposal of excess spoil materials if any: on an all complete net basis.

The works shall include furnishing all materials, construction or installation of the above referred items, and all ancillary works and any other incidental necessary to complete the Works in conformity with the Drawings and these Specifications, or as directed by the Engineer.

This work shall also include the Design Review and Updating of the Expressway (highway) Lighting System (HLS) by the Contractor based on the Conceptual Design provided by the Employer. The report shall also include all detailed drawings, applicable technical specifications and requirements for construction and materials.

The Contractor shall be responsible for providing all design, fabrication, and installation details necessary to provide work and operations as intended under and required by the Drawings and Specifications.

When local regulatory bodies, have jurisdiction over installation, the following Nepalese standards shall be applied:

- Nepal Electricity Authority
- Nepal National Building Code NBC207: 2003 – Electrical Design Requirements
- The following basic requirements shall be satisfied for the Expressway (highway) Lighting System (non-solar system):
- Type of the Expressway (highway) Lighting is 120-Watt LED IP 65 light. Power of the lamp is 250W. Luminous flux of the road lighting shall be 28,000 lumen minimum, and shall be the product of Phillips Wipro, Nichia Japan or equivalent as approved by the Engineer
- The lighting poles shall be made from octagonal steel plate with the thickness of 3.2mm minimum and also protected by hot dip galvanize.
- Lamp Power: 120 Watt
- Reliability / MTBF: 5 years (product life cycle) / 50,000 Hrs
- Gear SGR (SON gear)
- Ingress Protection IP 65
- Housing material Aluminium
- Voltage/Hz 220V / 50 Hz

5.3.5.3 Design codes and standards adopted for electric pole, Cable and transformer layout

1. Electric pole placement is adopted at 30 m interval in both side with octagonal steel plate with 11m height
2. Transformer position is adopted at every 2 to 3 km interval
3. Underground cable layout in both side of expressway
4. Color coding, as per internationally accepted rule, shall be followed for phases (Red/Yellow/Blue), neutral (Black) and earth wire (Green) everywhere, even including inside the main panel board, distribution board, main switch.

5.3.6 Design Criteria Slope Protection works

The Slope Stabilization Work and Bridge approach Slope protection report and back filling/ cutting works adjacent to the bridge pier and abutment shall comply the following:

1. Design Criteria
2. Geological Condition
3. Standard gradients of Slope
4. Slope Stability Analysis
5. Proposed Slope Protection Method
6. Analysis of Slope Protection Section
7. Landslide Monitoring System
8. New technology method

5.3.6.1 Cut and fill section slope design criteria

i) Gradient for fill and cut slope

The final gradient of the fill and cut slope is to be maintained according to the existing slope. The slope gradient must be redesigned if there are no similarities between design parameters and actual field conditions. The standard slope gradient for different material types and the necessary height proposed for the KTFT fill and cut slopes are presented below.

Table 5-7: Slope gradient standard for fill slope

Material	Height to track formation (m)	Fill slope gradient standards *(vertical: horizontal)*	
		Standard *(DoR, 2003)*	Proposed
Fill Materials	H < 5.0m	1:1.5 ~ 1:2.0	1:1.5
	5.0m ≤ H < 10.0m	1:1.5 ~ 1:2.0	1:1.8
	10.0m ≤ H < 15.0m	1:1.5 ~ 1:2.0	1:2.0
	H ≥ 15.0m	1:1.5 ~ 1:2.0	1:2.3

For the construction of the embankment, the benching terrace should be 1.5 m wide in every 5 m height.

Table 5-8: Slope gradient standard for cut slope

Material	Berm height (m)	Cut slope gradient standards *(vertical: horizontal)*	
		Standard *(DoR, 2003)*	Proposed
Soil	5	1:0.8 ~ 1:1.5	1:1.5
Weathered rock	5	1:1.0 ~ 1:1.5	1:1.0

Material	Berm height (m)	Cut slope gradient standards *(vertical: horizontal)*	
		Standard *(DoR, 2003)*	**Proposed**
Soft rock	5	1:0.5 ~ 1:1.2	1:0.7
Hard rock	20	1:0.3 ~ 1:0.8	1:0.5

ii) Factor of safety

The factor of safety required for stable slope is reviewed and selected, comparing with the standards used internationally as it is not clearly mentioned in the Nepalese standard. For cutting sections the DPR applied Factor of Safety (FoS) 1.5 for the dry condition, 1.2 for the rainfall condition and 1.1 for the seismic condition. Similarly, for the filling area, FoS 1.5 for the dry condition, 1.3 for the rainy condition and 1.1 for the seismic condition to evaluate the slope stability. In the case of temporary slope for the short-term (construction period of less than 1 year), FoS of 1.1 for both the fill slope area and cut slope shall be considered. The groundwater level has used the result of seepage with rainfall record during 50 years. It is assumed that groundwater is the actual measurement or normal level during the earthquake as there are fewer chances of occurring the same. It is necessary to monitor the groundwater before and during construction and need to review the slope as per field condition. The minimum factor of safety required for the fill and the cut slope is presented below.

Table 5-9: Minimum factor of safety required for fill slope

Case		Groundwater Conditions	FoS
Permanent	Dry condition	No presence of groundwater in the embankment	1.5
	Rainfall condition	Determine the groundwater depth by comprehensively considering the site conditions and the most unfavourable conditions for stability that occur	1.3
	Seismic condition	Actual measurement or normal groundwater level	1.1
Temporary (< 1 year)		Actual measurement or normal groundwater level	1.1

Table 5-10: Minimum factor of safety required for cut slope

Case		Groundwater Conditions	FoS
Permanent	Dry condition	No presence of groundwater	1.5
	Rainfall condition	• Rock slope: The half depth of saturated groundwater within the tension crack or half depth of the slope saturated with groundwater along the active plane. • Soil slope: Determine the groundwater depth by comprehensively considering the site conditions, or performance of a seepage analysis considering the rainfall intensity & duration of the target basin, etc.	1.2
	Seismic condition	Actual measurement or normal groundwater level	1.1
Temporary (< 1 year)		Actual measurement or normal groundwater level	1.1

5.3.7 Design Criteria for River Training Works

5.3.7.1 Hydraulic Analysis

Hydraulic Analysis of the River for determination of hydraulic Parameters

- High flood level of design return period
- River morphology, bed forms and channel geometry
- River behavior and river channel pattern
- Sediment load and instability of rivers

Hydraulic analysis shall be performed to compute the hydraulic parameters in the geometrical shape of cross section from survey data and design flood discharge to choose the type of protection work.

5.3.7.2 Design HFL

- Provided after contract awarded from design report for reference. Contractor shall responsible for the analyzing the HFL

5.3.7.3 Free board

- Provided after contract awarded from design report for reference. Contractor shall responsible for the analyzing the free board

5.3.7.4 Design of Slope Pitching

- Design flood for pitching/revetment for 100 years return period using the flood frequency analysis.
- For special cases, where damage potential justifies, observed flood may also be considered for fixing the crest level.
- The design HFL should be obtained from gauge discharge relationship /hydraulic computational techniques
- Stable riprap rock size is desired

5.3.7.5 Size of Stone

- Isbash equation,

$$D = \frac{V^2}{2gC^2(s-1)}$$

Where,

V = Water velocity approaching the riprap (m/s)

C = Isbash constant. C=0.86 for highly turbulent conditions or C=1.2 for low turbulence

D = Median diameter of spherical stone or rock. Also known as D50 (m)

g = Acceleration due to gravity, 9.81 m/s^2

S = Specific gravity of stone or rock

5.3.7.6 Weight of Stone

- Stabilizing forces for hydrodynamic drag and lift forces.

The weight of stones on slopes (W in kg) may be worked using the formula given below

$$W = 0.02323 * S_s * V^6 / K * (Ss-1)^3 \text{ in kg}$$

Where,

K (correction factor for slope) =$[1-Sin2\theta/Sin2\Phi\ ]^{1/2}$

Ss=specific gravity of boulders (may be adopted as 2.65)

Φ = Angle of repose of material of protection works (adopted as 300 for boulders)

θ= Angle of sloping bank 2 (H) :1 (V) (Normally 26.560 for Boulders)

V= Velocity in m/s

5.3.7.7 Launching Apron Design

- Width of the launching apron depends upon the scour depth below HFL.
- Depth of scour below HFL (D) may be worked out using the following formula:

$D = 0.473\ (Q/f)^{1/3}$

Where,

Q = design discharge in cumecs

f = silt factor.

Silt factor (f) may be calculated using the following formula

$f= 1.76\ (d)^{1/2}$

Maximum scour depth (D_{max}) below HFL= 1.5* Scour depth (D below HFL).

Maximum Scour depth (D_{max}) below LWL = (D_{max}) below HFL – (HFL-LWL)

Width of launching apron= projection of expected stable slope up to the scour level, 1.5 to 3 * (D_{max}) below LWL

Thickness of launching apron (T) = 1.5* thickness of pitching (t).

5.3.7.8 Factor of Safety

$FS = \Sigma S/\Sigma V$

$\Sigma C + (N-U)\ tan\boldsymbol{\Phi}/\Sigma W\ sin\alpha$

Where,

FS = Factor of safety

S = Resisting or stabilizing Force

T = Driving or actuating force

C = C1x (b/ Cos α)

N = Force normal to the arc or slice

U = Pore water pressure.

α = Angle of shearing resistance

W = Weight of the slice

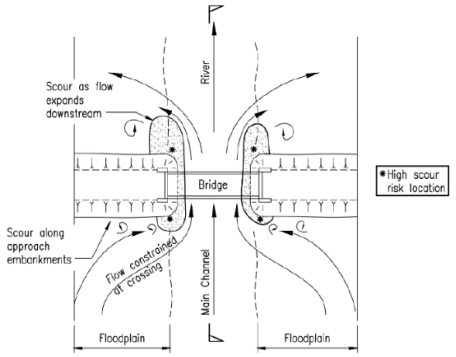
A = Angle made by the radius of the failure surface with the vertical at the center of slice.

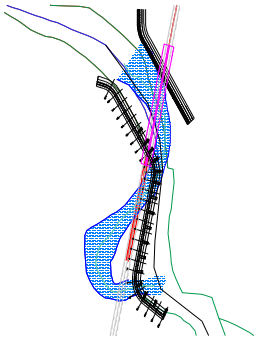
C1 = Unit cohesion, and b = Width of the slice

5.3.7.9 Bridge Scour Protection

Contraction Scour

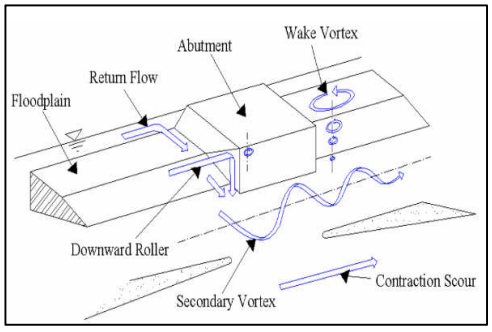
- caused by a constriction of flow in the floodplain
- increases erosive forces >> more material removed from bed and banks
- velocity and shear stress decrease until equilibrium is reached

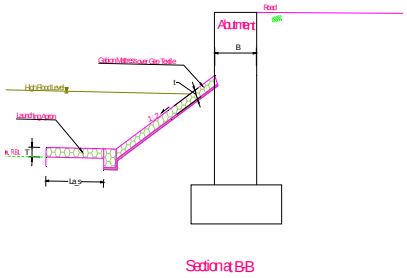




Bridge Abutment Scour

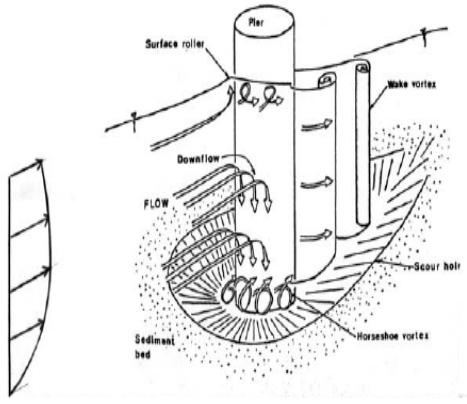
- Determining the magnitude of scour is complicated by the cyclic nature
- Scour can be deepest near the peak of a flood
- Designed (guide bank, revetment wall, spur and launching apron) for at least 2.5 times the adopted linear waterway in upstream and 1.25 times the linear waterway in downstream.





Bridge Pier Scour

- Scour can be deepest near the peak of a flood



5.3.8 Design Criteria for Bio engineering Works

5.3.8.1 Scope

Local species of vegetation are adopted for plantation on slopes as and where required.

Some major species are listed for bioengineering purposes;

broom grass (Thysanolaena maxima), Napier grass (Pennisetum purpureum), vetiver grass (Vetiver zinzaniodes), durva grass (Cynodon dactylon), turf grass (such as, Festuca arundinacea, Poa pratensis), kans grass (Saccharum spontaneum), different types of bamboo, giant cane (Arundo donax), Malabar nut (Adhatoda vasica), male fern (Dryopteris filixmas), artemesia (Artemisia spp.), weeping willow (Salix babylonica), mulberry (Morus alba), five-leaved chaste tree (Vitex negundo), ghogar tree (Garuga pinnata), coral tree (Erythrina variegata), tiger's milk spruce (Sapium insigne), and eastern cottonwood (Populus deltoides).

5.3.8.2 Details of Bio Engineering Techniques

Construction details of bio engineering systems are presented in tabular form below:

A. Comparison table for grass planting systems

Configuration	Description/ critical slope	Normal spacing's	Main advantages	Main limitations
Grass lines: Contour/ Horizontal	Planting of grass slips (or springs) in geometric lines across the slope or along the contour Slopes ≤ 65°	Plants at 100 mm centers within rows Row spacing's: Slope < 30°: 1000 mm; Slope 30-45°: 500 mm; Slope > 45°: 250 mm;	Traps material moving downslope Retards runoff on highly impermeable materials	Can increase the infiltration rate to the point of liquefaction on porous materials
Grass lines: downslope/ vertical	Planting of grass slips (or sprigs) in geometric lines down the slope or towards drainage lines. Slopes ≤ 65°	Plants at 100 mm centers within rows Rows spaced at 500 mm centers.	Maximizes while protecting against erosion. Minimizes infiltration	On very impermeable materials, runoff can become damaging Grass plants can suffer from drought.
Grass lines: diagonal	Planting of grass slips (or sprigs) geometric lines diagonally across the slope, usually at 45° to the contour. Slopes ≤ 65°	Plants at 100 mm centers within rows Rows spaced at 500 mm centers.	Appears to combine the best features of both horizontal and vertical planting in the majority of sites.	Where the specific advantages of horizontal and vertical planting patterns are critical, diagonal planting should not be used.
	Grass seeds are spread evenly over the surface, and are usually covered with mulch. Slopes≤ 50°	Most species require a seeding rate of 25 grams/m^2. Mulch, if applied, should be at a rate of 0.05 m^3 mulch/m^2.	Can be used to create an even cover overall surfaces.	None of the structural advantages of grass slip planting. Plants take longer to develop from seeds than from slips
Turfing	Turf cut from elsewhere is placed on the surface and pegged if necessary. Slopes ≤ 35°	Requires equal area of turf cut for the surface to be treated. Pegging should be at 250 mm	Complete instant surface cover.	Relatively costly. Creates equal bare areas at the source of the turf. There is a discontinuity

Configuration	Description/ critical slope	Normal spacing's	Main advantages	Main limitations
		centers on slopes > 15°.		between the turf and the under-lying material
Recommended species	Amliso Babiyo Dubo Dhonde Kans Katara khar Khar Khus Narkat Padang bans Phurke Sito Tite nigalo bans	Thysanolaena maxima Eulaliopsis binate Cynodon dactylon Neyraudia reynaudiana Saccharum spontaneum Themeda species Cybopogon microtheca Vetiver zizanoides Arundo clonax Himalayacamus hookeranus Arunduella nepalensis Neyraudia arundinacea Drepanostachyum intermedium		Terai - 2000 m Terai - 1800 m Terai - 1500 m Terai - 1500 m Terai - 2000 m Terai - 2000 m Terai - 2000 m Terai - 1500 m Terai - 1500 m 1500 - 2500 m 700 - 2000 m Terai - 1500 m 1000 - 2500 m

B. Larger plant system

Configuration	Description/ Critical slope	Normal spacing's	Main advantages	Main limitations
Shrub and tree planting	Seedings of shrubs or trees are planted on a geometric pattern. Slope ≤ 35° 35-45° with care	Plants spaced at 1000 mm centers in off-set rows. Rows 1000 mm apart	Establishes a plantation of larger plants effectively. These contribute to the reinforcement and anchoring of the slope.	Seedings take about 5 years to contribute significantly to slope strengthening. Care protection required in first three years.
Recommended species	Areri Bhujetro Dhanycro Dhusun Kanda phul Keraukose Tilka Bakeno Chilaune Gobre salla Kalo siris Khanyu (Khosro) Khayer Lankuri Painyu Rani (Khote) salla Rato siris Seto siris Sisau Utis	Acacia pennata Butea minor Woodfordia fruticose Colebrookea oppositifolia Lantana camara Indigofera atroturpurea Wendlandia puberula Melia azedarach Pinus wallichii Albizia lebbeck Ficus semicordata Acacia catechu Fraxinus floribunda Prunus cerasoides Pinus roxburghii Albizia julibrissin Albizia Procera Dalbergia sissoo Alnus nepalensis	500 - 1500 m 500 - 1500 m Terai - 1500 m Terai - 1000 m Terai - 1750 m Terai - 2000 m Terai - 1500 m Terai-1800 m 900 - 2000 m 1800 - 3000 m Terai - 1200 m Terai - 2000 m Terai - 1000 m 1200 - 2700 m 500 - 2400 m 500 - 1950 m 800 - 3000 m Terai - 1350 m Terai - 1400 m 900 - 2700 m	Shrubs Trees
Shrub and tree seeding	Direct sowing of shrub and tree seeds on any slopes. Direct	Direct sow at 50 to 100 mm centers, as conditions dictate. Broadcasting rate depends on seed	Establishes a cover of larger plants on any slope, however rocky. These provide	Plants take about 5 years to contribute significantly to slope strengthening.

Configuration	Description/ Critical slope	Normal spacing's	Main advantages	Main limitations
	seeding: slopes 35-80° Broadcasting: Slopes ≤ 50°	weight: (e.g. utis @ 1 g/m^2).	good reinforcement and anchorage.	Protection required in early years.
	Large clumping bamboos (bans) are planted, usually near the base of a slope. Slopes ≤35°	Individual plants spaced at 2000-3000 mm intervals in a single row or in off-set rows. Rows 200 mm apart	Establishes a very strong line of plants which provide the best reinforcement, trapping and support at the 2base of a slope.	Bamboos take about 5 years to contribute significantly to slope strengthening. Protection required in early years. Not in hot, dry sites.
Recommended Species	Choya/tama bans Dhanu bans Mal bans Nibha/ghopi/lyas bans Tharu bans	Dendrocalamus hamiltonii Bambusa balcooa Dendrocalamus hookeri Bambusa nutans Ampelocalamus patallaris Bambusa nutans	300 - 2000 m Terai - 1600 m 1200 - 2500 m Terai - 1500 m 1200 - 2000 m Terai - 1500 m	

C. Vegetation structures

Configuration	Description/ Critical slope	Normal Spacing's	Main advantages	Main Limitations
Bush layering	Lines of woody cuttings laid in trenches. The tops protrude above the surface. Slopes ≤ 45°	Cuttings laid in double rows at 50 mm centers (i.e. 40 cuttings/ running m). Layers Spacing's: slope < 30°: 4000 mm; slope 30-45°: 2000 mm.	A very strong and low-cost barrier to trap material and reinforce useful on debris slopes, however loose.	Construction gives rise to a considerable level of disturbance to the slope.
Palisades	Lines of woody cuttings inserted in the ground. The tops protrude above slopes ≤ 60°	Cuttings Planted in double rows at 50 mm centers (40 cuttings/ running m). Row spacing's: slope < 30°: 4000 mm; Slope 30-45°: 2000 mm	Provides a strong and low cost barrier to trap material and reinforce the soil, with minimum disturbance to the slope.	Not as strong as brush layering.
Line check dams	Flexible check dams made from a variety of woody cuttings Gully slopes≤ 45°	Spacing depends on gully conditions but they should normally be at 3000 to 5000 mm centers.	Affective low cost structure to reduce erosion in smaller gullies. Can also be used in between masonry check dams.	Large and very active gullies require stronger measures than can be provided by vegetation alone.

Configuration	Description/ Critical slope	Normal Spacing's	Main advantages	Main Limitations
Fascines construction	Bundles of live woody cuttings are laid in trenches just below the surface. Slopes ≤ 45°	Cuttings planted @ 4 or 8 cuttings/running meter). Fascine spacings: Slopes< 30°: 4000 mm; Slope 30-45°: 2000 mm	A very strong and low cost barrier to trap material and reinforce on a wide variety of sites.	Fascines do not form a barrier Immediately like brush layers Construction gives rise to disturbance to the slope.

Recommended Species

Assuro	Adhatoda vasica	Terai - 1000 m
Bainsh	Salix tetrasperma	Terai - 2700 m
Kanda phul	Lantana camara	Terai - 1750 m
Namdi phul	Colquhounia coccinea	1000 - 2000 m
Saruwa/bihaya	Ipomoea fistulosa	Terai - 1500 m
Simali	Vitex negundao	Terai - 1750 m
Dabdabe	Garuga Pinnata	Terai - 1300 m
Phaledo	Erythrina Species	900 - 3000 m

D. Small scale physical measures

Configuration	Description/ critical slope	Normal spacing's	Main advantages	Main limitations
Wire bolster cylinders	A 300 mm diameter gabion tube laid in a trench, with the top flush with the surface Slopes ≤ 50°	Spacing depends on site condition. Normal spacing's: Slopes<35°: 4000 m Slopes35-50°: 2000 m	The strongest and longest-lasting method of reinforcing a slope surface and preventing gully development.	Relatively expensive in comparison within comparison with bio-engineering measures such as brush layers.
Jute netting	A temporary surface cover to aid grass establishment on very steep slopes Slopes ≥ 50°	Complete cover of standard netting with 40×40 mm mesh of 5 to 8 mm yarn. Anchoring pegs at 5200 to 1000 mm centers.	A very effective aid to the establishment of a permanent grass cover on hard, dry materials on steep cut slopes.	As it forms a mulch, it raises the moisture content of the soil: if the material has poor internal drainage, this can lead to liquefaction.

5.4 Reference Specification and Codes for Design

5.4.1 Bridge Design Standard

The Employer Standard and Required/Compliance Specification document provides guidance and requirements for the design /construction of bridges and associated civil engineering throughout the Expressway. It defines design principles and best practice to be applied to construction of the bridges in accordance with IRC loading. The design approach defined here embraces the IRC vision and reflects the project's commitment to secure design, construction and operation as per minimum requirement. The scope of design and construction work considered here encompasses the majority of civil engineering structures within the contract. It is to meet at least Bridge design standard mentioned in Heading 5.2.2

The bridges shall be designed as per IRC loadings. The Load combination shall be based on IRC: 06 latest editions. The preferred type of Bridge is PSC Box Girder (FCM of construction), Extradosed, Cable Stayed Bridge, PSC Girder Bridge for Major Bridge and no Steel Bridge is permitted. The preferred type of foundation is bored cast in situ/driven pile foundation and no open foundation shall be permitted.

However, the Engineer in rare cased can accept open foundation for abutment with strong foundation strata is meet sufficiently at shallow depth.

i. All the bridges are located in seismic terrain of V category. The method of analysis shall be Elastic Seismic Acceleration method, Elastic Response Spectrum Method, Elastic Response Spectrum Method and Time history method or Elastic Response Spectrum and Time History Method with site specific studies based on IRC: SP-114-2018.
ii. The span arrangement and pile cross section are conceptual only. The limited geotechnical and geological information to the available extend for each bridge is attached as separate report for reference. The contractor is to carryout confirmatory survey and site investigation report to substantiate the detail design as per employer's requirement. i.e. 5-4 Requirement of Bridge Design.
iii. The bridge superstructure carriageway may > 11.80m to match with highway geometric; super elevation requirement parameters etc. but 11.80m is the minimum required superstructure width including safety barrier. The deck is to overlay by 75mm thick asphalt concrete.
iv. The pier and abutment protection is to propose by the contractor based on site specific hydrological characteristics but river channeling; river protection etc. are separate item of work and is allocated in item rate basis.
v. The utilities facilities optical fiber, bridge lighting, marking; approach RCC slab, RCC return wing wall and back filling, slope work for the additional 10m on either side is the responsibilities of the Design and Build Contractor.
vi. The proposed length is the minimum required length. No reduction in length is permitted unless and until unavoidable site condition has arisen and got approved by the Engineer. Despite if it is to increase the bridge length, no cost variation shall be applicable thereof.
vii. The design shall be based upon a useful economic life of 100 years for all elements structural facilities assuming the employer will perform normal routine maintenance.

5.4.2 Slope Protection Design Standard

Specification for the slope stabilization is as per standard Specification of Road and Bridge Works, Department of Roads, Nepal 2073 (with amendment 2075) under section 2400, sub section with additional sub section new clauses 2417 and also the soil nails or rock bolts shall comply with the DIN 4125 standards and bar tendons shall be DYWIDAG Y 1050H Prestressing Steel or approved equivalent type with yield strength of at least 950 MPa and tensile strength of at least 1050 MPa. Section 2400 River Training and Protection works "Ground Anchors, Soil Nails, Rock Bolts and Rock Dowels"; 2418 "Pull out Testing of Test Anchors" 2419 "Micro Pile"; 2420 "Horizontal Drains"; 2421 "HDP Drainages Pipes" and the "Rock Nets" for the slope protection works as follow:

Soil Nailing

- Standard Specification for Road and Bridge Works, DoR, 2073 (with amendment 2075) under section 300, sub section 302
- FHWA-NHI-14-007 Soil Nail Walls Reference Manual

Anchor (PC Strand Type)

This specification applies to the manufacture and construction of permanent anchors. The anchor (PC Strand Type) shall conform to the latest editions of the following Standards or, where not covered by these Standards, to their equivalent International Standards, subject to the approval by Client (Geotechnical Engineer/Geologist).

- IS: 1786 Specifications for high strength deformed-steel bars and wires for concrete reinforcement
- IS: 2062 Steel for general structural purposes
- IS: 10270 Guidelines for design and construction of pre-stressed rock anchors
- IS: 11309 Method of conducting pull out test on anchor bars and rock bolts
- ASTM D4435 Standard Test Method for Rock Bolt Anchor Pull Test

- IS: 13219 Rock bolts for mines (cement grouted) - general requirements
- KS D 7002 SWPC 7B

Rock Bolts:
The rock bolts/rock anchor shall conform to the latest editions of the following Standards or, where not covered by these Standards, to their equivalent International Standards, subject to the approval by Client (Geotechnical Engineer/Geologist).

- Standard Specification for Road and Bridge Works, DoR, 2073 (with amendment 2075) under section 2400, sub section 2413
- IS: 1786 Specifications for high strength deformed-steel bars and wires for concrete reinforcement
- IS: 2062 Steel for general structural purposes
- IS: 10270 Guidelines for design and construction of pre-stressed rock anchors
- IS: 11309 Method of conducting pull out test on anchor bars and rock bolts
- ASTM D4435 Standard Test Method for Rock Bolt Anchor Pull Test
- IS: 13219 Rock bolts for mines (cement grouted) - general requirements

Ground Anchor
The following Standards or, where not covered by these Standards, to their equivalent International Standards, subject to the approval by Client with quality conformations.

- IS: 10270 Guidelines for design and construction of pre-stressed rock anchors
- DIN 4125 Ground anchorages; design, construction and testing

5.4.3 Reference Codes and Specification for River Training Design

The following codes shall be used as references to be consulted for more specialized aspects of design not covered in the ruling design code:

1. Flood Control and Management Manual, WECS (2019), Singhadurbar, Kathmandu
2. IS Code 8404 (1994), Planning and design of groynes in alluvial river - Guidelines [WRD 22: River Training and Diversion Works]
3. Handbook for Flood Protection, anti-erosion and river training works, CWC (2012) New Delhi
4. EM 1110-2-1418, CHANNEL STABILITY ASSESSMENT FOR FLOOD CONTROL PROJECTS, U.S. Army Corps of Engineers
5. Nepal Bridge Standards 2067, DOR, Kathmandu
6. IRC 5-2015, Standard Specification and code of practices for Road Bridges, Section I, General Feature and Design
7. IRC 5-2014, Standard Specification and code of practices for Road Bridges, Section VII, Foundations and Sub Structures

5.4.4 Electrical Design and Installation

5.4.4.1 Standards and codes

The reference code for electrical works is presented in table below:

Table 5-11: Reference code for electrical works

Description of works	Code reference
Low Voltage Molded Case Circuit Breaker	IS 2516-1977
Transformer installation	IS 2026-1962
Earthing works	IS 3043-1966

Description of works	Code reference
Wiring installation	IS 732-1963
PVC Cable	IS 1554-1964
Three pin plugs and socket outlets	IS 1293 - 1967
PVC insulated (Heavy Duty) electric cables for working voltages up to and including 1100 volts (revised).	IS 1554 - 1976 (Part - I)
Air break switches and fuse combination units for voltage not exceeding 1000 V	IS 4064 - 1978
Polythene insulated and PVC sheathed cable	IS 1596 - 1977
Conductors for insulated electric cables and flexible cords	IS 8130 - 1984
General and safety requirements for electric light fittings	IS 1913 - 1978
Flood lights	IS 1947 - 1980
Rigid non-metallic conduits for electrical installation	IS 9537 - 1983
Switches for domestic and similar purposes.	IS 3854 - 1966
Switch socket outlets	IS 4615 - 1968
Guide for electrical layout in residential buildings	IS 4648 - 1968
switches for domestic and similar purposes	IS 4949 - 1968
Decorative lighting outlet	IS 5077 - 1968
Selection of switches (voltage not exceeding 1000 volts).	IS 10118 - 1982
Wiring Installation	IS 732 - 1963
Distribution Board	IS 2675 - 1966
HDPE Pipes	NS 40
Distribution Transformer	IS 2675 - 1977
Bush bar	IS 375
PVC Insulated cables for working voltages up to and including 1100 V	IS 694
Code of Practice for installation and maintenance of Power Cables up to and including 11 KV rating (Second Revision)	IS 1255
Bayonet lamp holders (Third revision)	IS 1258
Code of practice for fire safety of buildings (general): Electrical installations.	IS 1646
Glossary of items for electrical cables and conductors	IS 1885
High voltage test techniques: Part 1 General definitions and test requirements	IS 2071
Protection of building and allied structures against lightning Danger notice plates.	IS 2309 IS 2551
AC Metal enclosed switch gear and control gear for rated voltages above 1 KV and up to and including 11 KV.	IS 3427
Flexible steel conduits for electrical wiring.	IS 3480
Accessories for rigid steel conduit for electrical wiring.	IS 3837
Application guide for voltage transformers	IS 4146
Boxes for the enclosure of electrical accessories.	IS 5133 (Part -I)

Description of works	Code reference
Recommendations on Safety Procedures and Practices in Electrical Work - Part I: General	IS 5216 (Part-I)
Brass glands for PVC cables	IS 12943
Marking and arrangement of bus bars	IS 5578 & 11353
Cross linked polyethylene insulated PVC sheathed cables. For working voltages from 3.3 KV up to and including 33 KV Factory built assemblies of switchgear and control gear for voltages up to and including 1000 V AC and 1200 V D C.	IS 7098 - (Part - II) IS 8623 - (Part -I)
Bus Bar trunking system	IS 8623 - (Part -II)
Miniature Circuit Breakers	IS 8828
Methods of test for cables.	IS 10810
Earth Leakage Circuit Breakers	IS 12640
Air Circuit Breakers	IS 13947- (Part- I)
Molded Case Circuit Breakers	IS 13947 (Part-II)
Degree of protection provided by enclosures for LV switchgear and control gear.	IS 13947
General requirement for switchgear and control gear for voltage not exceeding 1000 Volts.	IS 13947
Stationary cells and batteries lead acid type.	IS 1651 & 1652

6 Tests during construction stage and/or Completion and Governing Codes/References

All the tests specified in the Employer's Requirements to be conducted during construction stage and/or completion shall comply with Standard Specification for Road and Bridge (SSFRB) Works, DoR, 2073 (with amendment 2075). The test conducted during design and construction phase are solely responsibility of the contractor. The relevant tests not covered by aforesaid SSFRB, the IRC/AASHTO standard test specification shall prevail in order.

6.1 Reference manual for the tests of slope protection works

1. ASTM D4435 or method of conducting pull out test on anchor bars and rock bolts according to IS 11309
2. IS 12269- 2013: Specification for ordinary and low heat Portland cement

6.2 Testing of Optical fiber works

Testing of laid duct shall be carried out as per the DIT (Duct integrity test) procedure to blowing of optical fiber cable. Section wise test shall be done with foam mandrill prior to blowing of optical fiber cable. However, in case any defect is found, the duct-laying contractor shall be responsible for removing of the defect at the earliest. Testing of the complete section (between two stations) to the satisfaction of the Engineer as per test schedule submitted by the Contractor according to his work schedule. Testing and Handover of the network along with test report and as-built documentation.

7 Tests after Completion and Governing Codes/References

All the tests after completion if applicable shall comply Standard Specification for Road and Bridge Works, DoR, 2073, (with amendment 2075) and it should have better than the Nepal Standard to suit the relevant codes i.e. IS., AASHTO, The British code as per priority order.

8 Warranties

The warranties for the goods/materials/item of works shall be as per the specifications and the catalog of the goods/materials supplied by the Manufacturer, if applicable.

The works designed by the Contractor shall be fit for the Purposes specified in the Employer's Requirement. The Contractor shall affect and maintain insurance policy for the breach of professional duty including the liability against the fit for purposes.

9 Drawings

The Tender/Bid Drawings for Expressway Road, Slope Protection, River Training Works etc. and the Reference/indicative Drawings for the Bridge, Slope Protection are provided in separately bound volume.

10 Technical Specifications

10.1 General Specification

The General Specification shall be the followings:

a. Standard Specification for Road and Bridge Works, DoR, 2073 (with amendment 2075), Ministry of Physical Planning and Works, Department of Roads, Government of Nepal.

b. Specifications of Building Construction (Civil) Works issued under the authority of Government of Nepal, Department of Urban Development and Building Construction.

10.2 Particular Specifications

10.2.1 Specification for Optical Fiber

Technical Specification of Laying of Optical Fiber

Optical Fiber cable -96F Armoured type Ribbon Fiber shall be used as per Nepal Telecom Standard.

Overall Scope of Work:

The following works shall be carried out:

- Survey and Design
- Installation, Testing and Handover of Underground Optical Fiber Network
- The Contractor shall carry out, survey, site layout, installation and testing for the construction, acceptance testing.
- Facilitating access to all locations in performing all the works as and when required
- Necessary right of way permissions from relevant authorities like road department, Municipality, Bridge division, local authorities, Nepal telecom etc. for trenching and construction works with close coordination and instruction of the Engineer.

The Contractor shall submit the Quality Assurance Plan (QAP). The Quality Assurance Plan should clearly set out working procedures, equipment, materials, workmanship, tests requirements, testing frequency the Contractor will adopt in carrying out the works so that the material and works are in compliance to the requirements of contract and as per the Technical Specifications.

PLHDPE Duct

The contractor shall be responsible for laying of 2 Way ducts in the trenches, cleaning, testing and jointing of laid ducts, carry out the integrity test of laid ducts and placement of manholes. The contractor shall physically inspect each and every material such as PLHDPE duct and accessories, jointing kit etc.

Trench

The trench excavation shall be carried out by the contractor on the prescribed route as per the Conceptual Detailed Project Report of Kathmandu-Terai-Fast-Track (Expressway) Road project.

The minimum depth at which the duct is to be laid through trenching is as follows:

Ordinary Soft/Silty Soil	1.3 meter
Boulder mixed soil	1.0 meter
Soft Rock	1.0 meter
Hard Rock	0.7 meter
Mixed soil of different strata	1.3 meter

Bridges/Culverts, Drain, pipelines, Highway crossing, Densely Built- up area etc. shall be carry out through the mechanized/ mechanical/ augur boring/ moiling/ tunneling/ trench-less technology, unless & until it is not technically possible. The duct shall be constructed accordingly with the international standard and requirements as specified in best code of practices.

10.2.2 Specifications for Electrical works

Power Supply System Application

This Chapter describes the provision to be made for the supply and distribution of electrical power for the electrical equipment and services installed to provide safe conditions for the full range of operational requirements, including emergencies. Requirements for earthling and circuit breakers are important in reducing the risk of electrical fire.

Power is normally received at high voltage 11kV from the NEA 11 kV power supply and it is transformed down to 400 volts for final distribution to plant and equipment throughout the road lighting systems, via allow voltage main switchboard, which contains control and protection equipment for the numerous circuits. An emergency generator facility, DC power supply, and uninterruptible power supply are also included to secure safe operation of electrical facilities during times of NEA power outages.

Incoming supplies and key items of equipment such as transformers and main distribution cables are frequently duplicated, and appropriately sized so that if one is out of service, either because of a fault or for maintenance, service can be maintained via the other for as long as necessary. To maintain supplies to essential equipment in the event of failure of the incoming supplies, standby power shall be provided. This may take the form of uninterruptible power supply (UPS) equipment, which uses battery power to maintain supplies without a break to connected equipment for a limited period of time, and diesel powered standby generators which will start automatically when a mains failure is detected and run for as long as fuel is available or until mains power is restored. In the latter case, a limited amount of UPS provision is needed to cover the short period required for the standby generator to start and run up to speed, and also for the possibility of a failure to start. A stand-by generator will be necessary such as where there are essential loads, such as pumping, which exceed the practical capacity of the UPS.

The main equipment comprises 11kV and 400V switchgear, transformers, distribution boards, luminaires and associated equipment supported by stand-by supplies.

Facility Structure

The power distribution equipment comprises the following facilities:

- Substation Building at service area, electrical room facilities (including DC power supply uninterruptible power supply), generator room
- Substation Building stand-by generator room (including underground fuel tank)

Applicable Standards

These facilities abide by the laws and standards below:

- Electricity Business Act
- International Electro Technical Commission (IEC)
- Institute of Electrical and Electronics Engineers (IEEE)
- Illuminating Engineering Society (IES)
- Emergency Generator Facility Earthquake Resistance Design Guidelines (NEGA)

These facilities must be manufactured, installed, tested, and commissioned under a quality guarantee and quality management system meeting ISO 9001 standards. The manufacturer must be an organization which possesses ISO 9001 certification from an independent public body.

Basic Requirements

a. Basic Design

The power distribution equipment will receive 11kV, 50Hz power from NEA and these lines will run into the high voltage electrical room in the substation building and total O&M building. The boundary of responsibility for NEA jurisdiction will be installed at the switchgear panels and the interior sector switchgear (DS) will be the primary NEA cable bed. The high voltage electrical room will comprise 11kV switchgear and a transformer board for step-down conversion of 11kV to 400V. The 400V electricity will be supplied to the electrical room, where it will be converted to either 220V or 110V as needed to supply power for each piece of equipment. The status of each device can be monitored from the front of the switchgear and cubicle, and the necessary signals will connect to a control system device through the relay terminal board, to enable monitoring control.

Backup power for use during NEA power outages is provided according to facility importance level. Circuits are classified into general circuits (AC), emergency generator circuits (GC) and important circuits (INV). Requirement for electricity shall be assessed for each main area of demand, to determine the total connected load in kVA and the likely maximum demand. This will enable the supply capacity and the ratings of the plant (transformers, switchgear, and cabling) to be established. Electricity supply organizations shall be consulted at the design stage about the estimated installed load for all electrical equipment (lighting, pumps, fans etc.). Information for discussion shall include sufficient predicted load profiles, plotted against time over typical 24-hour periods and any seasonal variations as well as peak demands during an emergency.

Maintaining a high-power factor is necessary to minimize tariff penalties from the supply authority and to reduce electrical losses. Power factor correction equipment shall be installed, where necessary, to achieve a minimum overall power factor of 0.92. One high voltage (HV) supplies, at 11kV and derived from near NEA substation, and duplicated two HV/LV transformers shall be installed ensure maximum security of the power supplies. The cables associated with these services are separately routed for maximum security of supply. The HV is transformed to 400V and distributed via the low voltage (LV) switchboards to distribution panels mounted at road level For security of essential loads an uninterruptible power supply (UPS) is provided, and a standby generator shall also be provided.

b. Reliability

This system will run 24 hours a day, 365 days a year. Devices which can bear up to sustained use will be employed. Security of supply is paramount. Primary supplies shall ideally be derived from two independent sections of the 11kV network which, in turn, should preferably be derived from different points on the National Grid system. Careful consideration shall be given to establish if faults on one section of the system feeding one side can affect the second supply. It can be difficult to obtain two truly independent separate supplies. They may be independent up to a point but still be derived from a common 11kV grid substation. Failure of the supply at the 11kV level, such as by damage to overhead lines, could lead to loss of both incoming supplies and this possibility shall be taken into account when assessing standby supply requirements. A UPS with a 2-hour back up capacity will normally be provided for essential loads (as discussed under UPS).

c. Extensibility

Extensibility will be made possible, to promote ease of future expansions and repairs. It will be made easy to add basic facilities, etc.

d. General requirement of Design and Maintenance

Electrical equipment to supply and control electrical services shall be designed to have a minimum 25-year

service life. Its design requires special care and attention to detail to ensure continuity of supply, safe working conditions, performance, proper operating sequences and physical measures to combat a hostile environment.

The maintenance philosophy to be adopted shall be taken fully into account in the initial design of the whole of the electrical system. The system shall be capable of being safely maintained. Onerous maintenance requirements may be reduced by specifying the most appropriate plant. The cable layout and circuitry shall be designed with maintenance in mind and particular attention paid as to how future electrical testing will be carried out and at what frequency. Ease of fault finding in the system shall also be taken into consideration together with provision for removing and replacement of the installation at the end of its useful life. Minimum standards for the design and installation shall be those given in BS 7671: Requirements for Electrical Installations or IEC 60364 Low Voltage Electrical Installations. If the minimum standards included in the Standard are not acceptable and higher standards, or particular alternatives, are required, these shall be defined under the relevant section of the project specification, with reference to other appropriate standards. The requirements of relevant legislation such as EEC Directives and the Electricity at Work Regulations1989 must be met.

Power Distribution Equipment

This item will be applied to devices installed as part of power supply control facilities (here in after, "the facilities.")

Equipment Outline:

a. Use Locations

The equipment will be installed in the electrical room and the devices shall be supplied indoor devices.

b. Surrounding Conditions

Temperature:
Indoor 0°Cto+40°C
Outdoor -10°Cto+40°C
Humidity
Indoor 10% to 85% RH.
However, this assumes no condensation.

Specification of Substation equipment

a. Device List:

The device list for the power distribution equipment shall be prepared as per actual requirements as shown in drawing and design.

b. Device Design:

The designs for the devices and equipment are detailed below:

(a) All devices are "indoor use" except when specified otherwise.
(b) The shape of the housing for high-voltage devices must be IEC 62271-1 HV switchgear conforming to the standards.
(c) The shape of the housing for low-voltage devices must be IEC 60059 LV Switchgear conforming to the standards:
(d) All sides of the high voltage power distribution panel must have doors, and the back side must have a hooking cover or door.
(e) Materials for the high-voltage and low-voltage panels must have capacities exceeding those of a steel sheet (hot rolled steel sheet) or equivalent item.

c. Temperature Increase

Temperature increase inside the panels and within each device must meet the compliance standards mentioned in the previous item detailing ambient conditions and must be within a range that does not interfere with any of the components.

Detail Specification for power supply system

a. Transformers

The power supply shall be equipped with a transformer. The transformer shall be a 11000/400V Dy11 type, with sufficient kVA rating to enable one transformer to carry the whole of the required load without excessive temperature rise, although load shedding may be implemented to disconnect nonessential loads. Restricted Earth Fault protection shall be provided for the transformers.

Vector groups other than Dy11 may be more appropriate where large inductive loads are connected to the transformer. Depending on earthling configuration and resistance, the neutral point of each transformer shall be earthed through an adequate link within the LV switchboard. Low Voltage (LV) System

b. LV Switchboards

The design of the low voltage system shall be based on the following.

LV switchboards shall be suitable for operating on a 400V, three phase, 4 wire, 50 Hz supply with ingress protection to IEC IP31. They shall be fault rated for 50KA for 1 second. Switchboard enclosures shall be of cubicle construction, with units mounted in tiers within each cubicle, assembled to form a flush fronted, floor mounted, free standing, dust protected metal enclosure having 1 to 1.25m minimum access from the front, with bottom cable entries whenever possible. To allow for future requirements, a minimum of 25% spare ways shall be included. The maximum overall height of the switchboards shall be 2.2 m to aid access and operation, with the operating switches and dial reading instruments at a maximum height of 2.0m, minimum height 0.45m, from the finished floor level. Switchboards shall be arranged with 2.5m free space at the front and back and 2m at each end.

c. Protection systems

All protection systems for the LV distribution shall be compatible. Certain HV protection circuits or circuit breaker operations may require a response from the related LV protection system. When specifying any form of protection system, it is necessary to ensure that discrimination is maintained throughout each circuit and sub-circuit, to prevent tripping of higher-level circuits.

d. LV Distribution for Lighting, Electrical Distribution Panels

The LV switchboards shall provide separate circuits for the various stages of lighting, (emergency lighting shall also be connected to the UPS equipment). Electrical distribution panels (EDPs) are required throughout a road. Equipment within the EDPs shall be rated for the temperature rise within the enclosures. Particular care shall be taken in the design of the EDPs to ensure that adequate space is available for all equipment and connections. EDPs shall incorporate other electrical equipment such as connections for CCTV, communications, traffic loop detectors, control outstations etc. Suitable socket outlets (220V AC) for the TOA and special socket outlets for the use of the Fire Brigade may be required.

Care shall be taken to provide adequate terminations and space to allow reasonable bending radii of tails and outgoing cables. Conduits for the final circuits from the EDPs to luminaires shall comply with IP65 and the use of stainless-steel conduits and accessories is required. Final circuits shall be arranged to suit the characteristics of the lamps served (including starting currents).

IEC 60364 requires that the earthling bonding system from the services buildings shall be extended to each EDP to ensure the integrity of the earthling system (TN-S system) by the provision of a separate circuit protective conductor (PE) other than using the armoring of the sub-main cables. The PE shall also be bonded to extraneous conductive parts.

e. LV Distribution in Services Buildings, etc.

In addition to the LV supplies for lighting, LV distribution is needed for the various services. A "clean" supply may be needed for computer systems.

Earthling systems to provide equipotential bonding, frame earthling, neutral point earthling, computer system "clean" earths and general protection shall be considered when designing Services Buildings. High quality copper systems shall be installed, and allowance made for the testing facilities to be provided. The laying of earth electrode mats may be required before building superstructure work commences. The bonding system may require to be extended to connect equipment outside the Service building.

Stand-by Generator Facility

a) General

Where it is likely that drainage pumps will need to be operated under mains failure conditions to maintain the security and administration facility, such loads will be beyond the capacity of a UPS. For such cases, automatic start standby generating equipment shall be considered. Separate accommodation, with 4 hours' fire protected enclosure, shall be provided for the standby generating equipment, fuel tanks etc. As an alternative to permanently installed standby generating plant, consideration may be given to the provision of suitable connecting points for the use of mobile generators. The availability of a suitable generator shall be carefully assessed, particularly taking into account competing demands that may be made for use of such plant.

b) Standby Generator Design Considerations

A standby generator, where required, may be specified to accept load in two stages, the first not exceeding 60%, and the system design shall allow for this. Fuel storage tanks, shall store sufficient fuel for two days running at full load. A dump tank shall be provided external to the diesel set room to take the contents of the day service fuel tank which will empty automatically should a fire occur in the diesel room. The dump tank shall be provided with pumps to empty it.

Separate accommodation shall be provided for the standby generating equipment, fuel tanks etc.

c) Equipment Outline

i) Location

The usage location shall be the east-side generator room, and an indoor model shall be used.

ii) Ambient Conditions

Temperature:
Indoor 0°Cto+40°C
Outdoor -10°Cto+40°C
Humidity
Indoor 10% to 85% RH.
However, this assumes no condensation.

d) Facility Structure

The emergency generator facility will consist of the following items:

Item	Unit	Qty	Comments
AC Generator	Unit	1	***** KVA, 3P3W, 11kV, 50Hz, 4P**
Diesel Engine	Unit	1	TBD KW, radiator cooling, light oil or electric start-up
Generator Panel	Panel	1	VCB, EVT, CT
Automatic Start-Up Panel	Panel	1	EXTR, AVR, auxiliary circuit

Start-Up DC Power	Set	1	DC24V200Ah
Supply			
Exhaust Muffler	Unit	1	85 dB (A) attached to generator
Fuel Transfer Pump	Unit	1	0.75kW
Fuel Tank	Unit	1	*** liters
Fuel Supply Box	Panel	1	SUS-made outdoor, wall-mounted
Vent Fan	Unit	2	85dB(A), fan5.5kW, damper, anti-vibration
Exhaust Duct	Unit	1	With damper and hood

Device Structure and Specification

Device designs are stipulated as follows:

(a) All devices shall be "indoor type" unless specified otherwise.

(b) The shape of the housing for high-voltage devices must be IEC 62271-1 HV switchgear conforming to the standards in the table below.

Panel Type	Format	Standard
Generator Panel	CW	IEC 62271-1

First format letter: C: Cubicle-Type Switchgear

Second format letter: W: Pull-Out-Type Device X: Fixed-Type Device

Y: Carry-Out Type

The panel material must have capacities exceeding steel sheet (hot rolled steel sheet) or the equivalent.

(c) Devices and power distribution wires must be heat-resistant so as not to be affected by heat generated by the motor and must be firmly affixed. The motor and generator must include anti-vibration rubber or similar measures to absorb vibration.

(d) The engine must include a device exceeding the capacities of the lubricating oil pump, and the sliding portion and moving parts of the lubricating oil supply nozzle must not cause a breakage in the oil film when switched off.

(e) The devices must be coated or painted to prevent rust. Pipes must be painted the same color as the generator. Once the pipes are painted, a color stripe shall be painted at the entrance/exit of the pipe, along with an arrow indicating the direction of the flow through the pipe. Furthermore, the surface of pipes to be buried in the outdoor pit must be painted to prevent rust.

(f) All components of devices, etc. must meet or exceed JIS or IEC or IEEE standards, and effort should be made to increase reliability of all devices by using a standard for components that exceeds actual usage conditions by as much as possible. In addition, anti-explosive designs must also be compatible with these standards

(g) These devices must provide a stable supply of electricity to each type of load system.

(h) To prevent movement and falls during earthquakes, items equipped with anchor bolts and anti-shake devices selected based on earthquake engineering calculations must include anti-quake stoppers.

(i) Radiator shutters must automatically open during diesel engine operation and close when operation is stopped.

(j) Dimensions must fit the radiator-equipped Stand-by generator facility structure, and not impede exhaust.

(k) Meters must be included to measure the following operational conditions.

(l) Rotation or frequency of the internal combustion engine.

(m) Lubricating oil pressure on the internal combustion engine. (However, for items which supply lubricating oil through a forced circulation system, it must be possible to change to measuring lubricating oil amount or lubricating oil surface.)

(n) Lubricating oil temperature in the internal combustion engine (however, for items which operate based on the temperature of the water used to cool the lubricating oil, it must be possible to change to measuring the temperature of the cooling water.)

(o) Cooling water temperature in the internal combustion

(p) Silencers must satisfy area noise regulations and must be designed so as not interfere with the performance of the motor.

Monitoring Control Format

a) Power Reception Control

Control is achieved through the power receiving (automatic/manual) toggle switch mounted on the power receiving panel and the remote-direct toggle switch.

b) Power Recovery Control

i. When power restoration is detected at the voltage relay at the power receiving point, after being confirmed by the timer and tripping the bus-tie circuit breaker, the power receiving circuit breaker is thrown.
ii. When the power receiving circuit breaker (52) is thrown, a stop order is sent to the generator simultaneously.

c) Lighting Control

Lighting control is achieved using remote manual toggle switch mounted on the lighting control panel, and the power receiving remote-direct share toggle switch mounted on the power receiving panel.

d) Lighting Control Details

i) Individual Control

- Switch the toggle switches to "manual" and "direct," then press the push-button switch on the front of the control center unit to achieve individual control.
- If the switches are set to "manual" and "direct," the interlocking display light on the front of the lighting control panel will go out, and display signals will be sent as-is to the remote monitoring control facility.

ii) Manual Interlocking Control

- Switch the toggle switches to "manual" and "remote" to achieve interlocking control, with each applicable circuit controlled by the remote monitoring control facility operations switches.
- The signal from the main electrical room lighting control panel automatic light modulation device automatically controls the entrance lights on the main electrical room side, while the signal from the auxiliary electrical room lighting control panel automatic light modulation device automatically controls the entrance lights on the auxiliary electrical room side.

Cabling

a) General requirement

Cable fire protection shall be in accordance with the requirements of Fire Fighting section. Design of cabling shall also be based on the following.

b) Services Below Ground

Where cables are to be buried in the ground, the depths of cable trenches shall be defined so that there is no ambiguity regarding the depth required. For example, it may be specified that an LV cable shall be laid at a minimum depth of 500mm on a bed of sand 150mm deep (i.e. a trench depth of 650mm). Cable tiles or marker tape shall be provided over the installed cables.

Where cables are housed in glazed or plastic duct pipes, it shall be arranged, where economically practical, for only one cable to be installed in each pipe. At least 25% spare ducts shall be provided, above the initial assessment, to allow for future requirements.

c) Services in Switch rooms and Services Buildings

The design of switch rooms and service buildings shall allow for adequate space for known and possible future cable

routes beneath floors. In switch rooms, floors shall be of the suspended type with approximately 1m of space below them and shall conform with the Building Regulations and Local Authority requirements. Fire partitioning and barriers to aid system segregation shall be incorporated. In switch rooms or similar locations, cable trays shall be designed and erected so that they do not say when the cable installation is completed. All fixings and accessories shall be of stainless steel or hot dipped galvanized materials may be used. Wall or ceiling mounted support systems to the cabling may be required. Such systems need to be purpose designed for each project.

Entries to equipment shall be arranged to give access to cables approaching from below. In the case of major short interconnections (such as between the LV terminals of a transformer and a main LV switchboard) consideration may be given to the use of bus duct connections rather than cable, but care needs to be taken in the physical layout of the equipment to ensure maximum economy. Cables shall not be run beneath the floor in battery rooms.

d) Cable Design Requirements

Cables shall have copper cores. Cable cores shall be stranded (except for MICC cables) where used on any part of the lighting, power distribution, final circuit and control systems. Care is required in the selection of cable entry gladding materials suitable for a road environment.

All LV cables shall be manufactured to suitable standards and shall be XLPE insulated, steel wire armored and red LSOH (Low Smoke Zero Halogen) sheathed.

e) LV Cable Sizing

Long route lengths may require the use of cables having large core sections to meet the voltage drop, disconnection time requirements and the power correction factors for groups of cables. Cable terminations shall be sized to suit these requirements. As the distance between the low voltage switchboard and the furthest fan or luminaire increases, cable sizes may need to be increased to compensate for the drop in voltage along the cables. Voltage drop in the LV cable system may be reduced by the provision of more frequent sources of supply, through the extension of the HV system to additional substations. A cost benefit analysis shall be undertaken to assess the benefits of providing such additional substations compared to the provision of larger cross-section LV power cables.

f) Cable and Termination Identification

A system of identification for cables, and cable cores in terminations, shall be established and recorded. Except where buried in the ground or in enclosed ducts, all cables shall be identified externally by standard cable markers, fixed over the external sheath, at intervals not exceeding 25 meters. All cables shall have the same identification provided at each cable termination, at each change of direction and where passing through barriers. Cable cores and terminations shall be identified, with a previously agreed code of alphabetic and numerical symbols, by means of pre-engraved indented circular markers closely fitted to the core insulation of each constituent core. Cores not utilized shall be identified as 'spare' and shall be terminated in a spare terminal arrangement of the same pattern as that used for the 'in use' cores.

Cable voltage ranges shall be indicated by the color of the outer sheath, such as red sheath for HV, black sheath for LV and the sheath for control cables to be of some other distinguishing color.

g) Cable Segregation

Throughout an installation, strict segregation shall be maintained between services derived from different sources, or operating at different voltages, or whose operating characteristics may interfere with the satisfactory operation of other cables or services.

Tests and Inspections

a) Independent Inspection

The devices used in the facilities must be subject to an independent inspection including all the tests below at the factories where they are manufactured, and the results of the inspections must be submitted for review.

b) On-Site Inspection

Once construction on the site is complete, the following on-site inspections shall be performed, and the results shall be submitted for review.

c) General Operation Tests

When on-site inspections are finished, all facilities must be subject to commissioning as a whole and adjusted if necessary.

- Power Distribution Equipment Internal General Operation Tests
- Counter Test with Monitoring Control Facilities

Road Lighting equipment

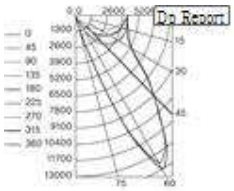
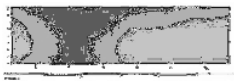
General Requirement

1) Design overview

- Reduction of human and property damage caused by traffic accidents and prevention of night crimes
- Considering energy saving, install the most appropriate and economical road lighting.

2) **Design focus**

- At night, if there is no light across the road, it is difficult for the approaching motorist to grasp the width and alignment of the road.

Design criteria and review	⇨	lighting calculation and design	⇨	actual measurement data collection	⇨	simulation verification
· KS A 3701 (Road lighting) · Light source: LED · Installation interval: By section		· Standard illumination: · Calculation illuminance · Separate receiving from NEA		 · Light distribution curve, lighting rate table, etc		 TI value verification

Review Results	· Provides a comfortable viewing environment and secures safety for drivers operating IC etc. · KS A 3701 verified the uniformity system and threshold increment (within 10%) according to the road lighting standard

3) Lighting installation standards

A) Lighting installation target

- From the user's point of view on traffic roads, the more lighting facilities are better, but the facility costs and maintenance costs are required, so it is necessary to select the facility location.
- Criteria for lighting installation places of general national highways specified in the application standards (Road Safety Facility Installation and Management Guidelines, Road Design Manual)

Continuous lighting installation location	· Sections where light from buildings adjacent to the road affects road traffic · The section between intersections and places where lighting facilities such as rest facilities are installed, with an extension of less than 1km · Sections with special circumstances that require continuous lighting in cases other than the above

Special area lighting	· Intersection · Where the road width alignment changes rapidly · Places that require local lighting in cases other than the above

B) Road lighting equipment Standards

i) Korea Expressway Corporation illumination standard

Category	Pavement	Road surface luminance (cd/m^2)	Road surface illumination (lx)
I/C, Main Line	concrete	1	10
	asphalt	1	15
Accident vulnerable section	concrete	2	20
	asphalt	2	30
Rest area, T/G area	-	-	15~30

ii) **Standard of Korea Expressway Corporation**

Category	Area	No of Lane	concrete(asphalt)		Pole (m)	Arr.
			1cd/m^2			
			Distance (m)	LED(W)		
Continuous lighting	Main Line	4 Lanes	75(55)	250	12-2.8	zigzag (Facing)
Special area lighting	I / C Access to rest area Etc.	one-way 1	35(35)	100	10-2.0	One Side
		one-way 2	30(25)	100	〃	One Side
		one-way 3	25(20)	100	〃	zigzag
		4 Lanes	55(45)	150	12-2.8	Facing

iii) A 3701 - IC, JCT Ramp Design Standard

1) KS A 3701(2007)

The road lighting class is adopted based on Korean lighting standard which is based on the traffic type and road grade. Condition 1of following table is adopted for expressway illumination level.

<Table 1> Road lighting grade by road and traffic type

Type of road		Type of traffic and vehicle traffic volume	Road lighting class
1.Expressways and automobile-only roads.	High-speed roads with separate upper and lower lines and all intersections are multi-level intersections, and access is completely restricted.	In case of heavy traffic 1) and complex road alignment2).	M1
		Heavy traffic or complex road alignment.	M2
		Low traffic and simple road alignment, or dark surroundings.	M3
2.Main road and auxiliary arterial road	High-speed roads and roads where the up and down lines are separated	Lack of separation 5) from other types of road users 4) and insufficient traffic control 3)	M1

		Separation of different types of road users, traffic control is well established	M2
	Major urban traffic routes and national highways	Lack of separation from other types of road users and insufficient traffic control	M2
		Separation of different types of road users, traffic control is well established	M3
3.Collective and local roads	Connection roads of low importance, local connection roads, main access roads in residential areas, access roads and connecting roads to private lands	Lack of separation from other types of road users and insufficient traffic control	M4
		Separation of different types of road users, traffic control is well established	M5

Notes:

1) Higher and lower traffic is based on the annual average daily traffic volume (AADT) of 25,000 vehicles, and if it is higher than that, it is considered to be high, and if it is less, it is considered to be less.
2) The complexity of the road linearity means the basic structure of the road, the movement of the vehicle, and the visual environment. The factors to be considered at this time are as follows.
   -Number of lanes, number of slopes
   -Traffic lights and signs
   -The presence of entry and exit ramps, entry vehicles and exit vehicles must also be considered.
3) Traffic control refers to the existence of traffic lights and signs and laws. The means of control include traffic lights, rules of right-of-way, rules and signs of priority, traffic signs, direction signs and road signs. In the absence or inadequate of these means, traffic control is considered insufficient.
4) Other types of road users are, for example, cars, trucks, low-speed vehicles, buses, bicycles, and pedestrians.
5) Separation may consist of imposing restrictions on the method of dedicated lanes or one or more types of traffic. With this separation, low-grade lighting can be achieved.

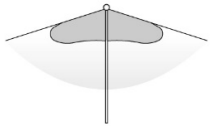
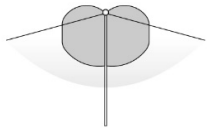
2) KS A 3701(2007) Road surface brightness standards for drivers

Road lighting grade	Average road surface luminance (Minimum allowable value) L_{avg} (cd/㎡)	Brightness equalization system (minimum allowable value)		TI (%) (Maximum allowable value)
		Overall uniformity system (Uo) L_{min}/L_{avg}	Lane Accumulation System L_{min}/L_{max}	
M1	2.0	0.4	0.7	10
M2	1.5	0.4	0.7	10
M3	1.0	0.4	0.6	10
M4	0.75	0.4	0.6	15
M5	0,5	0.35	0.4	15

Note: 1) The horizontal plane illumination is the average illuminance on the sidewalk.

2) The vertical surface illumination is the minimum illumination on the vertical surface perpendicular to the road axis 1.5m high from the road surface on the sidewalk centerline.

3) Lighting fixture and light distribution

Category	Cut-off type	Semi-cut-off type	Non-cut-off type
Light distribution			
Characteristics and Applicable target	· A device that gives little glare · Increased number of luminaires installed · Especially important high-speed road	· Apparatus with limited glare · General national highway by normal road	· Devices that do not limit glare · Low speed road with normal road
Review result	· As road lighting equipment needs to control light distribution according to the structure and characteristics of the road, select the cut-off type, which is a light distribution type suitable for the characteristics of the road.		

4) Selection of light source

a) Light source condition

Item	Condition	Reason
efficiency	High Efficiencies	Reduce Power cost
life span	Long Life Using	Reduce maintenance cost
Luminance	Low luminance	Anti-glare
Color rendering	Good	Easy obstacle identification
Permeability	Good	Identification of obstacles in fog

Item	Condition	Reason
Instant re-lighting	possible	Easy lighting control pattern
Life cycle cost	low price	Reduce maintenance cost
Product	Local market	Easy procurement
Size	Point light source	Easy light distribution control
Step of Standard capacity	proper	Need to adapt without segmentation

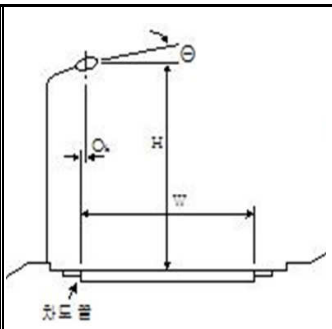
b) Required characteristic of lamps

Item \ Type of light		LED lamp
Average usage		50,000 h
Efficiency		110(lm/W)
Light color		white
Color rendering		Good
Ambient temperature Influence	Efficiency	No
	Start	No
Where to use		Fog area, smoke area, etc. City area
Apply		All sections

5) Selection of streetlight

6) Installation of streetlight poles

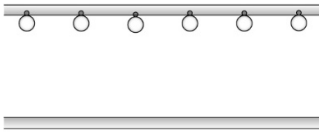
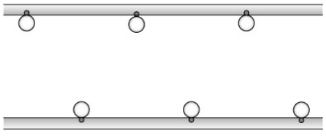
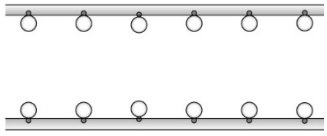
A) Installation height, overhang and inclination angle of lighting equipment

Schematic diagram	 W : Road width(m) H : Installation height of lighting fixture(m) O_H : Overhang(m) Θ : Angle of inclination (°)
Installation height of lighting fixture	· In principle, more than 10m. However, except when it is necessary to change the height due to restrictions such as prevention of glare on adjacent roads and roadways · Maintain a constant installation height of lighting fixtures with the same road width
Overhang	· It is desirable to keep the overhang as short as possible. · Constantly applied overhang in continuous road lighting facilities
Angle of inclination	· In principle, the angle of inclination is set within 5°

B) Arrangement of streetlights

· The relationship between the height (H) and spacing (S) of the roadway to the width (W) determines the light distribution of the luminaire.

· Streetlight poles are arranged in one side, zigzag, and face to face, and are selected according to the width and height of the streetlight

One side placement	Zig zag placement	Face to face placement
		

C) Mounting height (H) and spacing (S) of lighting equipment

Type of equip. Array H and S	Cut-off type		Semi-cut-off		Non-cut-off	
	H	S	H	S	H	S
One side	1.0W or more	3H or less	1.2W or more	3.5H or less	1.4W or more	4H or less
Zig zag	0.7W or more	3H or less	0.8W or more	3.5H or less	0.9W or more	4H or less
Face to face & Center	0.5W or more	3H or less	0.6W or more	3.5H or less	0.7W or more	4H or less
Review result	· If the uniformity system is satisfied after the road lighting simulation is conducted, the above arrangement interval is applied.					

D) Calculation of the placement interval of the light pole

· The maximum distance of lighting equipment is arranged in consideration of the distribution and induction of road surface luminance by the height of the light source and the effective width of the roadway according to KS A 3701.

$$S = \frac{N \cdot F \cdot U \cdot M}{E \cdot W}$$

· S: Installation interval (m) · N: Number of arrays · U: Illumination rate
· E: Average illuminance (lx) · F: Luminous flux of light source (lm)
· M: Maintenance rate (0.6~0.75)
· W: Width of roadway (m)

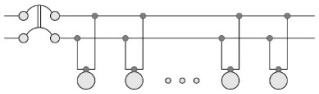
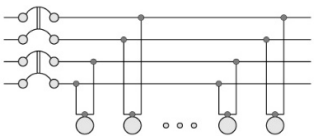
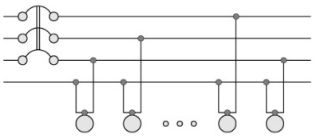
7) Piping and wiring

A) Voltage drop rate

· Sufficient wiring capacity is adopted to supply less than 6% of the total from the NEA power receiving point to the extreme end to extend the life of the luminaire and prevent deterioration of the mark by supplying a stable voltage.

(Main line: 1% or less, branch line: 5%)

B) Wiring method

Item	1P2W 1line	1P2W 2 lines	3P4W 2 lines
Circuit			
Advantage	· Most economical for short distance wiring · Uneconomical for long distances · All turn off in case of circuit failure	· Increased wiring cost · Even when cut in one circuit Lighting possible	· Economical for long distance wiring · Not economical for short-distance wiring · All turn off in case of circuit failure
Review the results	· 1 P2W 2 line, 3P 4W 2-line method makes it easy to establish safety measures, and it is possible to light up even when power failure in 1 circuit, so reliability is good. · 3P4W 2-line method applied		

C) piping

Road crossing	Earthwork section	Bridge section
· Conduit direct burial method · Buried more than 1.2m underground · Use of polyethylene conduit · Handhole installed on the cross section	· Direct conduit burial method · Buried more than 0.6m underground · Use of polyethylene conduit	· Burial method in the barrier · Use of polyethylene conduit

9) Streetlight distribution board

A) Control box basics

- Material that has not been damaged or corroded for a long time
- Structure that can withstand even minor impacts
- Maintenance of electrical facilities function as rain-proof type

- Structure that does not intrude dust inside
- Breakers and relays are parts that do not deteriorate their function even after long-term use
- Prohibit manipulation by the person concerned by locking device
- Facilities in a place that is in harmony with the surrounding landscape and does not interfere with traffic and traffic
- Enclosure made of stainless steel 2.0t or more

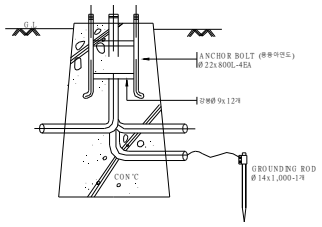
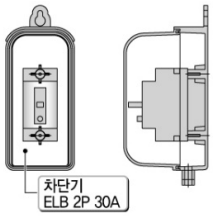
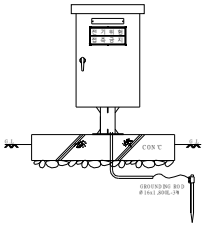
B) Circuit breaker

Main switch	Branch switch
· Type: Circuit breaker · Rated current: 200AT or less · Rated breaking capacity: 10kA or more · Protection function: Overload, short circuit protection function	· Type: Earth leakage circuit breaker 2P · Rated current: 30AT or less, 1.5kA or more · Rated sensitivity current: 50㎃, within 0.1 seconds · Protection function: both short circuit, overload, short circuit protection

C) Streetlight control

Circuit classification	Load classification	Application time	Remark
Continuous light	1/2 of street light	Lights up from sunset time to sunrise time	Control using GPS
Intermittent street light	1/2 of street light	Lights up from sunset to midnight	

10) Security equipment

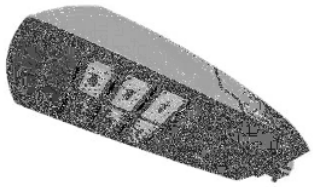
Street light pole ground	Earth leakage circuit breaker	Control panel grounding
		
· Independent of earthworks, connecting ground of bridge · Ground rod Ø14×1,000mm	· Independent ground · Connect three Ø16×1,800mm ground rods	· Electrical safety management and prevention of electric shock accidents · Adoption of an appropriate capacity earth leakage circuit breaker

A) Review of KS C 8324 (distribution board for street lighting) standards

- Branch switch should use an earth leakage breaker in principle.
- The earth leakage circuit breaker is a current-operated type for medium-sensitivity electric shock protection (rated sensitivity current 30mA, operation time within 0.03 seconds).
- If the connection ground resistance value is maintained below 10Ω, it is possible to install an earth

leakage circuit breaker within a rated sensitivity current of 50mA and an operating period of 0.1 seconds → (Prevent traffic accidents caused by lights off by slowing the sensitivity current)

B) Mine damage reduction plan

Classification	Improvement Plan	
Energy saving	· Streetlight lighting control (50% dimming at night) · 50% incremental control possible in case of emergency	
Light pollution measures	· Reduce light pollution damage by controlling light distribution (Use Cut Off luminaire)	
Review result	· Plan to control 50% of late-night lighting and control by season and time by program · Review of backlight control lighting method taking into account the inhibition of growth of agricultural land or animals and plants in the road lighting section (additional shading screen is installed if necessary)	

Choice of Light Source

1) Luminaires will be aligned with their long axis parallel to the road. Their light is predominantly directed transversely across the expressway giving a longitudinally symmetrical light distribution.
2) The following characteristics shall be considered when determining the most appropriate types of lamp:
   i. Lamp Circuit Luminous Efficacy: A measure of the energy efficiency of a lamp, presented in terms of lumens of light output per watt of power consumed by the lamp and its associated control gear.
   ii. Lumen Maintenance: The average number of operating hours from new when light output will have dropped to 80% of the initial value.
   iii. Lamp Survival: The number of operating hours from new when 20% of lamps in an installation will have failed.
   iv. Restrike time: The time taken to restore full light output after restoration from interruption of the normal electricity supply.
   v. Color Rendering Index: A measure of the ease with which different colors can be distinguished under the light from the lamp. This is particularly important if compatibility with color CCTV is required.
   vi. Shape: Linear sources emit light over the full length of the lamp and therefore differ in beam appearance and apparent brightness from more concentrated point sources.
   vii. Dimmable: Dimmable luminaires offer greater flexibility of control for energy saving but with higher capital and possibly higher maintenance costs.
3) The design of luminaires shall be related to expressway profile, systems of support, ease of access and vulnerability from traffic. Luminaires shall be of robust construction, sealed to IP65 requirements to prevent the in grass of moisture, and adequately protected against the harsh conditions of the expressway environment.

Led Modules for road Lighting

1. General

This section covers technical requirements for LED luminaires used on roads areas. This includes road lighting, lighting under bridges, decorative lighting.

2. Applied Standard

The following standards, in whole or in part, are applied for this project. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

CIE 017:2016 ILV International Lighting Vocabulary

IEC 62717:2015 LED modules for general lighting - Performance requirements
IEC 62722-1:2014 Luminaire performance - Part 1: General requirements
IEC 62722-2-1:2014 Luminaire performance - Part 2-1: Particular requirements for LED luminaires

3. Ingress protection IP class used to define levels of sealing effectiveness of enclosures against intrusion from foreign matter (tools, dirt etc.) and moisture. Ratings are defined in the standard IEC 60529.
4. Constant light output functionality to constantly adjust the luminous flux of the light source based on the known or predicted depreciation behavior of the light source to enable a constant luminous flux over time
5. The technical specifications and the performance of a luminaire shall be presented in accordance with the standards IEC 62722-1:2014, IEC 62722-2-1:2014 and IEC 62717:2015, taking the specifications of this document into account.
6. The rated useful lifetime of a luminaire shall be submitted by the contractor for approval.
7. The maintenance factor fM shall be employed in lighting designs to ensure that the target requirements are met throughout the rated useful lifetime of a luminaire when the luminaire is maintained according to the defined maintenance schedule.
8. The luminous flux factor f is defined as the ratio of depreciated luminous flux to the initial luminous flux. For outdoor lighting the luminous flux factor f shall be determined at luminaire level.
9. A constant light output (CLO) control of a luminaire shall always be used, if available, for the selected luminaire type. The CLO lifetime shall be the same as the rated useful lifetime of a luminaire Luminaires utilizing a constant light output control adjust the luminous flux based on the known or predicted depreciation behavior of the light source to enable a constant luminous flux over time.

This is realized by initially dimming the light source to the predicted end-of-life flux and increasing the current (and as such the power consumption) over time to compensate for the depreciation in luminous flux due to ageing of the light source.

10. General structural requirements

All electronics of a luminaire shall be protected against moisture, condensation and corrosion.
The ingress protection class of a luminaire shall be IP65 in accordance with the standards IEC 60598-1:2015 and IEC 60529:1992. The ingress protection class for spaces in a luminaire not containing electronics or optics shall be at least IP4X. The ingress protection class of a luminaire shall remain the same for the whole rated useful lifetime of the luminaire, including appropriate maintenance. Cable entries shall provide the degree of protection against dust or moisture in accordance with the ingress protection class of the luminaire, when an appropriate external cable is installed. Cable entries shall have rounded edges with a minimum radius of 0.5 mm. A luminaire housing (not including flat glass, seals, vents, nuts, screws, latches and so on) shall be made from die cast aluminum, extruded aluminum or stainless steel. The service life of the luminaire housing shall be at least the same as the rated useful lifetime of the luminaire. The hot dip galvanized coating of a luminaire housing and exterior luminaire components shall be performed in accordance with the standard EN ISO 1461:2009. The corrosion resistance of a luminaire and exterior luminaire components shall fulfill the requirements of the standard IEC 60598-1:2015. Metal parts of a luminaire shall be galvanically separated when different metals are in interaction. The exterior nuts, screws, latches and other fasteners of a luminaire shall be made from stainless steel A4-80 according to the standard IEC ISO 3506:2009. The cord anchorage of a luminaire shall fulfill the requirements of the standard IEC 60598- 1:2015 so that the external cable and wires are relieved from strain, including twisting, when they are connected to the wiring block of the luminaire.

11. Lighting control requirements for road luminaires

A road luminaire shall enable the luminaire luminous flux to be controlled using one or several of the following lighting control methods:

- preprogrammed stand-alone dimming,

- outdoor luminaire controller and external control, mains voltage amplitude modulation (additional requirement).

Remote Monitoring and Control System

General

The Traffic Management System shall consist of basically the following facilities and devices

- Monitoring control equipment
- CCTV camera equipment

Applicable Standards

IEC 60870 Tele control equipment & System or unless otherwise specified, items in this list of specifications shall apply the following standards:

SN	Application Standards
1	Part 5 CCTV Facilities in "Standard Design Specifications Vol. 8 Communications Facilities" (NEXCO RI, July 2014)
2	"Standard Specifications, etc. for CCTV Facilities", Specification No. 17219 (NEXCO RI, July 2017)
3	"Standard Specifications, etc. for Intelligent Remote-Control Monitoring Equipment Vol. 2", Specification No. 17210 (NEXCO RI, July 2017)
4	"(Draft) Specifications for CCTV Facilities" (Ministry of Land, Infrastructure, Transport and Tourism, January 2017)
5	"Standard Specifications for Digital Land Mobile Communication Systems (K-X)", MLIT Specification for Communication Facilities No. 55 (Ministry of Land, Infrastructure, Transport and Tourism, October 2015)
6	"Degrees of Protection Provided by Enclosures" (IP Code), IEC 60529
7	"Degrees of Protection Provided by Enclosures for Electrical Equipment" (JIS C 0920), Japanese Industrial Standards
8	IEC 60870 Tele control equipment & System

For any maters referred to multiple documents, these Specifications shall prevail

The System shall be manufactured, installed, tested, and test-operated under the quality assurance and quality control system in compliance with ISO 9001. The manufacturers are required to have a copy of ISO 9001 issued by International Organization for Standardization.

Basic Requirements

- The Traffic Management System is a system that shall be installed in the Control Office of the administration building and monitor and control disaster prevention facilities in the road (such as emergency, lighting and other facilities).
- The System shall enable operators to monitor the real-time states of facilities and alerts from the operation terminal and large screen display in the Control Office. It shall also provide road users with appropriate information through appropriate road boards and radio broadcasting.
- The system shall be operated 24 hours a day, 365 days a year; the hardware must be durable for continuous operation.
- The integrated management server shall represent the core of the System, and secure redundancy so that defect of any component shall not adversely affect the entire System. In case of any trouble with the operation system hardware of the integrated management server or application programs to be created, the backup system hardware shall automatically take over the operations for continuous operations of the entire System.

- The system shall be easily linked to other system and have additional functions for possible system extensions.
- The Telecommunication each device and equipment in the Control Office shall be powered at 220V AC via the uninterruptible power system. Other equipment shall be compatible with 220V AC, single phase 50Hz.

10.2.3 Specification for Stabilization and Supporting of Excavated Slope Face

Please Refer to **Appendix 3**

11 Supplementary Information

The summary of Geotechnical Investigation Report for Bridges is provided here below.

11.1 Geotechnical Investigation Report for Bridges

11.1.1 Project Description

The proposed bridges of this contract Package -4 belong to the rocks of the Siwalik Group. In general, the proposed expressway alignment between CH 57+400 to CH 65+160 (Figure 11.1) comprised of sandstone and mudstone of the Siwaliks.

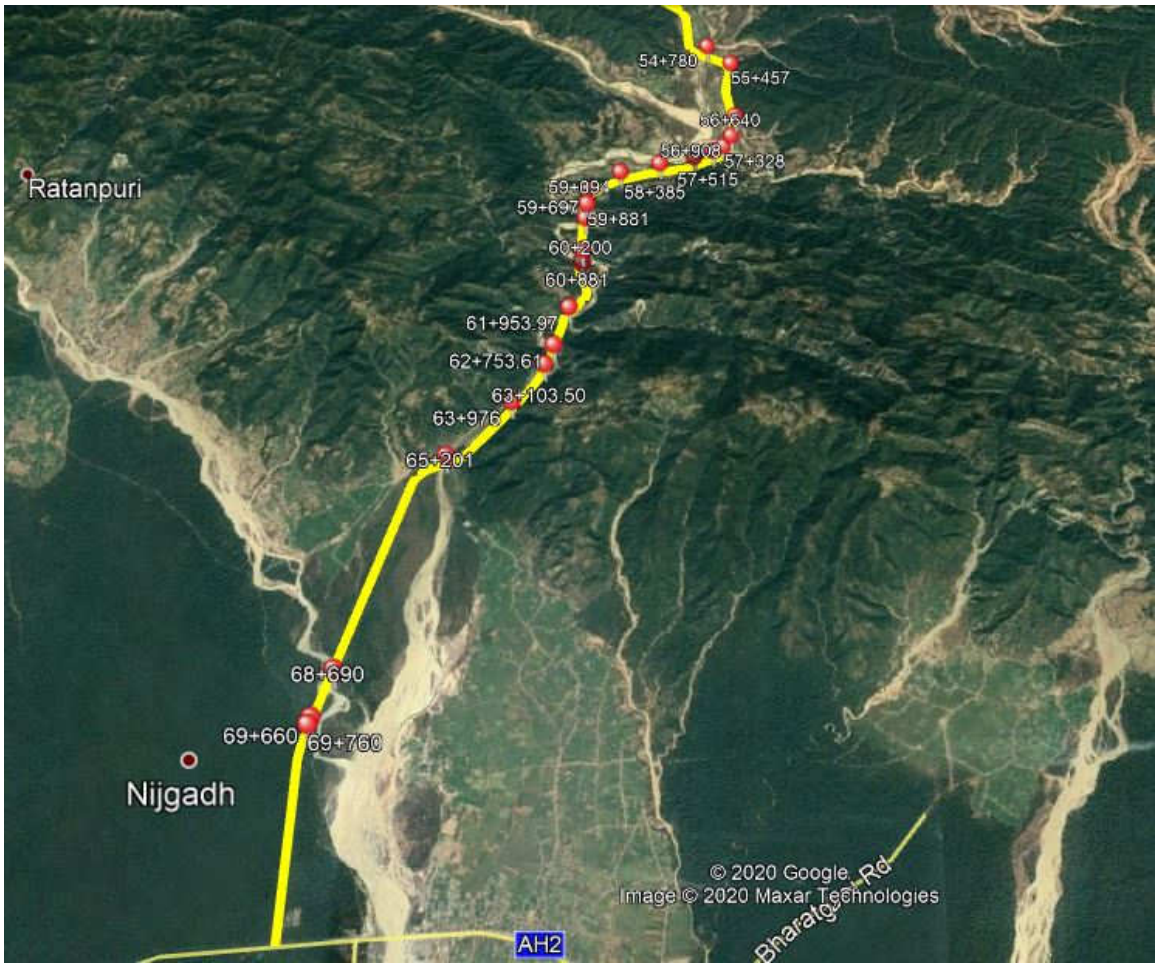


Figure 11.1: KTFT Alignment with the Proposed Bridges

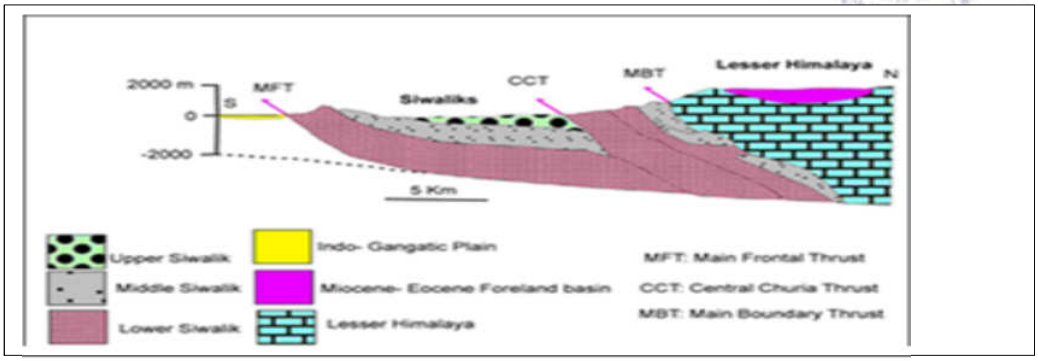
This report has been prepared with the objective to summarize the findings from the Geotechnical Investigation for reference.

11.1.2 Regional Geology

The Sub-Himalaya (Siwaliks or Churia Group) exists in the southern part of the country (Figure 11-3) which is represented by low hills of the Churia Range. 5-6 km thick fluvial sediments of Siwalik Group of Nepal are mainly composed of mudstone, sandstone and conglomerate that are deposited in the middle Miocene to early Pleistocene age. Based on lithology and in increasing grain size, Siwalik Group is further divided into the Lower, Middle and Upper Siwalik in ascending order. The Lower Siwalik is comprised of mudstone and sandstone, whereas the Middle Siwalik represented by thick-bedded, coarse-grained, "pepper and salt" appearance sandstone. The Upper Siwalik is identified with the presence of conglomerate with lenses of mud and sands. Lithostratigraphic division of the Bakiya Khola section of central Nepal, Ulak (2002), Siwalik section further divided into Northern and Southern belt as shown in table below.

Table 11-1: Lithostratigraphy of Siwalik, Central Nepal

Group	Formation	Member	Thickness (m)	Lithology
Lesser Himalaya				
Main Boundary Thrust (MBT)				
Northern Belt				
Siwaliks	Upper Siwaliks		500	Cobble-pebble bearing conglomerates with lenses of muds and sands
	Middle Siwaliks	Upper Middle Siwaliks (MS20)	1200	Thick bedded pebbly sandstone and mudstone
		Lower Middle Siwaliks (MS1)	1000	Thick bedded sandstone and mudstone. Proportion of sandstone is greater than mudstone
	Lower Siwaliks		1000	Interbedding of mudstone and sandstone. Ratio of mudstone gradually decrease and sandstone increases
Marin Khola Thrust (MKT) or Main Dun Thrust (MDT)				
Southern Belt				
Siwaliks	Upper Siwaliks		1000	Cobble-pebble bearing conglomerates with lenses of muds and sands
	Middle Siwaliks	*Upper Middle Siwaliks (MS2)*	1500	Thick bedded pebbly sandstone and mudstone
		Lower Middle Siwaliks (MS1)	1000	Thick bedded sandstone and mudstone. Proportion of sandstone is greater than mudstone
	Lower Siwaliks		1800	Interbedding of mudstone and sandstone. Ratio of mudstone gradually decrease and sandstone increases
Main Frontal Thrust (MFT)				
Indo-Gangetic Plain				
Indo-Gangetic Plain	Bhabar zone		500	Boulders, cobble and pebbles
	Middle Terai zone		500	Sands, cobble and pebbles
	Southern Terai zone		500	Silt, clay and sands



The contract area is mainly composed of mudstone and sandstone. This section of expressway falls in between the Main Boundary Thrust (MBT) and Marin Khola Thrust (MKT).

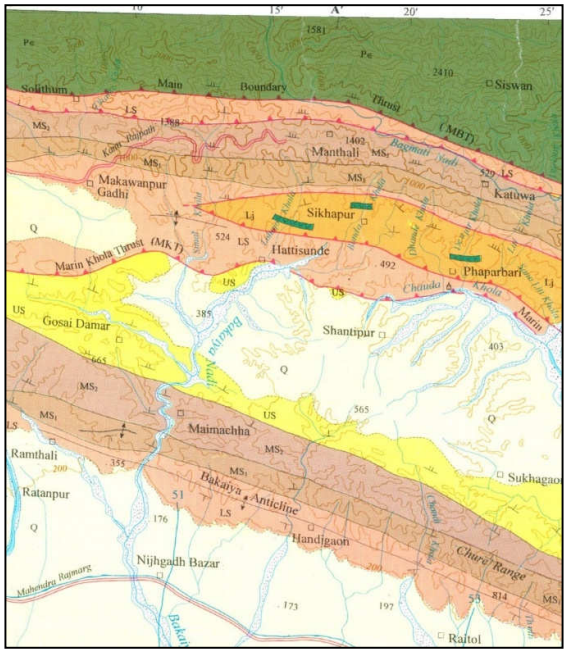


Figure 11-3: Regional geological maps of Bakiya Khola section (DMG 2002)

11.1.3 Ground Characterization and Baseline Information

11.1.3.1 Stratigraphy

The detail description of proposed bridge site, drilling depth additional point of drillings for this contract have been shown in table below;

Table 11-2: Location of borehole on the bridge sites

S.N	Bridge No.	Chainage	Borehole No.	Co-ordinate			Drilled Depth (m)
				Longitude	Latitude	Elevation	
1	CP 4-1	57+542 ~ 57+577	**D6B70**	619744.62	3019994.38	289.4	20
2	CP 4-2	57+866 ~ 57+901	**D7B71**	619449.90	3019857.44	293.7	20
3	CP 4-3	58+427 ~ 58+507	**D8B72**	618867.99	3019705.67	254.9	25
4	CP 4-4	59+090 ~ 59+150	**D9B73**	618236.88	3019552.24	272.7	20
5	CP 4-5	59+830 ~ 59+870	**D10B74**	617769.26	3019186.52	278.9	20
6	CP 4-6	59+900 ~ 60+150	**D11B75**	617727.89	3018965.48	261.4	35

S.N	Bridge No.	Chainage	Borehole No.	Co-ordinate			Drilled Depth (m)
				Longitude	Latitude	Elevation	
7	CP 4-7	60+250 ~ 60+440	**D12B76A**	617736.43	3018650.39	253.1	35
8	CP 4-7	60+250 ~ 60+440	**D13B76B**	617729.91	3018575.19	253.4	30
9	CP 4-8	60+780 ~ 61+050	**D14B77B**	617716.99	3018029.15	272.7	30
10	CP 4-8	60+780 ~ 61+050	**D15B77A**	617707.61	3017919.89	247.3	30
11	CP 4-9	61+980 ~ 62+300	**D18B80A**	617575.20	3016888.26	231.2	30
12	CP 4-9	61+980 ~ 62+300	**D19B80B**	617563.07	3016788.63	260.4	45
13	CP 4-10	62+595 ~ 63+020	**D20B81B**	617323.07	3016143.38	222.9	40
14	CP 4-10	62+595 ~ 63+020	**D21B81A**	617393.52	3016150.03	223.7	30
15	CP 4-11	63+140 ~ 63+390	**D22B82**	617291.25	3015832.56	231.3	40
16	CP 4-12	64+020 ~ 64+070	**D23B83**	616881.38	3015173.86	250.9	30

The general stratigraphy indicated by boreholes in terms of strata encountered and their distribution across the Bridges are summarized in Table 11-3 below;

Table 11-3:General lithology of Package No.: 4 area

S.N.	Bridge No.	Borehole No.	Stratum	Min./ Max. Levels below existing ground level (m)	Min. / Max RQD (%)	Min. / Max UCS (MPa)	SPT (N-Field value)
1	CP 4-1	D6B70	Overburden (Dense to very dense, Dark grey colored, coarse-grained, fresh, Salt and Pepper sand)	7			28 ~ 69
			Dark grey colored, fine grained, slightly weathered Mudstone.	7 ~ 20	0 ~ 80	285 ~ 472	
2	CP 4-2	D7B71	Overburden (Dense light grey color, fine-grained,moderatly weathered silty sand with pebbles)	10.5			27 ~ 39
			Grey color, fine-grained, salt and pepper rich, slightly weathered, pebbly Sandstone.	10.5 ~ 20	0	-	
3	CP 4-3	D8B72	Overburden (Very dense Grey color, fine to medium grain sand)	25			> 50
4	CP 4-4	D9B73	Overburden (Dense to very dense grey color, coarse-grained silty sand with pebbles.)	10.5			31 ~ 53
			Weathered dark grey mudstone.	10.5 ~ 20	0	-	

S.N.	Bridge No.	Borehole No.	Stratum	Min./ Max. Levels below existing ground level (m)	Min. / Max RQD (%)	Min. / Max UCS (MPa)	SPT (N-Field value)
5	CP 4-5	D10B74	Overburden (Mod. dense to dense light grey , fine-grained sand with pebbles and cobbles on top of BH)	20			22 ~ 38
6	CP 4-6	D11B75	Overburden (Dense to very dense dark grey color, slightly weathered, coarse-grained sand with pebble and cobble)	11.5			37 ~ 65
			Weathered to hard rock of light to dark grey color, slightly weathered, Mudstone	11.5 ~ 35	10 ~ 85	2 ~ 215	
7	CP 4-7	D12B76A	Overburden (Mod. dense to very dense grey , fine-grained, fresh, salt and pepper rich silty sand)	28			29 ~ > 50
			Weathered to hard grey , fine-grained Mudstone	28 ~ 35	20 ~ 60	4 ~ 332	
8	CP 4-7	D13B76B	Overburden (Mod. dense to very dense dark grey color, fine-grained, salt and pepper rich clayey silty sand)	27			21 ~ 71
			Hard grey color, coarse-grained, slightly weathered sandstone	27 ~ 30	20 ~ 35	149	
9	CP 4-8	D14B77B	Overburden (Very dense dark grey color, fine-medium grained, salt and pepper rich fresh silty sand with pebbles)	12			> 50
			Mod. Hard rock of Mudstone and Sandstone layers	12 ~ 30	0 ~ 80	39 ~ 49	
10	CP 4-8	D15B77A	Overburden (Loose to very dense grey to dark grey color, fine	11.5			9 ~ 87

S.N.	Bridge No.	Borehole No.	Stratum	Min./ Max. Levels below existing ground level (m)	Min. / Max RQD (%)	Min. / Max UCS (MPa)	SPT (N-Field value)
			to coarse grained, clayey silty sand)				
			Weathered to hard rock of grey color, coarse-grained, fresh Sandstone.	11.5 ~ 30	0 ~ 55	5 ~ 310	
11	CP 4-9	D18B80A	Overburden (Very dense brown color, fine-grained silty sand with pebbles and cobbles)	4.5			> 50
			Weathered to hard rock of light grey color, coarse-grained, salt and pepper, fresh, Sandstone	4.5 ~ 30	0 ~ 55	7 ~ 327	
12	CP 4-9	D19B80B	Overburden (Very dense grey color, fine to coarse grain sand with pebbles and cobbles)	15			> 50
			Soft to hard rock of grey color, medium-grain, partially weathered beds of Siltstone, Mudstone and Sandstone	15 ~ 45	0 ~ 95	7 ~ 249	
13	CP 4-10	D20B81B	Soft to hard rock of light-grey color, fresh, calcareous, Mudstone and Sandstone beds	40	0 ~ 75	6 ~ 47	
14	CP 4-10	D21B81A	Overburden (Mod. dense to very dense brown color, fine-grained, moderately weathered silty sand with pebbles and cobbles)	5			12 ~ 53
			Mod. hard to hard rock of light grey, fresh, calcareous, Sandstone and dark grey Mudstone beds.	5 ~ 30	45 ~ 85	24 ~ 337	

S.N.	Bridge No.	Borehole No.	Stratum	Min./ Max. Levels below existing ground level (m)	Min. / Max RQD (%)	Min. / Max UCS (MPa)	SPT (N-Field value)
15	CP 4-11	D22B82	Overburden (Very dense dark grey color, fine to medium grain, clayey silty sand with pebble and cobble)	6			> 50
			Mod. hard to hard rock of grey color, medium to coarse grain, slightly weathered Sandstone and Mudstone beds.	6 ~ 40	0 ~ 65	28 ~ 453	
16	CP 4-12	D23B83	Overburden (Very dense grey color, fine to coarse grained pebble and cobble of sandstone)	4.5			> 50
			Mod. hard to hard rock of grey color, fine-grain, calcareous, Sandstone and grey colored, Mudstone beds.	4.5 ~ 30	0 ~ 95	43 ~ 429	

11.1.4 Field Investigation and Laboratory Testing

The investigation and tests carried out are summarized below for reference.

11.1.4.1 Core Drilling

A total of 100.0 m of linear core drilling has been carried out during the investigation as given in Table 11-2 above.

11.1.4.2 IN-SITU Testing

Two different in-situ tests were carried out as below:

- SPT
- DCPT

SPT/DCPT test were carried as per IS 2131-1981 (Reaffirmed 2002).

11.1.4.3 Ground Hydrology

The water table observed during borehole drilling is given in table below,

Table 11-4: Ground water condition in boreholes

S.N.	Bridge No.	Borehole No.	Water level below ground level	Observed water loss level
1	CP 4-1	D6B70	7.5	None
2	CP 4-2	D7B71	12.0	None

S.N.	Bridge No.	Borehole No.	Water level below ground level	Observed water loss level
3	CP 4-3	D8B72	12.7	None
4	CP 4-4	D9B73	4.9	None
5	CP 4-5	D10B74	7.9	None
6	CP 4-6	D11B75	2.0	None
7	CP 4-7	D12B76A	3.0	None
8	CP 4-7	D13B76B	3.0	None
9	CP 4-8	D14B77B	1.5	None
10	CP 4-8	D15B77A	9.3	None
11	CP 4-9	D18B80A	1.5	None
12	CP 4-9	D19B80B	14.1	None
13	CP 4-10	D20B81B	2.0	None
14	CP 4-10	D21B81A	1.5	None
15	CP 4-11	D22B82	1.5	None
16	CP 4-12	D23B83	4.5	None

Water table has been observed in the drilled boreholes. Water level varying from 1.5 m to 14.1 m from the surface was noticed in the borehole.

11.1.4.4 SPT and DCPT Test VALUES

The SPT and DCPT values observed at bridge borehole sites are provided below;

S. No	Depth	DCPT		DCPT to SPT	SPT (N)	Combined SPT
	(m)	No. of blows	Penetration (cm)			
1	1.5				54	54
2	3.0				29	29
3	4.5				30	30
4	6.0				36	36
5	7.5				30	30
6	9.0				29	29
7	10.5				28	28
8	12.0				31	31
9	13.5				69	69
10	15.0				50	50
11	16.5				38	38
12	18.0				36	36
13	20.0				32	32

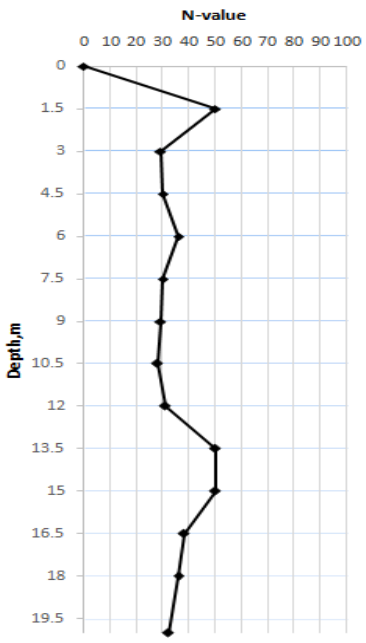


Figure 11.4: ***SPT value observed at D6B70***

S. No	Depth	DCPT		DCPT to SPT	SPT (N)	Combined SPT
	(m)	No. of blows	Penetration (cm)			
1	1.5				33	33
2	3.0				39	39
3	4.5				28	28
4	6.0				32	32
5	7.5				27	27
6	9.0				33	33
7	10.5				31	31
8	12.0				36	36
9	13.5				36	36
10	15.0				34	34
11	16.5				27	27
12	18.0				39	39
13	20.0				33	33

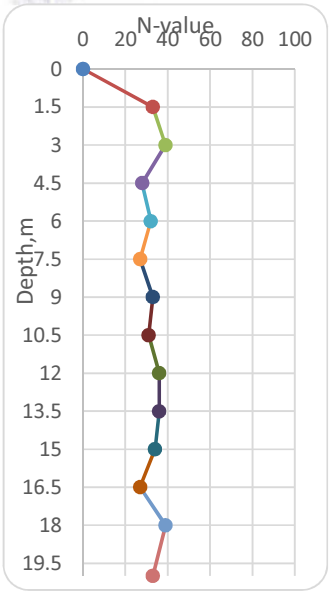


Figure 11.5: ***SPT value observed at D7B71***

S. No	Depth	DCPT		DCPT to SPT	SPT (N)	Combined SPT
	(m)	No. of blows	Penetration (cm)			
1	1.5	50	7	**143**		>50
2	3.0	50	6	**167**		>50
3	4.5	50	5	**171**		>50
4	6.0	50	2	**429**		>50
5	7.5	50	3	**250**		>50
6	9.0	50	12	**63**		>50
7	10.5	50	9	**83**		>50
8	12.0	50	4	**188**		>50
9	13.5	50	6	**125**		>50
10	15.0	50	3	**250**		>50
11	16.5	50	2	**375**		>50
12	18.0	50	8	**94**		>50
13	19.5	50	5	**150**		>50
14	21.0	50	7	**107**		>50
15	22.5	50	4	**188**		>50
16	24.0	50	6	**125**		>50

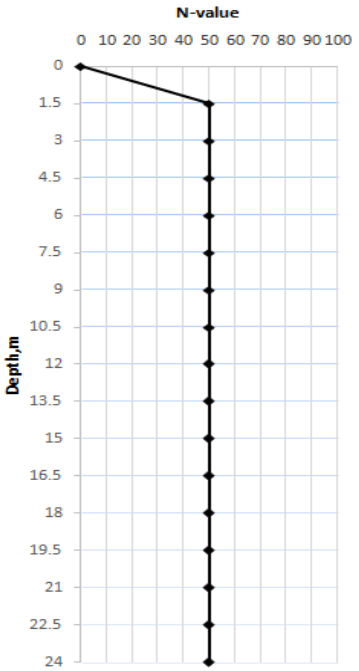


Figure 11.6: ***SPT value observed at D8B72***

S. No	Depth (m)	DCPT No. of blows	DCPT Penetration (cm)	DCPT to SPT	SPT (N)	Combined SPT
1	1.5				53	53
2	3.0				35	35
3	4.5				40	40
4	6.0				31	31
5	7.5				34	34
6	9.0				34	34
7	10.5				52	52
8	12.0				32	32
9	13.5				45	45
10	15.0				33	33
11	16.5				35	35
12	18.0				36	36
13	19.5				37	37

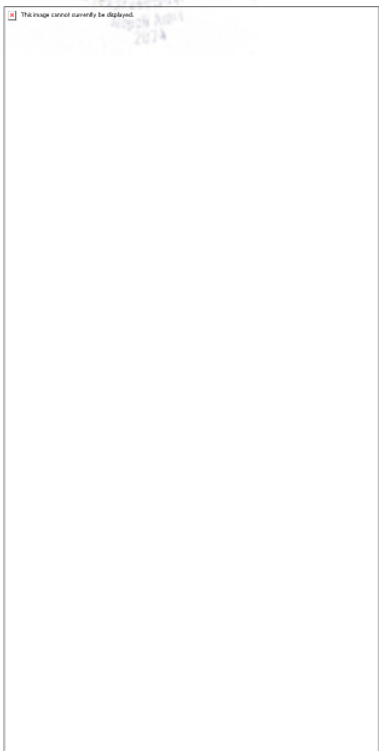


Figure 11.7: ***SPT value observed at D9B73***

S. No	Depth (m)	DCPT No. of blows	DCPT Penetration (cm)	DCPT to SPT	SPT (N)	Combined SPT
1	1.5				27	27
2	3.0				28	28
3	4.5				22	22
4	6.0				30	30
5	7.5				38	38
6	9.0				29	29
7	10.5				38	38
8	12.0				27	27
9	13.5				29	29
10	15.0				33	33
11	16.5				37	37
12	18.0				36	36
13	19.5				33	33

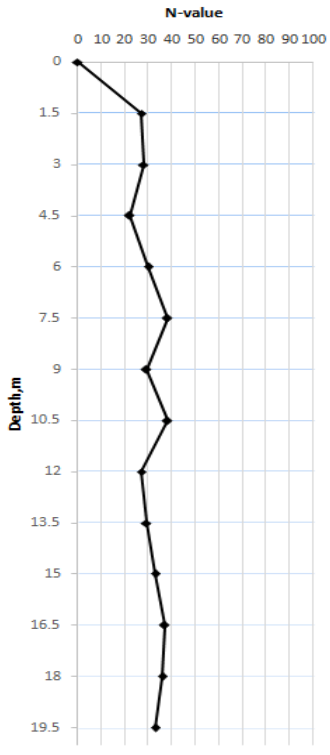


Figure 11.8: ***SPT value observed at D10B74***

S. No	Depth	DCPT		DCPT to SPT	SPT (N)	Combined SPT
	(m)	No. of blows	Penetration (cm)			
1	1.5				37	37
2	3.0				37	37
3	4.5	50	11	**78**		>50
4	6.0				50	50
5	7.5				45	45
6	9.0				43	43
7	10.5				65	65
8	12.0				73	73
9	13.5				72	72
10	15.0				64	64
11	16.5				66	66
12	18.0				51	51
13	19.5				61	61
14	21.0				65	65
15	22.5				68	68
16	24.0				60	60
17	25.5				75	75
18	27.0				92	92
19	28.5				87	87
20	30.0				96	96
21	31.5	50	6	**125**		>50
22	33.0	50	5	**150**		>50
23	35.0	50	7	**107**		>50

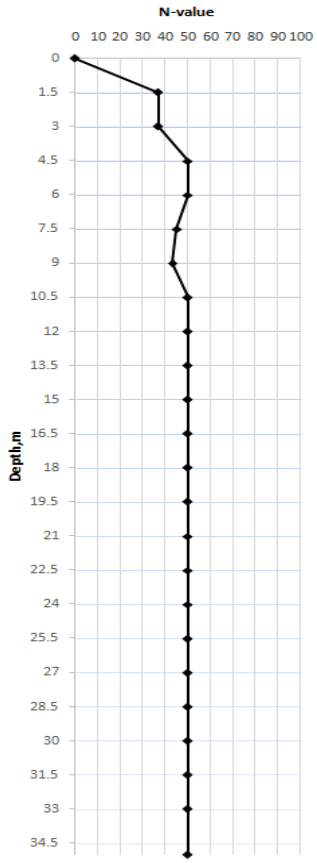


Figure 11.9: ***SPT value observed at D11B75***

S. No	Depth	DCPT		DCPT to SPT	SPT (N)	Combined SPT
	(m)	No. of blows	Penetration (cm)			
1	1.5				55	55
2	3.0				55	55
3	4.5	50	8	**107**		>50
4	6.0	50	5	**171**		>50
5	7.5				46	46
6	9.0				51	51
7	10.5				44	44
8	12.0				40	40
9	13.5				36	36
10	15.0				34	34
11	16.5				35	35
12	18.0				34	34
13	19.5				47	47
14	21.0				59	59
15	22.5				53	53
16	24.0				50	50
17	25.5				30	30
18	27.0				29	29
19	28.5				91	91
20	30.0	50	5	**150**		>50
21	31.5	50	11	**68**		>50
22	33.0	50	12	**63**		>50
23	35.0	50	3	**250**		>50

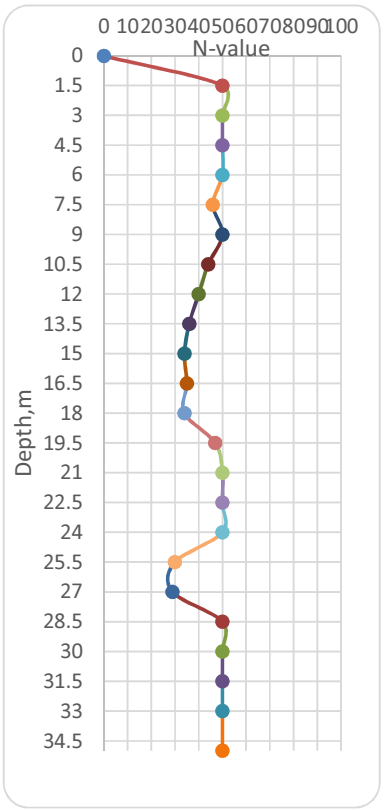


Figure 11.10: ***SPT value observed at D12B76A***

S. No	Depth	DCPT		DCPT to SPT	SPT (N)	Combined SPT
	(m)	No. of blows	Penetration (cm)			
1	1.5				21	21
2	3.0				21	21
3	4.5				21	21
4	6.0				20	20
5	7.5				40	40
6	9.0				62	62
7	10.5				71	71
8	12.0				57	57
9	13.5				61	61
10	15.0				61	61
11	16.5				59	59
12	18.0				67	67
13	19.5				64	64
14	21.0				70	70
15	22.5				58	58
16	24.0				54	54
17	25.5				52	52
18	27.0				58	58
19	28.5				57	57
20	30.0				85	85

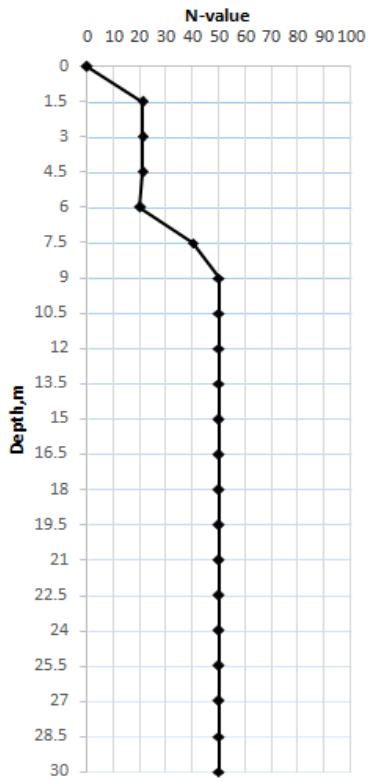


Figure 11.11: ***SPT value observed at D13B76B***

S. No	Depth	DCPT		DCPT to SPT	SPT (N)	Combined SPT
	(m)	No. of blows	Penetration (cm)			
1	1.0	50	12	**83**		>50
2	2.1				9	9
3	3.0				20	20
4	4.5				23	23
5	6.0				23	23
6	7.5				24	24
7	9.0				22	22
8	10.5				25	25
9	11.7				87	87
10	12.0	50	4	**188**		>50
11	13.5	50	3	**250**		>50
12	15.0	50	4	**188**		>50
13	16.5					>50
14	18.0	50	6	**125**		>50
15	19.5	50	12	**63**		>50
16	21.0	50	3	**250**		>50
17	22.5	50	4	**188**		>50
18	24.0	50	3	**250**		>50
19	25.5	50	10	**75**		>50
20	27.0	50	8	**94**		>50
21	28.5	50	6	**125**		>50
22	30.0	50	7	**107**		>50

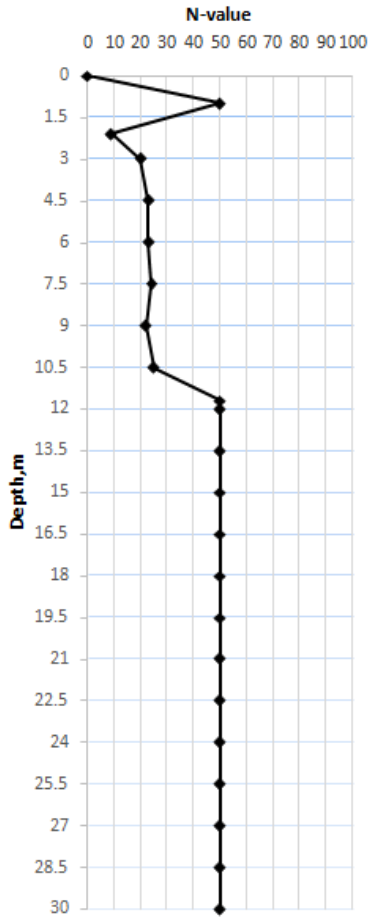


Figure 11.12: SPT value observed at D14B77A

S. No	Depth	DCPT		DCPT to SPT	SPT (N)	Combined SPT
	(m)	No. of blows	Penetration (cm)			
1	1.5	50	7	**143**		>50
2	3.0	50	5	**200**		>50
3	4.5	50	2	**429**		>50
4	6.0	50	9	**95**		>50
5	7.5	50	7	**107**		>50
6	9.0	50	6	**125**		>50
7	10.5	50	8	**94**		>50
8	12.0	50	10	**75**		>50
9	13.5	50	7	**107**		>50
10	15.0	50	6	**125**		>50
11	16.5	50	5	**150**		>50
12	18.0	50	5	**150**		>50
13	19.5	50	3	**250**		>50
14	21.0	50	4	**188**		>50
15	22.5	50	5	**150**		>50
16	24.0	50	3	**250**		>50
17	25.5	50	6	**125**		>50
18	27.0	50	3	**250**		>50
19	28.5	50	7	**107**		>50
20	30.0	50	3	**250**		>50

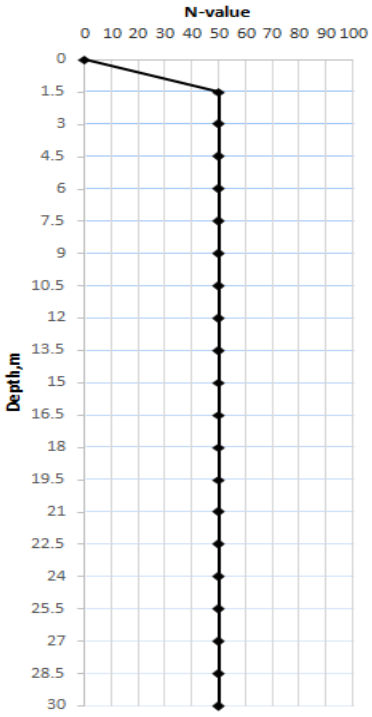


Figure 11.13: *SPT value observed at D15B77B*

S. No	Depth	DCPT		DCPT to SPT	SPT (N)	Combined SPT
	(m)	No. of blows	Penetration (cm)			
1	1.5				43	43
2	3.0				49	49
3	4.5				37	37
4	6.0	50	5	**171**		>50
5	7.5	50	7	**107**		>50
6	9.0	50	5	**150**		>50
7	10.5	50	3	**250**		>50
8	12.0	50	2	**375**		>50
9	13.5	50	4	**188**		>50
10	15.0	50	3	**250**		>50
11	16.5	50	3	**250**		>50
12	18.0	50	5	**150**		>50
13	19.5	50	4	**188**		>50

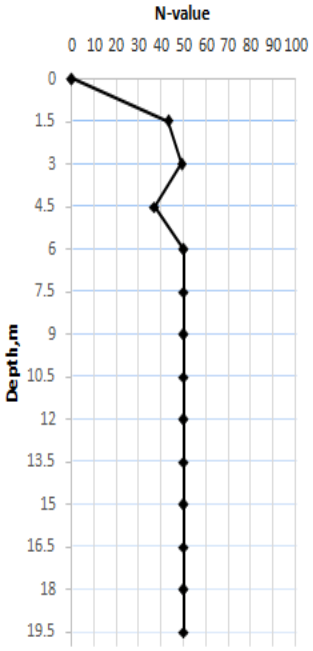


Figure 11.14: SPT value observed at D16B78

S. No	Depth	DCPT		DCPT to SPT	SPT (N)	Combined SPT
	(m)	No. of blows	Penetration (cm)			
1	1.5				16	16
2	3.0	50	6	**167**		>50
3	4.5	50	4	**214**		>50
4	6.0	50	4	**214**		>50
5	7.5	50	14	**54**		>50
6	9.0	50	9	**83**		>50
7	10.5	50	10	**75**		>50
8	12.0	50	12	**63**		>50
9	13.5	50	5	**150**		>50
10	15.0	50	4	**188**		>50
11	16.5	50	6	**125**		>50
12	18.0	50	7	**107**		>50
13	19.5	50	4	**188**		>50

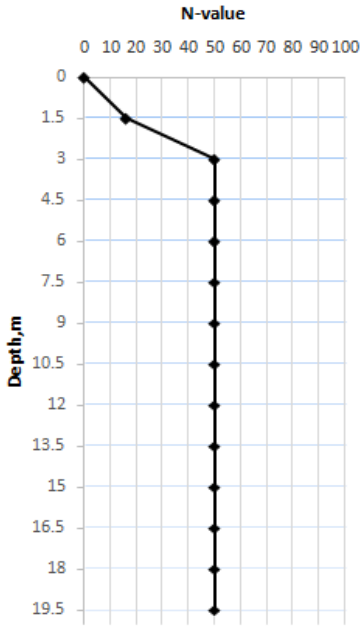
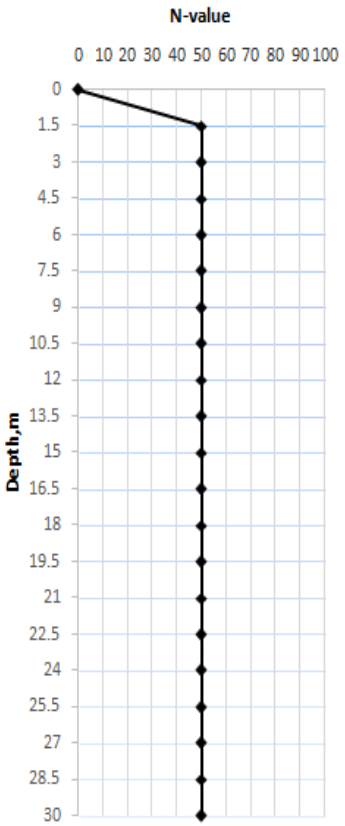


Figure 11.15: ***SPT value observed at D17B79***

S. No	Depth	DCPT		DCPT to SPT	SPT (N)	Combined SPT
	(m)	No. of blows	Penetration (cm)			
1	1.5				100	100
2	3.0	50	6	**167**		>50
3	4.5				90	90
4	6.0				100	100
5	7.5	50	14	**54**		>50
6	9.0	50	12	**63**		>50
7	10.5	50	8	**94**		>50
8	12.0	50	13	**58**		>50
9	13.5				62	62
10	15.0				100	100
11	16.5				100	100
12	18.0	50	10	**75**		>50
13	19.5				85	85
14	21.0	50	10	**75**		>50
15	22.5				89	89
16	24.0	50	10	**75**		>50



S. No	Depth	DCPT		DCPT to SPT	SPT (N)	Combined SPT
	(m)	No. of blows	Penetration (cm)			
17	25.5				74	74
18	27.0				100	100
19	28.5	50	10	**75**		>50
20	30.0	50	6	**125**		>50

Figure 11.16: ***SPT value observed at D18B80A***

S. No	Depth	DCPT		DCPT to SPT	SPT (N)	Combined SPT
	(m)	No. of blows	Penetration (cm)			
1	1.5	50	5	**200**		>50
2	3.0	50	7.5	**133**		>50
3	4.5	50	4	**214**		>50
4	6.0	50	3	**286**		>50
5	7.5	50	5	**150**		>50
6	9.0	50	3.4	**221**		>50
7	10.5	50	4	**188**		>50
8	12.0	50	5	**150**		>50
9	13.5	50	4	**188**		>50
10	15.0	50	3	**250**		>50
11	16.5	50	2	**375**		>50
12	18.0	50	3	**250**		>50
13	19.5	50	3	**250**		>50
14	21.0	50	4	**188**		>50
15	22.5	50	4	**188**		>50
16	24.0	50	3	**250**		>50
17	25.5	50	5	**150**		>50
18	27.0	50	6	**125**		>50
19	28.5	50	3	**250**		>50
20	30.0	50	2	**375**		>50
21	31.5	50	3	**250**		>50
22	33.0	50	4	**188**		>50
23	34.5	50	6	**125**		>50
24	36.0	50	5	**150**		>50
25	37.5	50	5	**150**		>50
26	39.0	50	3	**250**		>50
27	40.5	50	6	**125**		>50
28	42.0	50	7	**107**		>50
29	43.5	50	6	**125**		>50
30	45.0	50	6	**125**		>50

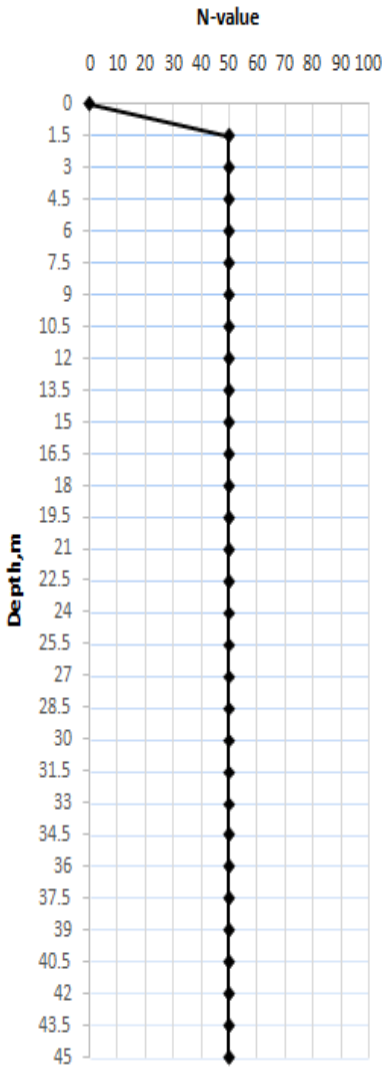


Figure 11.17: ***SPT value observed at D19B80B***

S. No	Depth	DCPT		DCPT to SPT	SPT (N)	Combined SPT
	(m)	No. of blows	Penetration (cm)			
1	**0**					
2	1					
3	2				12	12
4	4				14	14
5	5				53	53
6	6	50	5	**171**		>50
7	7.5	50	4	**188**		>50
8	9	50	5	**150**		>50
9	10.5	50	3	**250**		>50
10	12	50	4	**188**		>50
11	13.5	50	5	**150**		>50
12	15	50	3	**250**		>50
13	16.5	50	3	**250**		>50
15	18	50	3	**250**		>50
16	19.5	50	5	**150**		>50
17	21	50	3	**250**		>50
18	22.5	50	3	**250**		>50
19	24	50	4	**188**		>50
20	25.5	50	4	**188**		>50
21	27	50	2	**375**		>50
23	29.5	50	3	**250**		>50
24	30	50	3	**250**		>50

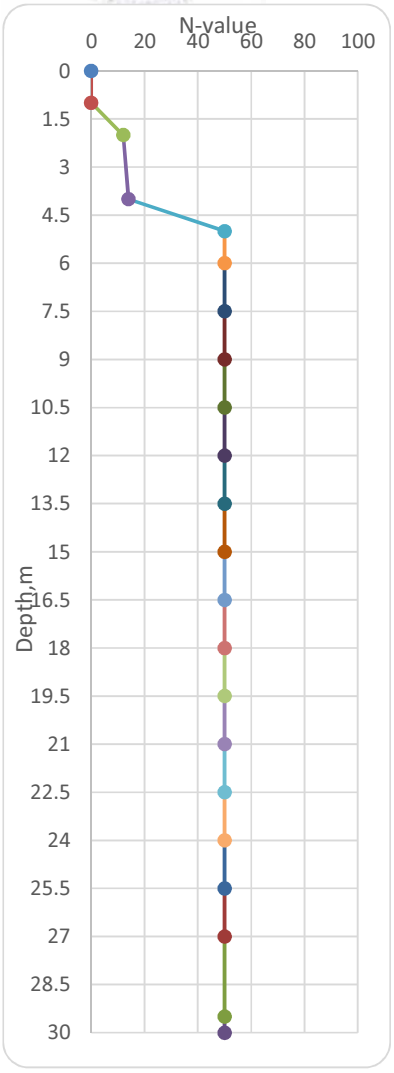


Figure 11.18: ***SPT value observed at D21B81A***

S. No	Depth	DCPT		DCPT to SPT	SPT (N)	Combined SPT
	(m)	No. of blows	Penetration (cm)			
1	0	0				
2	1.5	50	5			>50
3	3	50	6			>50
4	4.5	50	4			>50
5	6	50	8			>50
6	7.5	50	5			>50
7	9	50	5			>50
8	10.5	50	4			>50
9	12	50	5			>50
10	13.5	50	5			>50
11	15	50	8			>50
12	16.5	50	6			>50
13	18	50	4			>50
14	19.5	50	5			>50
15	21	50	8			>50
16	22.5	50	3			>50
17	24	50	4			>50
18	25.5	50	4			>50
19	27	50	3			>50
20	28.5	50	3			>50
21	30	50	3			>50
22	31.5	50	4			>50
23	33	50	5			>50
24	34.5	50	4			>50
25	36	50	2			>50
26	37.5	50	4			>50
27	39	50	4			>50
28	40.5	50				>50

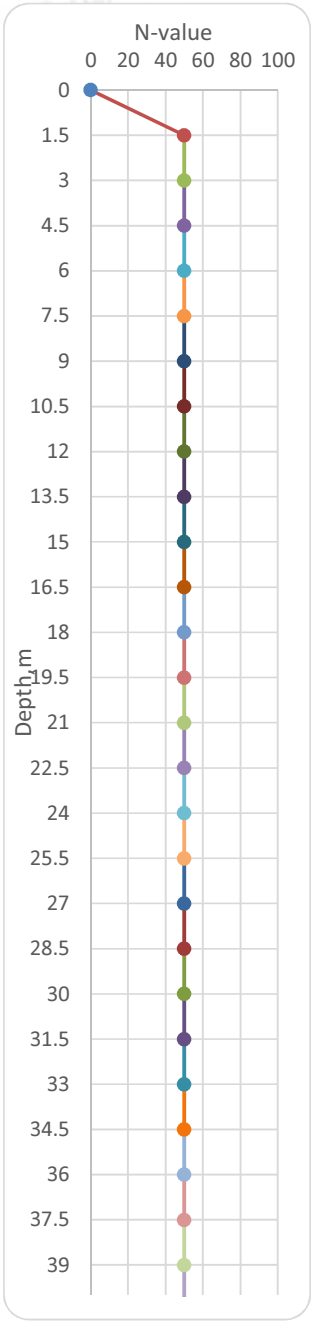


Figure 11.19: ***SPT value observed at D20B81B***

S. No	Depth	DCPT		DCPT to SPT	SPT (N)	Combined SPT
	(m)	No. of blows	Penetration (cm)			
1	1.5	50	2	**500**		>50
2	3.0	50	4	**250**		>50
3	4.5	50	2	**429**		>50
4	6.0	50	8	**107**		>50
5	7.5	50	3	**250**		>50
6	9.0	50	2	**375**		>50
7	10.5	50	9	**83**		>50
8	12.0	50	6	**125**		>50
9	13.5	50	8	**94**		>50
10	15.0	50	3	**250**		>50
11	16.5	50	6	**125**		>50
12	18.0	50	7	**107**		>50
13	19.5	50	5	**150**		>50
14	21.0	50	2	**375**		>50
15	22.5	50	3	**250**		>50
16	24.0	50	7	**107**		>50
17	25.5	50	5	**150**		>50
18	27.0	50	3	**250**		>50
19	28.5	50	4	**188**		>50
20	30.0	50	5	**150**		>50
21	31.5	50	3	**250**		>50
22	33.0	50	4	**188**		>50
23	34.5	50	2	**375**		>50
24	36.0	50	3	**250**		>50
25	37.5	50	2	**375**		>50
26	39.0	50	2	**375**		>50

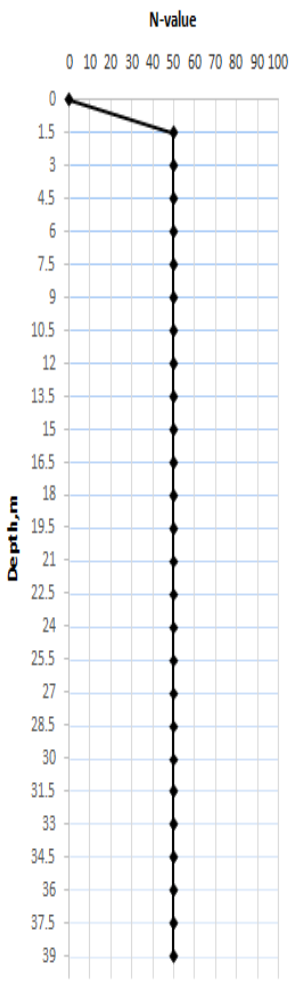
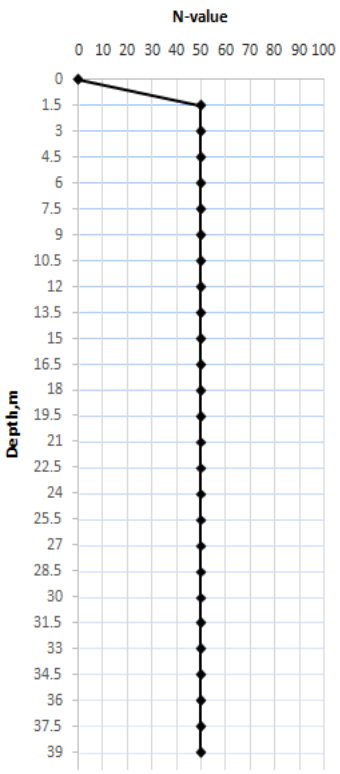


Figure 11.20: ***SPT value observed at D22B82***

S. No	Depth	DCPT		DCPT to SPT	SPT (N)	Combined SPT
	(m)	No. of blows	Penetration (cm)			
1	1.5	50	10	**100**		>50
2	3.0	50	2	**500**		>50
3	4.5	50	4	**214**		>50
4	6.0	50	3	**286**		>50
5	7.5	50	2	**375**		>50
6	9.0	50	3	**250**		>50
7	10.5	50	3	**250**		>50
8	12.0	50	12	**63**		>50
9	13.5	50	12	**63**		>50
10	15.0	50	10	**75**		>50
11	16.5	50	3	**250**		>50
12	18.0	50	2	**375**		>50
13	19.5	50	15	**50**		>50
14	21.0	50	3	**250**		>50
15	22.5	50	1.5	**500**		>50
16	24.0	50	2	**375**		>50
17	25.5	50	1.5	**500**		>50
18	27.0	50	2	**375**		>50
19	28.5	50	13	**58**		>50
20	30.0	50	2	**375**		>50



11.1.5 Laboratory Tests and Result

11.1.5.1 Laboratory Tests on Rock and soil

All together eight different geotechnical tests had been conducted during the investigation period. The list of such tests are;

i. Natural Moisture Content Test
ii. Specific Gravity Test
iii. Bulk Density Test
iv. Sieve Analysis
v. Atterberg's Limit Test
vi. Direct Shear Test
vii. Unconfined Compression Test
viii. Point Load Test

Table 11-5: Summary of lab test result on Borehole D6B70

S.N	Depth	Soil Sample												Rock Sample						
		Natural Moisture Content (%)	Specific Gravity	Bulk Density (gm/cc)	Sieve Analysis				Atterberg's Limit test			Direct Shear Test		Specific Gravity	Water Absorption (%)	Bulk density(gm/cc)	Unit Weight (Kg/cc)	Unconfined compression test (UCS), Mpa	Point load test, Mpa	
					Clay (%)	Silt (%)	Sand (%)	Gravel (%)	LL (%)	PL (%)	PI (%)	Cohension (KN/m^2)	Friction angle (deg)						Axial	Diametrical
1	4.5	21.64	2.58	–	0.00	13.87	86.13	0.00	–	–	–	21.62	23	–	–	–	–	–	–	–
2	6	21.80	2.59	–	0.00	23.47	76.53	0.00	–	–	–	31.68	17	–	–	–	–	–	–	–
3	6.0-7.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	285.17	79.12	153.21
4	12.0-13.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	471.95	57.60	41.89

Table 11-6: Summary of lab test result on Borehole D8B72

S.N	Depth	Soil Sample												Rock Sample						
		Natural Moisture Content (%)	Specific Gravity	Bulk Density (gm/cc)	Sieve Analysis				Atterberg's Limit test			Direct Shear Test		Specific Gravity	Water Absorption (%)	Bulk density (gm/cc)	Unit Weight (Kg/cc)	Unconfined compression test (UCS), Mpa	Point load test, Mpa	
					Clay (%)	Silt (%)	Sand (%)	Gravel (%)	LL (%)	PL (%)	PI (%)	Cohension (KN/m^2)	Friction angle (deg)						Axial	Diametrical
1	3.0	12.903	2.609	1.475	0.00	17.26	78.11	4.63	–	–	–	–	–	–	–	–	–	–	–	–
2	6.0	15.126	2.500	1.333	0.00	21.62	77.70	0.68	–	–	–	–	–	–	–	–	–	–	–	–
3	9.0	22.727	2.500	1.230	0.00	21.63	78.37	0.00	–	–	–	–	–	–	–	–	–	–	–	–
4	12.0	20.253	2.500	1.131	0.00	24.24	75.76	0.00	–	–	–	40.80	18	–	–	–	–	–	–	–
5	19.5	23.529	2.609	1.253	0.00	21.87	55.60	22.53	–	–	–	31.43	26	–	–	–	–	–	–	–

Table 11-7: Summary of lab test result on Borehole D9B73

S.N	Depth	Soil Sample												Rock Sample						
		Natural Moisture Content (%)	Specific Gravity	Bulk Density (gm/cc)	Sieve Analysis				Atterberg's Limit test			Direct Shear Test		Specific Gravity	Water Absorption (%)	Bulk density (gm/cc)	Unit Weight (Kg/cc)	Unconfined compression test (UCS), Mpa	Point load test, Mpa	
					Clay (%)	Silt (%)	Sand (%)	Gravel (%)	LL (%)	PL (%)	PI (%)	Cohension (KN/m^2)	Friction angle (deg)						Axial	Diametrical
1	1.5	10.39	2.609	1.239	0.00	4.95	85.61	9.45	–	–	–	20.10	24	–	–	–	–	–	–	–
2	6	14.10	2.564	1.663	0.00	11.93	76.25	11.82	–	–	–	17.85	25	–	–	–	–	–	–	–
3	12	20.83	–	1.357	0.00	7.56	91.49	0.95	–	–	–	–	–	–	–	–	–	–	–	–
4	15	20.83	2.500	1.291	17.22	21.75	60.37	0.66	–	–	–	25.74	19	–	–	–	–	–	–	–

Table 11-8: Summary of lab test result on Borehole D10B74

S.N	Depth	Soil Sample												Rock Sample						
		Natural Moisture Content (%)	Specific Gravity	Bulk Density (gm/cc)	Sieve Analysis				Atterberg's Limit test			Direct Shear Test		Specific Gravity	Water Absorption (%)	Bulk density (gm/cc)	Unit Weight (Kg/cc)	Unconfined compression test (UCS), Mpa	Point load test, Mpa	
					Clay (%)	Silt (%)	Sand (%)	Gravel (%)	LL (%)	PL (%)	PI (%)	Cohension (KN/m^2)	Friction angle (deg)						Axial	Diametrical
1	4.5	40.96	2.61	–	0.00	3.53	96.47	0.00	–	–	–	30.79	24	–	–	–	–	–	–	–
2	6.0	78.18	2.56	–	0.00	4.29	95.71	0.00	–	–	–	29.13	23	–	–	–	–	–	–	–
3	16.5	49.07	2.59	–	0.00	8.97	91.03	0.00	–	–	–	30.45	25	–	–	–	–	–	–	–

Table 11-9: Summary of lab test result on Borehole D11B75

S.N	Depth	Soil Sample											Rock Sample						
		Natural Moisture Content (%)	Specific Gravity	Bulk Density (gm/cc)	Sieve Analysis				Atterberg's Limit test			Direct Shear Test (^{0})	Specific Gravity	Water Absorption (%)	Bulk density (gm/cc)	Unit Weight (Kg/cc)	Unconfined compression test (UCS), Mpa	Point load test, Mpa	
					Clay (%)	Silt (%)	Sand (%)	Gravel (%)	LL	PL	PI							Axial	Diametrical
1	3.0	8.955	2.564	–	0.000	6.343	54.104	39.552	–	–	–	–	–	–	–	–	–	–	–
2	21.0-22.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5.225	–	67.818
3	27.0-28.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	215.331	–	–

Table 11-10: Summary of lab test result on Borehole D12B76A

S.N	Depth	Soil Sample												Rock Sample						
		Natural Moisture Content (%)	Specific Gravity	Bulk Density (gm/cc)	Sieve Analysis				Atterberg's Limit test			Direct Shear Test		Specific Gravity	Water Absorption (%)	Bulk density (gm/cc)	Unit Weight (Kg/cc)	Unconfined compression test (UCS), Mpa	Point load test, Mpa	
					Clay (%)	Silt (%)	Sand (%)	Gravel (%)	LL (%)	PL (%)	PI (%)	Cohension (KN/m^2)	Friction angle (deg)						Axial	Diametrical
1	1.5	16.667	2.500	1.432	0.00	11.56	87.01	1.43	–	–	–	33.24	24	–	–	–	–	–	–	
2	4.5	21.429	2.609	1.352	0.00	10.77	89.23	0.00	–	–	–	34.52	19			–	–	–		
3	9	17.500	2.564	1.338	0.00	14.93	85.07	0.00	–	–	–	32.07	22	–	–	–	–	–		–
4	12	8.219	2.609	1.371	0.00	7.49	91.12	1.39	–	–	–	29.76	23	–	–		–		–	–
5	16.5	12.644	2.564	1.390	0.00	15.07	84.93	0.00	–	–	–	34.86	24	–	–	–	–	–		–
6	21	16.000	2.564	1.338	0.00	12.12	87.88	0.00	–	–	–	27.90	22	–	–	–	–	–	–	–
7	25.5	18.090	2.586	1.013	0.00	16.78	82.01	1.21	–	–	–	–	–				–			
8	28.5-30.0	–	–	–	–	–	–	–	–	–	–	–	–			2.217	–	4.452	–	–
9	31.5-33.0	–	–	–	–	–	–	–	–	–	–	–	–			2.551	–	332.630		

Table 11-11: Summary of lab test result on Borehole D13B76B

S.N	Depth	Soil Sample											Rock Sample						
		Natural Moisture Content (%)	Specific Gravity	Bulk Density (gm/cm³)	Sieve Analysis				Atterberg's Limit test			Direct Shear Test (°)	Specific Gravity	Water Absorption	Bulk density (gm/cm³)	Unit Weight	Unconfined compression test (UCS) (Mpa)	Point load test (Mpa)	
					Clay (%)	Silt (%)	Sand (%)	Gravel (%)	LL (%)	PL (%)	PI (%)							Axial	Diametrical
1	28.5-30.0	–	–	–	–	–	–	–	–	–	–	–				–	148.680	28	21

Table 11-12: Summary of lab test result on Borehole D15B77A

S.N	Depth	Soil Sample												Rock Sample						
		Natural Moisture Content (%)	Specific Gravity	Bulk Density (gm/cm³)	Sieve Analysis				Atterberg's Limit test			Direct Shear Test		Specific Gravity	Water Absorption	Bulk density (gm/cm³)	Unit Weight	Unconfined compression tes (UCS) (Mpa)	Point load test (Mpa)	
					Clay (%)	Silt (%)	Sand (%)	Gravel (%)	LL (%)	PL (%)	PI (%)	Cohension (KN/m²)	Friction angle (deg)						Axial	Diametrical
1	1.5	15.108	2.609		0.000	9.414	87.830	2.755	–	–	–	35.16	25	–	–	–	–	–	–	
2	10.5-12.0	–	–		–	–	–	–	–	–	–	–	–	–	–	2.310	–	310.240		
3	16.5-18.0	–	–		–	–	–	–	–	–	–	–	–	–	–	2.333	–	4.702		–
4	22.5-24.0	–	–		–	–	–	–	–	–	–	–	–	–	–	2.282	–	252.474	–	–
5	25.5-27.0	–	–		–	–	–	–	–	–	–	–	–	–	–	2.550	–	12.828		–
6	28.5-30.0	–	–		–	–	–	–	–	–	–	–	–	–	–	2.600	–	58.436	–	–

Table 11-13: Summary of lab test result on Borehole D14B77B

S.N	Depth	Soil Sample											Rock Sample						
		Natural Moisture Content (%)	Specific Gravity	Bulk Density (gm/cm³)	Sieve Analysis				Atterberg's Limit test			Direct Shear Test (°)	Specific Gravity	Water Absorption	Bulk density (gm/cm³)	Unit Weight	Unconfined compression test (UCS) (Mpa)	Point load test (Mpa)	
					Clay (%)	Silt (%)	Sand (%)	Gravel (%)	LL (%)	PL (%)	PI (%)							Axial	Diametrical
1	10.5-12.0								–	–	–		–	–	–	–	–	–	33.909
2	12.0-13.5								–	–	–				2.693	–	47.718	125.631	73.470
3	15.0-16.5								–	–	–		2.636	–	2.622	–	39.110		60.085
4	19.5-21.0								–	–	–		–	–	2.661	–	39.110	181.924	–
5	24.0-25.5								–	–	–		–	–	–	–	–	99.379	–
6	27.0-28.5								–	–	–		–	–	–	–	–	–	31.447

Table 11-14: Summary of lab test result on Borehole D16B78

S.N	Depth	Soil Sample												Rock Sample						
		Natural Moisture Content (%)	Specific Gravity	Bulk Density (gm/cm³)	Sieve Analysis				Atterberg's Limit test			Direct Shear Test		Specific Gravity	Water Absorption	Bulk density (gm/cm³)	Unit Weight	Unconfined compression test (UCS) (Mpa)	Point load test (Mpa)	
					Clay (%)	Silt (%)	Sand (%)	Gravel (%)	LL (%)	PL (%)	PI (%)	Cohension (KN/m²)	Friction angle (deg)						Axial	Diametrical
1	1.5	20.325	2.564	1.310	0.000	22.928	77.072	0.000	–	–	–	21.97	23	–	–	–	–	–	–	
2	4.5	5.051	2.586	1.150	0.000	22.206	77.794	0.000	–	–	–	15.74	23			–	–	–		

Table 11-15: Summary of lab test result on Borehole D17B79

S.N	Depth	Soil Sample											Rock Sample						
		Natural Moisture Content (%)	Specific Gravity	Bulk Density (gm/cm³)	Sieve Analysis				Atterberg's Limit test			Direct Shear Test (°)	Specific Gravity	Water Absorption	Bulk density (gm/cm³)	Unit Weight	Unconfined compression test (UCS) (Mpa)	Point load test (Mpa)	
					Clay (%)	Silt (%)	Sand (%)	Gravel (%)	LL (%)	PL (%)	PI (%)							Axial	Diametrical
1	13.5-15.0	–	–	–	–	–	–	–	–	–	–	–	–	–	2.347	–	261.745	–	–
2	15.0-16.5	–	–	–	–	–	–	–	–	–	–	–	–	–	2.590	–	5.022	–	–
3	18.0-19.5	–	–	–	–	–	–	–	–	–	–	–	–	–	2.355	–	5.326	–	–

Table 11-16: Summary of lab test result on Borehole D18B80A

S.N	Depth	Soil Sample											Rock Sample						
		Natural Moisture Content (%)	Specific Gravity	Bulk Density (gm/cm³)	Sieve Analysis				Atterberg's Limit test			Direct Shear Test (°)	Specific Gravity	Water Absorption	Bulk density (gm/cm³)	Unit Weight	Unconfined compression test (UCS) (Mpa)	Point load test (Mpa)	
					Clay (%)	Silt (%)	Sand (%)	Gravel (%)	LL (%)	PL (%)	PI (%)							Axial	Diametrical
1	4.5-6.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	39.561	–
2	7.5-9.0	–	–	–	–	–	–	–	–	–	–	–			–	–	–	39.561	22.606
3	12.0-13.5	–	–	–	–	–	–	–	–	–	–	–	–	–	2.232	–	92.828	23.407	38.236
4	15.0-16.5	–	–	–	–	–	–	–	–	–	–	–	–	–	2.187	–	115.923	40.963	33.909
5	18.0-19.5	–	–	–	–	–	–	–	–	–	–	–	–	–	2.263	–	327.485	–	–
6	24.0-25.5	–	–	–	–	–	–	–	–	–	–	–	2.650	–	2.215	–	6.696	49.160	–
7	28.0-30.0	–	–	–	–	–	–	–	–	–	–	–				–	111.698	16.387	

Table 11-17: Summary of lab test result on Borehole D19B80B

S.N	Depth	Soil Sample											Rock Sample						
		Natural Moisture Content (%)	Specific Gravity	Bulk Density (gm/cm³)	Sieve Analysis				Atterberg's Limit test			Direct Shear Test (°)	Specific Gravity	Water Absorption	Bulk density (gm/cm³)	Unit Weight	Unconfined compression tes (UCS) (Mpa)	Point load test (Mpa)	
					Clay (%)	Silt (%)	Sand (%)	Gravel (%)	LL (%)	PL (%)	PI (%)							Axial	Diametrical
1	4.5-6.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	39.561	–
2	15.0-16.5	–	–	–	–	–	–	–	–	–	–	–			2.602	–	145.243	28.258	28.258
3	18.0-19.5	–	–	–	–	–	–	–	–	–	–	–	–	–	2.559	–	249.386	–	–
4	22.5-24.0	–	–	–	–	–	–	–	–	–	–	–	–	–	2.489	–	26.174	56.515	43.698
5	28.5-30.0	–	–	–	–	–	–	–	–	–	–	–	–	–	2.272	–	6.544	–	28.258
6	39.0-40.5	–	–	–	–	–	–	–	–	–	–	–	–	–	2.518	–	7.152	38.236	185.716

Table 11-18: Summary of lab test result on Borehole D21B81A

S.N	Depth	Soil Sample											Rock Sample						
		Natural Moisture Content (%)	Specific Gravity	Bulk Density (gm/cm³)	Sieve Analysis				Atterberg's Limit test			Direct Shear Test (°)	Specific Gravity	Water Absorption (%)	Bulk density (gm/cm³)	Unit Weight	Unconfined compression tes (UCS) (Mpa)	Point load test (Mpa)	
					Clay (%)	Silt (%)	Sand (%)	Gravel (%)	LL (%)	PL (%)	PI (%)							Axial	Diametrical
1	6.0-7.5	–	–	–	–	–	–	–	–	–	–	–	2.678	–	–	–	–	190.193	–
2	10.5-12.0	–	–	–	–	–	–	–	–	–	–	–	–	–	2.575	–	337.225	43.698	79.247
3	16.5-18.0	–	–	–	–	–	–	–	–	–	–	–	2.639	–	1.819	–	24.381	52.832	73.964
4	27.0-28.5	–	–	–	–	–	–	–	–	–	–	–	2.656	–	2.695	–	41.240	58.115	47.548

Table 11-19: Summary of lab test result on Borehole D20B81B

S.N	Depth	Soil Sample											Rock Sample						
		Natural Moisture Content (%	Specific Gravity	Bulk Density (gm/cm³)	Sieve Analysis				Atterberg's Limit test			Direct Shear Test (◦)	Specific Gravity	Water Absorption (%)	Bulk density (gm/cm³)	Unit Weight	Unconfined compression tes (UCS) (Mpa)	Point load test (Mpa)	
					Clay (%)	Silt (%)	Sand (%)	Gravel (%)	LL (%)	PL (%)	PI (%)							Axial	Diametrical
1	3.0-4.5	–	–	–	–	–	–	–	–	–	–	–	2.572	4.125	2.675	–	7.305	79.247	52.626
2	9.0-10.5	–	–	–	–	–	–	–	–	–	–	–	2.626	0.933	2.622	–	41.544	285.290	168.746
3	13.5-15.0	–	–	–	–	–	–	–	–	–	–	–	2.624	4.465	2.830	–	47.023	70.222	141.288
4	16.5-18.0	–	–	–	–	–	–	–	–	–	–	–	2.590	2.931	–	–	–	–	–
5	28.5-30.0	–	–	–	–	–	–	–	–	–	–	–	–	–	2.648	–	9.927	60.085	180.849
6	34.5-36.0	–	–	–	–	–	–	–	–	–	–	–	–	–	2.357	–	6.391	32.773	36.982
7	39.0-40.0	–	–	–	–	–	–		–	–	–	–	2.618	6.349	2.674	–	44.740	47.548	65.547

Table 11-20: Summary of lab test result on Borehole D22B82

S.N	Depth	Soil Sample											Rock Sample						
		Natural Moisture Content (%	Specific Gravity	Bulk Density (gm/cm³)	Sieve Analysis				Atterberg's Limit test			Direct Shear Test (◦)	Specific Gravity	Water Absorption (%)	Bulk density (gm/cm³)	Unit Weight	Unconfined compression tes (UCS) (Mpa)	Point load test (Mpa)	
					Clay (%)	Silt (%)	Sand (%)	Gravel (%)	LL (%)	PL (%)	PI (%)							Axial	Diametrical
1	15.0-16.5	–	–	–	–	–	–	–	–	–	–	–	2.641	3.344	–	–	58.436	38.236	76.471
2	16.5-18.0	–	–	–	–	–	–	–	–	–	–	–	–	–	2.864	–	452.795	96.076	138.367
3	25.5-27.0	–	–	–	–	–	–	–	–	–	–	–	2.626	2.915	2.815	–	28.387	84.530	109.154
4	30.0-31.5	–	–	–	–	–	–	–	–	–	–	–	2.623	1.170	2.499	–	293.702	52.832	47.548
5	34.5-36.0	–	–	–	–	–	–	–	–	–	–	–	2.651	1.033	2.336	–	427.618	47.548	21.245
6	39.0-40.0	–	–	–	–	–	–	–	–	–	–	–	2.643	2.343	–	–	44.740	–	–

Table 11-21: Summary of lab test result on Borehole D23B83

S.N	Depth	Soil Sample											Rock Sample						
		Natural Moisture Content (%)	Specific Gravity	Bulk Density (gm/cm³)	Sieve Analysis				Atterberg's Limit test			Direct Shear Test (°)	Specific Gravity	Water Absorption (%)	Bulk density (gm/cm³)	Unit Weight	Unconfined compression test (UCS) (Mpa)	Point load test (Mpa)	
					Clay (%)	Silt (%)	Sand (%)	Gravel (%)	LL (%)	PL (%)	PI (%)							Axial	Diametrical
1	3.0-4.5	–	–	–	–	–	–	–	–	–	–	–	2.664	0.993	–	–	42.505	91	144
2	6.0-7.5	–	–	–	–	–	–	–	–	–	–	–	2.612	1.384	2.268	–	415.292	168	112
3	13.5-15.0	–	–	–	–	–	–	–	–	–	–	–	–	–	2.626	–	429.140	57	–
4	19.5-21.0	–	–	–	–	–	–	–	–	–	–	–	2.624	1.996	–	–	–	87	120
5	24.0-25.5	–	–	–	–	–	–	–	–	–	–	–	–	–	2.404	–	369.182	104	27
6	28.5-30.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	369.182	49	–

The laboratory test performed were on boulders obtained from borehole as no bed rocks were encountered in the boreholes. The tested rock samples though represent the sandstone boulders.

11.1.6 CONCLUSION AND RECOMMENDATION

11.1.6.1 CONCLUSION

- The bridge site topographical survey and cross-section were done prior to start-up of the geotechnical investigation works. Hence, the proposed drilling location may vary from the actual abutment/pier location during construction.
- It is observed that most of the core samples recovered are highly weathered and soft rock type and in many cases the sludge samples were recovered. Hence, the limited number of laboratory works were performed in such sub-soil strata thus requiring further tests for the detail design works during construction.
- The limited laboratory tests were not able to evaluate the shear strength parameters for the rock and soil thereby limiting to N-value for bearing capacity evaluation.

11.1.6.2 RECOMMENDATION

- It is recommended to insert the pile tip at minimum depth of 3m socket length. Based on the super-structure load the socket length can be increased to greater depth.
- There is limitation of number of drill holes per bridge site for the detail design of bridge as it is practice conducting drilling on each abutment/pier location. So, it is highly recommended to perform confirmatory drilling works before starting up the construction works.
- This report shall be used as reference document rather than final conclusion for sub-structure design.

11.2 Geotechnical Investigation Report for Slope

11.2.1 Ground Characterization and Baseline Information

11.2.1.1 Stratigraphy

The detail investigation of Slope with Drillings, Coring, Test pits and SRT/ MAM for Package-4 has been done and shown in table below;

Table 11-22: Location of Slope for Drilling in CP4

S.N	Chainage	Borehole No.	Co-ordinate			Drilled Depth (m)
			Longitude	Latitude	Elevation	
1	53+268.64	BH-P9-S-13	619579.826	3019903.406	281.778	15
2	60+490	BH-P10-RE-14	617743.916	3018404.407	293.740	10
3	63+772.94	BH-P11-S-N8	617049.114	3015378.215	251.647	30

Table 11-23: Location of core samples

SN	Coring ID	Chainage
1	C-P9-S-1	57+840
2	C-P9-S-2	57+840
3	C-P9-S-3	59+640
4	C-P9-S-4	59+650

SN	Coring ID	Chainage
5	C-P10-S-5	60+500
6	C-P10-S-6	60+500
7	C-P10-S-7	61+050
8	C-P10-S-8	61+120
9	C-P10-S-9	61+940
10	C-P10-S-10	61+940
11	C-P10-S-11	62+540
12	C-P10-S-12	62+580
13	C-P11-S-13	63+830
14	C-P11-S-14	63+830
15	C-P11-S-15	63+830
16	C-P11-S-16	63+830
17	C-P11-S-17	63+830
18	C-P11-S-18	63+830
19	C-P11-S-19	64+500
20	C-P11-S-20	64+500

Table 11-24: Location of exploration of all the Test Pit/Trench

SN	Test Pit ID	Chainage	X	Y	Z	Total Depth (m)
1	TP-P11-S-29	63+809.6	617143.309	3015259.688	384.456	2
2	TP-P11-S-30	63+489.1	617133.060	3015222.001	391.127	2
5	TP-P11-S-31	64+313.7	616749.731	3014926.122	248.054	2
6	TP-P11-S-32	64+548.0	616599.753	3014746.000	242.674	2

Table 11-25: SRT & MAM Location in CP4

SN	Chainage	Structure	SRT (m)	MAM (Nos.)
1	57+800-58+000	Slope	400	2
2	61+100-61+200	Slope	200	1
3	61+900-61+900	Slope	350	1
4	63+800-63+800	Slope	1,200	3
	Total		**2,150**	**7**

The general stratigraphy indicated by boreholes in terms of strata encountered and their distribution across the Slopes (Ch: 57+400 to 65+160), Package No.: 4 is summarized in Table below;

Table 11-26: General lithology of CP-4

S.N.	Borehole No.	Stratum	Min./ Max. Levels below existing ground level (m)	Min. / Max RQD (%)	Min. / Max UCS (MPa)	SPT (N-Field value)
1	BH-P9-S-13	Consolidated clayey silt mixed with sand	0-5		8	50
		Hetrouneous layers mostly indpended and none boded (5-6.0: Slided mass, mudstone; 6.0-6.30: Fine Sand; 6.30-7.50: Slided mass, mudstone; 7.50-8: Siltstone; 8-9: sand mixed siltstone; 9-9.15: Calcareous Sandstone	5-10		3.16	50
		Silty sand	10-15			23-50
2	BH-P10-RE-14	sandy soil with some pebbles of sandstone, siltstone etc	0-1			
		moderately to highly weathered siltstone and light grey to grey coloured, fine to medium grained, slightly to moderately weathered sandstone	1-10	0-90	5.85-10.69	39-50
3	BH-P11-S-N8	The bed rock encountered are light grey coloured, fine grained, slightly to moderately weathered calcareous sandstone, light grey coloured marl, dark grey coloured, slightly siltstone with some calcareous clay as inclusions within bed rock, light grey to greenish grey coloured, fine grained sandstone. The rock mass is fractured at several zones. At 21.50 to 21.60 m, shear clay of 5 cm is observed. The calcareous nature of bedrock was confirmed by acid test	0-30	0-100	19.46-28.28	

11.2.2 Field Investigation and Laboratory Testing

The investigation and tests carried out are summarized below for reference.

11.2.2.1 Core Drilling

Linear core drilling has been carried out during the investigation as given in Table 11-22 above.

11.2.2.2 IN-SITU Testing

Two different in-situ tests were carried out as below:

- SPT
- DCPT

SPT/DCPT test were carried as per IS 2131-1981 (Reaffirmed 2002).

11.2.2.3 Ground Hydrology

The water table observed during borehole drilling is given in below,

Table 11-27: Ground water condition in boreholes

S.N.	Chainage	Borehole No.	Water level below ground level	Observed water loss level
1	53+268.64	BH-P9-S-13	9.3	None
2	60+490	BH-P10-RE-14	7.54	None
3	63+772.94	BH-P11-S-N8	28.4	None

Water table has been observed in the drilled boreholes within this package.

Table 11-28: Summary of Constant Head Permeability Test

SN	Borehole	Chainage	Test Depth (m)	Water Table (m)	Discharge Q (Liter/ min)	Permeability (cm/sec)	Average Permeability (cm/sec)	Degree of Permeability	Soil Type	Rock mass Condition
1	BH-P9-S-13	57+734.50	6	3.55	0.6	1.33E-03	5.03E-03	Medium	Pervious	Open closely spaced or voids
			9	3.45	2.12	4.83E-03		Medium	Pervious	
			13	4.05	3.77	7.32E-03		Medium	Pervious	
			15	9.33	7.87	6.64E-03		Medium	Pervious	
2	P10-RE-14BH-	60+521.9	10	7.54	0.23	4.21E-04	4.21E-04	Low	Pervious	Some Open

Table 11-29: Summary of Lugeon Test

SN	Bore Hole	Chainage	Test Section	Representative Lugeon Value (Lu)	Classification of Lugeon Value	Behavior	Permeability cm/s	Rock Mass Condition
1	BH-P9-S-13	57+734.50	9m-12m	*Water Leakage and test was stopped*			3.54E-04	Some Open
2	BH-P11-S-N8	63+772.90	7m-10m	30.543	Medium	Turbulent Flow	1.23E-03	Some Open
	BH-P11-S-N8		19m-22m	22.503	Medium	Turbulent Flow	4.97E-04	Some Open
	BH-P11-S-N8		22m-25m	16.433	Medium	Dilation	3.55E-04	Some Open
	BH-P11-S-N8		27m-30m	17.157	Medium	Dilation	3.39E-04	Some Open

The lugeon test conducted on the borehole BH-P9-S-13 was not successful as the water was leaked from the casing pipe.

11.2.2.4 SPT and DCPT Test VALUES

The SPT and DCPT values observed at bridge borehole sites are provided below;

Table 11-30: Summary of SPT/DCPT at Slope boreholes

S.N.	Drill Hole	Chainage	Test Depth (m)	DCPT/ SPT	N-Value	N_{60}	N_{70}	$(N_1)_{60}$	$(N_1)_{70}$	Compactness/ Consistency
1	BH-P9-S-13	57+734.50	1	SPT	50	34	29	58	50	Dense to very Dense
2			2	SPT	50	34	29	58	49	
3			3	DCPT	50	34	29	47	40	
4			4	DCPT	50	37	31	44	37	
5			5	SPT	50	39	33	41	35	
6			7	DCPT	50	44	37	39	33	
7			8	SPT	50	44	37	37	31	
8			11	SPT	24	22	19	16	14	Medium Dense
9			12	SPT	23	21	18	15	13	Medium Dense
10			14	SPT	50	46	39	32	28	Dense to very Dense
11			15	SPT	50	46	39	32	27	
1	BH-P10-RE-14	60+521.942	1	DCPT	39	27	23	45	39	Dense
2			1.5	DCPT	47	33	28	55	47	Dense
3			4	DCPT	50	37	31			Bedrock

11.2.3 Laboratory Tests and Result

11.2.3.1 Laboratory Tests on Rock and soil

These geotechnical tests have been conducted during the investigation period. The list of such tests are;

Table 11-31: Summary of laboratory test carried out on soil samples from borehole

Sample No.		Depth (m)	USCS Classification	Moisture Content (%)	Specific Gravity	Density (gm/cc)	Percentage of				Atterberg's Limit			Direct Shear Test	
Bore Hole ID	Chainage						Gravel (%)	Sand (%)	Fines						
									Silt (%)	Clay (%)	LL (%)	PL (%)	PI (%)	C (kPa)	Φ (°)
BH-P9-S-13	57+734.52	1.0-2.0	ML-SP	16.45	2.44	1.97	14.51	38.1	40.43	6.96	-	-	-	0.66	33.42
		2	ML	8.1	2.5	1.59	0	26.09	63.05	10.86	-	-	-	0.00	28.69
		2.5-4	ML	11.83	2.49	1.81	0	4.17	78.61	17.21	-	-	-	1.31	31.82
		11.0-12.0	SM	20.77	2.55	1.76	3.81	74.64	21.54		-	-	-	0.16	22.96
		12.0-13.0	SP-ML	19.34	2.55	2.15	0	58.54	35.54	6.09	-	-	-	0	32.62
		14.0-15.0	SM	16.78	2.93	2.15	1.25	84.48	14.27		-	-	-	0	23.64
P10-RE-14	60+521.90	1.0-1.5	CL-GP	9.08	2.49	1.64	27.54	6.07	56.6	9.75	37.8	22.6	15.2	2.62	35.37

Table 11-32: Summary of laboratory test carried out rock samples from borehole

Chain age	Bore Hole ID	Depth (m)	Moisture Content (%)	Density (gm/cc)	Poro-sity (%)	Water Absorp-tion	Slake Durability Index		UCS (Mpa)	MOE (GPa)	Pissons Ratio	Triaxial Test		Direct Shear Test	
							Id1 (%)	Id2 (%)				C (MPa)	Φ (°)	C (MPa)	Φ (°)
57+734.52	BH-P9-S-13	5.2-7.5	4.46	2.29			78.82	33.05	8	2.24	0.32	1.7	33.59	0.09	30.92
		7.5-9.0	2.22	2.29			64.81	43.56	3.16	0.25	0.25	1.96	33.32	0.37	27.07
		9.0-10.0	14.33	2.17			-	-	0.45	-	-	-	-	-	-
60+521.94	BH-P10-RE-14	1.5-4	5.15	2.43			1.59	1.99	91.15	78.92	7.65	2.08	0.31	0.91	47.69
		4-5.5	-	-			-	2.24	77.75	66.06	-	-	-	-	-
		6.5-10	12.89	6.36			2.1	2.09	72.65	68.01	10.69	2.84	0.22	8.56	21.05
		6.5-10	13.53	6.61			11.99	2.23	84.96	77.02	5.85	0.93	0.25	0.56	47.8
63+800	BH-P11-S-N8	1.1	10.53	-	-	-	-	-	-	-	-	-	-	-	-
		3.4	-	-	-	-	-	-	21.48	16.93	0.26	-	-	-	-
		4.5	-	-	-	-	-	-	-	-	-	2.77	37.01	-	-
		6.2	-	-	-	-	-	-	-	-	-	3.39	37.65	-	-
		7	2.41	2.4	-	-	-	-	24.77	20.8	0.24	-	-	-	-
		7.9	-	-	2.4	5.18	-	53.4	-	-	-	-	-	-	-
		9.1	-	-	-	-	-	-	-	-	-	3.01	36.02	-	-
		9.6	-	-	-	-	-	-	28.28	20.48	0.26	-	-	-	-
		10.4	2.88	2.12	-	-	-	-	-	-	-	-	-	-	-
		11.5	12.91	-	-	-	-	-	-	-	-	-	-	-	-
		13.3	3.82	2.19	-	-	-	-	19.64	18.79	0.32	-	-	-	-
		15.6-15.7	-	-	2.12	2.83	-	44.9	-	-	-	-	-	-	-
		21.4-21.5	-	-	2.19	4.21	-	98.9	-	-	-	4.62	35.83	-	-
		22.1	2.79	2.46	-	-	-	-	-	-	-			-	-
		27.4-27.5	-	-	2.46	2.78	-	82.7	-	-	-	-	-	-	-

Table 11-33: Summary of laboratory test carried out on coring samples

Sample No.		Porosity (%)	Water Absorption (%)	Moisture Content (%)	Density (gm/ml)	Slake Durability		UCS (MPa)	MOE (GPa)	Poissons Ratio	Triaxial Test	
Chainage	Coring ID					Id1 (%)	Id2 (%)				C (MPa)	Φ (°)
57+800 - 58+000	C-P9-S-1	28.36	12.41	4.59	2.32	79.88	69.83	5.44	0.57	0.33	9.06	36.27
57+800 - 58+000	C-P9-S-2	6.42	2.58	0.56	2.51	88.84	83.49	14.9	12.79	0.20	5.92	48.14
57+800 - 58+000	C-P9-S-3	17.71	8.22	0.78	2.29			4.01	4.04	0.31	0.96	41.89
57+800 - 58+000	C-P9-S-4	19.64	8.99	6.62	2.89	56.65	42.92	2.93	1.88	0.74	1.48	39.21
60+550 - 61+050	C-P10-S-5	-	-	3.45	2.41	-	-	1.72	0.86	0.41	2.04	21.71
60+550 - 61+050	C-P10-S-6	-	-	4.69	2.44	-	-	1.57	0.44	0.32	1.57	35.56
61+100 - 61+200	C-P10-S-7	-	-	2.17	2.28	52.09	18.54	4.85	0.71	0.32	1.56	37.53
61+900 - 61+900	C-P10-S-8	-	-	1.88	2.97	56.21	33.77	3.01	0.70	0.20	2.03	32.79
61+900 - 61+900	C-P10-S-9	24	11.06	1.09	2.41	-	-	5.1	1.23	0.31	2.59	33.84
61+900 - 61+900	C-P10-S-10	27.71	13.31	2.98	2.22	-	-	2.59	0.73	0.33	1.44	39.55
62+600 - 62+800	C-P10-S-11	-	-	4.42	2.52	-	-	2.56	1.15	0.35	2.93	27.06
62+600 - 62+800	C-P10-S-12	9.62	3.86	2.08	2.54	87.2	79.09	13.67	4.20	0.27	2.84	34.30
63+800 - 63+800	C-P11-S-13	2	0.72	1.03	2.13	99.01	98.8	56.04	11.93	0.27	8.1	42.67
63+800 - 63+800	C-P11-S-14	3.37	1.28	0.76	2.32	95.46	91.55	17.43	7.41	0.43	6.92	48.09
63+800 - 63+800	C-P11-S-15	7	2.83	1.24	2.42	95.03	93.36	58.7	12.93	0.26	8.51	38.51
63+800 - 63+800	C-P11-S-16	7.67	2.99	1.79	2.4	-	-	29.58	3.18	0.27	4.65	46.92
63+800 - 63+800	C-P11-S-17	10.15	4.04	1.23	2.3	97.33	95.9	25.37	5.05	0.21	4.42	53.51
63+800 - 63+800	C-P11-S-18	4.38	1.66	1.51	2.54	98.58	98.2	51.7	10.55	0.28	13.7	44.61
64+000 - 65+100	C-P11-S-19	10.52	4.47	1.89	2.47	87.2	79.09	21.24	4.70	0.37	2.46	48.86
64+000 - 65+100	C-P11-S-20	14.9	6.18	1.15	2.43	97.72	96.89	30.36	7.25	0.21	11.96	29.97

Table 11-34: Summary of laboratory test carried out on Test Pit samples

Sample No.		Depth (m)	Natural Moisture Content (%)	Unit Weight (gm/cm)		Specific gravity	Particle Size Distribution				Atterberg Limits			Direct Shear			
							Gravel (%)	Sand (%)	Fines					Dried		Saturated	
Chain age	Coring ID			Bulk	Dry				Silt (%)	Clay (%)	LL (%)	PL (%)	PI (%)	C (kPa)	Φ (°)	C (kPa)	Φ (°)
63+809.6	TP P11-S-29	0.00 - 1.00	8.58	1.35	1.24	2.68	29.66	12.16	45.49	12.88	29.50	NP	-	7.30	32.20	7.80	31.30
		1.00 - 2.00	14.98	1.26	1.10	2.68	44.37	5.53	40.47	9.63	26.80			-			
63+849.1	TP P11-S-30	0.00 - 1.00	7.23	1.43	1.33	2.66	28.26	19.43	40.60	11.71	26.00	20.10	5.90				
		1.00 - 2.00	5.12	1.47	1.39	2.70	50.64	14.04	27.26	8.05	26.50	NP	-	5.84	33.20	8.60	32.60
64+313.7	TP P11-S-31	0.00 - 1.00	21.20	1.53	1.36	2.65	19.41	15.72	50.12	14.75	27.50	21.70	5.80	17.30	29.31	18.80	28.40
		1.00 - 2.00	18.06	1.61	1.26	2.65	20.98	17.09	46.29	15.65	27.25	21.22	6.03				
64+548.0	TP P11-S-32	0.00 - 1.00	7.31	1.62	1.51	2.68	47.09	21.76	24.09	7.05	NP			-			
		1.00 - 2.00	5.35	1.58	1.50	2.68	58.47	15.67	19.70	6.16				9.10	34.30	11.60	33.05

Summary of the Geophysical investigation to evaluate slope

The detailed interpretation of the result of the 2D-SRT and 1D-MAM field observations, the following conclusions are made.

Geologically, the project area lies in the Siwaliks comprising mudstone and sandstone.

- Along the hillslopes to the east from Katle Khola Gaun, bedrock is estimated at the depth of 10-22 m. The overlying sediments exhibit different lithology from silty sand to gravel with allowable bearing capacity 39 kN/m^2 and 304 kN/m^2. Uniaxial compressive strength of the bedrock in the area ranges between 42 MPa and 58 MPa.
- Along the hillslopes near the Matokori Village, bedrock is estimated at the depth of 10-25 m. The overlying sediments exhibit different lithology from silty sand to gravel with allowable bearing capacity 52 kN/m^2 and 275 kN/m^2. Uniaxial compressive strength of the bedrock in the area ranges between 28 MPa and 66 MPa
- Near the Jaspal Village, bedrock is estimated at the depth of 8-17 m. The overlying sediments exhibit different lithology from silty sand to gravel with allowable bearing capacity 61.34 kN/m2 and 244.00 kN/m2. Uniaxial compressive strength of the bedrock in the area ranges between 40 MPa and 44 MPa.
- Near the Kaileni Village, bedrock is estimated at the depth of 2-43 m. The overlying sediments exhibit different lithology from silty sand to gravel with allowable bearing capacity 44.4 kN/m2 and 279.00 kN/m2. Uniaxial compressive strength of the bedrock in the area ranges between 39 MPa and 51 MPa.
- At the toe part of the Mauri Bhir bedrock is estimated below the depth of 3-20 m. The overlying sediments exhibit different lithology from silty sand to medium sand with allowable bearing capacity 80 kN/m2 and 100.00 kN/m2. Uniaxial compressive strength of the bedrock in the area is estimated to 51-96 MPa characterized by a weak zone between the depth of 24 m and 27 m.
- At the crown part of Mauri Bhir, ~1-37 m. Bedrock is shallow in the eastern part of the area. The overlying sediments exhibit different lithology from silty sand to gravel with allowable

bearing capacity 40 kN/m2 and 310 kN/m2. Uniaxial compressive strength of the bedrock in the area ranges between 31 MPa and 53 MPa.

- Along the main landslide body from the crown in Mauribhir rockhead is expected below the depth of 35 m only in the eastern part.
- At Bakaiya Khola in Mauri Bhir, bedrock is expected below the depth of 6-42 m. The bedrock is shallow and good towards the southwest (downstream). Empirically calculated uniaxial compressive strength of the bedrock ranges between 73-75 MPa with RQD 56-59%.

11.2.4 CONCLUSION AND RECOMMENDATION

11.2.4.1 CONCLUSION

- The slope site topographical and cross-section was done prior to start-up of the geotechnical investigation works. Hence, the proposed drilling location may vary during construction.
- It is observed that most of the core samples recovered are highly weathered and soft rock type and in many cases the sludge samples were recovered. Hence, the limited number of laboratory works were performed in such sub-soil strata samples thus requiring further tests for the detail design works during construction.
- The limited laboratory tests were not able to evaluate the shear strength parameters for the rock and soil thereby limiting to N-value for bearing capacity evaluation.

11.2.4.2 RECOMMENDATION

- It is recommended to insert the pile tip at minimum depth of 3m socket length. Based on the super-structure load the socket length can be increased to greater depth.
- There is limitation of number of drill holes per slope site for the detail design as it is practice to conduct drilling on each location. So, it is highly recommended to perform confirmatory drilling works before starting up the construction works.
- This report shall be used as reference document rather than final conclusion for sub-structure design.

Appendix 1: Laboratory Equipment

The items of laboratory equipment shall be providing in the field laboratory as per approval of the Engineer, for guidelines list of laboratory equipment's are list in below table. The Laboratory equipment's shall be deliver to the site not later than sixty days after the issues a letter to commence the works.

S.N	Description	Unit	Quantity
1	**General**		
	Office Supply (furniture & Furnishes)		
	Laptop	Nos.	1
	Desktop	Nos.	1
	Printer & Photo copy	Nos.	1
	Book Slaves	Nos.	1
	Filing Cabinet	Nos.	2
	Office Table	Nos.	2

S.N	Description	Unit	Quantity
	Office Chair with Arm	Nos.	2
	Office Chair for Guest	Nos.	10
	Office Operation including Stationeries	months	36
	Providing Kitchen & Utilities with Tea & Coffee.	months	36
	Supply and Provide and maintained 4WD service Vehicle for the supervision and Monitoring (Quality Control).	months	36
	Others (Stand Fan/ Room Heater/ Water Filter/ Carpet/Curtain etc.)		
	Equipment Supply		
	5- 20 kg capacity, sensitivity 1 g	No	1
	500 gm capacity, sensitivity 0.01 g (electrical)	No	1
	5 kg capacity, sensitivity 0.1 g (electrical)	No	1
	Chemical Balance 100gm capacity, sensitivity 0.001gm		1
	Oven Electrically Operated	Nos.	1
	Water Bath Serological 2 racker solar	Nos.	1
	Mercury Thermometer 250 ^{o}C	Nos.	1
	Dial Thermometer 400 ^{o}C	Nos.	1
	Mercury Thermometer 50 ^{o}C	Nos.	1
	Wet & Dry Thermometer	Nos.	1
	Spatula's 200/150mm	Nos.	1
	GI tray Sets (various Size)	Nos.	1
	Aluminum Moisture container 75 X50mm	Nos.	1
	Rubber Mallet	Nos.	1
	Aggregate Steel Scoop	Nos.	1
	Aluminum Scoop	Nos.	1
	Gauging Trowel	Nos.	1
	S.S Bowel 2 lt.	Nos.	1
	Volumetric Flask (1000/500/250 ml)	Nos.	1
	Measuring Cylinder (1000/500/250/100ml)	Nos.	1
	Beaker(1000/500/250ml)	Nos.	1
	Evaporating Disc-100mm	Nos.	1
	Venire Caliper-150mm digital	Nos.	1
	Miscellaneous (Safety Accessories)	Nos.	1
	Specific Gravity Bottle	Nos.	1
	Sand Pouring Apparatus 200mm	Nos.	1
	Sand Pouring Apparatus 100mm	Nos.	1
2	**Sieves**		
	Set of GI Sieve 450 dia Size, as per IS 462 with lead and pan;	Set	1
	Set of Brass Sieve 200mm/850mm size dia.as per IS 462 with lead and pan;	Set	1
	Sieve Shaker capable of shaking 200mm & 450 mm dia sieve 9 Electrically operated0	nos	1
3	**Other Miscellaneous (Measuring Cylinders/Beakers/Tray/wash bottle/glass funnels/safety Gloves etc.)**	LS	1
4	**Soil Tests**		
i.	Liquid Limit test set	set	1
ii.	Compaction Apparatus (Proctor) as per IS 2720	set	1

S.N	Description	Unit	Quantity
	Dynamic Cone Penetration Equipment complete	set	2
	Water Testing Kit	set	1
	Organic Content testing kit	set	1
	Compaction Mold	set	1
5	**CBR Test set**	Set	1
6	**Core Cutter Apparatus**	Set	1
7	**Concrete tests**		
i.	Slump test Apparatus	set	3
ii.	Aggregate crushing testing machine(ACV)	No	1
iii.	Aggregate Impact testing machine (AIV)	No,	1
iv.	Los Angle Abrasion test Machine (LAA)	No.	1
v.	Concrete cube mold (150*150*150) mm^3	set	3
vi	Mortar cube mold (70.7*70.7*70.7) mm^3	set	3
vii.	Standard sand (Coarse, medium and fine)	Bag	2
8	**Cement Tests**		
i.	Le-chatelier Apparatus for soundness test of cement all complete	set	1
ii.	VI cat needle apparatus for setting time with plungers as per IS 2542 (Part 2)	set	1
9	**Machines**		
2	Digital Compression Testing Machine, Capacity 2000kN Flexure Test Attachment, 100 KN capacity for Digital CTM.	set	1
3	Digital Compression Testing Machine, Capacity 500kN	set	1
6	Concrete/ Pavement Core Drilling Machine Diamond Core Bit, 100mm dia x 200 LONG FOR CONCRETE	set	1
B	**Part 2 Bituminous Test**		
1	Constant temperature bath for accommodating bitumen test specimen, electrically operated, and thermostatically controlled (to accommodate minimum six specimens)	No	1
2	Marshall compaction apparatus, automatically operated as per EN 12697-10-30 complete with accessories (with 180 N Marshall Moulds)	set	1
3	Viscometer set (for Absolute and Kinematic viscosity of Bitumen, Emulsion,etc.)	set	1
4	Ductility meter	set	1
5	Softening point (Ring and Ball) apparatus	set	1
6	Bitumen laboratory mixer including required accessories (20 litres)	set	1
7	Soxhlet extraction or centrifuge type apparatus complete with extraction thimbles with solvent and filter paper	set	1
8	Penetrometer automatic type, including adjustable weight arrangement and needles as per IS 1203	set	1
9	Riffle box (Riffle Sample Divider,14 slots(13 mm slot width)	No	1
11	Thin film oven test apparatus for modified binder either with PMB or CRMB	No	1
12	Core drilling machine suitable for 150 mm dia core	set	1

S.N	Description	Unit	Quantity
	Specific Gravity Apparatus Test for Asphalt core with buoyancy balance of 5kg capacity complete set	set	1
	Filter Paper for Marshal and Extractor Test	set	1
	Water Bath (Digital Automatic temp. controller) for Marsalis Sample.	No.	1
C	**Zinc Coating Tests**		
	Chemical	LS	1
	Digital Screw Gauge	No.	1

Note: The items and their numbers listed above table are indicative only and shall be decided by the Engineer as per requirements of the Project and modified accordingly.

Appendix 2: Optical Fiber Works and Rehabilitation & Reconstruction of Electric work

1. Optical Fiber Details

S.N.	Item	Unit	Qty
1	Normal soil(Depth 1.50 m)	Mtr.	1161
2	Soft Rock(Depth 1.20 m)	Mtr.	3515
3	Hard Rock(Depth 1.00 m)	Mtr.	1900
4	6" GI Clamp in Bridge/Culvert with supply of GI Pipe	Mtr.	370
5	Duct Laying	Mtr.	30527
6	Duct Bed preparation	Mtr.	6576
7	Laying of warning Tape	Mtr.	6576
8	450X450 mm Manhole	Mtr.	8
9	DIT	Mtr.	30527
10	OFC Laying/Blowing	Mtr.	15263
11	Spicing and termination	Fiber	435
12	Drum Test	Nos.	15263
13	Link Test with LSMP	Nos.	1
14	Survey	Mtr.	7632
15	As built drawing with GIS information	Mtr.	7632
16	Earthing	Mtr.	1
17	PCC Protection	Mtr.	63
18	Placement of Route indicator	Nos.	76
19	HDPE Duct(40 mm)	Mtr.	18000
20	End Plug	Mtr.	91
21	Sealing Plug	Mtr.	30
22	Push Fit coupler	Mtr.	30
23	Joint Closure-Branched(T) Type for 96 F	Mtr.	9
24	Optical Fiber cable -96F Armoured Typ Ribbon Fiber	Mtr.	18000
25	Warning Tape(100 mm W & 0.25 mm thickness	Mtr.	6576
26	96 fiber 2U FMS LCPC/LCPC	Mtr.	1

2. Rehabilitation & Reconstruction of Electric Work Details

S.N	Material	Qty.	Unit
1	STP Pole (11Mtr)	16.00	nos
2	STP Pole (8Mtr)	11.00	nos

S.N	Material	Qty.	Unit
3	T - Channel	10.00	nos
4	8 ft Channel	4.00	nos
5	11 KV Disc insulator (With grapher Set)	36.00	Set
6	12 KV Disc insulator (With Spindle Set)	36.00	Set
7	ACSR Conductor (Size 0.03 sq. inch)	0.90	km
8	Stay set with stay insulator	18.00	Set
9	Stay Wire	90.00	kg
10	HT Cable Connecting kit.	12.00	set
11	HT XLPE Cable (70 mm. sq.) 3 core	920.00	mtr
12	LT Cable connecting kit	6.00	set
13	LT XLPE cable (95 mm. sq) 305 core	360.00	mtr
14	D- Iron Shackle Insulator	16.00	nos
15	Pole Clamp	22.00	nos
16	Full thread nutbolts (Diff. Size)	1.00	kg
17	Washer	16.00	kg
B)	**Total Material Cost (1+……)**		
S.N (C)	Labour Charge	Qty.	Unit
1	Erection work of STP Pole (11 Mtr)	16.00	nos
2	Erection work of STP Pole (8Mtr)	11.00	nos
3	Installation of stay set	18.00	Set
4	Dis/ Restringing of HT3 Wires (Size 0.05 ACSR)	0.60	km
5	Dismantling of HT 3 Wires (Size 0.05ACSR)	0.80	km
6	Stringing of LT 2 Wires (Size 0.03ACSR)	0.43	km
7	Installation work of HT XLPE Cable head	12.00	Set
8	Laying of HT Cable underground	800.00	mtr
9	Installation work of LT XLPE Cable head	6.00	Set
10	Laying of LT Cable underground	300.00	mtr
11	Dis/Reconnection of Service cable	1	nos
12	Labor Charge (Sum of item 'C')	1	Job
13	Rechargeable Charge (10%)	1	Job
14	Shutdown Charge	1	Job
15	Contingency Charge	1	Job

Appendix 3: Specification for Stabilization and Supporting of Excavated Slope Face

1. General

1.1. Scope of Work

(a) This section covers the stabilization and supporting works of excavated soil, boulder mixed soil (BMS) and rock face to be expected under this Contract, the procurement of materials and equipment and the in-situ tests to be required for these works.

(b) This section covers the investigation and analysis work through slope face mapping of face to be expected under this Contract.

(c) The use of the support systems specified in this Section shall be coordinated into the overall support arrangement and procedures established by the Contractor's experts to maintain safe slope conditions during the construction of the Works. The support systems specified herein are primarily for long term stability during operation of the project. The Contractor shall remain solely responsible for safety and stability of all slope during construction.

(d) Range of support measures for slope with soil, BMS and rock

i. Rock Bolt/Rock Anchor
ii. Earth Anchor (Strand Type)
iii. Soil Nailing
iv. Gabions and Gabion Mattresses
v. Wire Mesh
vi. Shotcrete
vii. R.E Wall (Reinforced Soil all)
viii. Bio Engineering Works
ix. Piling for Structure
x. Galvanized Wire Net for Slope Protection
xi. Geotechnical Monitoring for Slope

1.2. Related Works

1.2.1.Dewatering

1.2.2.Protection Works

1.3. Submittals

(a) The Contractor shall submit the geological face map of rock face and reports related to analysis of slope stability to the Client (Geotechnical Engineer/Geologist), after excavation of slope.

(b) The Contractor shall submit the details of work scheme, including the supporting method, the sequence for the works, equipment, machines, as well as the detailed information of the supports to be installed including quality assurance, environment protection, safety measures to the Client (Geotechnical Engineer/Geologist).

(c) Construction drawings

(d) The detailed information of supports shall include the type and quality of supports, manufacturer's instruction and certificates.

(e) The Contractor shall record and submit the results of pull-out test performed after installing the supports including the Rock Bolt/Soil Nailing/Earth Anchor to the Client (Geotechnical Engineer/Geologist).

1.4. Definitions and Descriptions

Supporting: Installation of supports to reinforce the excavated face by using the soil nails, rock bolts, rock anchor and shotcrete with or without wire mesh, etc.

1.5. Equipment / Materials

(a) The equipment and machines shall meet the requirements for the stabilization and supporting of excavated soil, BMS and rock face under this Contract.

(b) The Contractor shall be responsible for providing the adequate equipment and machine to execute the supporting works.

(c) Materials including rock bolt, rock anchor, shotcrete, wire mesh, galvanized wire net, etc. to be supplied for the works of this clause shall satisfy the requirements and quality as specified in the related works.

(d) The Contractor shall have the responsibility for the timely procurement and supply of the adequate materials in order to avoid the suspension of the supporting works.

(e) The Contractor shall be held responsible for all the consequential losses including operation revenue losses caused by delay in scheduled completion date of the Project because of the failure of the Contractor for the timely procurement & supply of adequate quantity of quality construction materials, equipment and manpower of all grades to the Project work.

1.6. Execution

In case of existing cut slope where the supporting requirement deviates from the design and incase of newly excavated slope, the contractor will be responsible for following activities:

(a) The Contractor shall submit report of slope stability including geological map and engineering geological map to the Client (Geotechnical Engineer/Geologist) for approval.

(b) The Contractor shall map surface geological features in order to establish slope stability, which including all excavated slope permanent slope as well as excavated slope of access road.

(c) The Contractor shall be analyzing slope stability which is utilized by computer program, for example GeoStudio (Slope/W, Seep/W), DIPS, PC Stable etc.

(d) The reinforcement method of slope stability should be appropriate to condition of slope that consists of soil or rock type.

(e) The report shall state method of reinforcement, which includes location, quantity, process of work, equipment, machine, as well as detailed geological condition and analysis.

2. Rock Bolts / Rock Anchor

2.1. General

Please refer Standard Specification for Road and Bridge Works DoR 2073 Under Section; 2400 subsection 2413 Heading Nos 11 for the provisions 'Rock Bolt'. Additional specifications are as provided on the following paragraphs.

2.2. Standards

The rock bolts/rock anchor shall conform to the latest editions of the following Standards or, where not covered by these Standards, to their equivalent International Standards, subject to the approval by Client (Geotechnical Engineer/Geologist).

- IS: 1786 Specifications for high strength deformed-steel bars and wires for concrete reinforcement
- IS: 2062 Steel for general structural purposes
- IS: 10270 Guidelines for design and construction of pre-stressed rock anchors
- IS: 11309 Method of conducting pull out test on anchor bars and rock bolts
- ASTM D4435 Standard Test Method for Rock Bolt Anchor Pull Test
- IS: 13219 Rock bolts for mines (cement grouted) - general requirements

2.3. Materials

(a) The Contractor shall furnish, install, test and maintain rock bolts/rock anchor as specified herein. The properties of the reinforcement element shall follow the drawing and specification.

(b) For the sake of clarity, the terms used in this Section are defined as follows:

- Reinforcement element is a general term for rock bolts / rock anchor which are made from the steel product satisfying the proper specification.

- Random rock bolting refers to the installation of reinforcement elements in localized areas of instability or weakness as determined during excavation. It is synonymous with "spot bolting".
- Pattern rock bolting/rock anchor refers to the installation of reinforcement elements in a regular pattern over the excavation surface.

(c) The type, length, diameter, inclination and pattern of the rock bolts/rock anchor shall be proposed by the Contractor, for approval, except when the dimensions are explicitly shown on the construction Drawings.

(d) Rock bolts/rock anchor shall be furnished complete with all accessories and other materials necessary for their installation and grouting.

(e) Bearing plates shall be flat or dished steel plates. The bevel or hemispherical washers shall be made of steel. The nuts shall be heavy hexagonal type. Where the above components are to be used with grouted rock bolts, they shall be hot-dip galvanized.

(f) All surfaces of the bearing plates, nuts, washers and wedges, and threads on the projecting ends of rock bolts/ rock anchor shall be protected and lubricated with rust preventive compound.

2.4. Testing and Monitoring of Rock Bolts/Rock Anchor

The method of pull-out test shall be subject to ASTM D4435 or method of conducting pull out test on anchor bars and rock bolts according to IS 11309.:

(a) The Contractor shall furnish at least 2 sets of testing equipment including hydraulic jacks, fixing device, hydraulic pump with manometer, extensometer, and all necessary accessories. The testing equipment shall be capable of stressing the largest diameter rock bolt / rock anchor to the yield stress of the bolt.

(b) The rock bolt / rock anchor shall be subjected to a pre pull-out test to confirm the pull-out strength. The constructed rock bolt/rock anchor should be the same as the rock bolt/ anchor used in the pre pull-out test. The pull-out test of the constructed rock bolt / rock anchor is acceptable when it reaches 80% of the designed pull-out strength. Tests of constructed rock bolts / rock anchor are carried out 1 per 100 rock bolts / rock anchor

(c) The Contractor shall replace at his/her own expenses any rock bolts which fails during tests or has become ineffective through his fault or improper operation.

2.5. Drilling Holes and Preparation for Installation

(a) Holes for rock bolts/rock anchor shall be drilled as specified herein.

(b) The diameter of each hole shall be in accordance with manufacturer's recommendations where the hole diameter shall be at least 1.5 times that of the rod specified for that hole.

(c) The length of drill hole shall be such as to receive the specified rock bolt / rock anchor and to provide for its satisfactory anchorage. The downward holes shall extend 15 to 20 cm beyond the length of the rock bolt/rock anchor.

(d) After drilling, each hole in compact, washable rock shall be washed out with clean water and cleaned by blowing out all drill cuttings and debris with compressed air. The holes in rock which tends to swelling or is interspersed with clay filled fissures shall be cleaned with compressed air only. The compressed air shall not contain any oil or other material preventing the bond.

(e) Prior to installing the rock bolts/rock anchor which will be stressed, the rock surface adjacent to the hole shall be prepared for the bearing plate. When the surface is not perpendicular to

the hole axis, bevel washer shall be placed between the bearing plate and the nut, or dished bearing plate and hemispherical washer used, to ensure uniform bearing.

(f) If a rock bolt is not installed immediately after drilling the hole, the hole shall be washed and cleaned as stipulated above immediately prior to installing the rock bolt

2.6. Resin-Cement Type

(a) For resin-cement type rock bolts, the resin cartridges approved by the Client (Geotechnical Engineer/Geologist) shall be used.

(b) Manufacturer's directives concerning the time restrictions for utilization of resin cartridges shall be strictly observed. The resin package which shows signs of hardness or other indications of deterioration shall not be used.

(c) The cartridge consists of cylindrical charge made up of a double walled tube of impermeable paper closed at each end. A catalyst is spread uniformly between the two walls and the resin mixed with a mineral is enclosed in the internal envelope.

(d) The cartridges shall be pushed into the drill hole for the full length of the hole. The rod consisting of reinforcing steel bar with one end tapered shall be inserted with a rock bolt auger. By rotating the bar, the cartridge will be torn and the catalyst mixed with the resin.

(e) The rapidity of the polymerization and hardening of the resin shall be such that the steel bar will not fall out of the upward hole due to its own weight by the time the tapered end of the bar has reached the end of the hole. The bar shall be able to sustain in dry ground after inserting the bar into the hole.

(f) Resin-cement type can be used as active as well as passive rock reinforcement. Should stressing be required, a cartridge containing fast-setting resin for anchoring the bar shall be pushed into the deepest portion of the hole. The rest of the hole shall be filled with cartridges containing slow setting resin grout which allows the stressing of the bar.

2.7. Cement Mortar Type

(a) Ordinary Portland cement is usually used. If adhesion capacity is required at initial stage, accelerating agent shall be mixed or high early strength cement shall be used.

(b) The sand to be used shall be the well-graded sand that has a maximum diameter under 2 mm.

(c) Mix ratio of cement and sand shall be 1:1.

(d) Water-cement ratio shall be 40 ~ 50% and flow value shall be 200 ~ 220 as a standard. But, the amount of water shall be adjusted to the conditions of underground water and ground, and the fluidity of cement mortar shall be maintained during construction.

3. Anchor (PC Strand Type)

3.1. Permanent Anchor Standard

This specification applies to the manufacture and construction of permanent anchors.
The anchor (PC Strand Type) shall conform to the latest editions of the following Standards or, where not covered by these Standards, to their equivalent International Standards, subject to the approval by Client (Geotechnical Engineer/Geologist).
IS: 1786 Specifications for high strength deformed-steel bars and wires for concrete reinforcement
IS: 2062 Steel for general structural purposes
IS: 10270 Guidelines for design and construction of pre-stressed rock anchors
IS: 11309 Method of conducting pull out test on anchor bars and rock bolts
ASTM D4435 Standard Test Method for Rock Bolt Anchor Pull Test
IS: 13219 Rock bolts for mines (cement grouted) - general requirements

KS D 7002 PC strand
Submittals:
Technical specification of anchor with all details about its components, details of manufacturer, method of statement: preparation, drilling, installation, grouting, quality control, stressing, testing, hydraulic jack capacity-calibration, precision of deformation gauges etc. and approval shall be taken before carrying out the work

3.2. Permanent Anchor Material

3.2.1. Normal

(1) The materials and members used in the permanent anchor construction method have dimensions, shapes and strengths in each standard, specification, , guideline, etc., and each material and member should not adversely affect each other.

(2) Permanent anchors have different anchor structure calculations and anchor design costs for each type of anchor body. Therefore, when changing the anchor body, the structural calculation and design unit cost must be changed with the approval of the supervisor and design manager and Client (Geotechnical Engineer/Geologist).

(3) With regard to permanent anchorage, anchor device which allows re-applying and releasing pre-stress shall be used for future maintenance.

3.2.2. Materials for PC Strand

(1) PC strand shall be used in accordance with Design Drawing or the equivalent.

(2) Its elongation shall be at least 3.5%, and it shall comply with the required allowable load shown in the table below.

Table 35 Required Allowable Load of PC Strand *

Items \ Type	F75TN	F90TN	F110TN	F130TN	F170TN
Cable configuration	4×Ø12.7	5×Ø12.7	6×Ø12.7	7×Ø12.7	7×Ø15.2
Cross sectional area (mm^2)	394.84	493.55	592.26	691.00	970.90
Unit weight (kg/m)	3.096	3.870	4.644	5.450	7.750
Ultimate tensile load (Tus) (ton)	74.64	93.30	111.96	130.62	171.32
Yield load (Tys) (ton)	63.60	79.50	95.40	111.30	145.62
Allowable load (ton) (0.6×Tus)	44.80	56.10	67.20	78.40	102.79

* a. Above table shows total strands per each cable.

3.2.3. Duct

Corrugated hard polyethylene pipe reinforced with pilot wire shall be used (Table below).

Table 36 The Tolerance Size of Polyethylene Pipe

Size	Inner Diameter(mm)	Outer Diameter(mm)	Pitch(mm)
Ø80	80	105	22
Ø100	100	130	25.5
Ø125	125	165	35

Ø150	150	195	40
Ø200	200	258	50

3.2.4. Nose Cone

(1) Steel plate with 2mm thickness shall be compressed and used for nose cone.

(2) Joint between nose cone and duct shall be completely filled with adhesive material in order to prevent infiltration of groundwater.

3.2.5. Polyethylene Hose

(1) Polyethylene hose shall be used for hose which is sheathed on free length for each PC strand.

(2) Gap between PC strand and polyethylene hose shall be sufficiently filled with grease in order to allow easy stretch when tensile load is applied.

3.2.6. Anchorage Device

(1) Anchorage device consists of bolt, nut, and bearing plate, and for each material is shown as follows in Table below.

Table 37 Anchorage Device and their Standard

Parts	Material	Symbol
Bolt	Chrome Molybdenum steel	SCM 435
Nut	Carbon steel for mechanical structures	SM 45C
Bearing plate	Rolled steel for general structures	SS 400

(2) Bearing Plate

After placing of spacers every 1.5m, bearing plate shall be protected with corrugated tube. The gap between bearing plate and free field shall be epoxy coated with polyethylene hose to avoid infiltration of grout.

3.2.7. Receiving the anchors specifications

Check for possible transportation damage. Do not use anchors that have been bent or that have any surface damage, do not use strands(bars) as ground for welding, do not allow hot slag to touch the strands(bars), do not weld to strands(bars). Handle anchors with care using nylon lifting slings (2 legs minimum). Upon unloading, protect the strands(bars) from dirt and mechanical damage. Important: the strands (bars) must not be dropped, thrown or dragged.

3.2.8. Couplers in the bond and free lengths (if, Required)

Grease each bars ends thoroughly. Install coupler, bar ends must be centered inside coupler. Torque bar against each other. If applicable, tighten set-screws against flat side of the bar.
Grease coupler thoroughly. Install heat-shrink sleeve. Important: do not burn the heat shrink sleeve nor the plastic sheathing.

3.2.9. Couplers in the free length only (if, Required)

Centre coupler tube over the heat shrink sleeve allowing for displacement of the heat-shrink sleeve during stressing. Secure coupler tube firmly by taping both end to the smooth sheathing.

3.2.10. Grout tube and outer spacer assembly

Install outer spacers (alternatively: segment spacers) within the bond length using adhesive tape and/or wire at the required spacing. If applicable, install grout tube using adhesive tape. The grout tube must start 50 to 100mm from the bottom of the anchor and extend at least 1 meter above the anchor head.

3.3. Permanent Anchor Construction

3.3.1. Normal

For the construction of the anchor, detailed plans for construction planning, construction management, quality control, and safety management are prepared, and a construction plan is prepared based on these to obtain approval from the responsible Client (Geotechnical Engineer/Geologist).

- Purpose of construction
- Construction overview (Name, place, air, quantity, ground, etc.)
- Planning and design conditions
- Construction process
- Organization chart
- Equipment used
- Materials used
- Provisional equipment
- Sequence of the work
- Construction management, quality management plan
- Safety management plan
- Technical data, catalog etc.

3.3.2. Construction Sequence and Method

The general construction management procedure of anchor construction is as follows.

(1) Retaining wall construction (if , Required)
(2) Anchor drilling
(3) Anchor insertion and installation, fixing
(4) Grouting
(5) Tensioning and protective cap

3.3.3. Retaining wall construction (if, Required)

(1) Reinforcing strand (bar)is reinforced on the stepped retaining wall. During reinforcement, the sleeve is installed in advance with a PVC pipe so that the anchor can pass through the stepped retaining wall.
(2) When pouring concrete, take care to ensure that the pedestal is well installed depending on the anchor installation angle.

3.3.4. Drilling

(1) Drilling point is marked at an appropriate position on the slope before drilling.
(2) When displaying the punctured position, consider the size of the concrete grid block to maintain a constant distance.
(3) Drilling diameter should be the diameter specified in the design.
(4) Drilling details such as diameter, length, orientation, inclination, etc. shall be in accordance with drawings. However, if assumed rock during design is not found through drilling to the designated depth in drawings, it shall be reported to the supervisor immediately. Test drilling shall be carried out to verify the rock condition, and drilling depth and anchor material can be adjusted after consultation with the supervisor.
(5) The length of drilling is required to be + 0.5m (the slime treatment plant).
(6) When drilling, take necessary measures such as installing a casing, if necessary, so that the drilling hole does not collapse until the grouting finish.
(7) After drilling, the slime is processed using pneumatic or hydraulic pressure.
(8) The tolerance between the axis of the drilled hole and the axis of design is sufficient to cause contact in the anchor body. In principle, it should be within ±2.5° unless approached.

3.3.5. Anchor insertion and installation, fixing

(1) Before inserting the anchor, assemble the spacer (spacer) and grouting injection pipe into the anchor brought into the site.

(2) The spacer consists of a total of 5 sets, and one set is fastened to both ends (upper and lower ends) of the anchor fixture, and the other 3 sets are evenly distributed and fastened.
(3) The grouting injection pipe is assembled using an electric tape to the end of the anchor body (lower mansion).
(4) After completing the assembly, insert the anchor into the hole. When installing and fixing after insertion, it is drilled 0.5m deeper for slime treatment, so it is fixed with a wedge or tied with a steel wire, temporarily fixed to the top surface of the perforation. Fix it firmly on the top surface of the perforation.
(5) For the protruding length (free length), consider the height of the concrete grid block and the minimum free length before tension (acupressure plate + NUT + thread length required for tension) and consult with the person in charge.

3.3.6. Grout Injection

(1) After inserting anchor into the drill hole, grout shall be injected without pressure till grout is ejected out of the drill hole in order to remove groundwater, drilling fluid or any debris in the hole.
(2) If ground condition is discrepant from the design so the assumed skin frictional resistance cannot be achieved, pressurized injection shall be carried out after approval of the supervisor, and the additionally required cost shall be calculated as a design change. There are packer method and casing method for pressurized injection. Method of pressurized injection, injection pressure, mixture ratio of grout, etc. shall be determined in consideration of ground condition of site, purpose of use of anchor as well as constructability.
(3) When grout injection work is complete, special action shall be taken not to allow any movement of anchor body till adequate strength is achieved.
(4) Over the course of grout injection, responsible technician shall record mixture ratio of grout, amount of mixture used, injection pressure, etc.
(5) Projecting length of anchor head shall be reconfirmed prior to curing of grout.
(6) When the grout amount is significantly higher than the design amount, which is different from the estimated ground condition at the time of design, the cost of the increase in quantity is changed by the confirmation of the supervisor.

3.3.7. Tensioning and protective cap

(1) Tension work is performed immediately after installation of the Grid block or Wall (as shown in drawing volume)
(2) Anchoring load means the amount of tensile force acting on a tendon immediately after completion of anchoring. Anchoring load shall be determined based on purpose of use of anchor, ground condition as well as period of use. If spatial location of precast grid block or retaining wall is to be changed due to ground settlement in time of anchoring with design anchoring load, resulting in irregular linear configuration, anchoring load shall be above 20% of design anchoring force by introducing anchoring concept which expects effect of lapse of time. Anchoring force shall be determined based on ground condition as well as size of structures, and wall installation shall be carried out after approval of the supervisor.
(3) If the ground consists of rocks which will not cause any ground settlement, design load multiplied by 1.03 shall be exerted for tensioning as Pull out test Standard (ASTM D 4435, IS 11309) At least 3 sets of tension test shall be carried out on about 2% of quantities of anchors designed
(4) Pressure gage of tensioner which is verified and certified shall be used.
(5) Exerted load and displacement occurred in time of tensioning shall be recorded.
(6) In time of tensioning and anchoring, workers shall not be standing behind of tensioner for safety reason. If required, protective boards shall be installed behind the tensioner.
(7) Sequence of tensioning are as follows.

i. Anchor head shall be cleaned, and all debris on the anchor head shall be removed prior to tensioning.
ii. Tension coupler shall be inserted to end of anchor head.
iii. Lock nut will be fastened to cable by anchoring jack.
iv. It shall be tensioned to the required anchoring load.
v. After completion of tensioning, it will be fastened with nut. Tensioning force shall be released, and tensioner shall be dismantled.

(8) Elastic displacement (δ) will be theoretically determined by the formular below, and the actual elongation shall be within the range of upper and lower limits of theoretical elongation.
* Lower limit: 80% of theoretical elastic displacement of free (unbonded) length
δe1 =0.8× [(Tt-To) × Lsf / Es ×As]
Where,
Lsf: Free (unbonded) length of tendon
Lsb: Bonded length of tendon
Es: Modulus of elasticity of strand = 1.9×106kg/cm2
As: Cross-sectional area of strand (cm2)
Tt: Final tensile strength
To: Initial tensile strength
* Upper limit: Theoretical elastic displacement of (free/unbonded length + bonded length/2)
δe2 = [(Tt-To) × (Lsf+Lsb/2) / Es ×As]

(9) If it is anchored on soil, test drilling shall be carried out to ensure design anchoring force in time of installation. If design anchoring force is proved insufficient for anchoring, skin friction resistance value shall be reassessed through field pull test, and design change shall be made through increase in drill hole diameter or anchoring field.

(10) Grease will be injected to cover the non-grouted part of the anchor after putting a protective anchor cap.

3.3.8. Safety Control

(1) Safety shall be the first priority over the course of construction, and construction process which avoids safety hazard shall be selected.
(2) Each site worker shall be given training in safety frequently and must wear protective gear on construction site at all times.
(3) If landslide, rockslide, or other hazardous conditions are foreseen by site workers, they shall signal by blowing a whistle so that other workers can evacuate from the danger zone immediately.
(4) Since precast panels are heavy element, care should be taken not to allow accidents to happen. Lift wire and connection link of lift bar shall be frequently checked if connections are secure.
(5) At the upper narrow portion of highly filled-up area, care should be taken against overturning of excavator or crawler drill.

4. Soil Nailing

4.1. General

Please refer Standard Specification for Road and Bridge Works DoR 2073 Under Section; 300 subsections 302 for the provisions 'Soil Nailing'. The Soil Nails shall conform to the latest editions of the Indian Standards or, where not covered by these Standards, to their equivalent International Standards, subject to the approval by the Client (Geotechnical Engineer/Geologist).

5. Gabions and Gabion Mattresses

5.1. General

Please refer Standard Specification for Road and Bridge Works DoR 2073 Under Section; 634 & 2400 for the provisions 'Gabions and Gabion Mattresses'. The Gabion and Gabion Mattresses shall conform to the latest editions of Nepal Standard or, where not covered by these Standards, to their

equivalent International Standards, subject to the approval by the Client (Geotechnical Engineer/Geologist).

6. Wire Mesh

6.1. Welded Wire Fabric

(a) Welded wire fabric shall be installed in surface as reinforcement for shotcrete usually in combination with rock bolts.

(b) If possible, the welded wire fabric shall be placed at the same time as rock bolts are installed. It shall not be placed between the rock surface and bearing plates of rock bolts, but shall be placed over the heads of rock bolts and fastened to them by separate plates and nuts. Sufficient intermediate anchors such as steel expansion bolts or dowels, or if directed by the Client (Geotechnical Engineer/Geologist) additional rock bolts, shall be placed to ensure that the fabric is drawn close to the excavated surface so that when shotcrete is applied subsequently, the mesh neither sag nor vibrate excessively and impair the effectiveness of the shotcrete.

(c) Usage of wooden pegs or pins for fastening of the wire mesh to the rock surface will not be permitted.

(d) Welded wire fabric shall be firmly stretched between the rock bolts. Care shall be taken to ensure that air pockets are not formed behind the wire mesh when used as reinforcement for shotcrete.

(e) Overlap of wire fabric shall be at least 3 times the mesh spacing with the clearance between parallel bars but not less than 30 cm.

(f) Welded wire fabric Standard: ASTM A 185 or ASTM A 497

7. Shotcrete

7.1. General

Please refer Standard Specification for Road and Bridge Works DoR 2700 Under Section; 2710 for the provisions. Sprayed concrete may be applied unreinforced or reinforced with wire mesh or fiber reinforcement. Sprayed concrete shall be carried out by experienced operators only. Except otherwise as specified in the Specification, all works related to sprayed concrete complies with the requirements of 'Norwegian Concrete Association Publication No. 7 Sprayed Concrete for Rock Support'.

7.2. Submittals

(a) Within 28 days from the commencement date, but prior to procuring or mobilizing the equipment, the Contractor shall submit to the Client (Geotechnical Engineer/Geologist), up cited and detailed plans and descriptions, of the following:

a. Batching and Mixing Equipment

3. Description and details of the equipment, which the Contractor intends to use to determine and control the quantity of shotcrete ingredient and mixing thereof into uniform mixture.

b. Placing Equipment

4. Full details of the equipment to be used for placement of shotcrete (Robotic Shotcreting machine) and details of standby equipment.

(b) At least 8 (eight) weeks in advance of any shotcrete work being carried out on the site, the contractor shall submit, to the Client (Geotechnical Engineer/Geologist) the following:

a. Notifications of any admixture and Pozzolana, which the contractor proposes to use, manufacturers thereof and information about the chemical names of the principal ingredients and the effect of under or over dosage.

b. Description and details of methods which the contractor proposes to adopt for Shotcreting.

c. Mix design details including gradings and admixture details

d. Details of methods to be employed for controlling the thickness of the layers of shotcrete applied (e.g., plug gauges or, boreholes, coring).
e. Qualifications and experience of the proposed personnel (foremen, nozzlemen and delivery equipment operators),

(c) The Client (Geotechnical Engineer/Geologist) reserves the right to require any additional information deemed necessary to be included in the submitted documents.

7.3. Materials

7.3.1. Cement

(1) Cement for sprayed concrete shall comply with following Specification

a. Prior to the commencement of the concrete works, the potential brands of cement shall be tested by the Contractor for its strength and other qualitative properties such as its reaction with the aggregates from different (at least three) quarry sites, reaction with water to be used in the concrete works etc.
b. Cement shall be best quality Ordinary Portland Cement of brands approved by the Client (Geotechnical Engineer/Geologist), and shall comply with IS 12269-2013: Specification for ordinary and low heat Portland cement. Each bag of cement shall clearly specify batch no, manufacture date and net weight. If so, required by the Client (Geotechnical Engineer/Geologist), the Contractor shall produce a current manufacturer's test certificate for each consignment of cement.
c. Cement shall be delivered to site in sound, well-sealed bags or in bulk and fresh with latest date of production. Cement delivered in bags shall be stored off the ground in a waterproof enclosure. Cement packed in jute bags shall not be used. Cement delivered in bulk shall be stored in a suitable water and condensation proof silo.
d. Sufficient storage facilities shall be provided at the batch plant to enable each new shipment of cement to be stored separately from the cement stored from earlier shipments.
e. Different consignments of cement shall be stored separately with access for inspection.
f. Cement shall be used in the order of delivery to the Site. Any consignment which shows signs of deterioration shall be rejected and removed from the Site immediately at the Contractor's expense. Cement having been stored in the Site for more than four months shall not be used unless proved to be satisfactory. Cement stored beyond nine months shall not be used.
g. In case of doubt regarding the quality of cement, the standard tests for cement shall be conducted to verify the quality of cement as directed by the Client (Geotechnical Engineer/Geologist).

Silica fume

Silica fume (or micro silica) shall be added to dry mix of ingredient for Shotcrete. The dosage shall be minimum 10% of dry weight of cement to be mixed. The quality requirement shall be as per ASTM C 1240 or as agreed by the Client (Geotechnical Engineer/Geologist).

7.3.2. Aggregates

In addition to Specification mentioned in concrete Section, the following specification shall also apply.

The nominal maximum particle size shall be 10 mm unless otherwise agreed with the Client (Geotechnical Engineer/Geologist), and the grading shall lie within the envelope given in the following Table below unless otherwise approved or specified elsewhere.

Table 38 Aggregate grading limits for grading for limits for sprayed concrete

Sieve size, mm	Percentage passing by weight

	Maximum	Minimum
10.0	100	100
5.0	100	70
2.36	100	45
1.18	75	30
0.6	50	18
0.3	30	10
1.5	15	5

The grading and moisture content of the individual fractions of the aggregate shall be checked and recorded daily by the Contractor.

7.3.3. Water

Water for sprayed concrete shall comply with Specification of Concrete.

7.3.4. Steel Fiber

Fiber shall be deformed steel fiber produced from mild steel or cold drawn wire and shall be ungalvanized and as directed by the Client (Geotechnical Engineer/Geologist). Fiber shall be stored in dry sealed containers until ready for use and shall be free from corrosion, oil, grease, chlorides and deleterious materials which may reduce the efficiency of mixing or spraying processes, or which may reduce the bond between the fiber and the sprayed concrete.

Fiber type shall be selected on the basis of compliance with EFNARC (European Specification for Sprayed Concrete, 1996) energy absorption test and on the basis of ease of use in the batching, mixing and spraying processes proposed, as demonstrated by site trials to the approval of the Client (Geotechnical Engineer/Geologist). Fiber which tend to form fiber balls during batching and mixing shall not be used.

Where fiber reinforced sprayed concrete is applied, wet mix method shall be used. Minimum content of steel fiber shall be 50 kg/m^3 in the mix. Fiber size shall be ranging from 20 - 40 mm in length and 0.3 to 0.6 mm in diameter. They may be in loose or glued form. Only approved fiber types approved by the Client (Geotechnical Engineer/Geologist) shall be included in the mix.

7.3.5. Admixtures

An alkali-free accelerating admixture shall be used where necessary in order to apply the sprayed concrete successfully or to maintain safe conditions. The objective in adding such an admixture should be to obtain high early strengths appropriate to the conditions.

The required characteristic values and consistency of delivery to the site shall be agreed in writing with the manufacturer of each admixture before commencement of concrete spraying. Storage conditions and usage of admixtures shall comply with the manufacturer's recommendations.

Only alkali free liquid accelerators shall be used. Only the minimum quantity of accelerator necessary shall be permitted in normal spraying operations and shall be within the limits recommended by the manufacturer. The quantity shall be determined by site trials subject to a maximum dosage of 6% by weight of cementitious material.

Plasticizers, Super plasticizers and retarders shall only be supplied from renowned manufacturers and approved by the Client (Geotechnical Engineer/Geologist). Plasticizers, super plasticizers and retarders may be used to reduce the quantity of the mixing water, to improve the pumpability and delay setting time of the concrete. The effects and optimum dosages of plasticizers and retarders shall be determined by site trials. Other requirements of admixtures of shotcrete shall be as specified concrete work.

Plasticizers, super plasticizers and retarders shall be checked regularly for setting time, water reduction and development of strength as compared with the base concrete.

7.4. Wet Sprayed Concrete

Wet sprayed concrete shall be used wherever specified. Wet sprayed concrete process shall be applied meeting the following basic requirements:

- high output capacity
- improved working conditions in the spraying area
- controlled mixing water quantity
- fulfilling the quality requirement as specified in this Specifications

7.5. Dry Sprayed Concrete

Dry sprayed concrete shall be used unless in specific cases as listed here. Dry shotcrete may be applied only when smaller quantities are required and high very early strength is essential. The final, the choice of process is also determined by the Contractor's preferences.

Applications for dry sprayed concrete may be carried out for the following cases:

- Concrete repairs
- Preliminary sealing against water leakage
- Medium spraying works
- Waterproofing works

7.6. Mix Design

The sprayed concrete mix shall be developed in two stages:

- The production of a suitable base concrete
- The production of a sprayed concrete mix from the base concrete

The Contractor shall submit the following to the Client (Geotechnical Engineer/Geologist) for approval at least one month before the expects to be called upon to supply sprayed concrete:

- Proposed mix details including gradings and admixture details
- Plant details and method of operation

The mixes for sprayed concrete shall lie within the following limits Table below.

Table 39 Content of Sprayed Concrete

Cement content	Min. 400 kg/m^3
Silica fume (Micro – Silica)	10% -15% by weight of cement
Aggregate / Cement ratio	3.0 to 5.0
Water / Cement ration	Max 0.40

In determining the water/cement ratio, account shall be taken of the water content in fine and coarse aggregate. Dosage of water reducing admixtures shall be such that the slump of the mix is enough for pumping and shall be determined be trial mixes.

Where the use of an accelerating admixture is agreed to be necessary in order to apply the sprayed concrete successfully or to maintain safe conditions, the amount used shall be within limits recommended by the manufacturer. The objective in adding such an admixture should be to obtain high early strengths appropriate to the conditions.

7.7. Strength Requirement

The Contractor shall ensure that the strength of the shotcrete is maintained such that the applied shotcrete offers necessary support pressure for stability of the applied surface at the early stage and for the long term. Dosage of set accelerator may be suitably chosen. For the purpose of determination

of early and final strength of the shotcrete, test panels of shotcrete shall be prepared and core obtained from those shall be tested for 24 hours, 3 days, 7 days and 28 days compressive strength. Normally, 7 days compressive strength is in the range of 65-75% of the 28 days compressive strength (Table below).

Table 40 Strength requirement of the shotcrete

S.N.	Parameter	Limiting value
1	Minimum Characteristics Compressive Strength of Cube sample at 28 days period of casting	Minimum 40 N/mm^2
2	Minimum Characteristics Compressive Strength of core (h: d=2) sample at 28 days period of casting from any sample obtained from site.	Minimum 25.6 N/mm^2
3	Flexural strength of sample of 28 days period of casting	Minimum 4.4 MPa
4	Early strength of cube sample of 24 hrs. of period of casting	Minimum 3 MPa

7.8. Testing

Initial and early compressive strength development of shotcrete, i.e., up to 24 hours shall be measured using indirect methods, namely penetrometer and Hilti stud. Both methods correlate the impact of the compressive strength on the penetration of the needle. Apart from any recommendations as they are given by this method statement or local regulations, one has to keep in mind that any general correlation function describing these impacts would be just an approximation. Thus, results from these methods depend on the mix design, i.e., on the used aggregates (0-10 mm), and would not necessarily result in absolute values of the compressive strength.

The entire compressive strength measurement of sprayed concrete requires three methods namely needle penetration method, stud driving method and drill core method. The development of initial strength, early strength and the final strength in the sprayed concrete shall be as presented in Table below.

Table 41 Methods for strength development measurement

S.N.	Development of	Method of Testing	Instrument	Compressive Strength, MPa	Time of Casting Sample
1	Initial Strength	Needle penetration	Penetrometer	Up to 1.5	0-3 hrs.
2	Early Strength	Stud driving	Hilti Dx450-SCT	3.0-20.0	3-24hrs
3	Final Strength	Curing	Compression Testing Machine	5.0-40.0	1-28 day

7.8.1. Needle penetration method

Results from this method are calculated from the force which is required to penetrate 15 mm of the specimen's surface using a 3 mm needle. The tip of needle has an angle of 60°. Using this method one can manually determine the strength up to approx. 1.5 MPa. Details of the procedure shall be as described in the 'Norwegian Concrete Association Publication No. 7 Sprayed Concrete for Rock Support'.

7.8.2. Stud driving method

Compressive strengths between 3 and 20 MPa are determined by threaded studs, which are driven into the shotcrete surface. The depth of penetration results in the compressive strength according to a calibration curve. Details of the procedure shall be as described in the 'Norwegian Concrete Association Publication No. 7 Sprayed Concrete for Rock Support'.

7.8.3. Drill core method

Core cutting shall be carried out at the surface of sprayed concrete for testing its strength and thickness of the layers. The final compressive strength is determined by subjecting the concrete drill

cores under compressive testing machine. Necessary preparation of either sides of the core shall be done prior the test is performed.
The Contractor shall be requested for core cutting and testing if Client (Geotechnical Engineer/Geologist) likes to confirm the quality and quantity of the sprayed concrete that is already in place.
The 28-day strength is that of I 00 mm diameter cores 70 - 80 mm long. If an alternative method of sampling is used by the Contractor, equivalent 28-day strength is to be agreed with the Client (Geotechnical Engineer/Geologist).
The target mean strength for the base concrete shall be 1.3 times the characteristic strength for the sprayed concrete.

7.9. Method

7.9.1. General

Sprayed concreting shall be carried out by experienced operators only.
The wet mix method shall generally be used. The dry mix method shall only be used with the approval of the Client (Geotechnical Engineer/Geologist).

7.9.2. Preparation and approval

The surfaces to which sprayed concrete is to be applied are to be barred down of all large loose material and the area cleaned down with a mixture of water and compressed air applied at high pressure through 20 mm dia. nozzle and at minimum pressure of I0 bars.

Where the inflow of groundwater renders the surface too wet for the normal application of sprayed concrete, the water be suitably drained before shotcreting commences so that the surface is free of running water. The Contractor shall determine the extent to which grouting may be necessary to reduce water inflow to acceptable limits, and shall carryout the routing of drains which may be necessary to dispose of the water. All surfaces to receive sprayed concrete shall be moist but free of all traces of dirt, oil, rebound or other deleterious material.

Where sprayed concrete is to be placed over a previous layer, that layer shall first be allowed to reach its initial set and then cleaned of all laitance, rebound or other loose material by brooming or sluicing. Sprayed concrete shall be applied wherever necessary and at all the times to ensure stability of the surface to be applied. The Client (Geotechnical Engineer/Geologist) may examine the freshly exposed rock prior to the application of sprayed concrete if necessary and instruct the Contractor as necessary.

7.9.3. Mesh reinforcements

Where based on the Site condition, steel mesh reinforcement shall be fixed before application of the sprayed concrete. The size of mesh reinforcement and opening shall be as specified in the design drawings. Unless otherwise specified, the reinforcement shall comprise a single layer of welded steel mesh fabric of 6mm wires at 150mm centers (or another mesh of equivalent weight per unit area) or a built-up system made from reinforced steel.

The steel mesh shall be securely fixed at maximum center 400 mm both ways at the optimum distance from the rock face for the application process such as to minimize rebound and prevent voids. The minimum cover between the reinforcement and the exposed face of the sprayed concrete shall be 30 mm or greater cover. Laps shall be 250 mm minimum (or two times mesh spacing whichever is the greater) for mesh. For steel bars the minimum lap shall be 50 diameters. Where possible the steel mesh shall be placed over a first layer of sprayed concrete and fastened to the surface with dowels.

7.9.4. Fiber reinforcement

The content of steel fiber shall not be less than 40 kg/m^3 with a fiber size ranging from 20 - 40 mm in length and 0.3 to 0.6 mm in diameter. Only fiber types as specified in the approved mix design shall be included in the mix when fiber reinforcement is used.

Fiber shall be stored in dry sealed containers until ready for use and shall be free from corrosion, oil, grease, chlorides and deleterious materials which may reduce the efficiency of mixing or spraying processes, or which may reduce the bond between the fiber and the sprayed concrete.

7.9.5. Equipment

Robotic spraying shall be applied in slopes. All the equipment used for the application of sprayed concrete shall be of approved design and in proper working order. Water needed for the process is to be clean, chemically satisfactory and supplied at the steady pressure of 4 bars. Air for the equipment is to be clean, dry and oil free and to be provided at the equipment within pressure range 4 to 7 bars. For applying sprayed concrete, only robotic sprayed concrete equipment shall be used by the Contractor for both wet and dry mix technique of the shotcreting.

7.9.6. Batching

Materials shall be matched by weight and cement shall not be added more than I hour before the anticipated time of placing the sprayed concrete.

7.9.7. Spraying/ placing

Shotcrete shall be applied in layers, either in the same operation by repeatedly spraying over the same area or in a subsequent operation after a stop. After a long stop the surface must be cleaned and wetted again. The amount that can be applied in one operation depends on various factors;

- adhesive strength of the sprayed concrete mix
- nature of substrate or base layer
- spraying process
- spray output
- spraying direction (upward horizontally)
- obstructions (reinforcement/water)
- distance between nozzle and substrate

The Contractor shall adopt suitable approach as necessary to conduct proper spraying and maintain the minimum quality of the sprayed shotcrete. The application of shotcrete shall be such that rebound is below 15%. Material out of rebound shall not be reused for the shotcrete. The Contractor shall also ensure that there remains no cavity behind reinforcement bars, any structural member or material of the shotcrete. If there remains any such, the Contractor shall fill the void by cement or mortar grout or any other suitable measure of rectification to which the Employer's Representative may agree.

There shall be good adherence to the rock, a reasonably smooth surface finish, no significant inclusion of rebound in the finished work and no hollow areas. Rebound shall be kept clear of sprayed concrete being placed and an air jet shall be provided for this purpose.

When thickness is stated, the sprayed mean thickness shall be at least the specified thickness. The Contractor shall demonstrate and prove to the Client (Geotechnical Engineer/Geologist) by probing, depth pins or other approved means that the layer thickness meets the minimum as specified in the design drawings. No foreign material shall be allowed in the shotcrete except those approved. Construction joints in the layer shall be formed at 45° to the face and precautions shall be taken to prevent weak and unsightly edges at construction joints. If necessary, timber strips may be temporarily fixed in place to give a neat, strong edge. Before placing the adjoining work, the edge shall be cleaned and thoroughly wetted.
Before the succeeding layer is placed the existing work shall be checked for hollow or non-adhering areas and these shall be cut out and replaced.

7.9.8. Spraying process

The spraying process defines the conveyance of the sprayed concrete or mortar from its transfer from the delivery vehicle through to the nozzle and spraying of the material. The distinction between dry

and wet sprayed concrete applies to the spraying processes also, because they have to be conveyed and sprayed differently due to their material properties. Dense-flow process and thin-flow processes are two types of processes for dry and wet spraying of the shotcrete. The two processes have specific advantages and disadvantages, resulting in their respective uses.

Dense-flow process

When substantial quantities must be applied, the concrete is pumped through pipelines in a dense flow to the nozzle, where it is dispersed by compressed air. Accelerator is mixed into the concrete with the compressed air. The nozzle forms the concrete-accelerator mixture to a spray jet.

Wet sprayed concrete by the dense-flow process demands more work at the beginning (startup) and end (cleaning) of spraying than the dry process. Also, the working time is preset during production and the sprayed concrete must be applied within that time, otherwise some concrete is wasted.

Thin-flow process

Rotor machines convey concrete pneumatically by means of air (thin flow), so that at the nozzle the concrete must not be additionally dispersed. The advantage of this method is that both wet and dry spray concrete can be applied in this manner. Since spray machines for thin flow process are considerably smaller than those for dense flow processing, this technique is ideally appropriate for applications in the area of refurbishments, in which spatial limitations often impede work.

The shotcrete accelerator is fed by the metering unit through separate hoses to the nozzle. The dosage is synchronized with the concrete quantity so that the set quantity of shotcrete accelerator is always added. In the dry spraying process, accelerators can be replaced by special rapid cement that set in a very short time after wetting water.

7.9.9. Protection, Curing and Finishing

i. Suitable screening of the nozzle and of the application surface shall be provided during periods of windy or draughty conditions.

ii. Freshly laid shotcrete shall be protected from rain or water until the surface is of sufficient hardness to prevent damage.

iii. When dry specks first appear at the surface of any shotcrete layer, it shall be wetted with a water jet at least once in every 4 hours or otherwise cured to the satisfaction of Client (Geotechnical Engineer/Geologist) for a minimum period of 7 days. Membrane curing shall not be used when a further layer of shotcrete or other bonded finish is to be applied.

iv. In underground excavations and surface excavations the shotcrete shall be water cured.

v. The surface of the shotcrete shall be left as shot without any finishing. As an exception, the surface of the annulus of reinforced gunite placed at the internal surface of the slope concrete lining shall be smoothened.

7.9.10. Rebound

i. The rebound shall be removed and disposed of, as required by the Client (Geotechnical Engineer/Geologist), before any adjacent area is shotcreted. Rebound material shall not be re-used. Special care shall be taken that rebound does not build up at the junction of walls and floors both underground and on the surface.

ii. The contractor shall make every effort to keep rebound to minimum. If in the opinion of the Client (Geotechnical Engineer/Geologist) the rebound is excessive, he may require the contractor to revise the mix design for shotcrete or its application procedures or take such other measures as the Client (Geotechnical Engineer/Geologist), deems necessary to reduce the rebound to a reasonable level.

7.9.11. Repair

i. Before a succeeding layer of shotcrete is placed, the preceding layer shall be checked for drumlines.

ii. The Contractor shall repair all drummy, sandy, cracked or spalled areas and any other areas where, in the opinion of Client (Geotechnical Engineer/Geologist), the shotcrete is faulty, by removing the shotcrete to a sound area of rock or shotcrete, carrying out surface preparation as specified herein and replacing that area to the satisfaction of Client (Geotechnical Engineer/Geologist).

7.9.12. Test of Shotcrete

Sprayed concrete shall only be carried out by experienced operators or under their immediate supervision. When required by the Client (Geotechnical Engineer/Geologist), each crew shall demonstrate their proficiency by producing test panels before beginning production work. At least two weeks before he expects to produce any sprayed concrete for inclusion in the Permanent Works, the Contractor shall prepare not less than three test panels for each mix for testing. The methods for carrying out test panels and taking samples for strength testing shall be agreed on site between the Contractor and Client (Geotechnical Engineer/Geologist).

All the panels shall be a minimum thickness of 80 mm or as directed by the Client (Geotechnical Engineer/Geologist) and shall be placed in the presence of the Client (Geotechnical Engineer/Geologist). When the final set has taken place samples shall be taken from the test panels and transported to the laboratory where the crushing strength of the samples will be determined.
During sprayed concrete operations, routine test panels shall be prepared beside the application zones for the purpose of quality control. Three panels shall be supplied for approximately each 1,000 m2 of sprayed concrete and shall be tested as described above.

In addition to the above, the Contractor shall conduct test on the applied shotcrete by coring directly from the applied surface in accordance with procedure as specified in the quality manual or as directed by the Client (Geotechnical Engineer/Geologist).

The quality of the sprayed concrete will be considered satisfactory if every test result meets the specified characteristic strength of the respective sample as presented in the herein. Notwithstanding with the supervision of the Employer's Representative, the Contractor shall be solely responsible for the shotcrete works to meet the requirement as specified in the Contract. Failure to comply with the requirements, the under-performed work shall not be measured for payment. The Contractor shall be required to remove the defective shotcrete and the shotcrete area that fails to meet the strength requirement and reply to the surface. The time and cost of remedying the work shall be the responsibility of the Contractor.

7.9.13. Tolerance

i. For shotcrete on natural surfaces or surfaces with an undefined shape, the thickness at any point shall not be less than 90% of the specified nominal thickness and also the average thickness of shotcrete shall not be less than specified nominal thickness.

ii. The thickness over the individual protruding rock pieces may not be less than two-thirds ($^2/_3$) of the specified nominal thickness.

7.10. Measurement and Payment

7.10.1. Measurement

(a) Shotcrete

Measurement for payment for plain and steel fiber reinforced shotcrete shall be made for the volume in m^3 of the shotcrete placed as indicated in the BoQ item Rate. The volume will be computed by multiplying the payment area by the specified thickness.
The payment area shall be defined as the projection of the irregular area covered on to the center line

of the strip between the excavation line and finished line of shotcrete as shown in the Drawings or as directed by the Client (Geotechnical Engineer/Geologist).

(b) Mesh reinforcement

Mesh reinforcement laid as per Drawing or as directed by the Client (Geotechnical Engineer/Geologist) shall be measured in square meter. No allowance shall be made for laps and wastage.

7.10.2. Payment

(a) Payment of plain and steel fiber reinforced shotcrete will be made at the unit rates quoted in the Bill of Quantities, which shall be complete compensation to the Contractor as per the provision of this specification and it shall include the entire cost of but not be limited to the following:

a. All labour, plant and material including Cement, admixtures and steel fibers (for SFRS only).

b. Storage, batching and mixing of all materials, water supply, preparation and cleaning of surfaces.

c. Placing of plug gauges for control of layer's thickness.

d. Placing of shotcrete and removal of rebound.

e. Temporary protection and curing.

f. Making test panels and conducting tests required for design and quality assurances.

(b) The unit rate shall also include the cost of steel fiber for SFRS. No extra payment shall be made in case the cement content in the mix design during execution stage is more than the minimum cement content specified for the mix deign.

7.10.3. Exclusions

No extra measurement for payment or payment will be made for the following:

(1) Removing the defective shotcrete, carrying out surface preparation and re-shotcreting the area where the shotcrete has been found to be faulty by the Client (Geotechnical Engineer/Geologist).

(2) Any replacement or repair or shotcrete damaged by blasting carried out by the contractor.

(3) Taking out of cores from the finished shotcrete and filling the core holes with dry pack mortar.

(4) Shotcrete placed by the Contractor in excess of the thickness shown in the Drawings or as directed by the Client (Geotechnical Engineer/Geologist).

7.11. Scaling work

Scaling Immediately following each blast and at any subsequent time during the work as required, the Contractor shall scale and remove all loose, unstable and potentially dangerous materials from surfaces exposed by the blast and in the vicinity of the blast and excavator. The fact that such scaling and removal may enlarge the excavation beyond the required excavation lines or may require removal and restoration of shotcrete or welded wire fabric shall not relieve the Contractor of the necessity of performing such scaling and removal. The Contractor shall inspect all exposed rock surfaces at least daily and scale as required.

7.12. Clearing, Grubbing and Stripping

Clearing and grubbing are required in all areas designated on the Construction Drawings and/or as directed. The surfaces of soil and rock slope shall be cleared of all vegetation, such as trees, stumps, exposed roots, brush, grass, and weeds, and all other objectionable matter as determined by the Client (Geotechnical Engineer/Geologist). The stripping of topsoil wi1l be required only in the area where the topsoil is usable for later stage landscaping.

Drawings shall be performed only as specified or directed by the Client (Geologist / Geo Technical Engineer). Within areas where open-cut excavation is to be carried out, the ground shall be cleared of all living or dead trees. All branches or tree extending into the limits shall be trimmed carefully to give a clear height as required over the Site. All trees designed by the Client (Geologist / Geo Technical Engineer) to be left intact shall be protected from damage by the Contractor's operations. The clearing limits shall extend 5m beyond the limits of excavation, toes of embankments and spoil tips except where otherwise indicated on the Construction Drawings or directed by the Client (Geotechnical Engineer/Geologist).

8. Retaining Wall (Reinforced soil retaining wall)

This Specification section addresses construction of reinforced soil structures together with the construction of earthwork in layers, assembly and placing of reinforcing elements and facia elements during the construction process and all associated works shown on the Drawings, or as required by the Client (Geotechnical Engineer/Geologist). Please refer Standard Specification for Road and Bridge Works DoR 2073 Under Section; 301 for the provisions 'Retaining Wall. The Retaining Wall work shall conform to the latest editions of the Standards or, where not covered by these Standards, to their equivalent International Standards, subject to the approval by the Client (Geotechnical Engineer/Geologist).

9. Bio Engineering Works

9.1. Description

This Specification section addresses requirements and procedures for providing and planting of sods of living grass plants (including shrubs, trees, drainage) in accordance with this Specification at locations shown on the Drawings, or as required by the Client (Geotechnical Engineer/Geologist). Please refer Standard Specification for Road and Bridge Works DoR 2073 Under Section; 2800.

Advance techniques like Hydroseeding is not included in Standard Specification for Road and Bridge Works DoR 2073 Under Section; 2800. So reference can be given as:

Road side bioengineering site hand book and reference manual published by Department of Road, Nepal.

The Bio Engineering work shall conform to the latest editions of the Indian Standards or, where not covered by these Standards, to their equivalent International Standards, subject to the approval by the Client (Geotechnical Engineer/Geologist).

10. Piling for Structures

10.1. Description

This section specifies materials and workmanship for the manufacture; installation and testing of precast reinforced concrete pile foundations and Cast in place concrete pile. Please refer Standard Specification for Road and Bridge Works DoR 2073 Under Section; 1600 for the provisions 'Piling for Structure and supplementary portion 'Testing and Sampling' the following paragraphs shall be used. The Piling for Structure shall conform to the latest editions of Nepal Standard or, where not covered by these Standards, to their equivalent International Standards, subject to the approval by the Client (Geotechnical Engineer/Geologist).

10.2. Testing and Sampling

10.2.1. Testing of Material for Drilling Fluid

(a) The contractor, based on the referred standards for drilling fluids, prior to the commencement of the work shall propose the frequency of testing drilling fluid and the method and procedure of sampling. The frequency may subsequently be varied as required depending on the consistency of the results obtained.

(b) Control tests shall be carried out on the bentonite suspension, using suitable apparatus. The density of freshly mixed bentonite suspension shall be measured daily as a check on the quality

of the suspension being formed. The measuring device shall be calibrated to read to within 0.01g/ml. Tests to determine density, viscosity, shear strength and pH value shall be applied bentonite supplied to the pile bore. For average boil conditions the results shall generally be within the ranges stated in the Table 42 shown in this sub-section. The tests shall be carried out until a consistent working pattern has been established, account being taken of the mixing process, any blending of freshly mixed bentonite suspension and previously used bentonite suspension and any process which may be used to remove impurities from previously used bentonite suspension. When the results show consistent behavior, the tests for shear strength and pH value may be discontinued, and tests to determine density and viscosity shall be carried out as approved by the Client (Geologist / Geo Technical Engineer).

(c) The Contractor shall submit to the Client (Geotechnical Engineer/Geologist) for his approval the method proposed for sampling and checking of contaminated bentonite and for the cleaning of the base of the bore. In the event of a change in the established working pattern tests for shear strength and pH value shall be reintroduced for a period if required.

Table 42 Measurement Range and Equipment for Viscous Fluid

Property to be measured	Range of results at 20° C	Test method	Code/Standard to be followed
Density	Less than 1.10g/ml	Mud density balance	
Viscosity	30-90s or Less than 20 cP	Marsh cone method Fann viscometer	ASTM D 6910-04
Shear strength (10-minute gel strength)	1.4-10 N/m^2 or 4-40 N/m^2	Spherometer Fann viscometer	
PH	7 – 9	pH indicator strips or electrical pH meter	

(d) Where the Fann viscometer is specified, the fluid sample should be screened by a number 52 sieve (300/um) prior to testing.

10.2.2. Static Load Test on Piles

(1) Testing

Testing shall be performed according to IS 2911 Part 4.

(2) Test Results

The Contractors shall submit within 48 hours of the completion of the pile test to the Client (Geologist / Geo Technical Engineer) for each pile tested a detailed record of testing and, in addition, graphs showing:

- Load and pile top displacement plotted above and below a common base line of time for static load tests.
- Pile top displacement plotted vertically against a base line of load for static load tests.
- Top pile displacement Vs mobilized static resistance plot as assessed from dynamic load test.

(3) A full comprehensive written report shall be submitted to the Client (Geologist / Geo Technical Engineer) within 10 working days for approval.

(4) After the completion of loading tests, all equipment and load used shall be removed from the site.

(5) If the results of the load tests on piles shall be considered as not having complied with the criteria specified or required a further pile shall be tested. If this second pile test also does not comply with specifications or requirements, the Client (Geologist / Geo Technical Engineer) shall order changes to the pile group as he considers necessary. New pile or piles shall be installed to replace the defective pile in a position or positions as instructed by the Client (Geologist / Geo Technical Engineer).

10.2.3. Integrity Testing of Piles

All piles shall be tested to determine their integrity. Testing shall be done by Core Testing, Sonic Coring and Impulse. Testing follow IS 14893 or as required by the Client (Geologist / Geo Technical Engineer). The Core sonic test to check the pile homogeneity must be performed for 100% length of the pile.

(1) Tubing for Sonic Coring

For the purpose of testing pile integrity by Sonic Coring, all Cast-in-Place Concrete piles, shall be placed with steel pipes with inside diameter of 104.5 mm and 53.9 mm, the pipes shall meet the following requirements:

(a) The length of the 104.5 mm tube shall extend from 500 mm above the bottom of the pile to at least 30 mm above the top of the pile temporary casing.

(b) The length of the 53.9 mm tube shall extend from the bottom of the pile reinforcement to at least 30 mm above the top of the pile temporary casing.

(c) The bottom of the tubing shall be permanently sealed.

(d) The top of the tubing shall be provided with a screw type plug, to prevent the intrusion of foreign materials into the tubing.

(e) Tubing shall be placed continuously straight from the bottom to the top so as to allow later introduction of Sonic Coring and core drilling apparatus.

(f) During placement the tubing shall be kept free of all foreign materials.

(g) Sonic coring shall be tested by minimum 03 sections per each pile.

(h) The Contractor shall be responsible for any corrective work necessary if testing and/or coring cannot be accomplished because of improper placement and/or the presence of obstructions in the tubing.

(i) When required by the Client (Geologist / Geotechnical Engineer), the Contractor shall fill all tubes with an expansive grout, acceptable to the Client (Geologist/Geotechnical Engineer), which is capable of displacing any water in the tubing. The grout shall be continuously injected into the tubing from the bottom of the tube to the top.

(2) Tube Placement for Sonic Testing

In addition to the requirements of Sub-section 10.2.5(1), tubing in each pile shall be installed as follows:

(a) Pile diameter 1000 mm or less

- One (1) 104.5-mm tube and two (2) 53.9-mm tubes shall be installed.
- Tubing shall be placed equal distance (or as otherwise may be required by the Client (Geologist / Geo Technical Engineer)) around the outer perimeter of the pile.

(b) Pile diameter greater than 1000 mm and less than or equal to 1300 mm:

- One (1) 104.5-mm tube and three (3) 53.9-mm tubes shall be installed.
- Tubing shall be placed equal distance (or as otherwise may be required by the Client (Geologist / Geo Technical Engineer)) around the outer perimeter of the pile.

(c) Pile diameter greater than 1300 mm

- One (1) 104.5-mm tube and five (5) 53.9-mm tubes shall be installed.

- Tubing shall be placed equal distance (or as otherwise may be required by the Client (Geologist/Geotechnical Engineer)) around the outer perimeter of the pile.

10.2.4. Mud Coring

(1) As required by the Client (Geologist / Geotechnical Engineer), core drilling shall be provided for completed piles from end of the 104.5-mm tube to at least 600 mm below the bottom of the pile. The cores obtained shall be placed in core boxes and the drill hole identification shall be clearly marked on the cores and boxes.

(2) The pile mud coring drilling test shall be performed for 1 pile per abutment.

(3) Upon the satisfactory completion of tests, all voids formed by core drills shall be pressure grouted with non-shrink grout.

10.2.5. Sonic Coring and Impulse Testing (PDA)

(1) Test shall not be carried out until the pile concrete has gained its 28 days characteristic strength.

(2) Sonic Coring and Impulse Testing shall be carried out following IS 14893 and by approved specialist firms, from whom a full method statement and testing quantity shall be obtained and approved by the Client (Geologist / Geotechnical Engineer) prior to commencement of testing.

(3) The PDA test shall be performed for 1 pile each abutment.

(4) The interpretation of the results shall be carried out by competent persons and an indication of the result of all testing shall be passed to the Client (Geologist / Geo Technical Engineer) immediately on completion of all tests. A full written report shall be provided directly to the Client (Geologist / Geotechnical Engineer) within 10 days of the test being carried out.

10.2.6. Positional Tolerance

The center of the completed pile at the cut off level shall not deviate more than 80-mm from the theoretically correct position shown on the drawings. The inclination of the pile shall not deviate more than 1:100 from vertical.

10.3. Reporting

10.3.1. Daily Records

The Contractor shall furnish the Client (Geologist / Geotechnical Engineer) daily with a detailed record of soils encountered during excavation and of the construction of the piles.

10.3.2. Piling Records

The Contractor shall keep records, as indicated in the following table, of the installation of each pile and shall submit two signed copies of these records to the Client (Geologist/Geotechnical Engineer) not later than noon of the next working day after the pile was installed. The signed records shall form a record of the work in accordance with the following:

Records of pile Borings

i. Date
ii. Contract
iii. Pile reference number (location)
iv. Pile Type
v. Nominal cross-sectional dimensions or diameter
vi. Nominal diameter of underream
vii. Length of preformed pile
viii. Standing groundwater level
ix. Date and time of boring
x. Date of concreting (is it relevant for precast concrete pile?)
xi. Ground level at commencement
xii. Working level

xiii. Depth from working level to pile toe
xiv. Toe level
xv. Depth from working level to pile head level
xvi. Length of temporary casing
xvii. Length of permanent casing
xviii. Verticality of borehole
xix. Set of pile or pile tube in mm per 10 blows or number of blows per 25 mm of penetration
xx. Soil samples taken and in-place tests carried out
xxi. Length and details of reinforcement
xxii. Concrete mix
xxiii. Volume of concrete supplied to pile where this can be measured in practice and corresponding levels of concrete and casing
xxiv. All information regarding obstructions delays and other interruptions to the sequence of work
xxv. Strength of corresponding concrete cylinders.
xxvi. If grouting done, mix and quantity of grout used.

11. Galvanized Wire Net for Slope Protection

11.1. Description

These specifications shall be applied to the installation of prevention net against falling stone for the prevention of falling stones due to weathering. They shall be installed at the locations, shown on the Drawings or as directed by the Client (Geotechnical Engineer/Geologist).
The Rock Draping system is installed at Excavated Slope to safeguard the running traffic from the falling rock. Installation of Rock Draping, commissioning and operation is the Contractor responsibility to its entirety.

11.2. Materials

11.2.1. Wire Rope

The circumcircle diameter of longitudinal wire rope shall exceed 20mm and the circumcircle diameter of transversal wire rope shall exceed 16mm.
It shall stand load over 117 kN when the wire rope diameter is 16mm and stand load over 183 kN when the diameter is 20mm.
Wire rope shall have 6 steel strands, and the number of sole wire of each strand shall be 24 pieces with Z twist. The diameter of sole wire shall be 0.88mm, and galvanization quantity shall be over 85 g/m^2.

11.2.2. Wire Mesh

Wire mesh used for prevention net against falling stone is a product suitable for Polyvinyl chloride coated steel wires and Chain link wire netting.
The diameter of wire mesh core wire shall be 4mm and diameter of zinc galvanized and PVC coated wire shall be over 5mm. The mesh size shall be 50 x 50mm.
The galvanization quantity shall be over $35g/m^3$. The colour of covered wire shall be green.

11.2.3. Binding Wire

(a) Binding wire is used to bind overlapped section of wire meshes and wire rope. The binding wire shall be the same standard as the wire mesh not to be loosened. It shall be strapped on every mesh following longitudinal and transverse wire rope, and it shall be 20% or more of wire rope span length.

(b) Lap joint shall be done over 500mm where wire meshes overlap. From upper part to lower part in the central area of lap joint, it shall be bound by way winding in each mesh.

11.2.4. Assembling Block

Assembling Block shall be installed in the wire rope crossing for the prevention of net against falling

stone so as to prevent separation of wire rope and to strengthen bearing capacity of the crossing. Over tensile strength 400~510N/mm^2, yield strength 245N/mm^2, elongation 17% shall be used as assembling block, and the tensile strength between assembling block and wire rope shall be more than 24.5 kN. In order to do so, epoxy, etc. shall be used so that there is no relaxation of wire rope.

11.2.5. Main / Auxiliary Fixing of Pin and Nut

The size of the main fixing pin shall be over Ø25mm and over 1,000mm length, and the auxiliary fixing pin shall be over Ø16mm and over 500mm length. The main fixing pin shall be installed 15º inclined from the right angle on the surface in the opposite direction to where force acts on wire rope.

11.2.6. Post

(1) Post shall be installed in the upper of prevention net against falling stone to protect against earth or unexpected falling stones and to prevent a falling accident of cut section maintenance personnel. The material shall be steel bars for concrete reinforcement. The tensile strength of the material shall be 441~598 N/mm^2 and the yield point shall be over 294 N/mm^2

(2) For the construction of the post, perforation shall be done around 35mm large than diameter. Grout (mortar, epoxy, etc.) shall be injected after installation of the post and a forceful way shall be used for injection.

(3) If mortar is used as grout, the mixing ratio of cement: sand: water shall be 1:1:1.

(4) The size of upper post shall be over Ø25mm and the length shall be over 2,000mm. The galvanization quantity shall be over 600g/m^2 and assisting facility of the post shall be over Ø16mm wire rope and Ø25mm anchor bolt, and it shall be a product with over 1,000mm length.

11.3. Construction Requirements

(a) During the installation of the prevention net against falling stone, timbering shall be executed up to 1~2m from the top of the slope. The prevention net against falling stone shall be firmly installed after sticking to the bedrock.

(b) After decision of the perforation depth and spacing of the anchor bolts through inspection of the joins of the bedrock, the anchor bolts shall be inserted in the perforated holes and injected with resin. After curing during more than 24 hours after the injection of resin, the next step shall ne proceeded. At that time, the residual buts remaining in the perforated holes shall be cleaned using an air-horse so as to remove the effects of dust on the bond between the anchor bolts and resin.

(c) After injection of resin, construction shall be executed so that the bedrock and anchor bolts are completely joined. Thereafter, the assembling block and wire rope shall be installed.

(d) The wire rope shall be tightly stretched and firmly installed.

(e) The main fixing pin shall be installed in firm ground 2~5m behind the end part of the left and right prevention net, and the auxiliary pin cannot be precisely installed in the wire rope crossing, it can be done in the surrounding of the crossing. Fixed Anchor length of auxiliary pin shall be secured more than 300mm.

(f) For the construction of main fixing pin, the perforation shall be done around 35mm larger than the diameter. After installation of the fixing pin, grout (motor, epoxy, etc.) shall be injected, and a forceful way shall be used for injection. If mortar is used as grout, the mixing ratio of cement: sand: water shall be 1: 1: 1

(g) The contractor shall imperatively examine the disposition and scope of the prevention net against falling stone to be appropriate with the field conditions. After deliberation in advance with the supervisor, the contractor shall install the prevention net against falling stone.

11.4. Measurement

The quantity of prevention net falling stone measured for payment shall be the area in m2 covered and accepted.

11.5. Payment

Payment shall in accordance with the price given in the Bill of Quantities and measured in accordance with the above requirements. Payment shall be full compensation for furnishing and placing all materials, wire rope, wire mesh, hardware and all labour, equipment, tools, and incidentals necessary to complete the work.

12. Micropiles

Micropiles are provided to support foundation of some of the retaining walls. The necessary drilling works for these micropiles, casting and grouting in conformity to This Specification and this Special Provision shall be executed by the Contractor.

Micropiles shall be of structural steel conforming to ASTM A36 or equivalent with a thickness according to drawings or directives of the Client (Geotechnical Engineer/Geologist), but minimum 3 mm, the outer diameter shall be minimum 70 mm and not exceed 90 mm. The pile head shall be of structural steel, minimum dimensions 160/160/20 mm, welded to the steel pipe. A central opening of diameter 40 mm or as directed by the Client (Geotechnical Engineer/Geologist) shall be cut for grouting.

The length of micropiles shall be according to drawings or directives of the Client (Geotechnical Engineer/Geologist). It is anticipated that the length shall be 6 m.

12.1. Measurement

Measurement shall be made per running meter of micropiles executed and fixed in place according to the drawings or as directed by the Client (Geotechnical Engineer/Geologist).

12.2. Payment

The payment shall be made at the Contract unit rate. The rate shall include all labor, material and transport costs including cement and sand grout according to Specification and this Special Provision, supply, transport, placing, providing and fixing micropiles, steel rods procurement, anti-rust protection measures, including drilling up to 6 m and all other incidental and provisions necessary to complete the work in conformity with the Specification.

Payment shall be done at the Contract unit price per running meter of the measured length as said above.

13. Horizontal Drains

Drilling of bore hole minimum diameter 75 mm shall be carried out by the Contractor as shown in drawing. The drainage pipes for horizontal drains shall be HDP-pipes diameter more than 50 mm and a minimum thickness of 3 mm unless otherwise specified on drawings or by the Client (Geologist / Geo Technical Engineer).

The pipes shall be perforated by drilling minimum 50 holes per meter length on the upper half of the pipe with a minimum diameter of 5 mm. Perforating has to be approved and might be adjusted to soil conditions by the Client (Geologist / Geo Technical Engineer).

The drain pipes shall be covered by a geo-textile having following Specifications:

- Permeability greater than 0.01 cm/s
- Pore width between 0.09 mm and 0.15 mm
- Strength greater than 8 KN per meter

The length of drains is anticipated to be 10 to 25 m but shall have to be decided by the Client (Geotechnical Engineer/Geologist) on hydro geological conditions encountered. The pipes shall be secured in drill holes properly and rigidly in such a way that it prevents tampering and pulling out of the drilled/bored hole.

13.1. Measurement

Measurement shall be made per running meter of completed horizontal drain according to the drawings or as directed by the Client (Geotechnical Engineer/Geologist).

13.2. Payment

The payment shall be made at the Contract unit rate. The rate shall include drilling operation, drilling machine charge, labour, material, other necessary tools and equipment, transport costs including perforated HDP pipes supply and laying, supply and wrapping of geo-textile and construction of water collection chamber as shown on the drawing/or as directed by the Client (Geotechnical Engineer/Geologist) and according to Specification and this Special Provision and all other incidental and provisions necessary to complete the work.

14. 3D Semi Flexible Galvanized Steel Mats System (For Slope Protection)

14.1. Description

Please refer Standard Specification for Road and Bridge Works DoR 2073 Under Section; 2400 subsection 2411 for the provisions 'Soil Nailing System with 3D Semi Flexible Steel Mat'. The Soil Nailing System with 3D Semi Flexible Mats shall conform to the latest editions of the Indian Standards or, where not covered by these Standards, to their equivalent International Standards, subject to the approval by the Client (Geotechnical Engineer/Geologist).
Additional specifications are as provided on the following paragraphs.

14.2. General

(1) Generally, this specification shall be applying on rock slope

(2) If rock block of slope is sliding and visible discontinuity such as joint, fracture, fold, fault exist, there needs to designed a rock bolt, rock anchor, etc. after detail geotechnical/geological investigation.

(3) The designed slope support method as rock bolt, rock anchor shall be pay of role as nail for fixing 3D steel net with slope.

15. Geotechnical Monitoring System for Slope

15.1. Scope of Work

(a) Measurement for slope displacement, inclination and ground water status. The measurement control of these specifications is for the safety control during the construction of highway

(b) The measurement control of soil, Boulder Mixed Soil (BMS) and rock slope is planned separately.

(c) It is applied to the site measurement and execution plan to measure error during instrumentation for the safety and the economization of the project

(d) The Contractor shall select the instruments to meet the requirements of the Specification and the Drawings and monitoring plan including frequency reading, duration, Control standard of instrument work shall submit to the Client (Geotechnical Engineer/Geologist) before 60 days of the commencement construction

15.2. Submittals

(a) The Contractor shall select the instruments to meet the requirements of the Specification and the Drawings, and shall submit to the Client (Geotechnical Engineer/Geologist) before 60 days of the commencement construction regarding each proposed instrument as specified below If the Client (Geotechnical Engineer/Geologist) determine an instrument does not meet the requirements of the Specification or Drawings, the Contractor shall within 30days of notification by the Client (Geotechnical Engineer/Geologist), submit information on an

alternative instrument which the Client (Geotechnical Engineer/Geologist) believes will conform to the specified requirements.

(b) The information to be submitted shall include but not be limited to:

- Name of manufacturer, instrument type and model.
- Performance data for five similar installations where the instrument has provided data over a period of at least 5years, giving the following details:
  - Name of project.
  - Owner and address.
  - Instrument installer and observer, and their addresses.
  - Description of instrument environment, including temperatures, embedment material, state of moisture, measurement range, etc.
  - Number of instruments installed and date installed.
  - Number of instruments operating today.
  - Design changes since installation.
  - Modifications to "Instrument Package", if any.
  - Description of performance.
  - The manufacturer's instruction manuals

(c) Within 30 days after installation of the last convergent point, the Contractor shall submit in tabular form all pertinent information on convergence points, including description, coordinate location, and elevation, and a location plan of all installed points.

15.3. Monitoring plan

(a) Monitoring plan, which was made before commencement of construction, is reviewed and detailed monitoring and analysis plan with consideration of site condition is proposed to Client (Geotechnical Engineer/Geologist) for approval.

(b) Monitoring plan established at the time of designing shall be updated and be applied for project based on site condition, ground status, and initial measurement result confirmed during execution.

(c) Monitoring of ground displacement, axial force at slope can be adjusted with installation interval and location based on actual exposed ground status and initial measurement result.

(d) In case that long-term safety control is required, geotechnical instruments for maintenance and control shall be installed and all relevant documents are transferred to employer when construction is completed to help them monitoring regularly.

15.4. Selection of geotechnical instruments

(a) Instruments should be verified by reviewing specifications of them before selection for project.

(b) Instruments should be easy to install, measure, and control and durability of them should be maintained during monitoring period. Embedment-type instruments should be considered with allowable rate and durability period.

(c) Instruments should have suitable accuracy for monitoring purpose and have measurement range which can cover the expected displacement in maximum.

(d) Monitoring system should be configured in consideration of the convenience of measurement, the frequency of reading, the compatibility of sensors, and the economicity.

15.5. Compensation of instruments

(a) Operability of instruments should be checked before and after installation and sensors should be compensated.

(b) If there is abnormal measurement value during monitoring, instrument should be inspected and compensated if necessary.

15.6. Installation of instruments

(a) Contractor shall possess instruments which are described on the design drawings and the specifications and Contractor shall install the instruments at the installation positions determined by geotechnical engineer during excavation.

(b) Instruments are attached and installed on specified grounds or members to measure the behaviors of them.

(c) Installed instruments should be managed with the sign plate indicating installation location not to damage by the following works.

(d) Instruments, which are supposed to be installed on slope should be installed right after the end of excavation, or member installation.

(e) Monitoring engineer shall review the manuals of each instrument in advance, understand the problems which might be occurred during installation, and establish the counterplans.

(f) Monitoring engineer shall install instruments according to installation procedures.

(g) Contractor and Engineer shall cooperate with monitoring engineer for the matter of monitoring.

(h) Installed instruments shall be protected from other works or influence of them.

(i) Embedment instruments shall be installed with drilling machine which can minimize the soil disturbance.

15.7. Control of instruments

(a) Instruments shall be controlled based on procedures proposed by manufacturers to preserve the performance and to secure the reliability.

(b) Proper illuminance shall be maintained at the area where instruments are installed to control instruments and to monitor them. The signs showing the name of instrument, the location of installation, and the initial measurement value are installed and managed.

(c) Installed instruments shall be protected from blasting, excavation, shotcrete pouring, and etc. In case that instrument is damaged, same kind of instrument shall be reinstalled near the damaged one for monitoring. The expenses for reinstalment shall be borne by the contractor.

15.8. Monitoring

(a) Monitoring team shall carry out the measurement and the control.

(b) Monitoring engineer shall be technical person who understands the characteristics of instruments and the ground behavior caused by excavation.

15.9. Monitoring result and analysis

(a) The recording paper of all measurement result shall include name of project, location, measurement point, measurement date, engineer name, and etc.

(b) Measurement result including measurement date, time elapsed, excavated distance, initial value, displacement, and etc. shall be arranged and classified by measurement items in the

predetermined form. The relationships between time and measurement value, and between excavated distance and measurement value shall be made by the graphs to understand changes promptly and be used for follow-up works.

(c) Measurement result shall be analyzed by experienced engineer.

(d) Measurement result shall be analyzed with reference of the experienced value, the measurement result, and the ground condition of the similar other site. Measurement control standard shall be made in consideration of absolute variation of measurement value and rate of change, and safety evaluation shall be performed based on it.

(e) If the safety of slope is not reliable based on the analysis of measurement result, the emergency plan is carried out immediately, the cause of it is clarified, and the countermeasure is planned.

(f) If instruments can be used after completion of construction, they are preserved for the maintenance and control purpose.

(g) When monitoring is completed, measurement result in the form of report is submitted to Client (Geotechnical Engineer/Geologist) for confirmation and then follow-up works should be carried out.

15.10. Frequency of reading

Frequency of reading might be modified based on site condition and ground condition after supervisory board's approval. However, if the safety of slope is not reliable because of occurrence of the relaxation area near slope and the continuous measurement is required, the modification on frequency of reading is not preferable.

15.11. Quality Control

15.11.1. General:

(1) Because of the critical function of the instrumentation equipment to be furnished under this Section, which necessitates that it be of the highest obtainable quality, and because of the specialized capabilities necessary for its design, manufacture and installation, the quality assurance requirements specified in this Article shall apply.

(2) The Contractor shall assume full responsibility for a complete and coordinated design of each system and all its associated equipment.

(3) Each manufacturer shall be required to test and inspect all instruments at the factory to verify that the instruments are working correctly, has no defects or missing parts or accessories. The manufacturer shall be required to provide certification of testing and inspection, and copies of such certification shall be included in the submittals to the Client (Geotechnical Engineer/Geologist).

(4) After delivery to the Site, all instruments shall be subjected to a comprehensive test procedure in accordance with the manufacturer's instruction manual, and six copies of test reports shall be furnished to the Client (Geotechnical Engineer/Geologist) for review not less than 15 days prior to scheduled installation.

15.11.2. Equipment Manufacture:

(1) The instruments shall be the products of internationally- recognized manufacturers of instrumentation who have been in the business of furnishing instrumentation for major project

(2) All instruments shall be new; reconditioned instruments will not be acceptable.

(3) In general, a technical representative from the instrument manufacturer shall be available at the Site to provide assistance and supervision in the initial installation of an instrument.

However, this requirement will be waived by the Client (Geotechnical Engineer/Geologist) if the Contractor's Instrumentation Specialist demonstrates to the Client (Geotechnical Engineer/Geologist) 's satisfaction that the specialist has had experience in installing that particular instrument.

15.11.3. Factory Calibration and Quality Assurance Requirements:

(1) Each manufacturer shall provide a Master Calibration (Tests required) sheet with each instrument. The calibration frequency shall be clearly specified by a calibration sticker placed on the unit.

(2) Certification shall be provided with each unit by the manufacturer certifying that its test equipment is calibrated and maintained in accordance with the test equipment manufacturer's calibration requirements.

(3) Complete copy of Quality Assurance final inspection report shall be provided with each instrument.

(4) Wherever feasible, the manufacturer shall provide in-place calibration check features for permanently embedded or attached instruments such that correct functioning may be verified in place. Wherever feasible, the features shall permit checking both of the "zero" reading and the slope of the calibration curve.

15.12. Execution

15.12.1. Monitoring plan

(1) Monitoring plan such as daily monitoring and detailed monitoring should be prepared, reviewed, and then executed for through control of slope construction.

(2) In case the monitoring plan needs to be changed, the changed plan should be submitted and approved from the Client (Geotechnical Engineer/Geologist).

15.12.2. Reporting Plan

(1) Reporting of monitoring results data should be submitted to the Client (Geotechnical Engineer/Geologist) at a frequency of once a week and cumulative report once a month.

(2) The Final Report should be submitted to the Client (Geotechnical Engineer/Geologist) before completion of construction time.

Appendix 4: Technical Specification and criteria for the specialized system or technology provider of RE Wall

1.1. REINFORCED EARTH (RE) WALL CONSTRUCTION

A. DESCRIPTION OF WORK

This work shall consist of Reinforced Earth structure comprising of construction of internally stabilized soil mass, built in layers, duly compacted with specific fill requirements in combination with 50/70mm wide Geosynthetic strap and 50mm wide high adherence Geosynthetic strap coated with Linear Low-Density Polyethylene (LLDPE) as soil reinforcing structural elements of designated grades and design strengths connected mechanically with the precast discrete RCC concrete facing panels. High adherence Strap with trapezoidal groove like rib (lateral teeth) on both edges shall be used in top three layers to generate high pull-out resistance. The work shall be carried out in accordance with this specification and in reasonably close conformity with the lines, grades design and dimensions shown on the approved drawings. This work shall consist of 'Design and construction of Reinforced Earth retaining walls' using Reinforced Earth Technique/system consisting of RCC Precast discrete concrete Panel with selected polymeric strap soil reinforcing elements, earthwork excavation, drainage system, other sub-systems and backfill material conforming to the detailed technical specification as laid down in this document and approved drawings.

Design and construction of Reinforced Earth retaining wall shall include loading from traffic or

pavement, seismic activity, drainage subsystem, provision of friction slab crash barrier and precast RCC discrete facia panel element of nominal 160mm thickness, PCC leveling pad, toe protection etc., drainage system, necessary foundation treatment, if required to ensure meeting deficiency of the bearing capacity of the underlying soil for adequate and uniform distribution of the stresses induced due to the incident loads to the base, besides ensuring stability against slip circle failure. The contractor shall need to assess and substantiate the availability and design adequacy of soil safe bearing capacity under the location of the wall before execution of the work.

Also, the contractor shall appoint a specialized agency for providing the system, which must include design, drawings, specialized materials like soil reinforcing element, connectors, lifting system, bearing pad (used between the panels) and on-site technical assistance. The specialized supplier must be ISO 9001:2015 certified company and must be able to produce BBA certificate for Reinforced Earth Wall system using Geosynthetic Strap (types are decided in design time) as soil reinforcement in their name or in the name of the parent/ principle company.

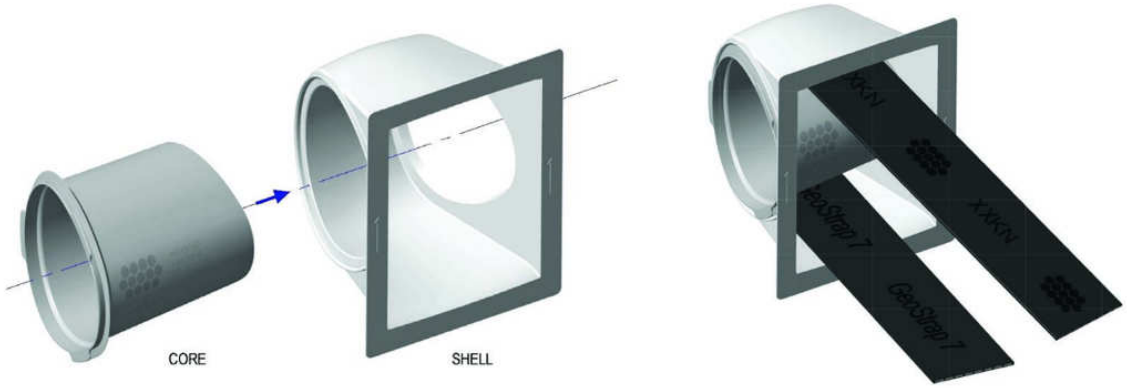
B. REQUIREMENT OF SPECIALIZED DESIGN TEAM / AGENCY

This work shall consist of Reinforced Earth retaining wall structures consisting of precast discrete concrete facing and reinforcement elements comprising of high tenacity Polyester Strap reinforcement with accessories/fittings material in accordance with this specification and in reasonably close conformity with the lines, grades, design and dimensions shown on the approved drawing.

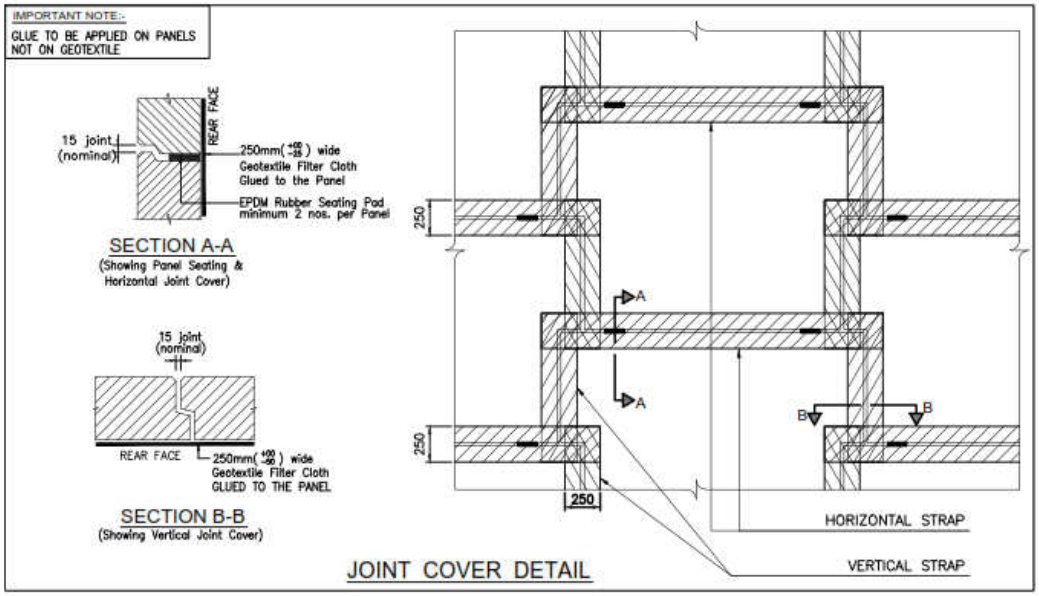
The work shall generally be done in conformity to specifications and in accordance to BS:8006:1:2010 "Strengthened/Reinforced Soils and Other Fills" meeting the ultimate and serviceability limit state requirements as per other international standards wherever relevant.

C. CASTING OF RE WALL CONCRETE PANEL / SLAB or Precast Concrete Facing

The elements shall be cast on flat area of a specially prepared mould. Connectors and lifting devices shall be cast in place to the dimensions and tolerances shown on approved System drawing and connectors shall be set on the rear face, prior to casting. No other type of connection system shall be used for durability and long-term performance purpose. The concrete in each unit shall be placed without interruption and shall be compacted using an approved vibrator supplemented by such hand-tamping as may be necessary to ensure that the concrete reaches into the corners of the forms and prevent formation of stone pockets or cleavage planes. Clear form oil of the approved and only from single manufacturing source shall be used throughout the casting operations to avoid colour variation. There shall not be any steel component in the connection system, neither encased nor coated inside the connector contributing to connection strength. R.C.C Precast concrete facing elements shall be mention in the approved design from the specialized design team. Concrete grade, thickness, height, all complete shall be define by designer drawings and shall conform to the requirements specified in section 1700 "Structural Concrete" of MORT&H or equivalent standard.



Connection system



CURING OF CONCRETE WALL PANEL

The precast elements shall be cured for a sufficient length of time as approved by Engineer so that the concrete develops the required compressive strength. Only fresh potable water shall be used for curing.

REMOVAL FORMS

The forms shall remain in place until they can be removed without damaging the elements. The scheme of removal of form work shall be as per relevant MORT&H specifications.

SCRIBING

The date of manufacture and batch number shall be clearly scribed on the rear face of each unit.

CONCRETE FINISH

The front (exposed) face of the elements shall have the finish approved by the Engineer-in-charge. The rear face shall have the finish of unformed surface and shall be roughly screened to eliminate open pockets of aggregates.

TOLERANCE

All elements shall be manufactured within the following tolerances:

- Evenness of the front face 1500mm : ±5 mm over
- Difference between lengths of two diagonals : ±10 mm max
- Thickness :±15mm

HANDLING, STORAGE AND TRANSPORTATION

All elements shall be handled, stored and transported in such manner as to eliminate the danger of chipping, cracks, fracture and excessive bending stresses. Elements in storage shall be supported on firm wooden / rubber blocks/pads placed adjacent to the Dowel bars to avoid bending.

ACCEPTABILITY

Acceptability of the precast elements shall be determined on the basis of compression tests, as per Ministry of Road Transport and Highways (MORT&H) Specifications and visual inspection. A minimum of one sample of 6 cubes shall be taken for each lot of 5 cum or 12

cubes above 5 cum per day. Elements shall be acceptable for placement in the structure if the strength at 10 days, or before, exceeds 75% of the 28 days requirements.

REJECTION

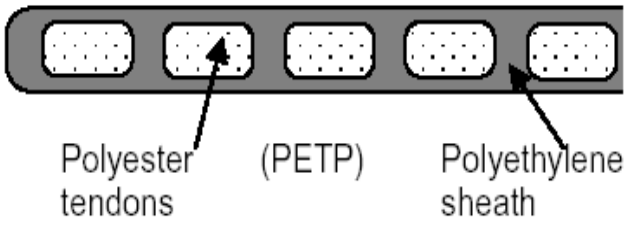
Elements shall be subject to rejection in case of failure to meet any of the requirements specified above. In addition, defects, which indicate imperfect moulding, or defects indicating honeycombed or open textured concrete, shall be sufficient cause for rejection.

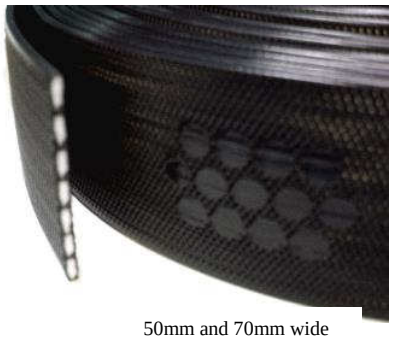
LEVELING PAD

A PCC leveling pad shall be provided under walls as seat beam just to rest the facing panel on leveled surface. Concrete shall have a grade either M-15 or M-20. Maximum size of aggregates shall be 20 mm. The pad shall be cured for at least 05 days prior to placing panels. The top surface shall be leveled at +/-3mm tolerance.

D. Geosynthetic strap

Geosynthetic strap shall be either 50mm or 70mm wide with smooth edges or equivalent or approved strap. Geosynthetic strap consist of discrete channels of closely packed high tenacity polyester tendons or equivalent encased in a Linear Low-Density Polyethylene sheath (LLDPE) or equivalent and for example shown in the figure below;





50mm and 70mm wide
Geosynthetic strap

High Adherence (HA) Geosynthetic strap

High Adherence (HA) Geosynthetic strap is 50 mm wide polymeric strap with trapezoidal groove like rib (lateral teeth) on both side of the strap to generate high friction. HA Geosynthetic strap consist of discrete channels of closely packed high tenacity polyester tendons encased in a Linear Low-Density Polyethylene sheath (LLDPE) as shown in the figure.

HA Geosynthetic strap shall be used at the top three layers of the wall as per design, rest all layers of soil reinforcement shall be either 50mm wide or 70mm wide Geosynthetic strap having smooth edge depending upon the detailed design of the structure.

High Adherence Geosynthetic strap

Specification

The PET and PE materials used for polymeric strap manufacturing shall be selected amongst the best available materials. The specific properties of each are listed below.

Table 1: *Core polyester fibres:* High tenacity polyester yarns are used

Specific properties	*Unit*	Typical value	Test Method
Molecular weight	*g/mol*	28000	
Elongation at break	%	< 15	DIN 53834
Resistance to hydrolysis	%	< 25	CEN ENV 124 47

Table 2: *Outer polyethylene sheath*: Virgin high quality black Low-Density Polyethylene is used for the outer sheath

Specific properties	*Unit*	Typical value	Test Method
Density	Kg/m^3	932	ISO 1183
Elongation at break	%	500-600	IEC 811.1.1
Carbon black content	%	2.5	IEC 811.4.1

Table 3: *Geosynthetic strap reinforcement*: Reinforcement specification

Grade		**Minimum Width**	**Tolerance**	**Characteristic Strength**
		mm	***mm***	***kN***
50mm wide Geosynthetic strap or HA Geosynthetic strap	25	49.5	+/- 0.5	25.0
	37.5	49.5	+/- 0.5	37.5
	50	49.5	+/- 0.5	50.0
	65	49.5	+/- 0.5	65.0
70 mm wide Geosynthetic strap	75	70	+/- 1.0	75.0
	90	70	+/- 1.0	90.0
	100	70	+/- 1.0	100.0

Metallic or non-metallic soil reinforcement in the form of grid/ mat/ sheet shall not be permitted.

Joint Fillers

a) Bedding material between the horizontal joints (excluding the joint between the PCC base and the bottom most panel) of the panels shall consist EPDM (Ethylene Propylene Diene Monomer) material.

b) Sealing material for filling joint gaps, if required, other than bedding joints shall consist of non- woven polypropylene geotextile of unit weight not less than 119 g/m^2.

c) For facia drainage and prevention of soil leaching wherever necessary, non-woven polypropylene geotextile strips shall be provided against the vertical and horizontal joints on the back face of the facia, as shown in the approved drawing.

Properties of the fill

a) The properties of wall fill, subsoil, the retained fill and their interface media shall be based on assumed representative soil data at the design stage, but the values shall be verified at the time of the construction.

b) Fill in the wall shall be well graded wholly frictional non-cohesive free draining material. Stratified layers of combined frictional and cohesive-frictional fill shall not be used without specific design check. The use of soft chalk, unburnt colliery shale and unsuitable material shall not be permitted. The pH value shall be confirmed before using such material. polyester strap shall be used as main reinforcement if pH < 9.

c) The angle of internal friction of the reinforced and retained fill shall not be less than 34 degree respectively. The design shall be done considering the actual properties of the fill material subject to conformity of the above minimum value.

d) Fill for reinforced earth structures shall be well graded selected material as specified. The fill must be so designed to allow dissipation of pore water pressure and shall have free draining characteristics or by providing vertical drainage galleries in front of reinforced soil wall. The association of drainage bay or interface drains shall be connected properly to the gradient required and shall be maintained during compaction in layers.

e) Backfill materials used in the Reinforced Earth volume shall be reasonably free from organic or otherwise deleterious materials and shall conform to the following mechanical and physico-chemical requirements.

Such drainage parameters can be achieved with backfill materials having Plasticity index (PI) =0 and coefficient of uniformity (Cu) ≥ 5.

- Mechanical requirements

Sieve Size	Percent Passing
150 mm	100%
100 mm	More than 75 %
75 micron	Less than 15 %

Acceptance limits for materials with more than 15% passing 75 micron are related to the percentage of particles smaller than 15 microns as follows:

- Materials with more than 15% passing 75micron sieve but less than 10% of particles smaller than 15 microns are acceptable.
- Materials with more than 15% passing 75micron sieve and more than 20% of particles smaller than 15 microns are inadequate and shall not be used except as specified in (e) below.
- The plasticity index (PI) shall be 0 (zero) and co-efficient of uniformity (C_u) shall be greater than 2.
- Materials with more than 15% passing 75micron sieve and 10 to 20 % of particles smaller than 15 microns are acceptable provided that the internal friction angle is not smaller than 34^0.

- Quality Control

Initially at approval of source and subsequent at each change of source, backfill is to be checked for gradation, pH and angle of internal friction. The results will indicate what further tests are needed, if any.

- Water for Compaction

Water of minimum resistivity exceeding 700Ωcm shall be used for compaction.

- Materials not conforming to the above

Materials not conforming to the above requirements may be used with the written consent of Engineer after carrying out test. Such materials shall be tested for their functional properties to assure that they are consistent with the parameters used in the design calculations.

E.CONSTRUCTION REQUIREMENTS

The wall shall be measured from the bottom of the panel up to formation level on the top of the pavement. The depth of the foundation below the finished ground level at the foot of the slope or wall shall not be less than 2m or scour depth, whichever is higher.

The plan area of the wall/shape shall be excavated to provide a nominally level base, with suitable plinth protection as required to receive the horizontal reinforcing element.

A strip footing as trough guide, made of PCC shall be provided at founding level to receive the facia or the bottom most Panel tier. This Plinth shall have adequate soil cover against erosion and scour.

1. Orientation

The reinforcing Polymeric Strap shall be placed at right angles to the face of the wall, with greater cross sectional dimension in the horizontal plane. The reinforcement shall be placed in the cross-sectional slope of 2.5 to 5% away from the facing towards the tail end to drain-out storm water away from facing element.

If for any reason this is not possible (e.g., wing wall to a curved facia), then allowance shall be made in the design for overlapping due to divergence of reinforcement.

Clear vertical spacing between the reinforcement shall not be less than 200mm except for cross walls / return walls and in general reinforcement spacing shall not exceed 800m.

2. Facing batter

With panel RCC facia initial batter (or set batter) shall be necessary for practical installation as per proprietary design guidelines.

3.Drainage

Drainage shall be very strictly followed as per drawing and specifications in detail. Although the reinforced Earth backfill is considered as self-draining media, having enough permeability to relive hydrostatic pressures, one layer of drain tube geocomposite drain or equivalent shall be used behind the RCC facia panels (drawing example presented below) and on the existing slope to allow laminar flow of the water, which may have ingressed into the fill. Both shall be constructed using Draintube geocomosite drain as per the following detailed specification;

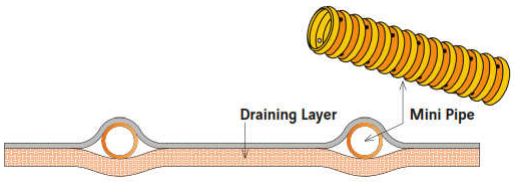


Figure: Drain Tube Geocomposite

The drain tube geocomposite consists of:

- A non-woven filter layer on the upper part
- A non-woven draining layer with mini-pipes regularly perforated according to a 90° dual alternated axis. Mini-pipes are 100% polypropylene made of granules and perforated.

All the components shall be made from polypropylene.

Components must be joined together by needle-punching to avoid any change in there mechanic and hydraulic characteristics described below.

Characteristics	Standards	Reference		MARV#1 Values	Units
Mass per unit area	NF EN 9864	Geocomposite		**360**	g/m²
Thickness	NF EN 9863 -1	Under 2 kPa		**3.60**	mm
		Under 20 kPa		**2.80**	
Tensile Elongation	NF EN ISO 10319	Machine direction		**13.9**	kN/m
		Cross direction		**13.9**	
Tensile Elongation	NF EN ISO 10319	Machine direction		**>50**	%
		Cross direction		**>50**	
Pyramidal puncture resistance	NF G 38-019	**1.1**			kN
Dynamic perforation resistance	NF EN ISO 13433	**12**			mm
CBR Resistance	NF EN ISO 12236	**2.4**			kN
Mini-pipes characteristics					
Diameter	NF EN 61386-1	Outside diameter		**20**	mm
Pipe stiffness at 5% deflection	ASTM D 2412			**4000**	kPa
Spacing of mini-pipes	mini-pipe every one metre widthways				
In-plane flow capacity (mini pipes)	NF EN ISO 12958	i=0,1	Under 20 kPa	**0.18**	I/s/m
			Under 100 kPa	**0.18**	
			Under 400 kPa	**0.18**	
			Under 400 kPa,/ during = 100h	**0.18**	
		i=0,3	Under 20 kPa	**0.32**	I/s/m
			Under 100 kPa	**0.32**	
			Under 400 kPa	**0.32**	
			Under 400 kPa,/during = 100h	**0.32**	
		i=1	Under 20 kPa	**0.70**	I/s/m
			Under 100 kPa	**0.70**	
			Under400 kPa	**0.70**	
			Under 400 kPa,/ during = 100h	**0.70**	

4. Excavations

Excavations shall be in accordance with the requirements of General and Special Specifications and in reasonably close conformity to the limits and construction stages shown on the drawings.

4.1 Foundation Preparation

The foundation for Reinforced Earth Structures shall be graded level for a width equal to or exceeding the length of reinforcing element or as shown on the drawings. Prior to wall construction, if required by the Engineer, the foundation shall be compacted with a smooth

wheel vibratory roller. Any foundation soils found to be unsuitable shall be removed and replaced.

5. Erection

Precast concrete panels shall be placed vertically with the aid of a compatible light crane. For erection, panels are handled by means of lifting devices set into the upper edge of the panels. Panels shall be placed in successive horizontal lifts in the sequence shown on the drawings as backfill placement proceeds. As fill materials is placed behind a panel, the panels shall be maintained in vertical position by means of temporary wooden wedges placed in the joint at the junction of the two adjacent top rows of panels during construction. As construction proceeds, and a fourth row is erected, the lowest row of wedges can be removed and so on.

External bracing may also be needed for the initial lift. However, bracings shall be placed in an area not more than 2.0 meter wide beyond the outer face of panels.

Vertical tolerances (plumb ness) and horizontal alignment tolerance shall not exceed 50mm when measured along a 4 meters straight edge. The maximum allowable offset in any panel joint shall be 25mm.

6. Laying and Compaction

Backfill placement shall follow closely the erection of each lift of panels. At each reinforcing element level, backfill should be roughly leveled before placing and connecting the reinforcing elements. Reinforcing elements shall be placed normal to the face of the wall or as shown on the drawings. The maximum layer thickness shall not exceed 200 mm. The Contractor shall decrease this thickness if that is necessary to obtain the specified density.

At the end of each day's operation, the Contractor shall shape the last level of backfill as to permit runoff of rainwater away from the wall face. Backfill shall be compacted in accordance to the project specifications for embankment to a minimum required compaction of 95% of modified proctor density in the entire width of the embankment, except up to 1.5m from the rear face of wall, where the required compaction shall be minimum 90 % of maximum density and shall be determined by the standard test and that the moisture content shall be plus or minus 2% of the optimum Moisture Content as determined. Backfill compaction shall be accomplished without disturbance or distortion of reinforcing elements and panels. Compaction in a strip of the 1.5 meter wide adjacent to the backside of the wall facing, shall be achieved by the use of a manually operated vibrating compactor, such that adverse edge stresses are not transferred to the facing panels during construction.

7. Protection of Beam

The berms, if any, in the Reinforced Earth wall shall be covered with one layer of Geosynthetic Clay Liner (GCL) and 100mm thick Plain Cement Concrete (PCC) of M-15 grade to mitigate ingress of any water into the subsequent tier of Reinforced Earth wall | slope. Provision for drainage on the berms shall also be provided. The specification of GCL shall be as under;

Technical parameters				
Geotextile properties	**Test method**	**Nominal value**	**MARV**	**Units**
Cap NON-WOVEN PP – mass per unit area	ASTM D5261	220	200	g/m2
Carrier WOVEN PP – mass per unit area	ASTM D5261	125	110	g/m2
Sodium Bentonite properties				
Montmorillonite content	XRD analysis	>80	>80	%
Swell index	Lin	>24	>24	ml/2g
Fluid loss	ASTM D5891	<18	<18	Ml
Finished TA - GCL properties				
Bentonite mass per unit area (at 12% moisture)	ASTM D5993	5,000	4,875	g/m2
Bentonite mass per unit area (at 0% moisture)	ASTM D5993	4,400	4,290	g/m2
GCL mass per unit area (at 12% moisture)	ASTM D5993	5,345	5,185	g/m2
Hydraulic conductivity (k_{20})	ASTM D5887	1.0×10^{-11}	$2{,}0 \times 10^{-11}$	m/s
Index flux (q_i)	ASTM D5887	4.0×10^{-9}	$5{,}0 \times 10^{-9}$	S

Tensile strength (TMAX) – MD	ASTM D6768	12.0	11.0	kN/m
Tensile strength (TMAX) – CMD	ASTM D6768	12.0	11.0	kN/m
Strain at max load – MD/CMD	ASTM D6768	≤ 30	≤ 30	%
Static puncture strength (F_P)	ASTM D6241	2.2	2.1	kN
Peel strength – MD	ASTM D6496	75	65	N/10cm
Roll size				
Thickness	ASTM D5199	7.0	6.5	Mm
Dimensions (H x L)		44 x 5.1		m x m
Total Area		220		m^2
Total Weight		1209		Kg

An edge drain (200mm clear depth and 200mm wide at bottom) made of M15 grade of Plain Cement Concrete (PCC) shall also be provided for surface drainage of water.

The top panel on each bench shall have provision of coping beam made of minimum M-30 grade Reinforced Cement Concrete.

7. Technical guidance during construction of RE Wall

A technical representative of the system provider shall provide technical guidance at site during the casting and installation phases to ensure that the quality of the works performed by the contractor is in accordance to the specifications.

F. ELIGIBILITY CRITERIA FOR THE SYSTEM PROVIDER FOR RE WALL SYSTEM

Since Reinforced Earth works is specialized in nature, the contractor shall appoint a specialized agency for providing the entire Reinforced Earth system, which must include design, drawings, specialized materials like soil reinforcing element, connectors, lifting system, bearing pad (used between the panels), geocomposite drainage and on-site technical assistance. Such specialized system provider must me the following eligibility criteria;

i. The system provider agency shall be a firm established must be existing in for minimum 20 years. Certificate of incorporation shall be submitted as a documentary proof.

ii. The average turn-over of the system provider must be NPR 72 Million in the last three financial years.

iii. The system provider shall produce completion certificate for the following;

a. 2500 sqm of Reinforced Earth wall;

b. One single project consisting design and construction of Reinforced Earth structure having minimum value of 1000 sqm.

c. Case study of at least one project where special compressible RCC concrete panels have been used.

d.At least one Reinforced Earth wall using RCC panels as facia and having 11m or more height and at least 100m in length anywhere in the world supporting airport runway or taxiway. Case study of such project shall be submitted for authentication.

iv.The system provider must possess the following certifications (Fully authenticated registration certificate shall be submitted to substantiate this clause)

a. ISO 9001:2015 certificate for **design, supply and supervision of Reinforced Earth structures** for last 15 years.

b. ISO 9001:2015 and ISO 45001:2018 certificate for **the Geosynthetic strap manufacturing plant**

c. CE certification for the **Geosynthetic strap**

d. BBA certificate for Reinforced Earth Wall system using Geosynthetic Strap as soil reinforcement in their name or in the name of the parent/ principle company.

1.4. ELIGIBILITY CRITERIA FOR THE BASAL REINFORCEMENT MATERIAL SUPPLIER

i. The average turnover of the technology provider shall be NPR 72 Million during the last three financial year. Auditor's certificate shall be submitted as documentary evidence.

ii. Fully authenticated certificate for the following shall be submitted;

a. ISO 9001:2015 certification for the last 15 years.

b. ISO 45001:2018 certification.

iii. The system provider | agency shall be a firm established for minimum 20 years. Certificate of incorporation shall be submitted as a documentary proof.

1.5. SPOILING

A. The Contractor shall during this Site inspection in the Tender Period, contact the Employer to obtain information regarding the destination of unacceptable materials and surplus materials. These materials remain the property of the Employer unless the Employer transfers his ownership to the Contractor.

B. Unacceptable materials and surplus materials that are released by the Employer shall become the property of the Contractor. They shall not be spoiled or stockpiled on site and shall be removed off the airport property.

C. The Contractor shall make his own arrangements with other public agencies, the municipality or private companies or landowners for the spoiling of unacceptable and surplus materials that became his property.

D. Topsoil material, if required, shall be stockpiled at approved locations, further specified in Section "Topsoil placement and grading" of these Specifications

E. The surface elevation of spoil areas shall not extend above the surface elevation of adjacent area. The spoil material shall be placed/spoiled and compacted to a reasonable density as instructed by the Engineer. All spoil areas shall be graded to allow positive drainage of the area itself and of adjacent areas. If required, the spoil area and adjacent area shall be put into condition acceptable for seeding or planting

1.6. TOLERANCES

A. In those areas upon which any pavement construction is to be placed, the top of the subgrade shall not vary from the design levels by more than 15 mm. The finished levels shall be determined by taking levels in a grid of 10 by 10 meters or less. A lot will be accepted for grade if not more than 10 percent of the measurements exceed the specified tolerance, but are less than 20 mm.

B. In areas outside pavement constructions the top of the formation shall not vary from the design levels by more than 25 mm. The finished levels shall be determined by taking levels in a grid of 20 x 20 meters or less. A lot will be accepted for grade if not more than 10 percent of the measurements exceed the specified tolerance, but are less than 40 mm.

C. The size of a lot shall be between 2,500 - 5,000 m2.

D. Any deviation in excess of the above tolerances shall be corrected by reshaping and re-compaction of the material.

1.7. PIONEER LAYER

A. An initial layer, known as a pioneer layer consisting of rock fill material, shall be constructed over a weak roadbed where selected material is used to provide stable platform for the construction of subsequent layers.

B. This rock fill shall be constructed across water-logged or soft clayey ground exhibiting excessive movement under normal compaction equipment and haulage trucks, and such

conditions preclude the effecting compaction of the bottom fill layer, in particular in the vicinity of the runway extension.

C. The maximum size of rock which may be engineer may prescribe that 5% of the oversize material shall be bladed off after the material has been dumped, and it shall be disposed of as required. The compacted layer shall not contain any rock fragments the largest dimension of which exceeds the thickness of the compacted layer.

D. This layer shall be constructed by successive loads of suitable coarse material being dumped and spread in a uniform layer with a thickness just sufficient to provide a stable working platform for constructing the further fill layers which are to be compacted to a controlled density.

E. Light hauling equipment shall be used, and, where necessary, end tipping for placing the material and the layer shall be compacted by light compaction equipment being used, which will give the most effective compaction without the roadbed being overstressed.

F. The compacted volume of material used may be determined by 70% of the loose volume in trucks being taken as an alternative to taking cross-sections before and after construction.

G. Rock fill shall be brought up in layers not exceeding 600 mm and every effort shall be made to fill the voids with the finer material to from a dense, compact mass.

H. Each (rock) layer shall be levelled and smoothed with suitable grading equipment and by distribution of spalls and finer fragments of rock.

I. Density requirements will not apply to portions of fill structure constructed materials which cannot be tested in accordance with specified methods (like rock fill).

1.8. ROADBED PREPARATION

A. Any part of the roadbed which is classified as being suitable for use in situ, save that it fails to meet density requirements, shall be scarified, watered and compacted to a percentage of modified AASHTO density. The type of compaction and the depth of compaction shall be as directed by the engineer. If necessary, roadbed material may have to be temporarily bladed off to windrow in order to achieve the necessary depth of compaction.

B. Where any additional material has to be imported to obtain the required level and layer thickness, and where the thickness of the layer of imported material would be less than the specified layer thickness after compaction, then the roadbed material shall be scarified, the necessary imported material placed, and this combined material mixed and compacted to the full specified depth of the layer. The imported material shall be measured and paid for under "Cut and borrow to fill".

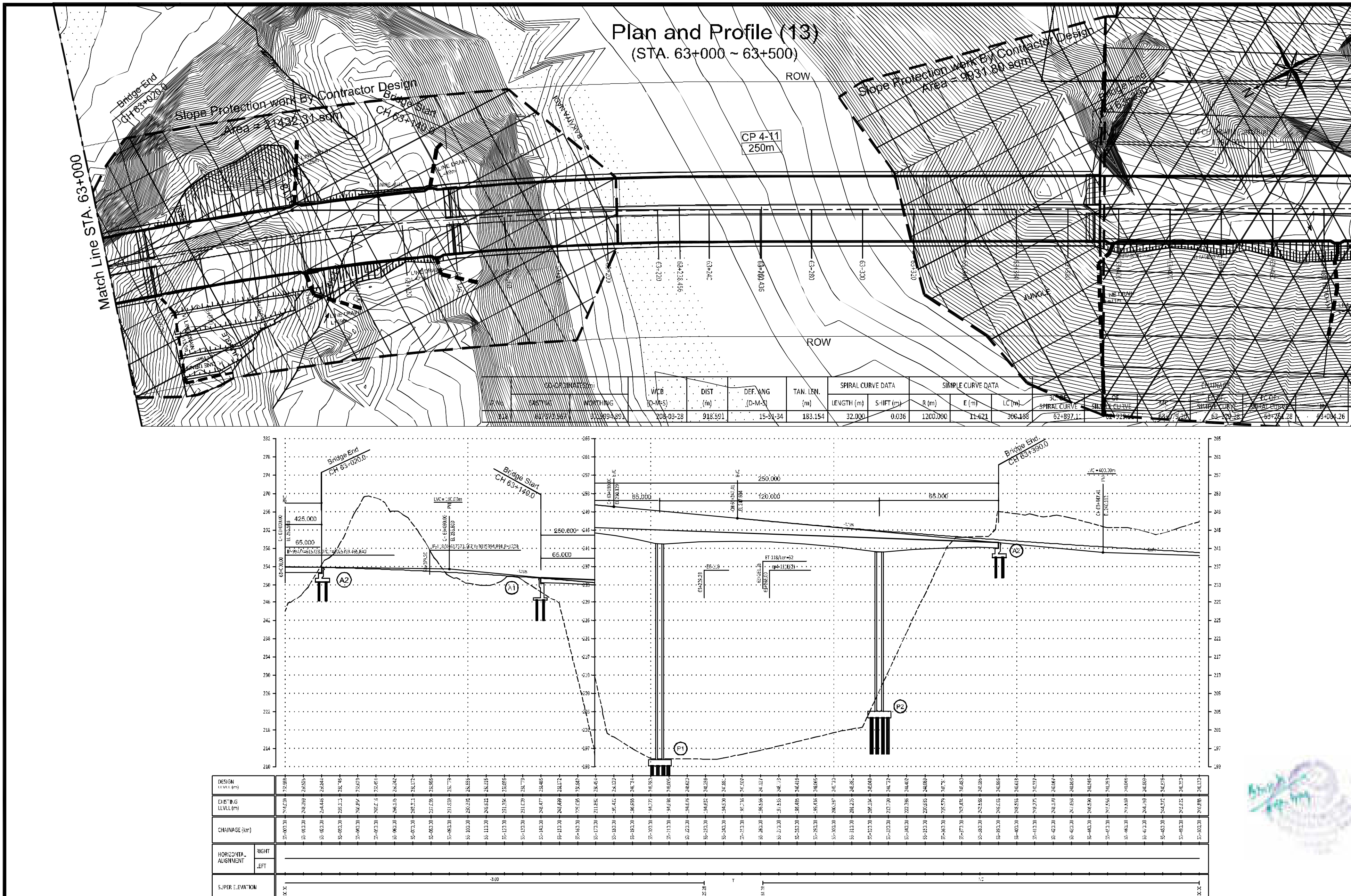
Appendix 5: Technical Specification for Four Wheel Vehicle

The technical specification for the four wheel Vehicle (Double Cab Pickup) are as follow:

S.N.	Particulars	Specification
1	Type	Pickup, Double cab including rear cover
2	Engine Emission Norms	Minimum Nepal emission norms or Euro-III or BSIII or equivalent
3	Engine	Minimum 2700 cc, DOHC, 16 valve fuel injection with common rail diesel engine, 4-cylinder inline engine with turbo charger and intercooler.
4	Power	Minimum : 3300 rpm
5	Torque	Minimum : 2300 rpm
6	Driver	RHD
7	Transmission	Min. 6 speed manual transmission with four wheel driver

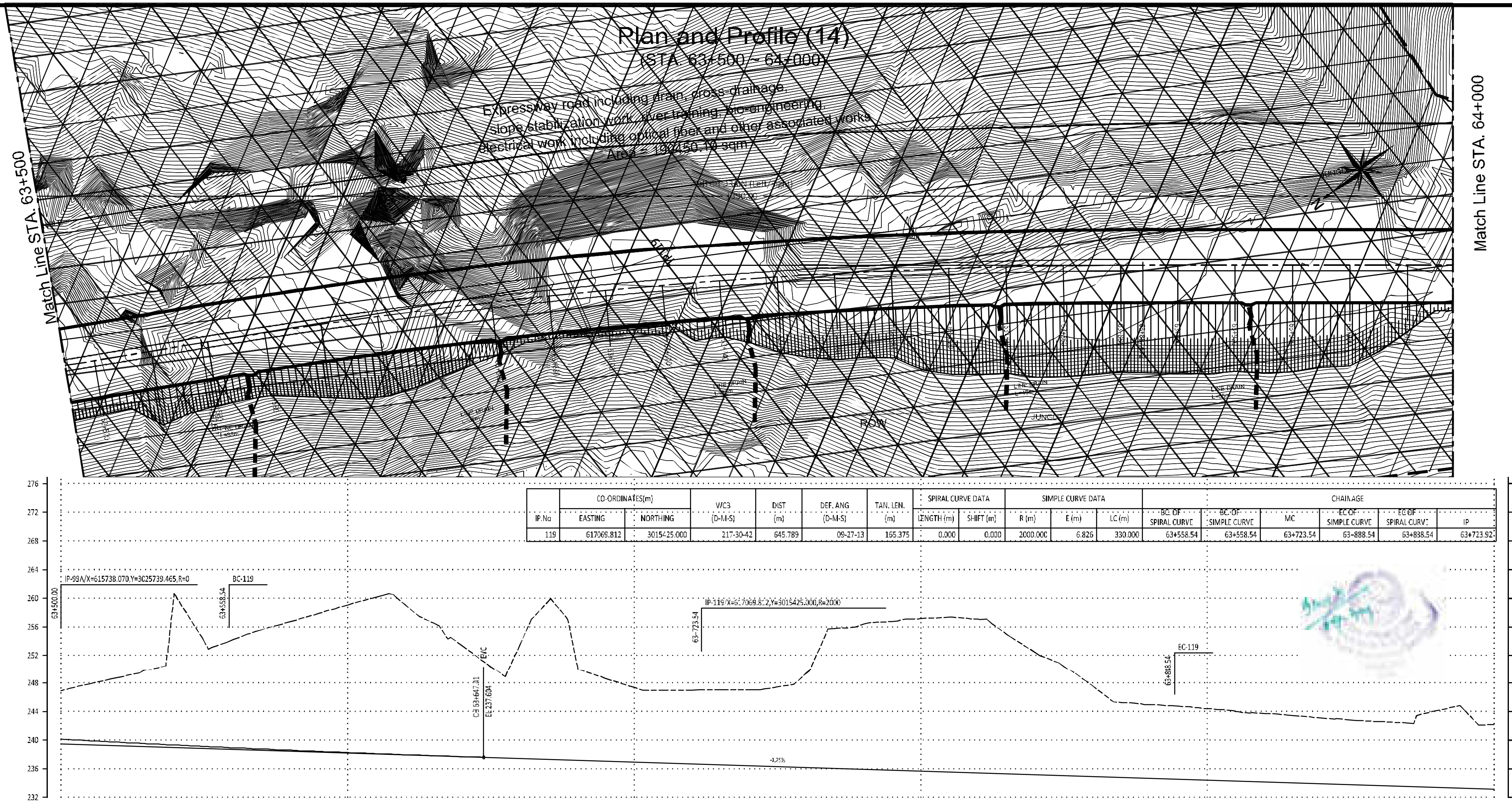
8	Drive train	4WD/AWD
9	Steering	Power steering and Tilt steering
10	Suspension	Front coil spring and rear leaf spring with hydraulic shock
11	Brakes	
	Front brakes	Ventilated disc
	Rear brakes	Drum type
12	Ground clearance	Minimum 220 mm
13	Fuel tank capacity	Minimum: 75 Liters
14	Seating capacity	5 numbers including driver seat
15	Air conditioning	Must be integral
16	Features	Seat belts for driver and passenger with air bag Rear window defogger Ant locking braking system (ABS) and power window ORVM
17	Accessories	Front fog light AM/FM/CD player, USB/Aux ports Cloth seats, seats belts, looking fuel cap, spare wheel, tool kit Fire extinguisher ABC type min 2Kg Which capable of pulling the weight of the vehicles

Plan and Profile
(Main Lane)



IP No	CO-ORDINATES(m) EASTING	NORTHING	WCB (D-M-S)	DIST (m)	DEF. ANG (D-M-S)	TAN. LEN. (m)	SPIRAL CURVE DATA LENGTH (m)	SHIFT (m)	SIMPLE CURVE DATA R (m)	E (m)	LC (m)	CHAINAGE BC OF SPIRAL CURVE	BC OF SIMPLE CURVE	MC	EC OF SIMPLE CURVE	EC OF SPIRAL CURVE	IP
118	617373.567	3013994.891	208-03-28	918.591	15-51-34	183.154	32.000	0.036	1200.000	11.621	300.188	62+897.11	62+929.[illegible]	63+079.28	63+229.28	63+261.28	63+064.26

PROJECT NAME	CLIENT	DESIGN AND SUPERVISION CONSULTANT	DRAWING TITLE	SCALE	REV. No		
KATHMANDU -TERAI/MADESH FAST TRACK (EXPRESSWAY) ROAD PROJECT	GOVERNMENT OF NEPAL MINISTRY OF DEFENCE NEPALI ARMY KATHMANDU NEPAL	YOOSHIN ENGINEERING CORPORATION, KOREA KOREA EXPRESSWAY CORPORATION, KOREA PYUNGHWA ENGINEERING CONSULTANT LTD, KOREA JV IN ASSOCIATION WITH GARIMA INTERNATIONAL DESIGN ASSOCIATES NEPAL PVT.LTD., NEPAL SITARA CONSULTANT PVT.LTD., NEPAL	Plan and Profile (13) (STA. 63+000 ~ 63+500)	H=1:1000 V=1:400		DESIGNED BY : CHECKED BY : APPROVED BY :	DATE : Aug-2021 DWG No : KTFT/HA SHEET No : 13/17



IP.No	CO-ORDINATES(m) EASTING	NORTHING	WCB (D-M-S)	DIST (m)	DEF. ANG (D-M-S)	TAN. LEN. (m)	SPIRAL CURVE DATA LENGTH (m)	SHIFT (m)	SIMPLE CURVE DATA R (m)	E (m)	LC (m)	CHAINAGE BC OF SPIRAL CURVE	BC OF SIMPLE CURVE	MC	EC OF SIMPLE CURVE	EC OF SPIRAL CURVE	IP
119	617069.812	3015425.000	217-30-42	645.789	09-27-13	165.375	0.000	0.000	2000.000	6.826	330.000	63+558.54	63+558.54	63+723.54	63+888.54	63+888.54	63+723.92

CHAINAGE (km)	DESIGN LEVEL (m)	EXISTING LEVEL (m)
63+500.00	240.130	246.885
63+510.00	239.915	247.891
63+520.00	239.708	248.779
63+530.00	239.506	249.912
63+540.00	239.311	260.294
63+550.00	239.121	253.860
63+560.00	238.938	254.235
63+570.00	238.762	255.625
63+580.00	238.591	256.772
63+590.00	238.427	257.925
63+600.00	238.269	259.064
63+610.00	238.117	260.189
63+620.00	237.971	259.119
63+630.00	237.832	256.511
63+640.00	237.699	253.359
63+650.00	237.572	250.378
63+660.00	237.447	253.467
63+670.00	237.321	259.617
63+680.00	237.196	250.496
63+690.00	237.070	248.657
63+700.00	236.945	247.351
63+710.00	236.820	246.973
63+720.00	236.694	247.015
63+730.00	236.569	247.055
63+740.00	236.444	247.061
63+750.00	236.318	247.448
63+760.00	236.193	249.371
63+770.00	236.067	255.778
63+780.00	235.942	256.391
63+790.00	235.817	256.783
63+800.00	235.691	257.170
63+810.00	235.566	257.374
63+820.00	235.441	257.067
63+830.00	235.315	254.975
63+840.00	235.190	252.381
63+850.00	235.064	250.441
63+860.00	234.939	247.527
63+870.00	234.814	245.253
63+880.00	234.688	244.945
63+890.00	234.563	244.742
63+900.00	234.438	244.395
63+910.00	234.312	244.013
63+920.00	234.187	243.726
63+930.00	234.061	243.436
63+940.00	233.936	243.102
63+950.00	233.811	242.825
63+960.00	233.685	242.594
63+970.00	233.560	242.400
63+980.00	233.434	244.100
63+990.00	233.309	244.083
64+000.00	233.184	242.178

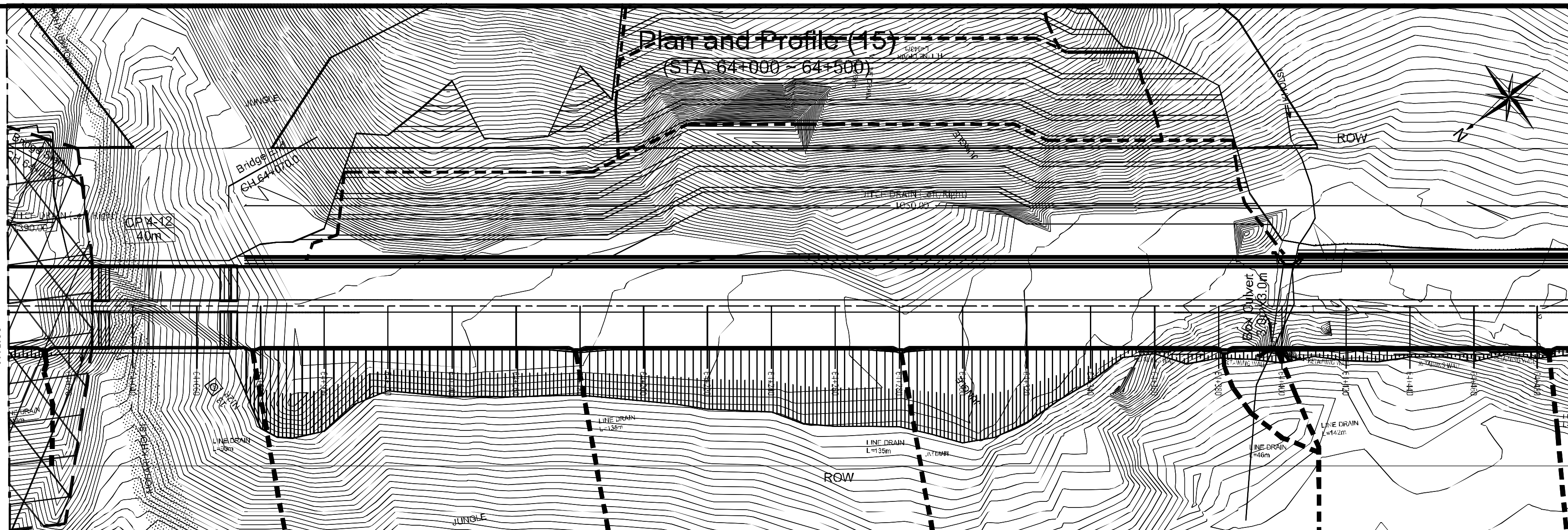
HORIZONTAL ALIGNMENT (RIGHT / LEFT): IP-119 R=2000.00

SUPER ELEVATION: NC +500.00 – +547.54; T; +554.04 – -3.00 – +883.04; T; +889.54 – NC – +000.00

PROJECT NAME	CLIENT	DESIGN AND SUPERVISION CONSULTANT	DRAWING TITLE	SCALE	REV. No		
KATHMANDU -TERAI/MADESH FAST TRACK (EXPRESSWAY) ROAD PROJECT	GOVERNMENT OF NEPAL MINISTRY OF DEFENCE NEPALI ARMY KATHMANDU NEPAL	YOOSHIN ENGINEERING CORPORATION, KOREA KOREA EXPRESSWAY CORPORATION, KOREA PYUNGHWA ENGINEERING CONSULTANT LTD, KOREA JV IN ASSOCIATION WITH GARIMA INTERNATIONAL DESIGN ASSOCIATES NEPAL PVT.LTD., NEPAL SITARA CONSULTANT PVT.LTD., NEPAL	Plan and Profile (14) (STA. 63+500 ~ 64+000)	H=1:1000 V=1:400		DESIGNED BY : CHECKED BY : APPROVED BY :	DATE : Aug-2021 DWG No : KTFT/HA SHEET No : 14/17

Match Line STA. 64+000

Plan and Profile (15)
(STA. 64+000 ~ 64+500)



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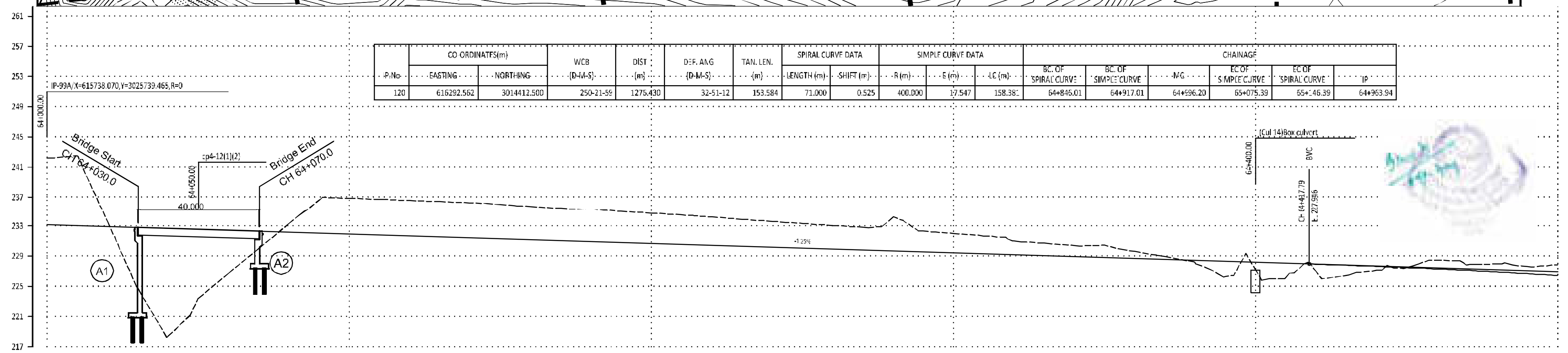

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120	616292.562	3014412.500	250-21-59	1275.430	32-51-12	153.584	71.000	0.525	400.000	17.547	158.381	64+846.01	64+917.01	64+996.20	65+075.39	65+146.39	64+963.94

CHAINAGE (km)	DESIGN LEVEL (m)	EXISTING LEVEL (m)
64+000.00	233.184	242.178
64+010.00	233.058	242.478
64+020.00	232.933	233.533
64+030.00	232.808	224.660
64+040.00	232.682	218.390
64+050.00	232.557	223.435
64+060.00	232.431	226.739
64+070.00	232.306	230.043
64+080.00	232.181	233.347
64+090.00	232.055	236.645
64+100.00	231.930	236.854
64+110.00	231.805	236.711
64+120.00	231.679	236.563
64+130.00	231.554	236.407
64+140.00	231.428	236.251
64+150.00	231.303	236.006
64+160.00	231.178	235.724
64+170.00	231.052	235.483
64+180.00	230.927	235.243
64+190.00	230.802	234.972
64+200.00	230.676	234.720
64+210.00	230.551	234.468
64+220.00	230.425	234.190
64+230.00	230.300	233.897
64+240.00	230.175	233.604
64+250.00	230.049	233.332
64+260.00	229.924	233.076
64+270.00	229.799	232.820
64+280.00	229.673	234.217
64+290.00	229.548	232.313
64+300.00	229.422	232.010
64+310.00	229.297	231.696
64+320.00	229.172	230.978
64+330.00	229.046	230.599
64+340.00	228.921	230.394
64+350.00	228.795	230.420
64+360.00	228.670	229.593
64+370.00	228.545	228.925
64+380.00	228.419	228.130
64+390.00	228.294	226.286
64+400.00	228.169	227.182
64+410.00	228.043	226.170
64+420.00	227.918	226.969
64+430.00	227.782	226.445
64+440.00	227.634	227.102
64+450.00	227.472	227.481
64+460.00	227.297	228.443
64+470.00	227.109	227.826
64+480.00	226.907	227.929
64+490.00	226.692	227.506
64+500.00	226.463	227.846

HORIZONTAL ALIGNMENT: RIGHT / LEFT

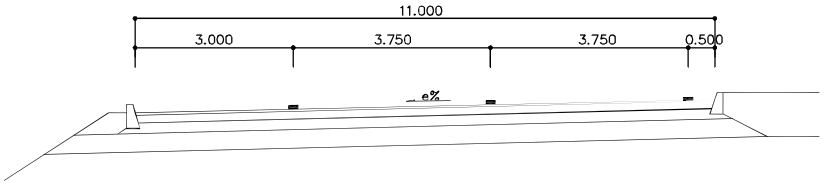
SUPER ELEVATION: NC (+000.00 – +946.01)

PROJECT NAME	CLIENT	DESIGN AND SUPERVISION CONSULTANT	DRAWING TITLE	SCALE	REV. No				
KATHMANDU -TERAI/MADESH FAST TRACK (EXPRESSWAY) ROAD PROJECT	GOVERNMENT OF NEPAL MINISTRY OF DEFENCE NEPALI ARMY KATHMANDU NEPAL	YOOSHIN ENGINEERING CORPORATION, KOREA KOREA EXPRESSWAY CORPORATION, KOREA PYUNGHWA ENGINEERING CONSULTANT LTD, KOREA JV IN ASSOCIATION WITH GARIMA INTERNATIONAL DESIGN ASSOCIATES NEPAL PVT.LTD., NEPAL SITARA CONSULTANT PVT.LTD., NEPAL	Plan and Profile (15) (STA. 64+000 ~ 64+500)	H=1:1000 V=1:400		DESIGNED BY :		DATE	: Aug-2021
						CHECKED BY :		DWG No	: KTFT/HA
						APPROVED BY :		SHEET No :	15/17

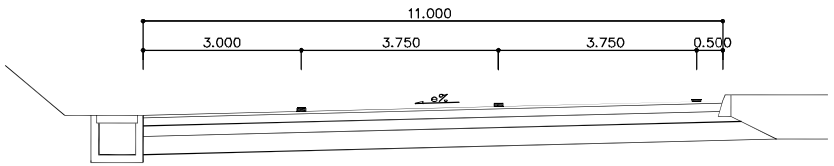
Pavement Structure

PAVEMENT TYPICAL CROSS SECTION

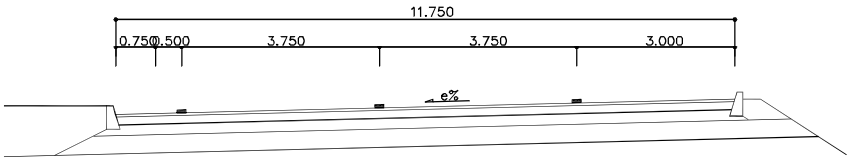
Banking Typical section – curve Inner(L=11.0m, TYPE-1)



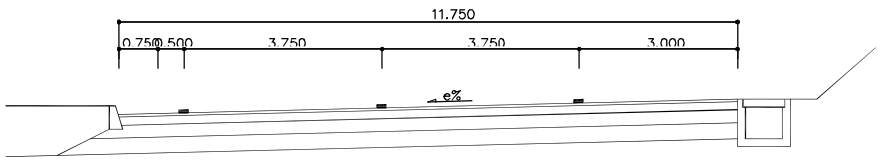
Cutting Typical section – curve inner(L=11.0m, TYPE-2)



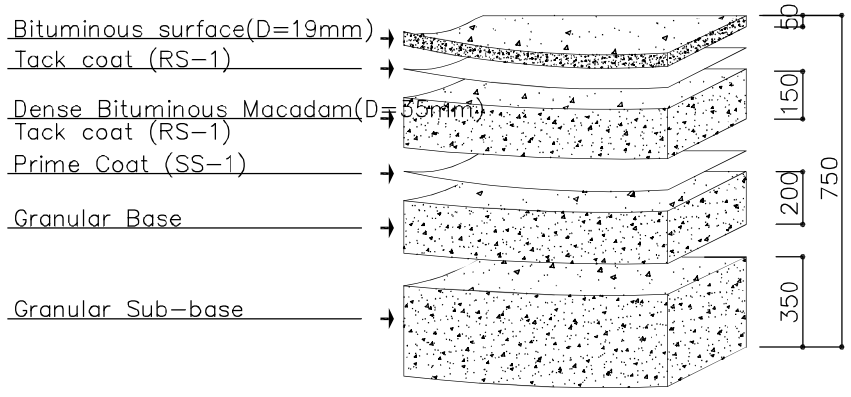
Banking Typical section – curve outer(L=11.75m, TYPE-3)



Cutting Typical section – curve outer(L=11.75m, TYPE-4)

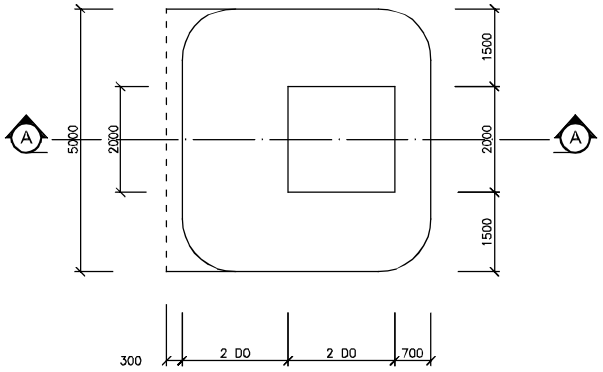


ASPHALT PAVEMENT TYPICAL SECTION

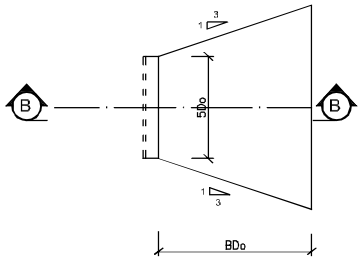


PROJECT NAME	CLIENT	DESIGN AND SUPERVISION CONSULTANT	DRAWING TITLE	SCALE	REV. No			
KATHMANDU-TERAI/MADESH FAST TRACK(EXPRESWAY) ROAD PROJECT	GOVERNMENT OF NEPAL MINISTRY OF DEFENCE NEPALI ARMY KATHMANDU NEPAL	YOOSHIN ENGINEERING CORPORATION, KOREA KOREA EXPRESSWAY CORPORATION, KOREA PYUNGHWA ENGINEERING CONSULTANT LTD, KOREA JV IN ASSOCIATION WITH GARIMA INTERNATIONAL DESIGN ASSOCIATES NEPAL PVT.LTD., NEPAL SITARA CONSULTANT PVT.LTD., NEPAL	PAVEMENT TYPICAL CROSS SECTION			DESIGNED BY : (HIGHWAY ENGINEER)		DATE : August-2021
						CHECKED BY : (DTL)		DWG No : HTP
						APPROVED BY : (TL)		SHEET No : 1

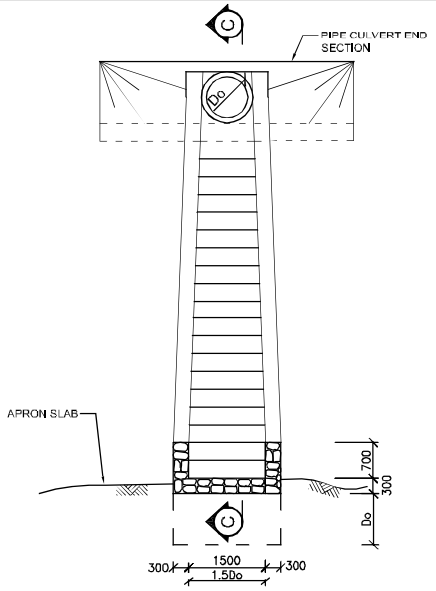
Drainage structure



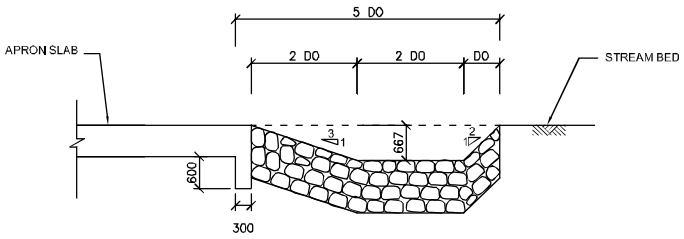
PLAN RIPRAP OUTLET APRON
(PREFORMED SCOUR HOLE TYPE)
(Scale 1:100)



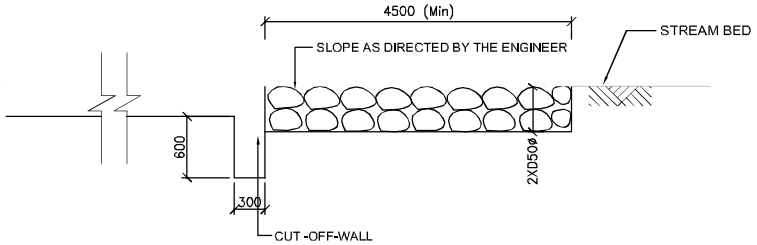
PLAN RIPRAP OUTLET APRON
(HORIZONTAL TYPE)
(Scale 1:100)



CHUTE DETAIL
(Scale 1:100)



SECTION A-A
(Scale 1:100)



SECTION B-B
(Scale 1:50)

Notes:-

1. Do represents clear span of culvert and D 50 for size of Riprap Stone.
2. Riprap outlet apron shall be provided as specified.
3. Riprap Inlet apron shall be provided as specified.
4. Riprap outlet apron or chute shall be provided wherever required.
5. For section C-C refer drawing of pipe culvert of hilly area.
5. The dimensions shown here are Indicative. For detailed design refer to "Roadside geotechnical problems: A practical Guide to their Solutions".

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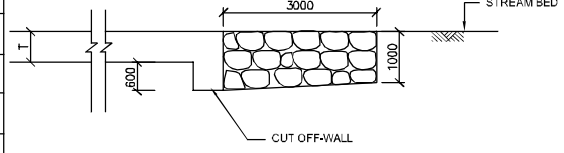
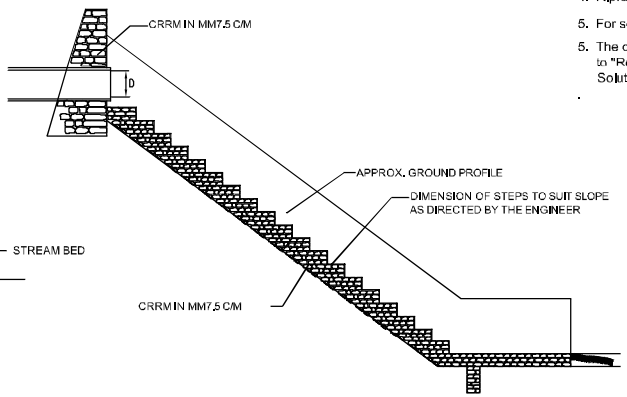
Do(M)	D5o(M) FOR PERFORMED SCOUR HOLE TYPE	D5o(M) FOR HORIZONTAL TYPE
0.60 Ø	0.10	0.15
0.90 Ø	0.12	0.20
1.20 Ø	0.15	0.30
1.00 Ø	0.20	0.40
1.5 Ø	0.30	0.40
2.00 Ø	0.40	0.45
2.50 Ø	0.45	0.50
3.00 Ø	0.50	0.75



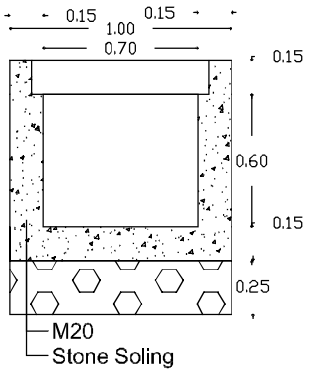
RIPRAP INLET APRON DETAIL
(Scale 1:100)



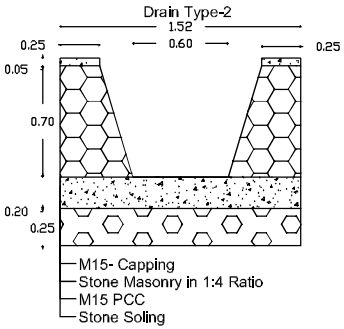
SECTION C-C
(SCALE 1:100)

PROJECT NAME	CLIENT	DESIGN AND SUPERVISION CONSULTANT	DRAWING TITLE	SCALE	REV. No			
KATHMANDU TERAI/MADESH FAST TRACK EXPRESS WAY ROAD PROJECT	GOVERNMENT OF NEPAL MINISTRY OF DEFENCE NEPALI ARMY KATHMANDU NEPAL	YOOSHIN ENGINEERING CORPORATION, KOREA KOREA EXPRESSWAY CORPORATION, KOREA PYUNGHWA ENGINEERING CONSULTANT LTD, KOREA JV IN ASSOCIATION WITH GARIMA INTERNATIONAL DESIGN ASSOCIATES NEPAL PVT.LTD., NEPAL SITARA CONSULTANT PVT.LTD., NEPAL	Typical Line Drain (Riprap Apron and Chute Detail)			DESIGNED BY : (HIGHWAY ENGINEER)		DATE : Aug-2021
						CHECKED BY : (DTL)		DWG No : KTFT/HT
						APPROVED BY : (TL)		SHEET No : 1/7

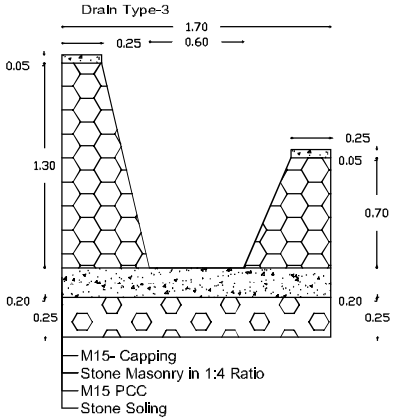
Drain Type-1



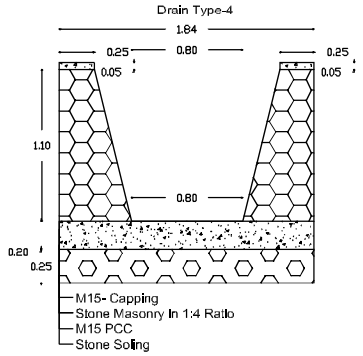
Drain Type-2



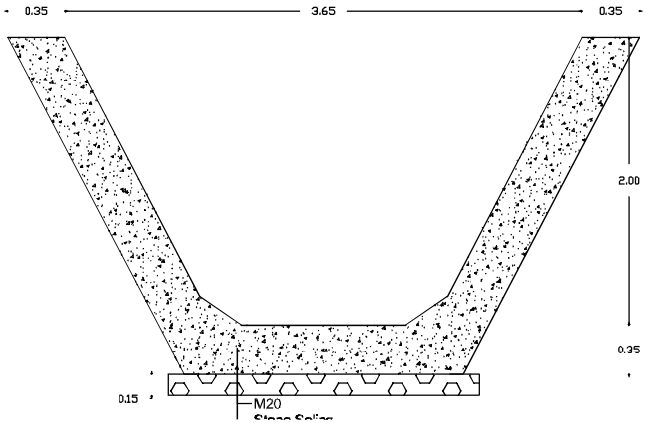
Drain Type-3



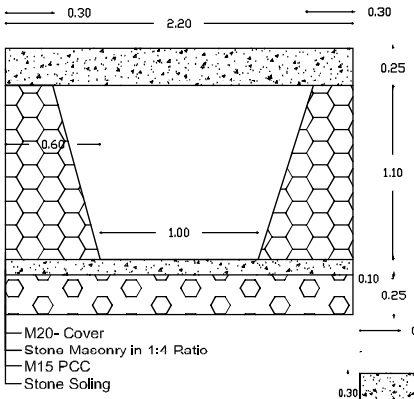
Drain Type-4



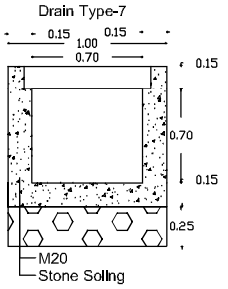
Drain Type-5



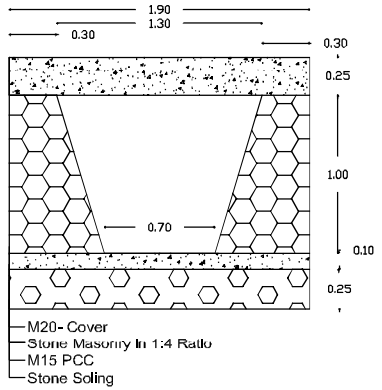
Drain Type-6



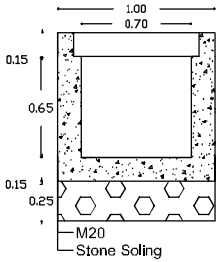
Drain Type-7



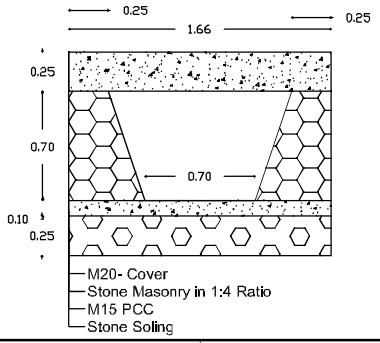
Drain Type-8



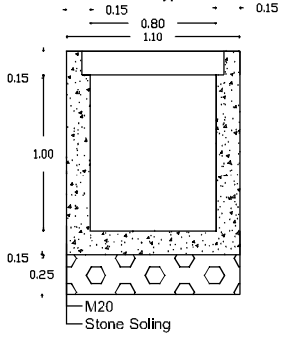
Drain Type-9



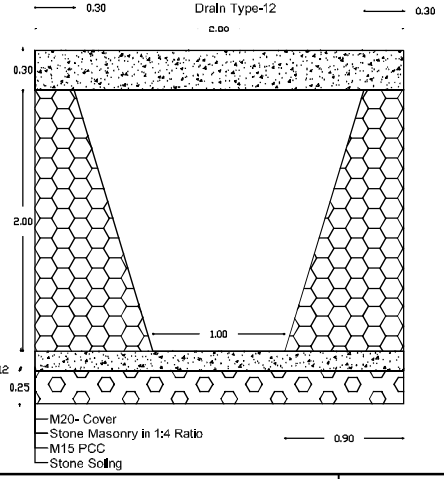
Drain Type-10



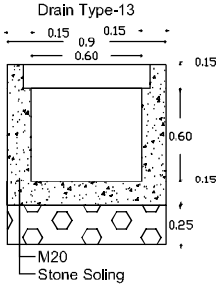
Drain Type-11



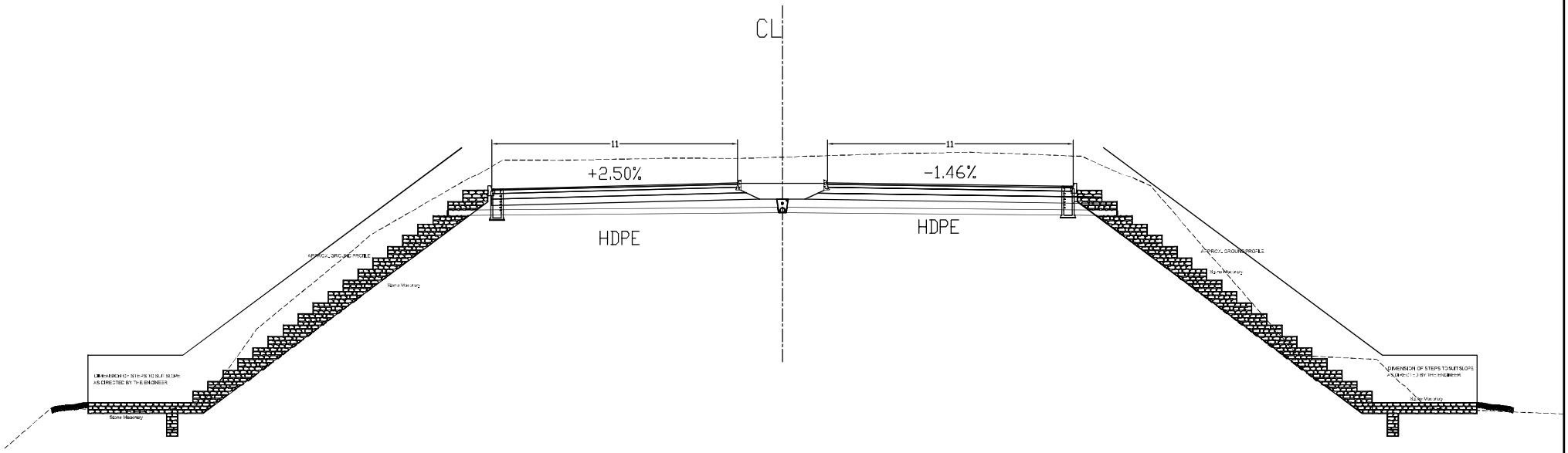
Drain Type-12

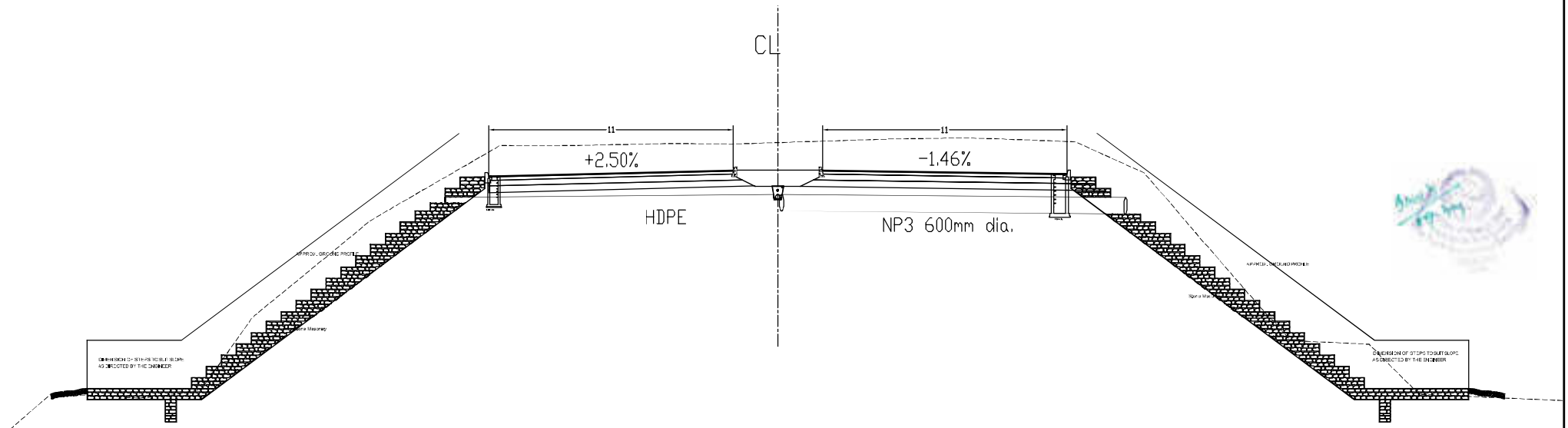


Drain Type-13

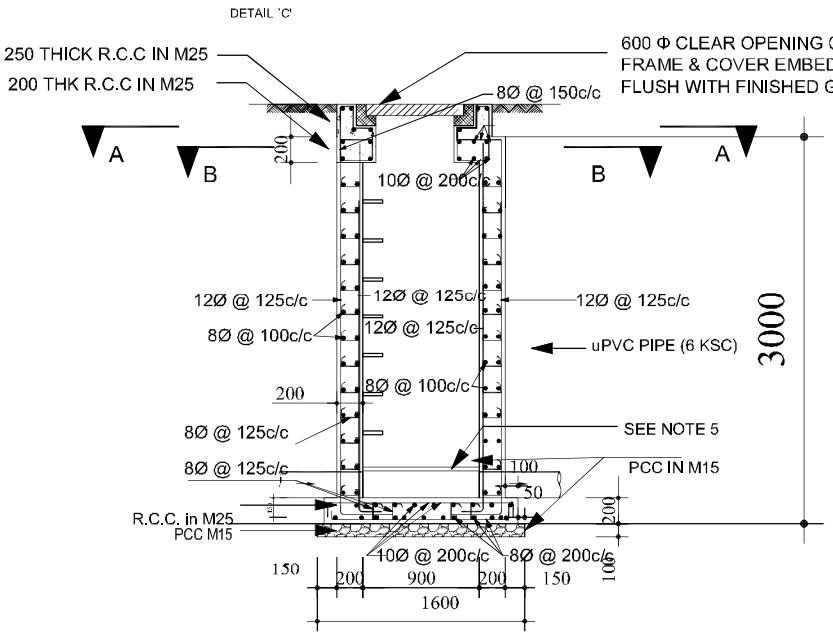


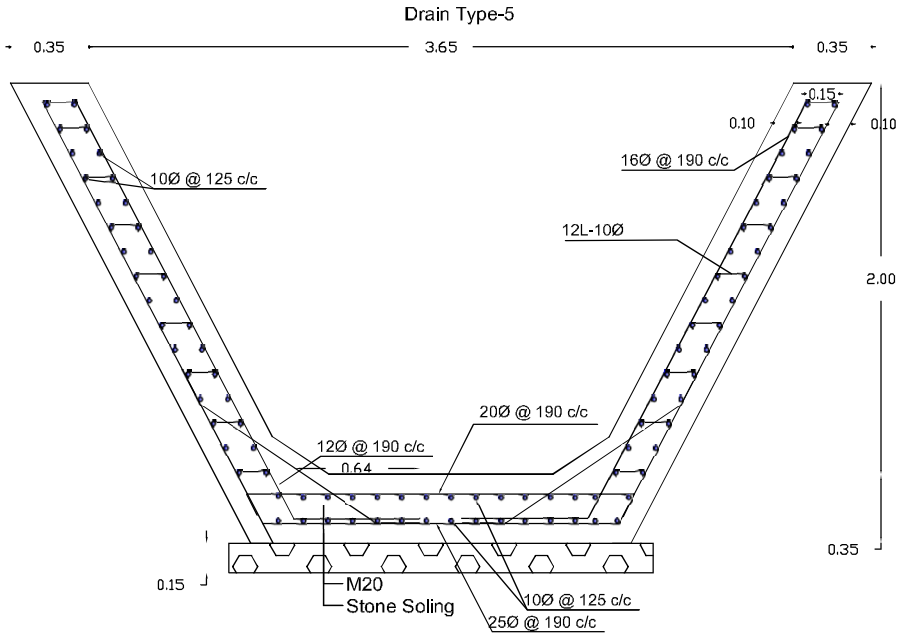
PROJECT NAME	CLIENT	DESIGN AND SUPERVISION CONSULTANT	DRAWING TITLE	SCALE	REV. No		
KATHMANDU TERAI/MADESH FAST TRACK EXPRESS WAY ROAD PROJECT	GOVERNMENT OF NEPAL MINISTRY OF DEFENCE NEPALI ARMY KATHMANDU NEPAL	YOOSHIN ENGINEERING CORPORATION, KOREA KOREA EXPRESSWAY CORPORATION, KOREA PYUNGHWA ENGINEERING CONSULTANT LTD, KOREA JV IN ASSOCIATION WITH GARIMA INTERNATIONAL DESIGN ASSOCIATES NEPAL PVT.LTD., NEPAL SITARA CONSULTANT PVT.LTD., NEPAL	Typical Drain			DESIGNED BY : (HIGHWAY ENGINEER)	DATE : Aug-2021
						CHECKED BY : (DTL)	DWG No : KTFT/HT
						APPROVED BY : (TL)	SHEET No : 2/7

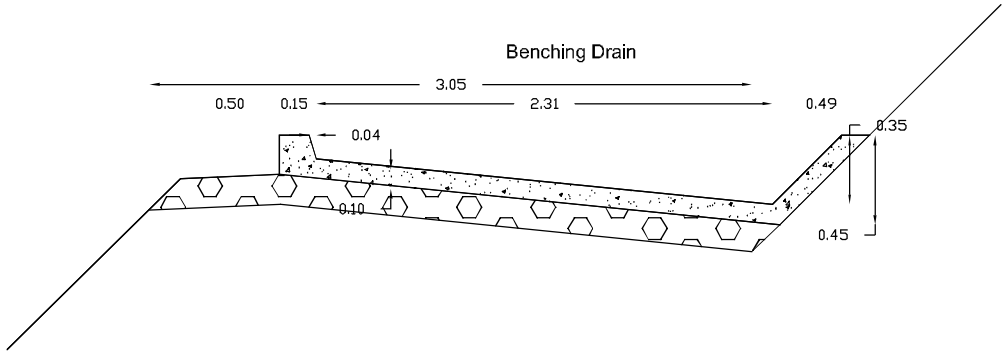




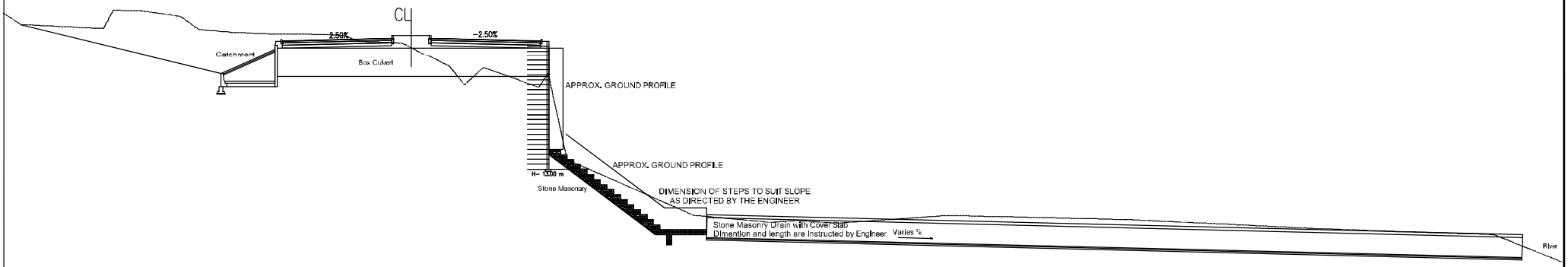
PROJECT NAME	CLIENT	DESIGN AND SUPERVISION CONSULTANT	DRAWING TITLE	SCALE	REV. No			
KATHMANDU TERAI/MADESH FAST TRACK EXPRESS WAY ROAD PROJECT	GOVERNMENT OF NEPAL MINISTRY OF DEFENCE NEPALI ARMY KATHMANDU NEPAL	YOOSHIN ENGINEERING CORPORATION, KOREA KOREA EXPRESSWAY CORPORATION, KOREA PYUNGHWA ENGINEERING CONSULTANT LTD, KOREA JV IN ASSOCIATION WITH GARIMA INTERNATIONAL DESIGN ASSOCIATES NEPAL PVT.LTD., NEPAL SITARA CONSULTANT PVT.LTD., NEPAL	Typical Line Drain and Drainage			DESIGNED BY : (HIGHWAY ENGINEER)		DATE : Aug-2021
						CHECKED BY : (DTL)		DWG No : KTFT/HT
						APPROVED BY : (TL)		SHEET No : 3/7

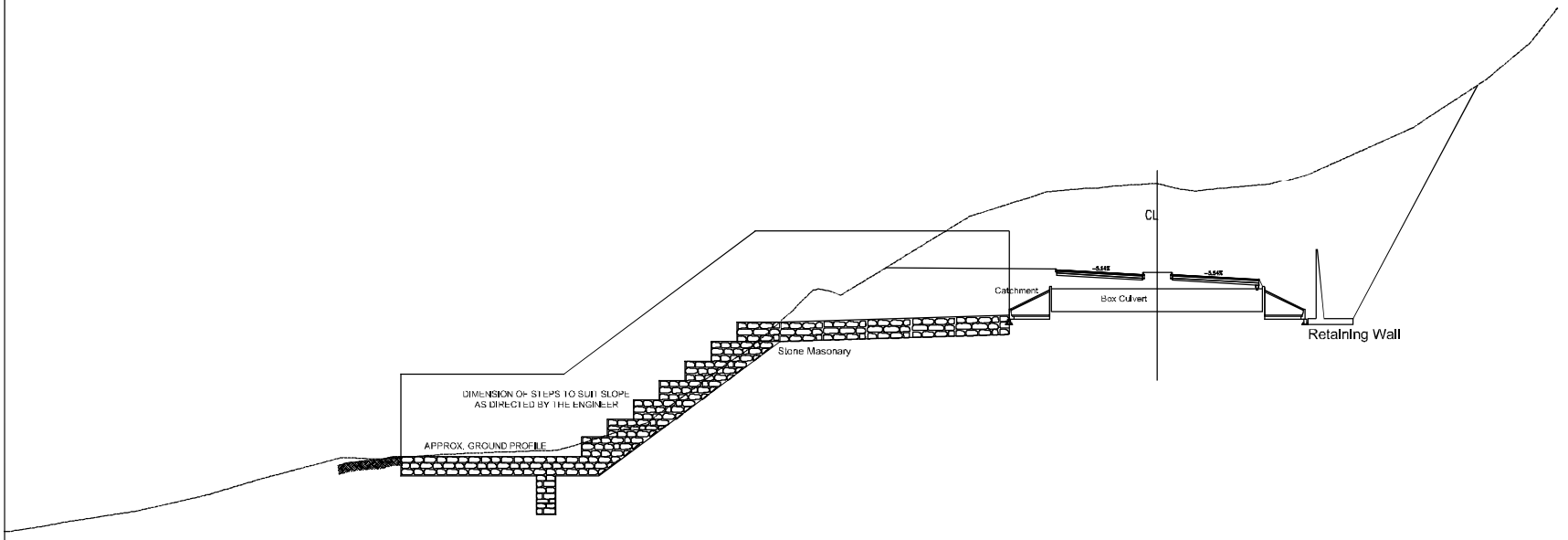




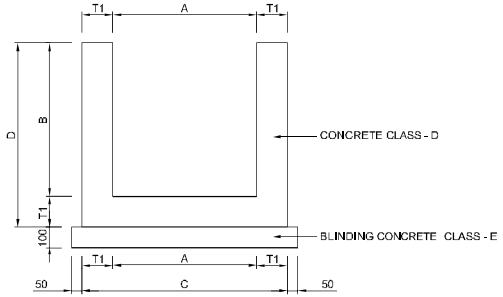


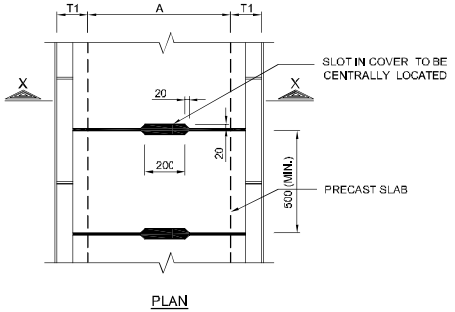
PROJECT NAME	CLIENT	DESIGN AND SUPERVISION CONSULTANT	DRAWING TITLE	SCALE	REV. No			
KATHMANDU TERAI/MADESH FAST TRACK EXPRESS WAY ROAD PROJECT	GOVERNMENT OF NEPAL MINISTRY OF DEFENCE NEPALI ARMY KATHMANDU NEPAL	YOOSHIN ENGINEERING CORPORATION, KOREA KOREA EXPRESSWAY CORPORATION, KOREA PYUNGHWA ENGINEERING CONSULTANT LTD, KOREA JV IN ASSOCIATION WITH GARIMA INTERNATIONAL DESIGN ASSOCIATES NEPAL PVT.LTD., NEPAL SITARA CONSULTANT PVT.LTD., NEPAL	Typical Manhole Drain Type - 5 Details Benching Drain			DESIGNED BY : (HIGHWAY ENGINEER)		DATE : Aug-2021
						CHECKED BY : (DTL)		DWG No : KTFT/HT
						APPROVED BY : (TL)		SHEET No : 4/7



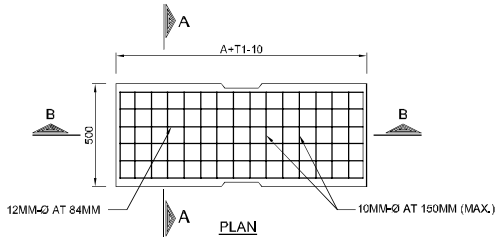


PROJECT NAME	CLIENT	DESIGN AND SUPERVISION CONSULTANT	DRAWING TITLE	SCALE	REV. No			
KATHMANDU TERAI/MADESH FAST TRACK EXPRESS WAY ROAD PROJECT	GOVERNMENT OF NEPAL MINISTRY OF DEFENCE NEPALI ARMY KATHMANDU NEPAL	YOOSHIN ENGINEERING CORPORATION, KOREA KOREA EXPRESSWAY CORPORATION, KOREA PYUNGHWA ENGINEERING CONSULTANT LTD, KOREA JV IN ASSOCIATION WITH GARIMA INTERNATIONAL DESIGN ASSOCIATES NEPAL PVT.LTD., NEPAL SITARA CONSULTANT PVT.LTD., NEPAL	Typical Drainage With Box Culvert			DESIGNED BY : (HIGHWAY ENGINEER)		DATE : Aug-2021
						CHECKED BY : (DTL)		DWG No : KTFT/HT
						APPROVED BY : (TL)		SHEET No : 5/7

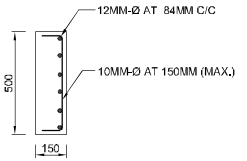




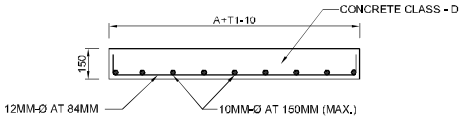
PLAN



PLAN

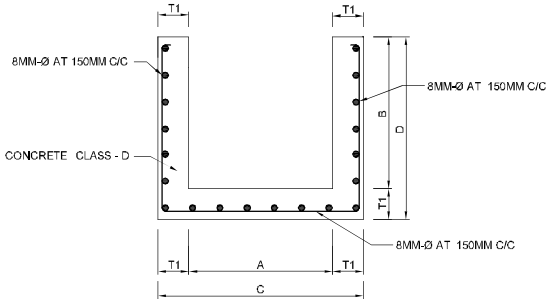


SECTION A-A

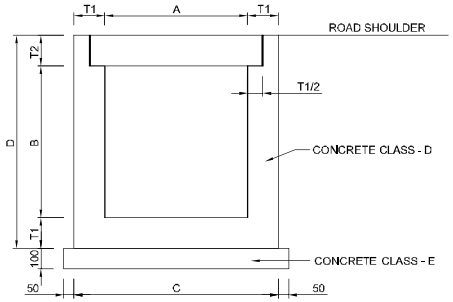


SECTION B-B

COVER FOR LIGHT VEHICLE



REINFOREMENT DETAIL



SECTION X-X

DETAIL DIMENSION

CU(LC)-AxB

DRAIN TYPE	DIMENSION (MM)					
	A	B	C	D	T1	T2
CU(LC)	600	600	900	900	150	150
CU(LC)	500	700	800	1000	150	150
CU(LC)	500	500	800	800	150	150
CU(LC)	450	450	750	750	150	150
CU(LC)	400	400	700	700	150	150

CONCRETE U SHAPE DRAIN WITH COVER FOR LIGHT VEHICLE CU(LC)-A x B

CONCRETE U SHAPE DRAIN
TYPE CU-A x B

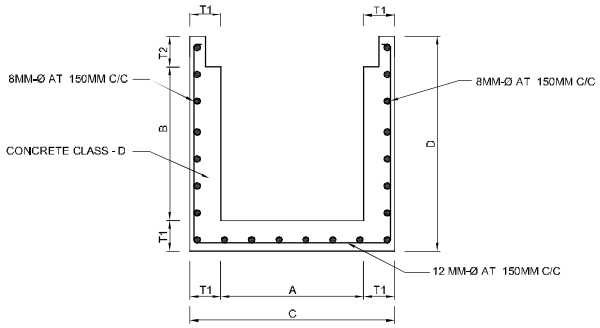
DETAIL DIMENSION

CU-AxB

DRAIN TYPE	DIMENSION (MM)				
	A	B	C	D	T1
CU	600	700	900	850	150
CU	500	700	800	850	150
CU	500	500	800	650	150
CU	450	450	750	600	150
CU	400	400	700	550	150
CU	350	350	650	500	150
CU	300	300	600	450	150

CONCRETE U SHAPE DRAIN (CU-A x B)

CONCRETE U SHAPE DRAIN WITH COVER
FOR LIGHT VEHICLE TYPE CU-A x B

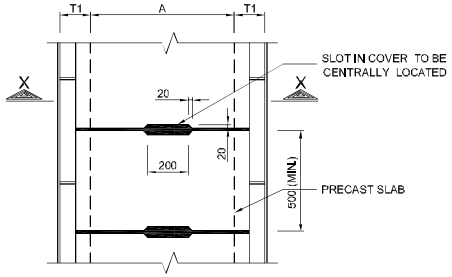


REINFOREMENT DETAIL

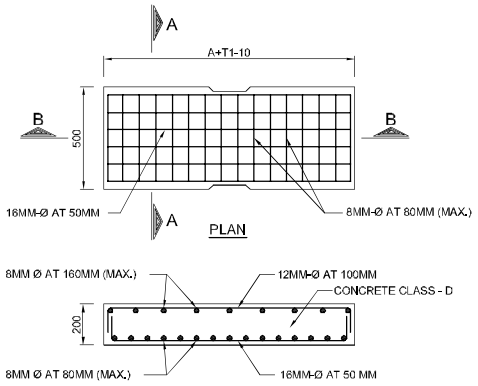
NOTES:

1. MIN COVER TO REINFORCEMENT IS 25MM
2. REINFORCEMENT TO BE HIGH YIELD DEFORME BARS GRADE 415.
3. ALL THE SURFACE DRAIN /SUB SURFACE DRAIN TO BE CONNECTED TO NEAREST PROPOSED OR EXISTING WATER-COURSE
4. ALL THE DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE MENTIONED.
5. CU-AxB - CONCRETE UTYPE SIDE DRAIN WITHOUT COVER
   CU(LC)-AxB - CONCRETE U TYPE SIDE DRAIN WITH COVER FOR LIGHT VEHICLE
   CU(HC)-AxB - CONCRETE U TYPE SIDE DRAIN WITH COVER FOR HEAVY VEHICLE
6. CU TYPE WILL BE EITHER PRECAST OR CAST IN SITU AS INSTRUCTED BY ENGINEER

PROJECT NAME	CLIENT	DESIGN AND SUPERVISION CONSULTANT	DRAWING TITLE	SCALE	REV. No	DESIGNED BY : (HIGHWAY ENGINEER)		DATE : Aug-2021
KATHMANDU TERAI/MADESH FAST TRACK EXPRESS WAY ROAD PROJECT	GOVERNMENT OF NEPAL MINISTRY OF DEFENCE NEPALI ARMY KATHMANDU NEPAL	YOOSHIN ENGINEERING CORPORATION, KOREA KOREA EXPRESSWAY CORPORATION, KOREA PYUNGHWA ENGINEERING CONSULTANT LTD, KOREA JV IN ASSOCIATION WITH GARIMA INTERNATIONAL DESIGN ASSOCIATES NEPAL PVT.LTD., NEPAL SITARA CONSULTANT PVT.LTD., NEPAL	Typical Drain			CHECKED BY : (DTL)		DWG No : KTFT/HT
						APPROVED BY : (TL)		SHEET No : 6/7



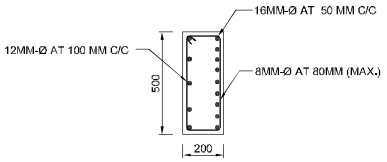
PLAN



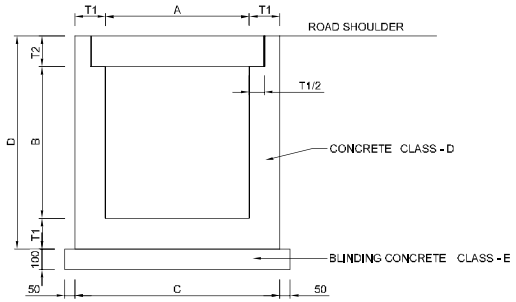
PLAN

SECTION B-B

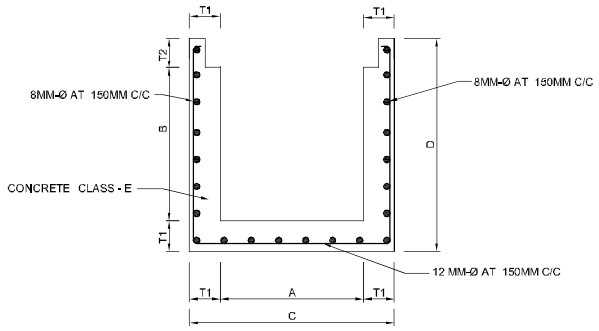
COVER FOR HEAVY VEHICLE



SECTION A-A



SECTION X-X



(REINFORCEMENT DETAIL)

DETAIL DIMENSION

Cover Slab								
Cover Slab	DIMENSION (MM)			Top Bar		Bottom Bar		Distribution Bar (No./Dia.)
	L	B	H	No.	Dia.	No.	Dia.	
Type-1, 7 & 9	500	1000	150	3	10	3	12	10/8
Type-6	500	2200	150	3	10	4	12	24/8
Type-8	500	1900	150	3	10	4	12	18/8
Type-10	500	1660	150	3	10	4	12	24/8
Type-11	500	1100	150	3	10	3	12	10/8
Type-12	500	2800	150	4	10	4	12	30/8
Type-13	500	900	150	3	10	3	12	10/8

CONCRETE U SHAPE DRAIN WITH COVER FOR HEAVY VEHICLE CU(HC)-A x B

DETAIL DIMENSION

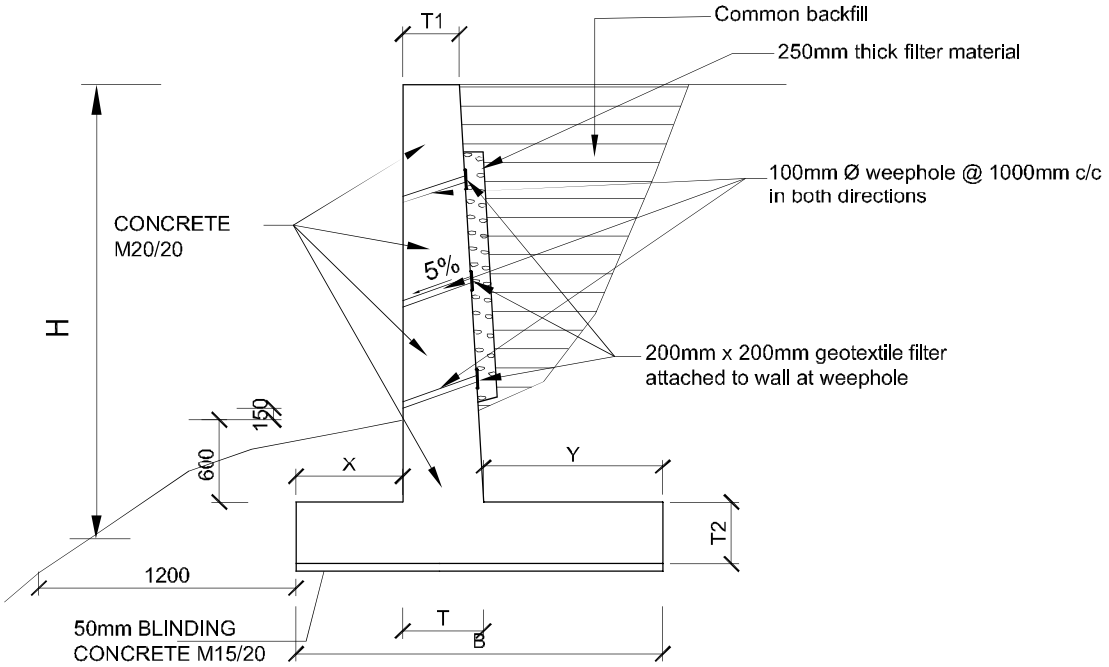
CU(HC)-AxB						
DRAIN TYPE	DIMENSION (MM)					
	A	B	C	D	T1	T2
CU(HC)	500	700	800	1050	150	200
CU(HC)	500	600	800	950	150	200
CU(HC)	500	500	800	850	150	200
CU(HC)	500	400	800	750	150	200
CU(HC)	400	400	700	750	150	200
CU(HC)	300	300	600	650	150	200

NOTES:

1. MIN COVER TO REINFORCEMENT IS 25MM
2. REINFORCEMENT TO BE HIGH YIELD DEFORME BARS GRADE 415.
3. ALL THE SURFACE DRAIN /SUB SURFACE DRAIN TO BE CONNECTED TO NEAREST PROPOSED OR EXISTING WATER-COURSE
4. ALL THE DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE MENTIONED.
5. CU-AxB - CONCRETE UTYPE SIDE DRAIN WITHOUT COVER
   CU(LC)-AxB - CONCRETE U TYPE SIDE DRAIN WITH COVER FOR LIGHT VEHICLE
   CU(HC)-AxB - CONCRETE U TYPE SIDE DRAIN WITH COVER FOR HEAVY VEHICLE
6. CU TYPE WILL BE EITHER PRECAST OR CAST IN SITU AS INSTRUCTED BY ENGINEER

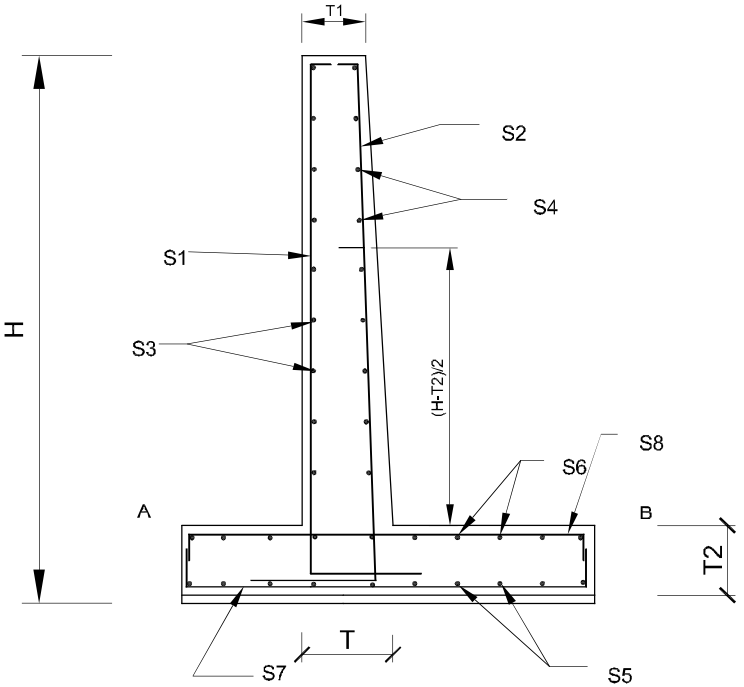
PROJECT NAME	CLIENT	DESIGN AND SUPERVISION CONSULTANT	DRAWING TITLE	SCALE	REV. No			
KATHMANDU TERAI/MADESH FAST TRACK EXPRESS WAY ROAD PROJECT	GOVERNMENT OF NEPAL MINISTRY OF DEFENCE NEPALI ARMY KATHMANDU NEPAL	YOOSHIN ENGINEERING CORPORATION, KOREA KOREA EXPRESSWAY CORPORATION, KOREA PYUNGHWA ENGINEERING CONSULTANT LTD, KOREA JV IN ASSOCIATION WITH GARIMA INTERNATIONAL DESIGN ASSOCIATES NEPAL PVT.LTD., NEPAL SITARA CONSULTANT PVT.LTD., NEPAL	Typical Drain Reinforcement and Drain Cover Reinforcement			DESIGNED BY : (HIGHWAY ENGINEER)		DATE : Aug-2021
						CHECKED BY : (DTL)		DWG No : KTFT/HT
						APPROVED BY : (TL)		SHEET No : 7/7

Wall Structure



TYPICAL DRAWING OF RCC CANTILEVER RETAINING WALL

(Scale 1:100)



ARRANGEMENT OF REINFORCEMENTS

(Scale 1:100)

TABLE FOR DIMENSIONS OF THE R.C.C WALLS WITH SURCHARGE LOAD OF 2T/m^{2}DUE TO ROAD TRAFFIC

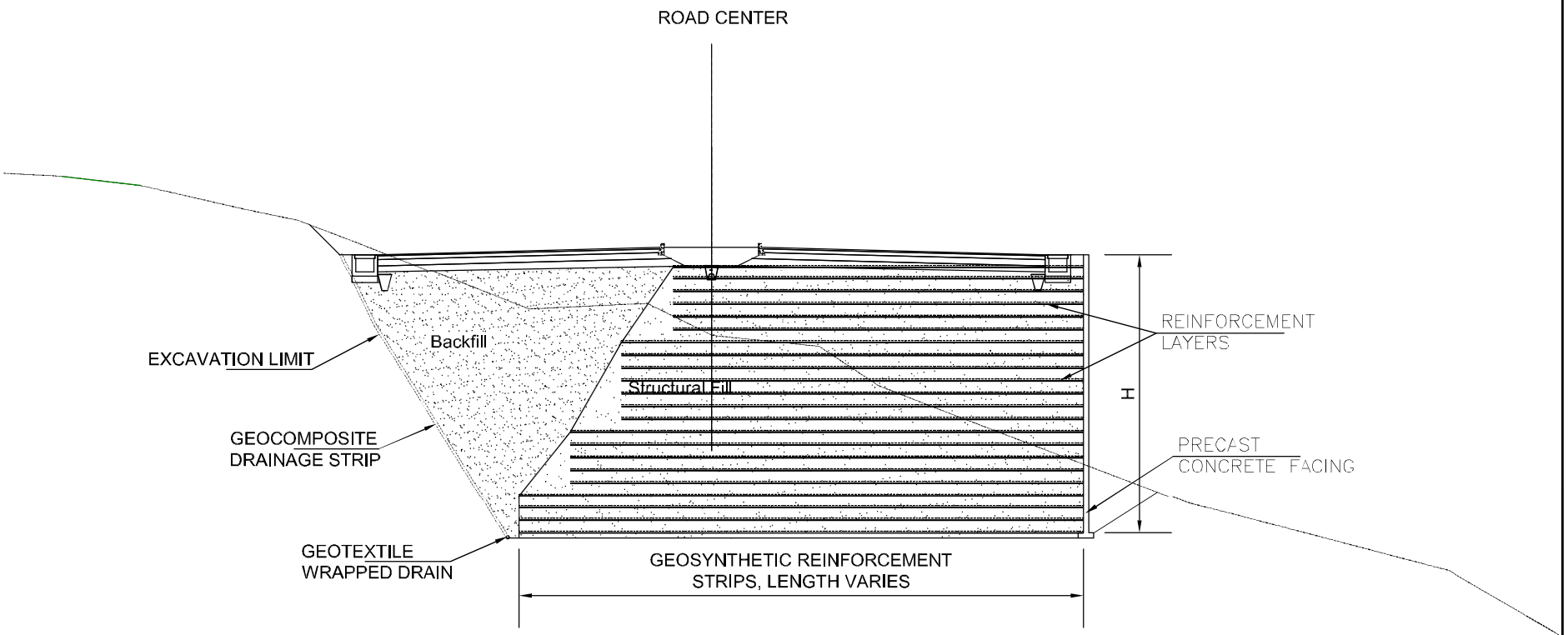
H m	B m	T m	T1 m	T2 m	X m	Y m	Maximum Pressure T/m^2
6	3.60	0.60	0.20	0.60	0.87	2.13	21.38
7	4.20	0.72	0.20	0.60	0.90	2.58	24.00
8	4.80	0.85	0.20	0.60	1.00	2.95	26.60
9	5.40	1.00	0.20	0.70	1.00	3.40	30.40
10	6.00	1.10	0.20	0.80	1.00	3.90	34.20

TABLE FOR REINFORCEMENT

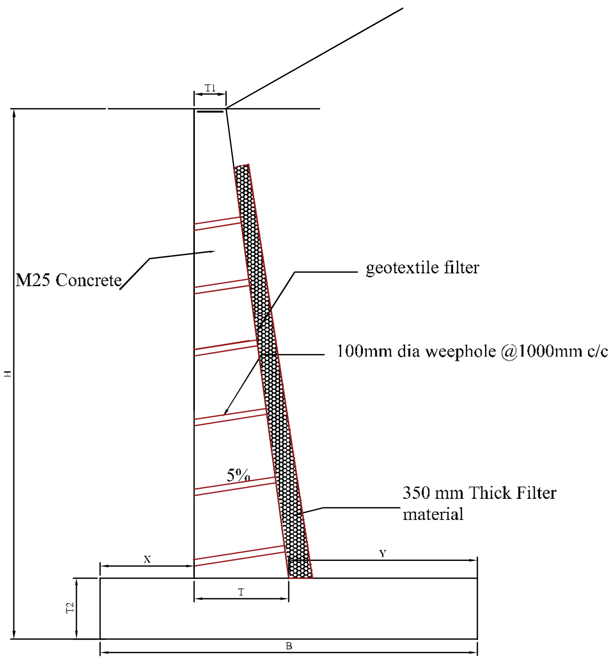
HEIGHT (H) m	HIGH YIELD STEEL REINFORCEMENT															
	S1		S2		S3		S4		S5		S6		S7		S8	
	Ø mm	Spacing mm	Ø mm	Spacing mm	Ø mm	Spacing mm	Ø mm	Spacing mm	Ø mm	Spacing mm	Ø mm	Spacing mm	Ø mm	Spacing mm	Ø mm	Spacing mm
6	12	180	20	135	12	180	12	180	12	160	12	160	12	180	16	105
7	12	180	20	100	12	180	12	180	12	160	12	160	12	150	20	100
8	16	200	20	90	12	170	12	170	12	160	12	160	16	190	25	110
9	16	200	25	119	12	150	12	150	12	160	12	160	16	190	25	105
10	16	200	25	100	12	140	12	140	12	140	12	140	16	180	25	100

PROJECT NAME	CLIENT	DESIGN AND SUPERVISION CONSULTANT	DRAWING TITLE	SCALE	REV. No	DESIGNED BY : BRIDGE ENG.		DATE : Aug-2021
KATHMANDU TERAI/MADESH FAST TRACK EXPRESS WAY ROAD PROJECT	GOVERNMENT OF NEPAL MINISTRY OF DEFENCE NEPALI ARMY KATHMANDU NEPAL	YOOSHIN ENGINEERING CORPORATION, KOREA KOREA EXPRESSWAY CORPORATION, KOREA PYUNGHWA ENGINEERING CONSULTANT LTD, KOREA JV IN ASSOCIATION WITH GARIMA INTERNATIONAL DESIGN ASSOCIATES NEPAL PVT.LTD., NEPAL SITARA CONSULTANT PVT.LTD., NEPAL	TYPICAL DRAWING OF RCC CANTILEVER RETAINING WALL	NA		CHECKED BY : (DTL)		DWG No : KTFT/ST
						APPROVED BY : (TL)		SHEET No : 1/1

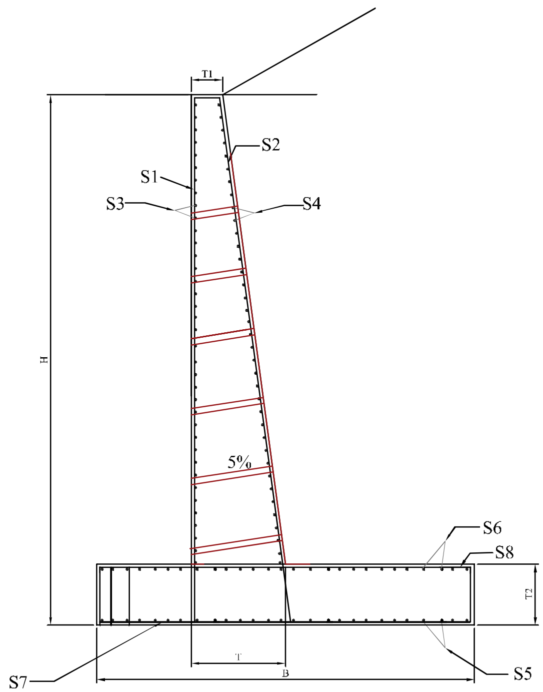
TYPICAL DRAWING FOR REINFORCED EARTH WALL



PROJECT NAME	CLIENT	DESIGN AND SUPERVISION CONSULTANT	DRAWING TITLE	SCALE	REV. No	DESIGNED BY : (HIGHWAY ENGINEER)		DATE : August-2021
KATHMANDU-TERAI/MADESH FAST TRACK (EXPRESSWAY) ROAD PROJECT	GOVERNMENT OF NEPAL MINISTRY OF DEFENCE NEPALI ARMY KATHMANDU NEPAL	YOOSHIN ENGINEERING CORPORATION, KOREA KOREA EXPRESSWAY CORPORATION, KOREA PYUNGHWA ENGINEERING CONSULTANT LTD, KOREA JV IN ASSOCIATION WITH GARIMA INTERNATIONAL DESIGN ASSOCIATES NEPAL PVT.LTD., NEPAL SITARA CONSULTANT PVT.LTD., NEPAL	Typical RE Wall			CHECKED BY : (DTL)		DWG No : KTFT/HT
						APPROVED BY : (TL)		SHEET No : 1/1



TYPICAL DRAWING OF RCC CANTILEVER RETAINING WALL



ARRANGEMENTS OF REINFORCEMENTS

Reinfrocement Details for RCC wall for Different height

Reinforcement Detail for Retaining wall (1m)

H	B	T	T1	T2	X	Y	Length(m)	Conc.M20(sqm)
7	4.90	1.00	0.40	0.80	1.00	2.90	1	8.95

(Per 1m)

SCHEDULE OF REINFORCEMENT

Code Of Bar	Shape Of Bar(mm)	a	b	c	Spacing (c/c) mm	Dia(mm)	Total Length(m)	No. Of Bars	Wt(Kg/m)	Quantity(kg)	Remarks
S1		1	6.9	0.2	150	20	8.10	7	2.46	139.48	
S2		1	7	0.2	150	25	8.20	7	3.85	220.99	
S3		0	1	0	140	16	1.00	45	1.58	71.1	
S4		0	1	0	140	16	1.00	45	1.58	71.1	
S5		0	1	0	150	16	1.00	33	1.58	52.14	
S6		0	1	0	150	16	1.00	33	1.58	52.14	
S7		0.45	4.8	0.5	150	16	5.75	7	1.58	63.64	
S8		0.45	4.8	0.5	125	25	5.75	1	3.85	169.23	
							GRAND TOTAL			839.23 0.84	KG MT

Reinforcement Detail for Retaining wall (1m)

H	B	T	T1	T2	X	Y	Length(m)	CONC. M20(sqm)
10	7.00	1.00	0.50	1.40	1.30	3.90	1	20.98

(PER 1m)

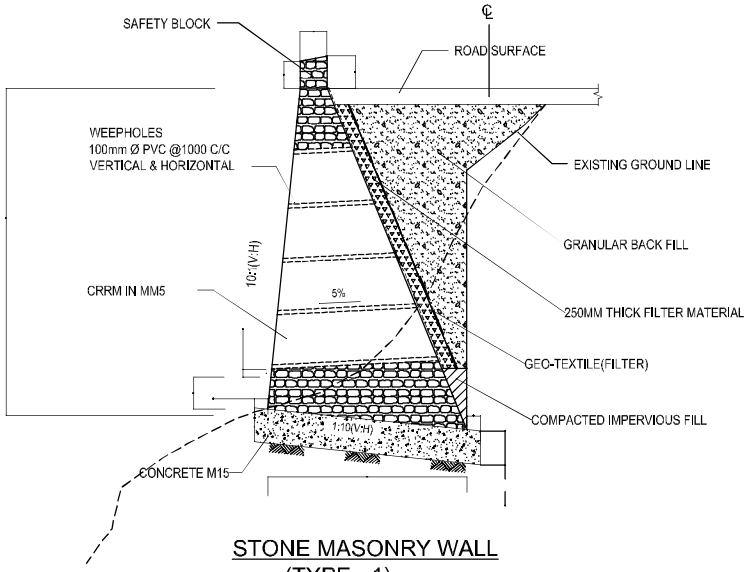
SCHEDULE OF REINFORCEMENT

Code Of Bar	Shape Of Bar(mm)	a (m)	b (m)	c (m)	Spacing (c/c) mm	dia(mm)	Total Length(m)	No. Of Bars	Wt(Kg/m)	Quantity(kg)	Remarks
S1		1.8	9.8	0.2	150	25	11.80	7	3.85	320.7	
S2		1.8	10	0.2	100	25	12.00	18	3.85	182	
S3		0.2	0.8	0.2	125	20	1.20	88	2.46	217.48	
S4		0.2	0.8	0.2	125	20	1.20	69	2.46	205.88	
S5		0.2	0.8	0.2	150	20	1.20	47	2.46	150.5	
S6		0.2	0.8	0.2	100	20	1.20	70	2.46	222.84	
S7		0.8	6.8	0.5	150	20	8.40	7	2.46	144.37	
S8		0.8	6.8	0.5	150	25	8.20	10	3.85	315.7	
							GRAND TOTAL			2357.08 2.36	KG MT

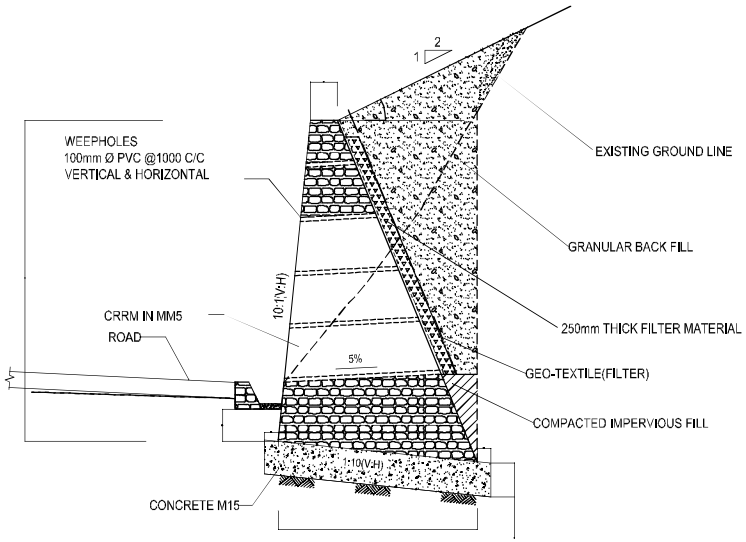
NOTES:

1. Expansion Joint is to be provided maximum distance of 30.00 m C/C. It should be located wherever possible at every major changes in wall height .
2. Lowest weep hole should not be more than 200mm above final ground level at the toe of wall.
3. Concrete mix used for structure is M25/20 and Rebar grade is Fe500.
4. Reingorcement Grade used for structure Fe500
5. Geotextile in wall back side (where expansion joint is located) is to be provided throughout height to control soil erosion from back side.
6. The clear cover of concrete shall be 75 mm.

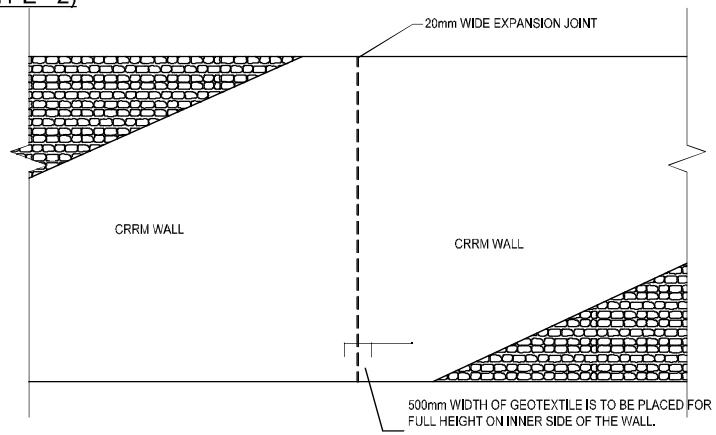
PROJECT NAME	CLIENT	DESIGN AND SUPERVISION CONSULTANT	DRAWING TITLE	SCALE	REV. No	DESIGNED BY : Bridge Engineer		DATE : August-2021
KATHMANDU-TERAI/MADESH FAST TRACK (EXPRESSWAY) ROAD PROJECT	GOVERNMENT OF NEPAL MINISTRY OF DEFENCE NEPALI ARMY KATHMANDU NEPAL	YOOSHIN ENGINEERING CORPORATION, KOREA KOREA EXPRESSWAY CORPORATION, KOREA PYUNGHWA ENGINEERING CONSULTANT LTD, KOREA JV IN ASSOCIATION WITH GARIMA INTERNATIONAL DESIGN ASSOCIATES NEPAL PVT.LTD., NEPAL SITARA CONSULTANT PVT.LTD., NEPAL	REINFORCEMENT DETAIL FOR RCC WALL	NA		CHECKED BY : DTL		DWG No : KTFT/ST
						APPROVED BY : TL		SHEET No : 1/1



STONE MASONRY WALL
(TYPE - 1)



STONE MASONRY WALL
(TYPE - 2)



EXPANSION JOINT DETAILS

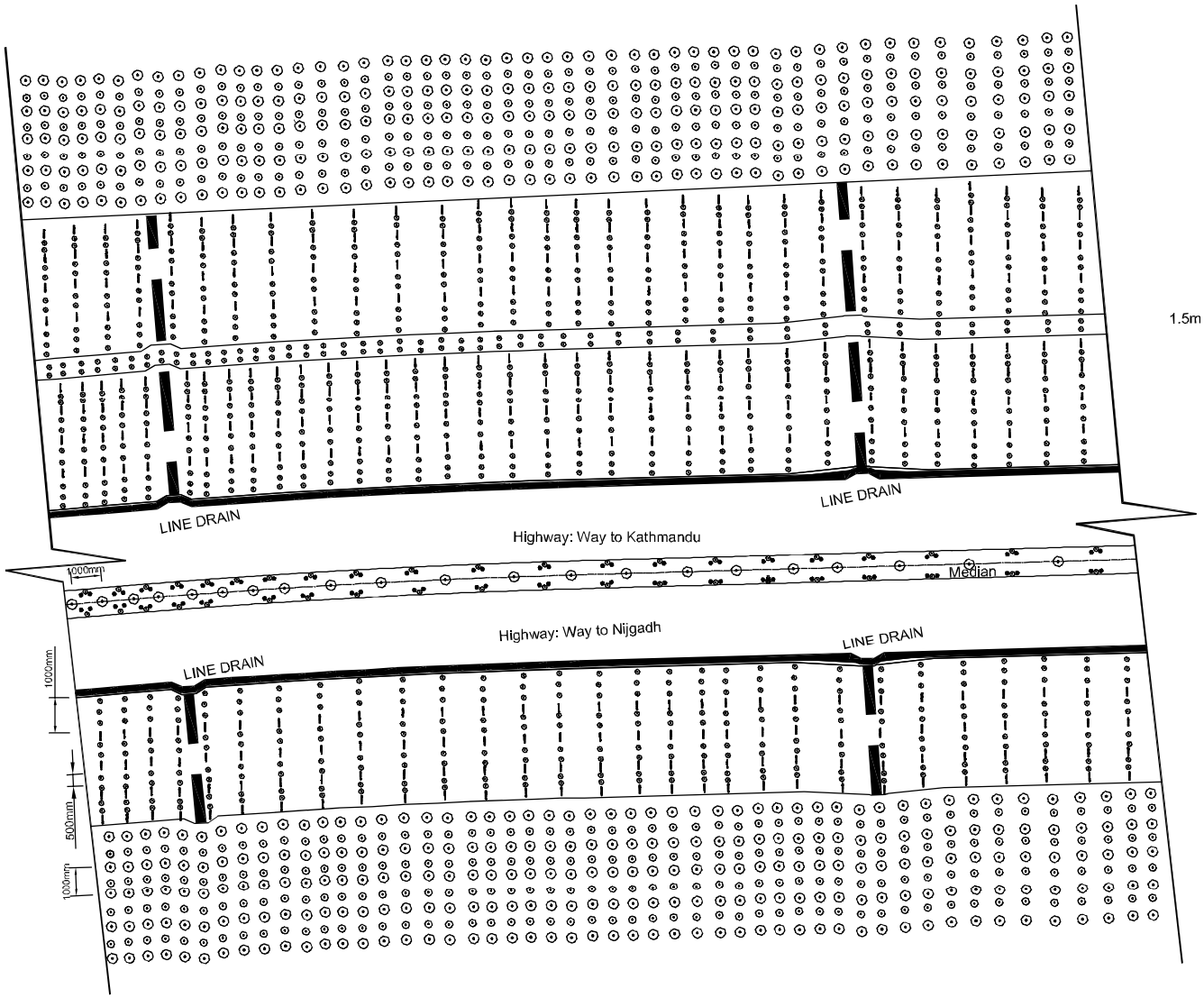
NOTES :

1. Ensure rock at foundaion for toe pressure >250 kN/m2
2. Expansion Joint is to be provided at a maximum distance of 10.0 m C/C or as directed by the Engineer.
3. FSS means factor of safety against sliding and FSO means factor of safety against overturning.
4. All dimensions are in mm except otherwise mentioned.
5. Safety blocks to be provided where the wall height is more than 3.0 m.

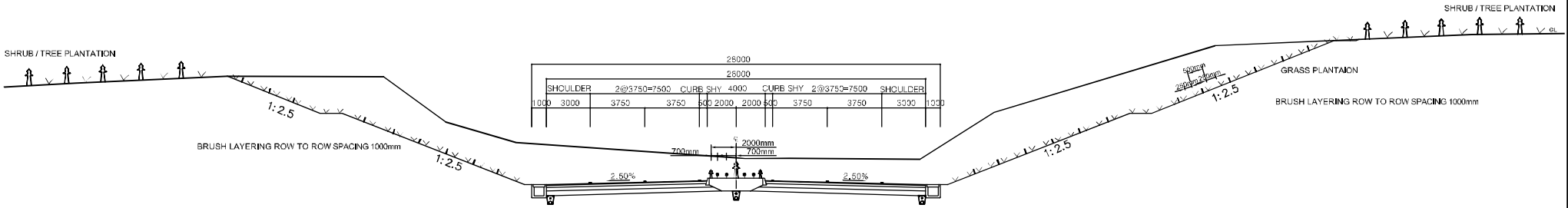
PROJECT NAME	CLIENT	DESIGN AND SUPERVISION CONSULTANT	DRAWING TITLE	SCALE	REV. No			
KATHMANDU-TERAI/MADESH FAST TRACK (EXPRESSWAY) ROAD PROJECT	GOVERNMENT OF NEPAL MINISTRY OF DEFENCE NEPALI ARMY KATHMANDU NEPAL	YOOSHIN ENGINEERING CORPORATION, KOREA KOREA EXPRESSWAY CORPORATION, KOREA PYUNGHWA ENGINEERING CONSULTANT LTD, KOREA JV IN ASSOCIATION WITH GARIMA INTERNATIONAL DESIGN ASSOCIATES NEPAL PVT.LTD., NEPAL SITARA CONSULTANT PVT.LTD., NEPAL	TYPICAL DRAWING OF STONE MASONARY WALL	NA		DESIGNED BY : BRIDGE ENG.		DATE : August-2021
						CHECKED BY : (DTL)		DWG No : KTFT/ST
						APPROVED BY : (TL)		SHEET No : 1/1

Bio Engineering

Bio-Engineering (TOP VIEW)



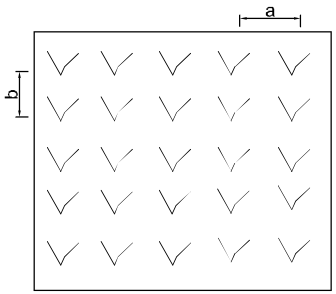
PROJECT NAME	CLIENT	DESIGN AND SUPERVISION CONSULTANT	DRAWING TITLE	SCALE	REV. No			
KATHMANDU TERAI/MADESH FAST TRACK (EXPRESSWAY) ROAD PROJECT	GOVERNMENT OF NEPAL MINISTRY OF DEFENCE NEPALI ARMY KATHMANDU NEPAL	YOOSHIN ENGINEERING CORPORATION, KOREA KOREA EXPRESSWAY CORPORATION, KOREA PYUNGHWA ENGINEERING CONSULTANT LTD, KOREA JV IN ASSOCIATION WITH GARIMA INTERNATIONAL DESIGN ASSOCIATES NEPAL PVT.LTD., NEPAL SITARA CONSULTANT PVT.LTD., NEPAL	Bio-Engineering (TOP VIEW)	NOT IN SCALE		DESIGNED BY: (BIO ENGINEER) CHECKED BY : (DTL) APPROVED BY : (TL)	DATE : August-2021 DWG No : KTFT/BE SHEET No : 1/2	



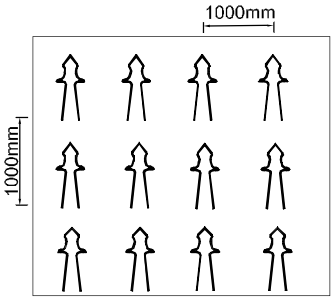
LEGEND:

- SHRUB / TREE PLANTATION
- FLOWER PLANTATION
- GRASS PLANTATION
- BRUSH LAYERING

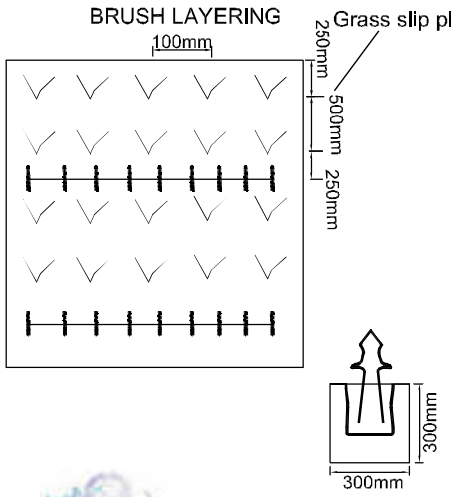
Contour line (HZ)



SHRUB / TREE PLANTATION



BRUSH LAYERING



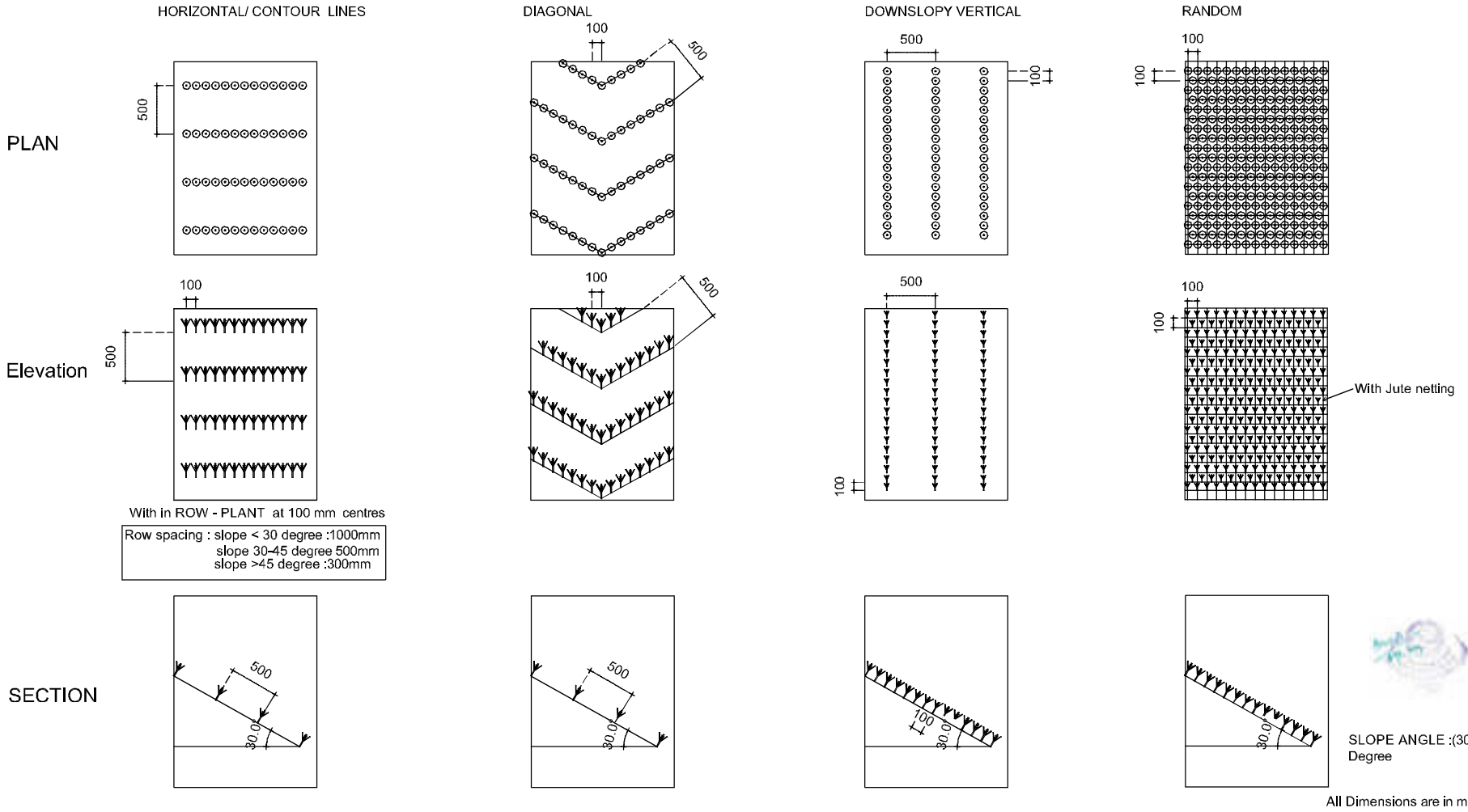
Compost Volume 1/4 of volume of the PIT mixed with original soil.

NOTE:

* All the diamensions in millimeter (mm) unless mentioned.
* For any unspecified and change in works, proceed director by site.

PROJECT NAME	CLIENT	DESIGN AND SUPERVISION CONSULTANT	DRAWING TITLE	SCALE	REV. No			
KATHMANDU TERAI/MADESH FAST TRACK (EXPRESSWAY) ROAD PROJECT	GOVERNMENT OF NEPAL MINISTRY OF DEFENCE NEPALI ARMY KATHMANDU NEPAL	YOOSHIN ENGINEERING CORPORATION, KOREA KOREA EXPRESSWAY CORPORATION, KOREA PYUNGHWA ENGINEERING CONSULTANT LTD, KOREA JV IN ASSOCIATION WITH GARIMA INTERNATIONAL DESIGN ASSOCIATES NEPAL PVT.LTD., NEPAL SITARA CONSULTANT PVT.LTD., NEPAL	Bio-Engineering (TYPICAL)			DESIGNED BY:		DATE : August-2021
						CHECKED BY :		DWG No : KTFT/BE
						APPROVED BY :		SHEET No : 2/2

GRASS PLANTATION



With in ROW - PLANT at 100 mm centres

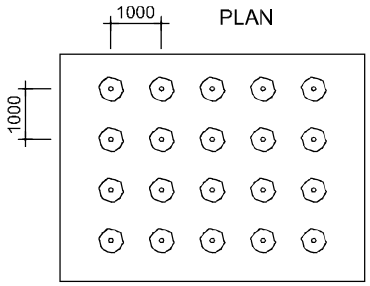
Row spacing : slope < 30 degree :1000mm
slope 30-45 degree 500mm
slope >45 degree :300mm

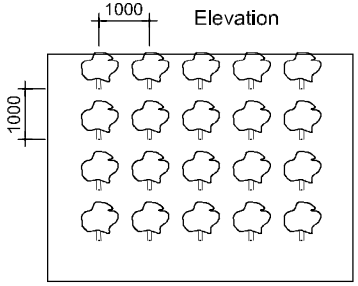
SLOPE ANGLE :(30-45) Degree

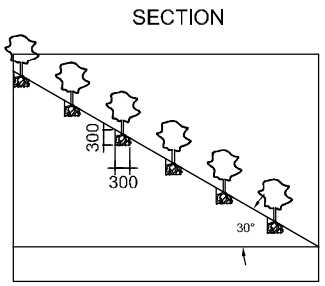
All Dimensions are in mm

PROJECT NAME	CLIENT	DESIGN AND SUPERVISION CONSULTANT	DRAWING TITLE	SCALE	REV. No			
KATHMANDU-TERAI/MADESH FAST TRACK(EXPRESS WAY) ROAD PROJECT	GOVERNMENT OF NEPAL MINISTRY OF DEFENCE NEPALI ARMY KATHMANDU NEPAL	YOOSHIN ENGINEERING CORPORATION, KOREA KOREA EXPRESSWAY CORPORATION, KOREA PYUNGHWA ENGINEERING CONSULTANT LTD, KOREA JV IN ASSOCIATION WITH GARIMA INTERNATIONAL DESIGN ASSOCIATES NEPAL PVT.LTD., NEPAL SITARA CONSULTANT PVT.LTD., NEPAL	Bio-Engineering (Grass Plantation)	NOT IN SCALE		DESIGNED BY : (BIO ENGINEER)	DATE : August-2021	
						CHECKED BY : (DTL)	DWG No : KTFT/BE	
						APPROVED BY : (TL)	SHEET No : 3/5	

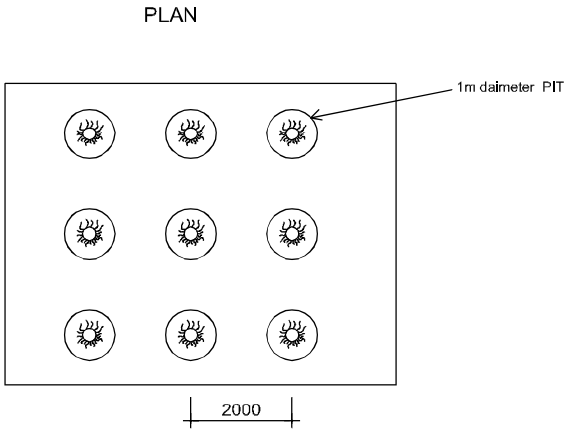
SHRUBS AND TREE PLANTATION

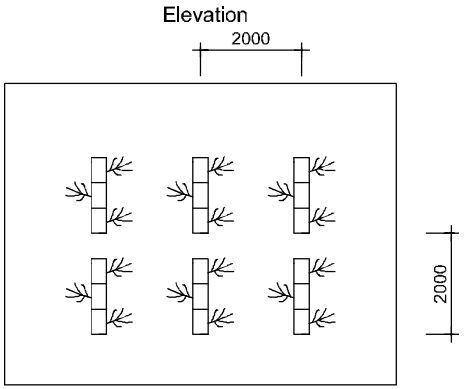


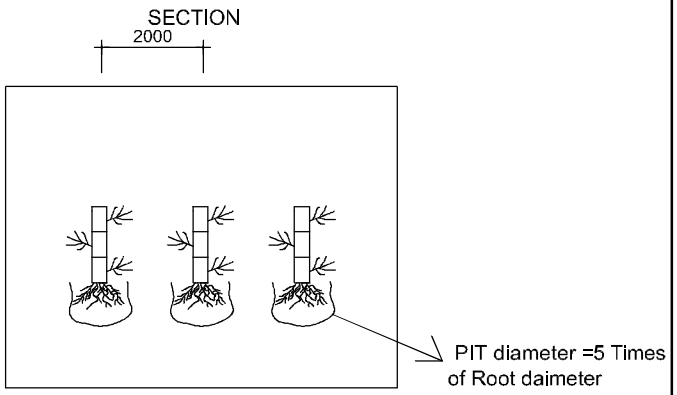




Bamboo Planting





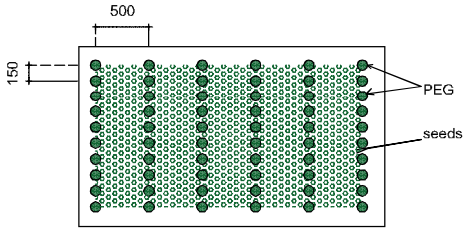


All Dimensions are in mm

PROJECT NAME	CLIENT	DESIGN AND SUPERVISION CONSULTANT	DRAWING TITLE	SCALE	REV. No			
KATHMANDU-TERAI/MADESH FAST TRACK(EXPRESS WAY) ROAD PROJECT	GOVERNMENT OF NEPAL MINISTRY OF DEFENCE NEPALI ARMY KATHMANDU NEPAL	YOOSHIN ENGINEERING CORPORATION, KOREA KOREA EXPRESSWAY CORPORATION, KOREA PYUNGHWA ENGINEERING CONSULTANT LTD, KOREA JV IN ASSOCIATION WITH GARIMA INTERNATIONAL DESIGN ASSOCIATES NEPAL PVT.LTD., NEPAL SITARA CONSULTANT PVT.LTD., NEPAL	Bio -Engineering (shrubs and tree plantation and bamboo plantation)	NOT IN SCALE		DESIGNED BY : (BIO ENGINEER)	DATE : August-2021	
						CHECKED BY : (DTL)	DWG No : KTFT/BE	
						APPROVED BY : (TL)	SHEET No : 4/5	

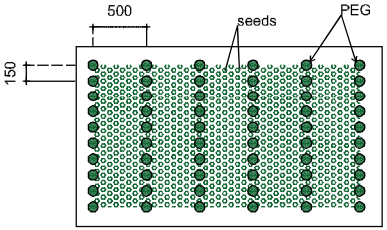
GRASS SEEDING

PLAN



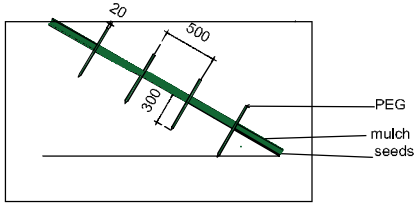
seed 25gm/m^2 Works -downward

Elevation



Jute netting >30 degree slope and mulching

SECTION

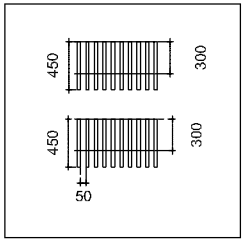


jute net mesh size :500*150 mm
Peging :(500-1000) mm
Mulch thickness :100mm

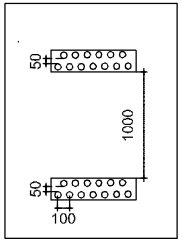
Sites : Almost bare site with slopes upto 45 degree

BRUSH LAYERING

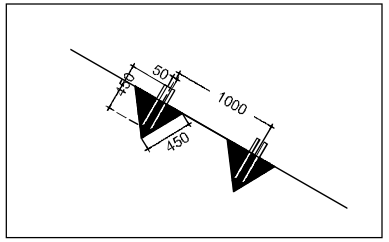
PLAN

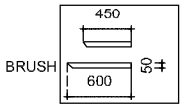


ELEVATION



SECTION





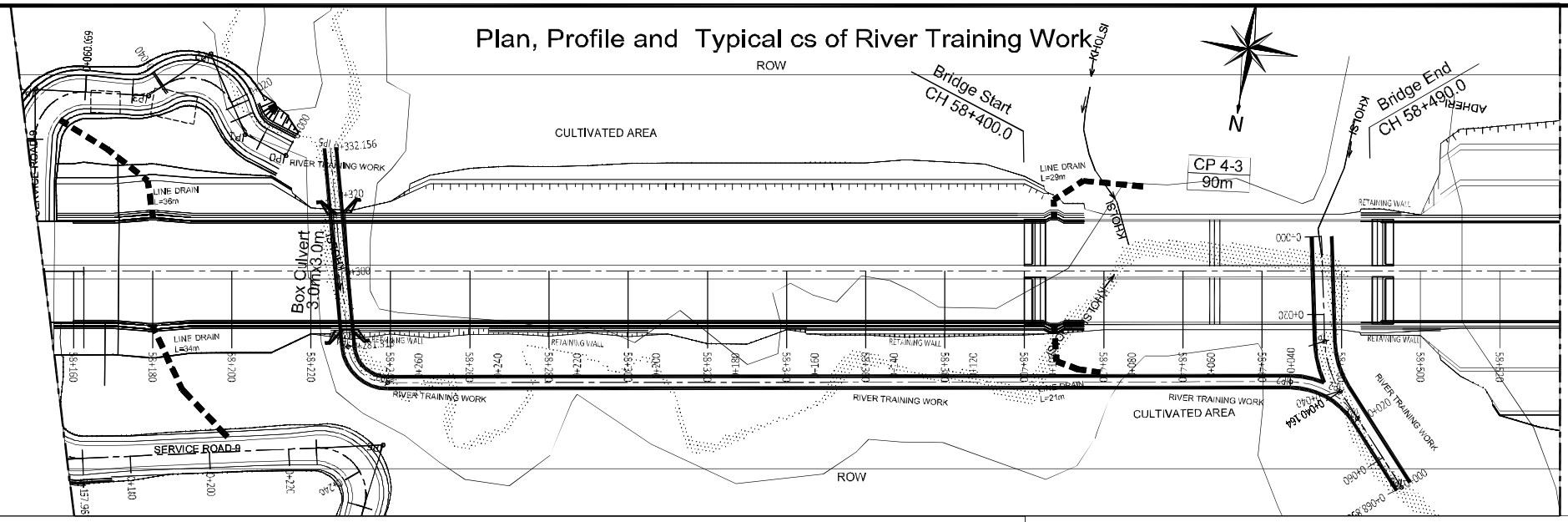
Function : Catch , armour and Reinforcement
Site : Debris sites ,Fill Slopes and High Embankment up to 45 degree slope

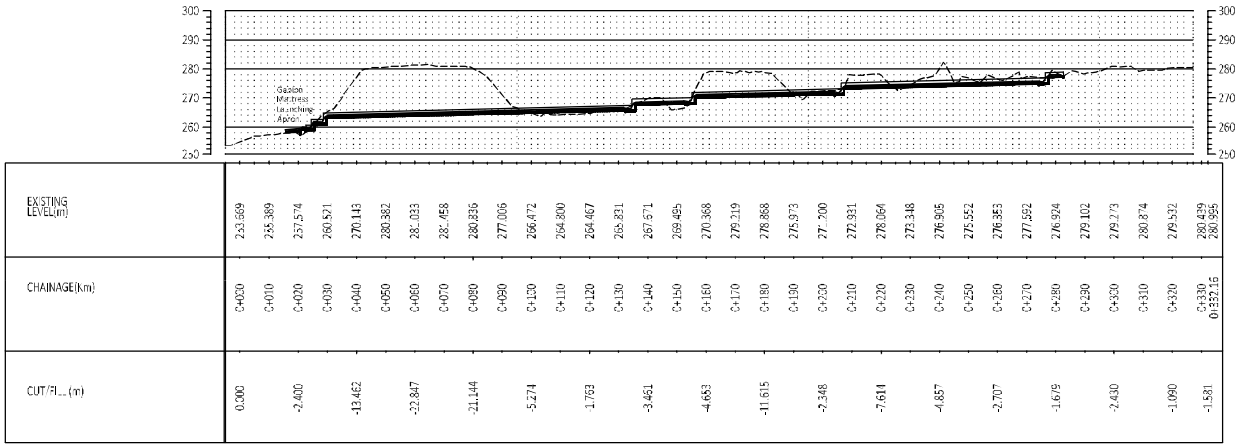
All DImenslons are In mm

PROJECT NAME	CLIENT	DESIGN AND SUPERVISION CONSULTANT	DRAWING TITLE	SCALE	REV. No			
KATHMANDU-TERAI/MADESH FAST TRACK(EXPRESS WAY) ROAD PROJECT	GOVERNMENT OF NEPAL MINISTRY OF DEFENCE NEPALI ARMY KATHMANDU NEPAL	YOOSHIN ENGINEERING CORPORATION, KOREA KOREA EXPRESSWAY CORPORATION, KOREA PYUNGHWA ENGINEERING CONSULTANT LTD, KOREA JV IN ASSOCIATION WITH GARIMA INTERNATIONAL DESIGN ASSOCIATES NEPAL PVT.LTD., NEPAL SITARA CONSULTANT PVT.LTD., NEPAL	Bio -Engineering (grass- seeding and brush layering)	NOT IN SCALE		DESIGNED BY : (BIO ENGINEER)	DATE : August-2021	
						CHECKED BY : (DTL)	DWG No : KTFT/BE	
						APPROVED BY : (TL)	SHEET No : 5/5	

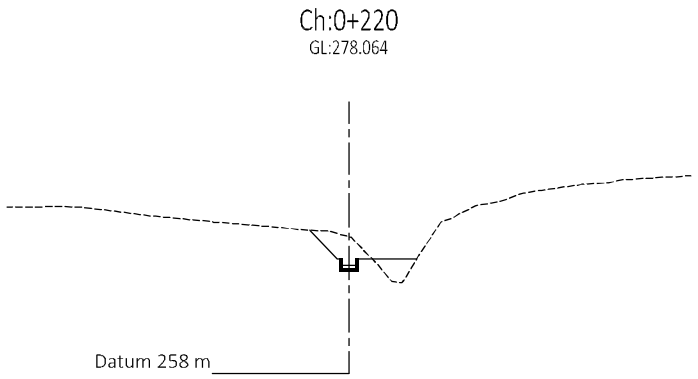
River Training

Plan, Profile and Typical cs of River Training Work





PROFILE



TYPICAL CROSS-SECTION

PROJECT NAME	CLIENT	DESIGN AND SUPERVISION CONSULTANT	DRAWING TITLE	SCALE	REV. No			
KATHMANDU -TERAI/MADESH FAST TRACK (EXPRESSWAY) ROAD PROJECT	GOVERNMENT OF NEPAL MINISTRY OF DEFENCE NEPALI ARMY KATHMANDU NEPAL	YOOSHIN ENGINEERING CORPORATION, KOREA KOREA EXPRESSWAY CORPORATION, KOREA PYUNGHWA ENGINEERING CONSULTANT LTD, KOREA JV IN ASSOCIATION WITH GARIMA INTERNATIONAL DESIGN ASSOCIATES NEPAL PVT.LTD., NEPAL SITARA CONSULTANT PVT.LTD., NEPAL	Plan , Profile and Typical cs of River Training Work 0+000-0+322.166	H=1:1000 V=1:400		DESIGNED BY : (RT ENGINEER)		DATE : Aug-2021
						CHECKED BY : (DTL)		DWG No : KTFT/RT
						APPROVED BY : (TL)		SHEET No : 1/1

SECTION-VI

Bill of Quantities

Notes for Unit Rate Contracts :

Objectives

The objectives of the Bill of Quantities are

(a) to provide sufficient information on the quantities of Works to be performed to enable Bids to be prepared efficiently and accurately; and

(b) when a Contract has been entered into, to provide a priced Bill of Quantities for use in the periodic valuation of Works executed.

In order to attain these objectives, Works should be itemized in the Bill of Quantities in sufficient detail to distinguish between the different classes of Works, or between Works of the same nature carried out in different locations or in other circumstances which may give rise to different considerations of cost. Consistent with these requirements, the layout and content of the Bill of Quantities should be as simple and brief as possible.

Content

The Bill of Quantities should be divided generally into the following sections:

(a) Preamble;

(b) Work Items (grouped into parts);

(c) Day works Schedule;

d) Provisional Sums; and

(d) Summary.

Preamble

The Preamble should indicate the inclusiveness of the unit prices, and should state the methods of measurement which have been adopted in the preparation of the Bill of Quantities and which are to be used for the measurement of any part of the works.

Work Items

The items in the Bill of Quantities should be grouped into sections to distinguish between those parts of the Works which by nature, location, access, timing, or any other special characteristics may give rise to different methods of construction, or phasing of the Works, or considerations of cost. General items common to all parts of the works may be grouped as a separate section in the Bill of Quantities.

Day work Schedule

A Day work Schedule should be included only if the probability of unforeseen work, outside the items included in the Bill of Quantities, is high. To facilitate checking by the Employer of the realism of rates quoted by the Bidders, the Day work Schedule should normally comprise the following:

(a) A list of the various classes of labor, materials, and Constructional Plant for which basic day work rates or prices are to be inserted by the Bidder, together with a statement of the conditions under which the Contractor will be paid for work executed on a day work basis.

(b) Nominal quantities for each item of Day work, to be priced by each Bidder at Day work rates as bid. The rate to be entered by the Bidder against each basic Day work item should include the Contractor’s profit, overheads, supervision, and other charges.

Provisional Sums

A general provision for physical contingencies (quantity overruns) may be made by including a provisional sum in the Summary Bill of Quantities. Similarly, a contingency allowance for possible price increases should be provided as a provisional sum in the Summary Bill of Quantities. The inclusion of such provisional sums often facilitates budgetary approval by avoiding the need to request periodic supplementary approvals as the future need arises. Where such provisional sums or contingency allowances are used, the Contract Data should state the manner in which they will be used, and under whose authority (usually the Project Manager’s).

Summary

The Summary should contain a tabulation of the separate parts of the Bill of Quantities carried forward, with provisional sums for Day work, for physical (quantity) contingencies, and for price contingencies (upward price adjustment) where applicable.

These Notes for Preparing Specifications are intended only as information for the Employer or the person drafting the Bidding documents. They should not be included in the final documents.

Bill of Quantities

1 Provisional Sum

Procument Item Details

SL. No	Item Description	Unit	Quantity	Unit Rate(NPR)	Amount(NPR)
1	Providing Insurance of Works, Plants, Equipments, Employers, Labors, Personal Injuries for the Employer's Design Work and Contractor's Design Work as per the conditions of contract, instruction of Engineer and all complete.	PS	1.0	4.0E8	400,000,000.00
2	Additional testing of materials as instructed by the Engineer if required. (Test: within the Country or outside of Country)	PS	1.0	5000000.0	5,000,000.00
3	Procure and supply 2 Numbers of four wheel vehicle as per Appendix 5 of Employer's Requirement and instruction of Engineer and handover to the Client in good condition.	PS	1.0	2.323E7	23,230,000.00
4	Miscellaneous: Dismantling & reconstruction of existing infra-structures and its disposal to approved site as per requirement. Construction & development of new civil supplementary infrastructures as per required and as per specification and instruction of Engineer	PS	1.0	5.0E7	50,000,000.00

2 Construction work

Procument Item Details

SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
1	Earthwork: Site clearance including removal of bushes, debris, rubbish, garbage in and outside of highway and service road etc. as per specification and instruction of Engineer. (Technical Specification 201)	m2	85200.0			
2	Earthwork: Excavation in roadway, drain, retaining structures foundation and sub-structures of the expressway in all types of soil including removal and satisfactory disposal and stacking or hauling (to sites of embankment construction) of suitable cut materials as required and excavation for existing all type of pavement as per specification and instruction of Engineer. Mechanical Means (Technical Specification 905)	m3	2572256.2			
3	Earthwork: Excavation in roadway, drain, retaining structures foundation and sub-structures of the expressway in all types of soil including removal and satisfactory disposal and stacking or hauling (to sites of embankment construction) of suitable cut materials as required and excavation for existing all type of pavement as per specification and instruction of Engineer.Manual Means (Technical Specification 905)	m3	520.2			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
4	Earthwork: Construction of roadway and drain in embankment and miscellaneous backfilling areas for road, drain and structures with approved material obtained from roadway excavation and from outside location including transportation, spreading in layers, watering and compaction by machine equipment / manually as per specification and instruction of Engineer. Earthwork in Filling (Technical Specification 908, 909 and 911)	m3	981507.7			
5	Earthwork: Construction of roadway and drain in embankment and miscellaneous backfilling areas for road, drain and structures with approved material obtained from roadway excavation and from outside location including transportation, spreading in layers, watering and compaction by machine equipment / manually as per specification and instruction of Engineer. Back filling with Granular Material behind (Technical Specification 908, 909 and 912)	m3	140173.78			
6	Earthwork : Transportation of exceed material within 3 km (for 1km no pay) as per instruction of Engineer. (Technical Specification 908, 909 and 912)	m3	1451095.0			
7	Structures and Drain & Drainage Structures: Supplying, Placing and compacting pitching / soling works of stone, according to the design line and level, all complete as mention in drawing, specification and directed by Engineer. (Technical Specification 1006)	m3	11969.59			
8	Structures and Drain & Drainage Structures: Providing and placing different grades of concrete for foundation, base, structures, cover slab, drain, box culvert etc. including mixing, laying, compacting, form work and curing all complete as mentioned in drawing, specification and directed by Engineer. M15 / 20. (Technical Specification 2000)	m3	2991.82			
9	Structures and Drain & Drainage Structures: Providing and placing different grades of concrete for foundation, base, structures, cover slab, drain, box culvert etc. including mixing, laying, compacting, form work and curing all complete as mentioned in drawing, specification and directed by Engineer. M20 / 20. (Technical Specification 2000)	m3	14356.46			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
10	Structures and Drain & Drainage Structures: Providing and placing different grades of concrete for foundation, base, structures, cover slab, drain, box culvert etc. including mixing, laying, compacting, form work and curing all complete as mentioned in drawing, specification and directed by Engineer. M30 / 20. (Technical Specification 2000)	m3	6422.0			
11	Structures and Drain & Drainage Structures : Providing and placing of reinforcement bar of high yield for structure, drain, drain cover, box culvert, existing & proposed infrastructures including cutting, placing, binding and fixing and all complete as mentioned in drawing, specification and directed by Engineer. (Technical Specification 2014)	MT	1643.44			
12	Structures and Drain & Drainage Structures : Providing and laying of hand pack cobble/natural Stone (approx. size 10cm x 9cm x 9cm) with granular material bedding on prepared surface in line & level of Dummy, drain and structures as per drawing, technical specification and directed by Engineer. (Technical Specification1000)	m3	1926.6			
13	Structures and Drain & Drainage Structures : Providing, fixing and erecting 50 mm diameter steel pipe railing in 3 rows duly painted on medium weight steel channels(ISMC series) 100 mm x 50 mm, 1.2 meters high aboveground, 2 m center to center, complete as per drawing, technical specifications and directed by Engineer. (Technical Specification 3105)	Rm	712.8			
14	Structures and Drain & Drainage Structures : Providing and filling joint sealing compound with coarse sand and 6 percent bitumen by weight as per drawing, technical specification and as directed by Engineer. (Technical Specification 3103)	Rm	229.6			
15	Structures and Drain & Drainage Structures : Providing, fixing and erecting of PVC water Stopper as per specification, drawings and all complete. (Technical Specification 3105)	Rm	123.2			
16	Structures and Drain & Drainage Structures : Supplying and laying of outer diameter 315mm perforated HDPE(10 kg/cm2) Pipe, including proper bedding underneath with water tight connections at the joints as per design, drawings, specifications and instructions all complete. (Technical Specification 3100 or WSS Specification)	Rm	10462.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
17	Structures and Drain & Drainage Structures : Providing and laying grating of different size (as per drawing) of steel material as per specification and instruction of Engineer. (Technical Specification 2811)	kg	527.0			
18	Structures and Drain & Drainage Structures : Providing and Laying Reinforced cement concrete 300mm NP3 internal diameter pipe including fixing with cement mortar 1:2 as per Drawing, technical specification and directed by Engineer. (Technical Specification 701)	Rm	527.0			
19	Structures and Drain & Drainage Structures : Providing and Laying Reinforced cement concrete 600mm NP3 internal diameter pipe including fixing with cement mortar 1:2 as per Drawing, technical specification and directed by Engineer. (Technical Specification 701)	Rm	3062.0			
20	Structures and Drain & Drainage Structures : Supplying and laying, brick masonry for structural works in 1:4 cement sand mortar all complete works as mention in drawing, specification and directed by the Engineer. (Technical Specification 2500)	m3	356.74			
21	Structures and Drain & Drainage Structures : Supplying and laying, stone masonry for structural works in 1:4 cement sand mortar all complete works as mention in drawing, specification and directed by the Engineer. (Technical Specification 2600, 2607 (A))	m3	31621.19			
22	Structures and Drain & Drainage Structures : Providing and filling stone/boulder in mechanically woven double twisted crates / mattress including rolling, cutting and with lacing wire and binding wire including dressing, bedding, bonding all complete as per Drawing and Technical Specifications. Heavy zinc coated Hexagonal mesh type 100 mm x 120 mm, mesh wire 3 mm, selvage wire 3.9 mm, lacing wire 2.4mm [2402]. (Technical Specification 2402)	m3	2470.42			
23	Structures and Drain & Drainage Structures : Supply, Providing and fixing of steel manwhole cover in line and level as per specification and drawings. (Technical Specification 1006)	No.	54.0			
24	Structures and Drain & Drainage Structures : Supply, Providing and fixing of Steel Galvanized Angle for the proposed work as per drawings, specification and instruction of Engineer. (Technical Specification 202 or as per IS Standard)	kg	168544.8			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
25	Structures and Drain & Drainage Structures : Supply, Providing and fixing of Galvanized steel wire of following size for the proposed work as per drawings, specification and instruction of Engineer. having size 2.1m width. (Technical Specification 203 or as per IS Standard)	Rm	10404.0			
26	Structures and Drain & Drainage Structures : Supply, Providing and fixing of Galvanized steel wire of following size for the proposed work as per drawings, specification and instruction of Engineer. having size 0.3m width. (Technical Specification 204 or as per IS Standard)	Rm	10404.0			
27	Structures and Drain & Drainage Structures : Providing, laying and fixing of Geo membrane (Geo-textile) all complete as per specification. (Technical Specification 2403)	m2	13321.23			
28	Structures and Drain & Drainage Structures : Reinforced Earth Structures: Design and Construction of reinforced earth structures 180mm thick precast RCC facia panels and 50mm / 70mm wide geosynthetic strap, mechanical connectors, Drainage system, other accessories and consumables complete as per the detailed technical specification and typical drawings laid down in the tender document including materials, manpower, machinery, tools, tackles, all complet as per Appendix-4 of Employer's Requirement. (Technical Specification 301)	m2 of wall facia	3318.0			
29	Slope Protection Work: Supplying and Installation of Soil Nails 25 Ø. Fe-D 500 bar or equivalent, including drilling with more than dia. 75mm, casing if required, grouting, inserting Rod, fixing with bearing plate, nut, coupler, etc. all complete accessory as per drawing, specfication. (Technical Specification 2000)	Rm	164607.0			
30	Slope Protection Work: Supplying and Installation of Rock Bolts 25 Ø. Fe-D 500 bar or equivalent, including drilling with more than dia. 75mm, grouting, inserting Rod, fixing with nut, plate, coupler, etc. all complete accessory as per drawing, specfication. (Technical Specification 1804, 1805)	Rm	189513.0			
31	Slope Protection Work: Supplying and Installation with more than 50mm HDPE perporated pipes for drainage ground water in slope and laying with Geotextileas as per Specification. (Technical Specification as per IS Standard)	Rm	21310.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
32	Slope Protection Work: Providing 3-D galvanized steel panels from the palette, cutting them if necessary, joining the panels to longer rows by overlapping and binding as necessary and laying on the slope, insertion of distribution bars or steel ropes , fixing with clamps including gravel filling humus filling all complete as per specification. (Technical Specification as per IS Standard)	m2	70171.2			
33	Slope Protection Work: Mobilization and Demobilization of drilling / Boring equipments, accessories, etc for Permanent Ground Anchors, Drainage hole, Water Level Indicator and Inclinometer etc. (Technical Specification as per IS Standard)	Job	14.0			
34	Slope Protection Work: Erect dismantle and move boring rig with drilling equipments at each bore hole complete for the Installation of Permanent Ground Anchors, Drainage pipe(HDPE), Water level Indicator and Inclinometers etc. as per drawing. (Technical Specification as per IS Standard)	No.	1285.0			
35	Slope Protection Work: Drilling/Boring with more than 76mm dia in all soils and rock to a depth below ground level complete for the Installation of Drainage pipe(HDPE), Water Level Indicator and Inclinometers etc. as per drawing and specification. (Technical Specification as per IS Standard)	rm	22140.0			
36	Slope Monitoring Works: Water Level Indicator : Providing & installing Water Level Indicator at the location of each bore holes for measure of the water level of slope. Water level reading and reporting work to be carried out daily for a period of 36 month. (Technical Specification as per IS Standard)	No.	7.0			
37	Slope Monitoring Works: Inclinometer : Providing & installing Inclinometer at the location of each bore holes for measure of the lateral movement of slope. Lateral movement reading and reporting work to be carried out daily for a period of 36 month. (Technical Specification as per IS Standard)	No.	16.0			
38	Slope Monitoring Works: Earth Pressure Cell : Providing & installing Earth Pressure Cell at the location as drawing for monitor of the total pressure in the earth fills and embankments. Total pressure reading and reporting work to be carried out daily for a period of 36 month. (Technical Specification as per IS Standard)	No.	1.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
39	Slope Monitoring Works: Target & Prism : Providing & installing Target & Prism at the location of each location as drawing for measurement of deformation during construction Slope . Total measuring work displacement to be carried out daily for a period of 36 month. (Technical Specification as per IS Standard)	No.	191.0			
40	Pavement work: Preparation of subgrade as mentioned in the drawing, specification and directed by the Engineer. (Technical Specification 1003 and 1005)	m2	184346.0			
41	Pavement work: Supplying, providing, laying, spreading, watering, leveling, compacting and all complete for gravel sub-base over prepared subgrade according to the designed camber including transportation all complete as mentioned in the drawing, specification and directed by Engineer. (Technical Specification 1201)	m3	54589.2			
42	Pavement work: Supplying, providing, laying, spreading, watering, leveling, compacting and all complete for crusher run base material grading of standard specification including transportation from source as mentioned in drawing, specification and directed by the Engineer. (Technical Specification 1204)	m3	28841.87			
43	Pavement work: Providing, laying, transporting and all complete of primer coat as mentioned in drawing, technical specification and directed by the Engineer. (Technical Specification 1302)	Lit.	244955.02			
44	Pavement work: Providing, laying, transporting and all complete of tack coat as mentioned in drawing, technical specification and directed by the Engineer. (Technical Specification 1302)	Lit.	366051.03			
45	Pavement work: Providing, mixing, laying, compacting, transport and all complete Dense Bituminous Macadam (DBM) pavement surface as mentioned in drawing, specification and directed by Engineer. (Technical Specification 1301 and 1303)	m3	17266.43			
46	Pavement work: Providing, mixing, laying, compacting, transport and all complete of asphalt concrete pavement as mentioned in drawing, specification and directed by Engineer. (Technical Specification 1309)	m3	6446.25			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
47	Bio-Engineering: Providing and planting of permanent hedges of ornamental plants not greater than 2m (center of median) and not greater than 1m (edge of median (both side) including digging of trenches, 60cm wide and 45cm deep, refilling the excavated earth mixed with farmyard manure, supplied at the rate of 4.65 cum per 100m and supplying and planting hedge plants at 30 cm apart all complete and maintenance of hedge for 5 years including all materials required as per instruction of Engineer & technical specification. (Technical Specification 2807)	Rm	15600.0			
48	Bio-Engineering: Providing and planting flowering plants and shrubs in central verge and providing & maintenance of flowering plants and shrubs in central verge for five years as per drawing, specification and directed by Engineer. (Technical Specification 2807)	Rm	20800.0			
49	Bio-Engineering: Providing and planting rooted grass slips on the slopes <45o including preparation of slips on site, a max of 5 cm depth with metal rod or operation includes digging planting hole to hard-wood peg, depending on the nature of the soil and as per directed by Engineer and drawing and specification. (Technical Specification 2807)	m2	122621.38			
50	Bio-Engineering: Planting containerized tree and shrub seedlings, including pitting, transplanting, composting and mulching, on slopes < 30o with pit size 30 cm diameter x depth mix Compost with soil and back fill into pit to 1/4 of the pit volume as per drawing, specification and directed by Engineer. (Technical Specification 2807)	No.	112221.38			
51	Bio-Engineering: Providing and Planting of trees by the road side in 0.60 m diameter holes, 1 m deep dug in the ground, mixing the soil with decayed farm yard/sludge manure, planting the saplings, backfilling the trench, watering, fixing the tree guard and maintaining the plants for five year as per drawing, specification and directed by the Engineer. (Technical Specification 2807)	No.	1650.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
52	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings. Providing, Supplying and Installing of 180W +/- 10 % Top Maintainable LED Street Light luminaire with System efficacy of 110 lm/W. LED Street Light shall be made up of Die Cast aluminum housing suitable to mounted on 55-68 mm OD bracket arm. Luminaire shall have two separate compartments for LEDs and driver and both compartments should be hermitically sealed to achieve IP 66 ingress protection. Optical compartment shall be provided to withstand IK 07 impact rating, while control gear shall be provided with die cast aluminum cover for safety. LM 80-08 compliant, LEDs should be provided. LEDs used in the product shall comply with EN 62471 for Photo-biological safety and certificate for the same from manufacturer shall be provided for Risk Group 2 maximum. Luminaire manufacturer shall produce certificate of association with LED manufacturer for minimum 5 year. LEDs used shall have maximum allowed junction temperature of 125 Deg C with actual operating junction temperature not more than 90 Deg C at an ambient temperature of 35 Deg C. The LENS used shall have optical grade PMMA-HT / Polycarbonate to provide street light distribution for Uniform lighting. LED optical lens should be properly fixed to MCPCB and should not be only fixed by glue. LED optical lens shall have temperature withstand capacity of greater than 85 Deg C and Transmissivity of more than 90%.The LED shall be compliant with LM80-08 standard with Useful L70 life of 50000 Hrs. tested at maximum current and at 105 Deg C case temperature (Complete LM 80 test report for LED should be submitted for 10000 hrs. of testing). The LEDs used in Street Light should be Macadam Step 5 standard Rated LED with CCT of 5700 K and CRI of Minimum 70. Maximum permissible driving current of LEDs are from 0.15A to 2A. Actual Driving Current of LEDs shall be less than 1000mA for life long reliability. LED Driver should be BIS Registered. LED Driver shall be Isolated type, Constant Current topology driver in metal enclosure with proper heat sink for heat dissipation suitable to operate	Nos.	523.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
	in input voltage range of 150V to 270V (nominal rated voltage – 240V) with 4KV internal surge protection in both Common Mode and Differential Mode. LED Driver shall be potted type. Power factor greater than 0.95 and total harmonic distortion (THD) of less than 10% should be integral to the luminaire. LED driver shall have output short circuit & over voltage withstanding protection inbuilt. Luminaire shall be external SPD of 10KV with minimum one TMOV mounted inside luminaire. Bidder shall submit necessary test reports as mentioned in the description. (Technical Specification as per NEA)					

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
53	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings. Providing, Supplying and Installing CCMS System Details: Smart Feeder Panel made up of single / double door CRCA Sheet Steel with Grey Powder Coating / Painting of minimum 22 SWG and with IP54 Protection with A) Switching Point Controller: This hardware consists of MCBs, Contactors and Fuses which protects system and operators in case of electrical malfunction, Switching point controller VA rating is designed for twice the lighting load requirement, SPC uses Class 1.0 Single or Three Phase energy meter, It should allow Manual override of the system with Isolator during maintenance and system faults. It should have single phase/ three phase energy meter, Street light Feeder pillar with CCMS Controller and Switching components, web based application and cloud server. System capabilities including Scheduling, Individual lamp dimming, fault notifications and report generation in command CVS format. B) Energy Meter: It compliance with the standard IS: 13779/1999 or IEC: 1036. CBIP Report-325 Complied. Voltage Rating should be 10- 60A, Class 1.0, Rated frequency 50Hz, Power factor 0.25 lag - Unity 0.5 lead, as per IS13779. The system monitors energy parameters and communicate it with CCMS unit to transmit it to server, Voltages each phase, Current each phase, PF each phase, Metering KWH cumulative, Metering KVAH, Number of operational light, Number of non-operational lights, Failure of contactor, Status of the incoming supply (power failure), High /low voltage, Overload on the phases. C) CCMS Controller: Power supply - 230VAC, Communication through GSM/GPRS or Wi-Fi. It Should supports Phase wise on /off switching by Schedule or by built in astronomical clock for ON/OFF/Dimming luminaires based on individual selection and Manual ON/OFF/Dimming of lights of a particular switching point or networked switching points from Central Control Station. Battery Backed RTC in built in side CCMS Controller. CCMS supports wireless Low Power RF 2.4 ZigBee	Nos.	15.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
	communication with maximum 100 nos. of individual node/Luminaire controller which can dim up/down the led lamp up to 500W. Network Fault Tolerance: self-forming and self-healing RF mesh network having Open Field Range: 200 m. internal storage Memory 256MB X NAND Flash. Optional - Ethernet. Inbuilt Micro SD card for data storage (Capacity up to 16GB). Alert message in pre-defined abnormal system conditions through SMS (5 numbers) and web based application through GSM/GPRS for: i) Phase-wise currents on crossing threshold values ii) Phase-wise voltages on crossing threshold values. iii) MCB trips, iv) Theft alerts, v) No output supply vi) Group failure of lights vii) No input/output supply. Serial Communication: RS485/RS232, CCMS Controller can be remotely configurable through server. Communication Protocol - Street Light Gateway supports RS485 MODBUS communication and HTTPS support for Wireless communication with server using SIM based GPRS Connection. (Technical Specification as per NEA)					

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
54	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Providing, Supplying and Installing of Local / Cloud managed Web based Application Software - It Enables comprehensive display of live and historical data with remote configurations features. Configuration and Control – Allows user to communicate with individual and networked switching points and Individual/Group of Street lights remotely. Fault Alarms/Alerts – Switching point failures, Group Luminaires failure, excess voltage/current drawn, no mains power, and GPS Location change and contactor failure. Allows user to trace switching points, Allows user to generate various reports, possible to configure switching points through web application. Remote configuration includes new ON/OFF/Dimming timings, RTC time, Real time data of each switching point, Energy meter parameters, Web application enables user safety with multiple user privileges and differentiates admin/general users, System is fail proof with password protection, Web application provides comprehensive dashboard with real time status of switching point, real time faults of various switching points, power consumption, cumulative data, Google map integration for individual lamp on map along with its real time status with basic energy parameters of individual controller etc., Web based software offers SMS and Email alerts for various faults. Also, provides daily/ weekly/ monthly reports through email, Minimal interval of data update – 15 mins and programmable up to 1 min (Recommended >5 mins). It also enables user to identify each SPC with unique/Asset ID with additional information like individual SPC's real time status and basic electrical parameters. It is also possible to link details of every street light with reference to particular switching point. (Technical Specification as per NEA)	Nos.	1.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
55	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Providing, Supplying and Installing of Server Cloud: The server/Cloud platform shall be of dedicated Windows / Linux server with minimum of 16GB RAM with sufficient bandwidth. Software shall be installed in server i. java language ii. MySQL server, The server/Cloud platform should support sufficient storage, Server/Cloud platform provider shall have capable to perform auto backup and restore facilities, Server/Cloud platform provider shall have regular maintenance of the server and immediately address in case of server down, Server/Cloud platform shall have minimum uptime of 99%, Server/Cloud should able to handle minimum of 1000 concurrent connections. It shall support GDPR guidelines prevailing at the time of commissioning and installation. Charges for 2 years to be quoted in the initial quote only. (Technical Specification as per NEA)	Nos.	1.0			
56	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Providing, Supplying and Installing of SIM based GPRS Connection (On clients scope) (Technical Specification as per NEA)	Nos.	15.0			
57	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Providing, Supplying and Installing of 11m Octagonal Pole: Top Dia. 90mm, Bottom Dia. 210mm Sheet, Thickness 4.5 mm, Base Plate Dimensions (L x B x T) 350X350X30, PCD (275mm), Foundation bolt M25mmX1000mmX4 (Technical Specification as per NEA)	Nos.	523.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
58	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Providing, Supplying and Installing of Single Arm Bracket 2000mm (Technical Specification as per NEA)	Nos.	1542.0			
59	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Providing, Supplying and Installing of RCC Concrete foundation for pole . (Technical Specification as per NEA)	No.	1542.0			
60	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Providing, Supplying and Installing of Junction box of IP-65 Grade with 3 phase 100 A copper busbar and two nos. 16 Amp DP MCB of 15 KA(as an option). (Technical Specification as per NEA)	No.	1542.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
61	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Providing, Supplying and Installing of Two Pole Structure: C Class Heavy Duty: Supply, Installation, Testing & Commissioning of 2 pole structure for terminating 11 KV O.H. supply from NEA as per specifications and drawing. The two pole structure shall comprise of:- steel tubular two pole structure 11 mtrs high(6" Dia) (as per NEA approved), in cement concrete foundation 1:1.5:3 (1 cement : 1.5 coarse sand : 3graded aggregate 40mm nominal size) including excavation and refilling etc. as required. The rate shall be inclusive of painting with 2 coats of aluminum paint (on red oxide). The portion of pole under the ground shall be provided with 2 coats of bituminous paint - 2 Nos. Steel sections, channels angles, flats, clamps, GI nuts, bolts and required hardware etc of different sizes for cross arms(with 42 x 42 and 5 mm thick, bracings, supports etc. for pole GOD etc. including ant climbing barbed wires (conforming to IS:278) having 4 points barbs spaced 75 ±12mm apart. All steel structure shall be given 2 coats of red oxide primer and 2 finishing coats of aluminum paint as required. - Lot. 11 KV class disc/pin/support insulators complete with clamps and fixing hard wares etc. complete as required. 11 KV station class thyrite type lightening arrestors complete with mounting arrangement (on all phases) - 3 Nos. Drop out - lock out (DOLO) fuse, gang operating device (Air Break Switch) with pad locking arrangement (operating rod to be supported properly), complete with operating handle and locking arrangement - 1 Set. GI stay set complete with 20mm dia 1.8 M long stay rod with 450 x 450 x 7.5 mm anchor plate with thimbles, stay clamps,8 mm dia GI stay wire, turn buckle (20mm x 600mm) strain insulator bow tighten in cement concrete 1:3:6 foundation as excavation and refilling - 2 Set. (Technical Specification as per NEA)	set	3.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
62	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Providing, Supplying, Installing, laying, testing and commissioning of H.T. Cabling: following sizes of 11 KV grade (earthed), copper conductor, cross linked polyethylene, insulated, individual core screened, flat steel strip armored, PVC sheathed cable complete as required. Laying of cable is Overhead/underground/trench. (The rate shall also include the laying of cable, excavation, sand filling, bricks and refilling the trench).If underground should make cable trench and provide cable marker above ground showing HT cable below on certain depth on every 5 m distance.: 3 C x 35 Sq.mm XLPE HT 11 KV AL cable. (Technical Specification as per NEA)	Rm	3675.0			
63	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Supply, installation of 11 meters high(6" Dia) steel pole for HT Cable support including cable hanging support with all accessories (as per NEA approved), in cement concrete foundation 1:1.5:3 (1 cement : 1.5 coarse sand : 3graded aggregate 40mm nominal size) including excavation and refilling etc. as required. The rate shall be inclusive of painting with 2 coats of aluminum paint (on red oxide). The portion of pole under the ground shall be provided with 2 coats of bituminous paint - 2 Nos. (Technical Specification as per NEA)	No.	184.0			
64	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Supplying and Installing of following types of End Termination: Heat shrinkable cable jointing of 3 core x 50 sq.mm 11 KV volts grade XLPE insulated armored cables with suitable cable termination using Raychem/ MECP kits including all accessories. (Technical Specification as per NEA)	set	3.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
65	Supply, installation, testing and commissioning of Maintenance Free compound earthling stations by means of 2 meter long, 50 mm diameter integrated with 100x32x6 mm terminals filled with earth enhancing compound in required quantity all complete with 300 x300 x450 mm masonry enclosure with pre cast cover. All earthling arrangements must comply with IS–3043.The resistivity should be below 3 ohm. (Technical Specification as per NEA)	No.	17.0			
66	Supply and installation of distribution transformer 100 KVA three phase NEA approved ONAN type with no load ratio of 11000/433 volts with both low and high voltage windings of high purity electrolytic copper. The transformer shall be complete with rating and diagram plate, 2 Nos. earthling terminals, and high winding temperature indicator. The distribution transformer shall be On load tap changer with -15% and +5% tapings in step of 2.5% each step on HV side, 3 phase 50 Hz with standard accessories. The transformer is pad mounted type so the cost must include 1.5 meter. high concrete foundation suitable for transformer installation. (Technical Specification as per NEA)	No.	3.0			
67	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Supplying and Installing of following types of End Termination: Supply, installation of 110 mm dia. HDP Pipe of 6 kg pressure on both side of road for laying of power cable. (Technical Specification as per NEA)	Rm	14385.0			
68	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Supplying and Installing of following types of End Termination: Trench for 110 mm HDP Pipe laying .The cost must include HT wrapping tape and cable marker up to height of 1000 mm at 5 meter spacing. The pipe must have 150 mm sand all around and then filling of digged material. (Technical Specification as per NEA)	Rm	14385.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
69	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Supplying and Installing of following types of End Termination: Supply, installation of 32 mm dia. HDP Pipe of 6 kg pressure on both side of road for laying of power cable. (Technical Specification as per NEA)	Rm	3138.0			
70	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Supplying and Installing of following types of End Termination: Supply, installation of hot dip galvanized ladder type cable tray of size 450x 60 mm with all support and accessories for cable laying in bridge. (Technical Specification as per NEA)	Rm	447.0			
71	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Supplying and Installing of following types of End Termination: Supplying, laying, testing & commissioning of the 1100 Volts PVC/XLPE insulated PVC sheathed/ XLPE cable of following size: 3C x 2.5 mm2 cu. Unarmored cable. (Technical Specification as per NEA)	Rm	7322.0			
72	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Supplying and Installing of following types of End Termination: Supplying, laying, testing & commissioning of the 1100 Volts PVC/XLPE insulated PVC sheathed/ XLPE cable of following size 4C x 10 mm2 cu. Armored cable. (Technical Specification as per NEA)	Rm	3960.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
73	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Supplying and Installing of following types of End Termination: Supplying, laying, testing & commissioning of the 1100 Volts PVC/XLPE insulated PVC sheathed/ XLPE cable of following size 4C x 16 mm2 cu. Armored cable. (Technical Specification as per NEA)	Rm	10425.0			
74	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Supplying and Installing of following types of End Termination: Supplying, laying, testing & commissioning of the 1100 Volts PVC/XLPE insulated PVC sheathed/ XLPE cable of following size 4C x 70 mm2 cu. Armored cable. (Technical Specification as per NEA)	Rm	56.0			
75	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Construction of brick masonry chamber of internal size 450x450mm with 250mm thick brickwork in 1:4 cement mortar, 450x450mm concrete manhole cover with frame (heavy duty), cement plaster inside, height varies from 300 to 1000mm.The manhole must have drain out provision.(Technical Specification as per NEA)	No.	523.0			
76	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Construction of brick masonry chamber of internal size 600x600mm with 250mm thick brickwork in 1:4 cement mortar, 450x450mm concrete manhole cover with frame (heavy duty), cement plaster inside, height varies from 300 to 1000mm.The manhole must have drain out provision. (Technical Specification as per NEA)	No.	6.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
77	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Panel-IP 65 floor mounted as per following details: Incomer: 125 4 pole MCCB of 25 kA with complete features of microprocessor release unit , for short circuit, over current and earth fault protection with adjustable setting with following accessories :(1) Under voltage protection (2) Over voltage protection (3) Instantaneous Over Current protection (4) Auxiliary contacts required for under voltage, over voltage and necessary interlocking of breakers. (5) Reverse Power relay. (6) Bus bar : (Heat shrinkable colored sleeve) 200 A TPN Copper (7) Outgoings:(a) 4 Nos. 32 A 15 kA 2-P MCB (b) 6 Nos. 32 A 25 kA 4-P MCCB. (Technical Specification as per NEA)	No.	3.0			
78	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Provide, supply and install, testing & commissioning and approvel from NTC/NEA as specified in Appendix-2 of Employer's Requirements to perform complete work of Optical Fiber. (Technical Specification as per NEA)	Job	1.0			
79	Electric Work: Electric Work and Optical Fiber Work: Providing, installing, excavation, testing and connecting, approved by NEA and Nepal Telecom all Complete as per instruction of Engineer, NEA specification, drawings: Provide, supply and install, testing & commissioning and approvel from NEA as specified in Appendix-2 of Employer's Requirements to perform complete work of Rehabilitation and Reconstruction of Electric work (i.e. 11kv crossing, 132 kv crossing, electric tower etc and newly construction of underground crossing of proposed electric work as per NEA specification, drawings and instruction of Engineer and all complete with closed co-ordination of NEA). (Technical Specification as per NEA)	Job	1.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
80	Road Furnitures: Providing and laying of hot applied thermoplastic compound on rough surface (similar to Asphalt concrete and rigid pavement) at least 2 mm thick including reflectorizing glass beads as per DOR Traffic sign manual/ Specifications . The finished surface to be level, uniform and free from streaks and holes. (Technical Specification 1504)	m2	7510.0			
81	Road Furnitures: Providing and fixing of retro- reflectorized warning, Regulatory and informatory sign as per specification clause 1501made of high intensity grade sheeting, fixed over aluminium sheeting, 1.5mm thick supported on a 50 mm internal dia steel tube or mild steel angle iron post 75 mm X 40 mm x 6mm firmly fixed to the ground by means of properly designed foundation with M 10/40 grade cement concrete 30cm x 30cm x 30cm below groung level or as per drawings and Technical Specification. 80cm x 60cm rectangular (Technical Specification 1501)	No.	129.0			
82	Road Furnitures: Providing and fixing of retro- reflectorized warning, Regulatory and informatory sign as per specification clause 1501made of high intensity grade sheeting, fixed over aluminium sheeting, 1.5mm thick supported on a 50 mm internal dia steel tube or mild steel angle iron post 75 mm X 40 mm x 6mm firmly fixed to the ground by means of properly designed foundation with M 10/40 grade cement concrete 30cm x 30cm x 30cm below groung level or as per drawings and Technical Specification. 90cm equilateral triangle (Technical Specification 1501)	No.	26.0			
83	Road Furnitures: Providing and Fixing Reinforced cement concrete M 15 grade kilometer Post including painting and printing as per Standard Drawing-2070 and Technical Specifications. One kilometer post (precast) (Technical Specification 1506)	No.	16.0			
84	Road Furnitures: Providing and Fixing Reinforced cement concrete M 15 grade kilometer Post including painting and printing as per Standard Drawing-2070 and Technical Specifications. Five kilometer Post (precast) (Technical Specification 1506)	No.	4.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
85	Road Furnitures: 200 m Marker Stone: Providing and fixing of rosad stud100x100, die-cast in aluminium, resistant to corrosive effct of salt and grit, fitted with lenses reflectors, installed in concrete or asphaltic surface by drilling hole 30mm upto a depth of 60mm and bedded in a suitable bituminous grout or epoxy mortar, all complete as per drawing and Technical Specifications. (Technical Specification 1505)	No.	24.0			
86	Road Furnitures: Bridge Name Plate Sign (C29): Providing, fixing and erecting 50 mm dia steel pipe railing in 3 rows duly painted on medium weight steel channels(ISMC series) 100 mm x 50 mm, 1.2 metres high aboveground, 2 m center to center, complete as per Drawing andTechnical specifications. (Technical Specification 3105)	No.	26.0			
87	Road Furnitures: Guard Rail: Providing and erecting "W" metal beam crashbarrier comprising of 3 mm thick corrugated sheet metal beam rail, 70cm above road/ground level, fixed on ISMC series channel vertical post, 150x75x5mm spaced 2m c/c, 1.8m high, 1.1m below ground/road level, metal beam rail to be fixed on the vertical post with a spacer of channel section 150x75x5mm, 330mm long complete as per drawing and technical specifications. (Technical Specification 1509)	rm	9056.0			
88	Road Furnitures: Road Delineators Post Providing and installation of 150 mm * 150 mm 1. 5 m long delineators (road way indicators, hazard markers, object markers), 80-100 cm high above ground level, painted black and white in 20 cm wide strips, buried or pressed into the ground and conforming to the drawings and Technical Specifications. (Technical Specification 1507)	No.	420.0			
89	Other Works: Provide, supply and install Laboratory building including services, essential supplies like water, electricity, sanitary services and their maintenance and cost of all equipment, tools, materials, labour and incidentals as specified in Appendix-1 of Employer's Requirements to perform tests and other operations of quality control according to the specification and directed by Engineer.	Month	36.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
90	Other Works: Prepare and submit monthly / Quarterly / Yearly / update of existing Environment Management Plan / progress report 6Nos. of copies each with soft copy and color prints in A4 size paper with color photo.	Month	36.0			
91	Other Works: Prepare and provide as built drawings in GIS base maps including report in 4hard copies and 2CDs all complete set as per instruction of Engineer	Set	1.0			

3 Construction work

3.1 Bridge Construction Work

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
1	Contractors Design Work: Conduct detailed survey, geo-physical and geo-technical investigation, hydrological investigation and preparation of detailed design and construction drawings for the Contractor’s Design Works comprising Bridges (12 Nos. of Twin Bridges & 2 Nos. of VOP single bridges), Expressway Road, Slope Protection/Stabilization, River Training and Associated Works (From Ch. 59+880 to Ch. 59+900 and Ch. 63+390 to Ch. 64+030) as per the Employer’s Requirement and Conditions of Contract.	LS	1.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
2	Contractors Design Work: Construction of foundations, sub-structures (Pier and Abutments), super structures, protection works; approach slab, wing/return walls, Asphalt overlay, Health monitoring system, including utility works e.g. electrical and lighting works, optical fiber works, ; ancillary. for double lane bridges(twin) all complete as per the employer's requirement and as per the Employer's Requirement and condition of contract for the Bridges and associated works as outlined below; i) (a) CH 57+535 to CH 57+575, approx. 40 m length (Kathmandu),(b) CH 57+545 to CH 57+585, approx. 40m length (Terai) ii) (a) CH 57+876 to CH 57+911, approx. 35m length (Kathmandu), (b) CH 57+856 to CH 57891, approx. 35m length (Terai) iii) (a) CH 58+400 to CH 58+490, approx.90 m length (Kathmandu), (b) CH 58+410 to CH 58+500, approx.90 m length (Terai) iv) (a) CH 59+080 to CH 59+140, approx.60 m length (Kathmandu), (b) CH 59+100 to CH 59+160, approx.60 m length (Terai) v) (a) CH 59+820 to CH 59+880, approx.60 m length (Kathmandu), (b) CH 59+820 to CH 59+880, approx.60 m length (Terai) vi) (a) CH 59+900 to CH 60+150, approx. 250m length (Kathmandu), (b) CH 59+901 to CH 60+151, approx. 250m length (Terai). vii) (a) CH 60+249 to CH 60+439 approx. 190 m length (Kathmandu), (b) CH 60+251 to CH 60+441 approx. 190 m length (Terai) viii) (a) CH 60+779 to CH 61+049 approx. 270 m length (Kathmandu), (b) CH 60+781 to CH 61+051 approx. 270 m length (Terai) ix) (a) CH 61+985 to CH 62+305 approx. 320 m length (Kathmandu), (b) CH 61+976 to CH 62+296 approx. 320 m length (Terai) x) (a)CH 62+592 to CH 63+017, approx. 425m length (Kathmandu) (PSC Girder + PSC Box (Extradose)/ICONIC Bridge), (b)CH 62+598 to CH 63+023, approx. 425m length (Terai) (PSC Girder + PSC Box (Extradose)/ICONIC Bridge) xi) (a) CH 63+136 to CH 63+386, approx. 250m length (Kathmandu), (b)CH 63+144 to CH 63+394 approx. 250m length (Terai) xii) (a) CH 64+024 to CH 64+064, approx. 40m length (Kathmandu), (b)CH 64+036 to CH 64+076 approx. 40m length (Terai) xiii) CH 58+150, approx. 40m length (VOP) xiv) CH 58+600, approx. 40m Length (VOP) Note: *Width of each bridge is 11.8 m as per standard and as per the	LS	1.0			

Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
	indicative drawings. The Bridge width may increase at the curved sections for extra widening. *The length and height of the Bridges may vary during design as per design requirements.					

3.2 Road Construction Work						
Procument Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
1	Contractors Design Work: Construction of Expressway Road, Slope Protection/Stabilization, River Training and Associated Works (From Ch. 59+880 to Ch. 59+900 and Ch. 63+390 to Ch. 64+030) including Side Drain, Cross Drainage, Stone Masonry Wall, Cantilever RCC wall for Hill side and Valley Side including piling foundation,, Bio-Engineering, Electrical work including optical fiber and other associated works as per the Employer's Requirement and Conditions of Contract.	LS	1.0			

Total of Procument Items	
Total Item Price	
VAT	
Grand Total	