NATIONAL HIGHWAYS & INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.

(Ministry of Road, Transport & Highways)
Government of India

NATIONAL COMPETITIVE BIDDING

BIDDING DOCUMENT

Special Protection Work on Rehabilitation and restoration of Sinking/Sliding Zone from Km 70+900 to Km 71+100 and Km 71+550 to Km 71+850 with JICA Technical Assistance including widening of Narrow Zone from Km 53+775 to Km 54+100 and from Km 63+045 to Km 63+470 on NH-10 (Rangpo To Ranipool section) in the State of Sikkim.

Nov -2019

BUILDING INFRASTRUCTURE - BUILDING THE NATION

National Highways & Infrastructure Development Corporation Ltd.
(A Government of India Undertaking)

INVITATION FOR BID

(IFB)

NATIONAL HIGHWAYS & INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.

(Ministry of Road, Transport & Highways)
Government of India

NATIONAL COMPETITIVE BIDDING

(CIVIL WORKS)

NAME OF WORK	**:**	Special Protection Work on Rehabilitation and restoration of Sinking/Sliding Zone from Km 70+900 to Km 71+100 and Km 71+550 to Km 71+850 with JICA Technical Assistance including widening of Narrow Zone from Km 53+775 to Km 54+100 and from Km 63+045 to Km 63+470 on NH-10 (Rangpo To Ranipool section) in the State of Sikkim.
PERIOD OF SALE OF BIDDING DOCUMENT	**:**	**From 20th Nov 2019 to 7th Jan 2020 Time 05:00 PM**
TIME AND DATE OF PRE-BID CONFERENCE	**:**	**Date 16th Dec 2019Time 11:00 AM**
LAST DATE AND TIME FOR RECEIPT OF BIDS	**:**	**Date 7th Jan 2020 Time 05:00 PM**
TIME AND DATE OF OPENING TECHNICAL BIDS	**:**	**Date 8th Jan 2020Time 11:00 AM**
TIME AND DATE OF OPENING FINANCIAL BIDS	**:**	**To be notified later**
PLACE OF OPENING OF BIDS	**:**	**National Highways and Infrastructure Development Corporation Limited 3rd Floor, PTI Building, 4, Parliament Street, New Delhi – 110001 Ph. No. 011-23461659**
OFFICER INVITING BIDS	**:**	**Mr. Shashank Kumar General Manager (Technical)**

National Highways & Infrastructure Development Corporation Limited.
3rd Floor, PTI Building, 4, Parliament Street, New Delhi -110001

INVITATIONS FOR BIDS (IFB)

NATIONAL COMPETITIVE BIDDING

Bid/Package no. **NHIDCL/Sikkim/NH-10/Sliding&Narrow Zone/2019** Dated: 20.11.2019

1. The National Highways & Infrastructure Development Corporation Limited (NHIDCL) (hereinafter call "the Employer") invites sealed item rate bids on Post qualification basis from reputed contractors for following work.

Name of Work	Approximate value of works (Rs. In crore)	Bid Security (Rs. in Lakhs)	Cost of Document (Rs. in Thousands)	Completion Period
Special Protection Work on Rehabilitation and restoration of Sinking/Sliding Zone from Km 70+900 to Km 71+100 and Km 71+550 to Km 71+850 with JICA Technical Assistance including widening of Narrow Zone from Km 53+775 to Km 54+100 and from Km 63+045 to Km 63+470 on NH-10 (Rangpo To Ranipool section) in the State of Sikkim.	**37.41**	**50.00**	**10000.00**	**24 (months)**

2. The contractors who have experience in construction of similar work and have established organization for taking up such works and who satisfy the qualification criteria of bid documents need only apply.

3. Bid on post-qualification is open to contracting firms and voluntarily formed joint ventures. Domestic contractors may apply for post-qualification independently or Joint Venture with domestic and/or foreign contractors.

4. The qualification criteria have been indicated in detail in Section-I (Instruction to Bidders) of volume –I of Bidding Documents**.**

5. Bidders may obtain further information from, and acquire the bidding documents at the office of the Employer from General M**an**ager (Technical) at NHIDCL ,3rd Floor, PTI Building, 4, Parliament Street, New Delhi – 110 001,India.

6. A complete set of bidding documents may be obtained between **10.00 AM to 05.00 PM** on all working days from **21.11.2019 to 06.01.2020** from the address of communication mentioned below. The bid documents can be obtained on payment of non-refundable cost of document of **Rs.10,000.00/-** in the form of a Demand Draft issued by any Nationalised Bank in favour of Managing Director, National Highways & Infrastructure Development Corporation Limited,

payable at New Delhi. The complete BID document can be viewed / downloaded from web portal of [NHIDCL http://www.nhidcl.com or from web portal www.eprocure.gov.in **20.11.2019 to 06.01.2020** (upto 05.00 PM).

7. Sealed Bids along with bid security mentioned above should reach NHIDCL, HQ, New Delhi at the address of communication given below not later than 05.00 PM on 07.01.2020.

8. All Bids must be delivered to General Manager (Technical) at NHIDCL ,3rd Floor, PTI Building, 4, Parliament Street, New Delhi – 110 001,India.

9. The Bid shall be submitted in two parts namely:

   (a) Technical Bid

   (b) Financial Bid

   Bidder must submit its Technical Bid and financial bid at [http://eprocure.gov.in] on or before (upto 07.01.2020 05:00 PM). Bids received online shall be opened on 08.01.2020 (at 11:00 AM). Bid through any other mode shall not be entertained. However, Bid Security, document fee, Power of Attorney and Joint Bidding Agreement etc. shall be submitted physically by the Bidder on or before 07.01.2020 (at 05:00 PM).

10. The "Financial Bids" of the responsive bidders will be opened by the Employer in the presence of interested bidders on date, time and venue to be notified separately after Technical Evaluation of bid is completed.

11. NHIDCL will not be responsible for any delay in receiving the bid documents and keep the right reserved to accept/reject any or all bids without assigning any reasons thereof.

Address for Communication:

Mr. Shashank Kumar
General Manager (Technical)
National Highways and Infrastructure
Development Corporation Limited
3rd Floor, PTI Building,
4, Parliament Street,
New Delhi – 110001
Tele Phone: 011-23461659
E-mail Address – Shashank.kr@gov.in

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SECTION-1: INSTRUCTIONS TO BIDDERS
A. GENERAL

1. Scope of Bid

1.1 The Employer (named in Appendix to ITB) invites bids for the construction of works (as defined in these documents and referred to as "the works") detailed in the table given in IFB. The bidders may submit bids for any or all of the works detailed in the table given in IFB.

1.2 The successful bidder will be expected to complete the works by the intended completion date specified in the Contract data.

1.3 Throughout these bidding documents, the terms 'bid' and 'tender' and their derivatives (bidder/tenderer, bid/tender, bidding/tendering etc.) are Synonymous.

2 Source of Funds

2.1 The funding for the work shall be done by the Government of India through National Highways and Infrastructure Development Corporation Limited (NHIDCL).

3. Eligible Bidders

3.1 This Invitation for Bids is open to all bidders.

3.2 All bidders shall provide in Section 2, Forms of Bid and Qualification Information, a statement that the Bidder is neither associated, nor has been associated directly or indirectly, with the Consultant or any other entity that has prepared the design, specifications, and other documents for the Project or being proposed as Project Manager for the Contract. A firm that has been engaged by the Employer to provide consulting services for the preparation or supervision of the works, and any of its affiliates, shall not be eligible to bid.

4. Qualification of the Bidder

4.1 All bidders shall provide in Section 2, Forms of Bid and Qualification Information, a preliminary description of the proposed work method and schedule, including drawings and charts, as necessary. The proposed methodology should include programme of construction backed with equipment planning and deployment duly supported with broad calculations and quality assurance procedures proposed to be adopted justifying their capability of execution and completion of work as per technical specifications, within stipulated period of completion.

4.2 Deleted

4.3 If the Employer has not undertaken pre-qualification of potential bidders, all bidders shall include the following information and documents with their bids in Section 2 :

(a) Copies of original documents defining the constitution or legal status, place of registration, and principal place of business; written power of attorney of the signatory of the Bid to commit the Bidder.

(b) total monetary value of construction work performed for each of the last five years;

(c) experience in works of a similar nature and size for each of the last five years, and details of works underway or contractually committed ; and clients who may be contacted for further information on those contracts ;

(d) major items of construction equipment proposed to carry out the Contract;

(e) qualifications and experience of key site management and technical personnel proposed for Contract;

(f) reports on the financial standing of the Bidder, such as profit and loss statement and auditor's reports for the past five years;

(g) evidence of access to line(s) of credit and availability of other financial resources facilities (10% of contract value), certified by the Bankers (Not more than 3 months old)

(h) Undertaking that the bidder will be able to invest a minimum cash upto 25% of contract value of work, during implementation of work.

(i) authority to seek references from the Bidder's bankers'

(j) information regarding any litigation, current or during the last five years , in which the Bidder is involved, the parties concerned , and disputed amount ;

(k) proposals for subcontracting components of the Works amounting to more than 10 percent of the Bid Price (for each ,the qualifications and experience of the identified subcontractor in the relevant field should be annexed): and

(l) the proposed methodology and programme of contraction ,backed with equipment planning and deployment, duty supported with broad calculations and quality control procedures proposed to be adoped, justifying their capability of execution and completion of the work as per technical specifications within the stipulated period of completion as per milestones *(for all contracts over Rs.5 Crore*)

4.4 Bids from Joint Ventures are acceptable.

4.5 A To qualify for award of the Contract, each bidder in its name should have, in the last five years, as referred to in Appendix

(a) Achieved a minimum annual financial (in all class of civil engineering construction works only) amount indicated in Appendix in one year (*usually not less than two and a half times the estimated annual payments under the contract*);

(b) satisfactorily completed (not less than 90% of contract value), as prime Contractor (or as a nominated sub-contractor , where the subcontract involved execution of all main items of work described in the bid document, provided further that all other qualification criteria are satisfied) at least **one similar work** of value not less than amount indicated in Appendix (*Usually not less than 50% of estimate value of contract*)

(c) executed in any one year, the minimum quantities of the following items of works as indicated in Appendix

- Cement concrete (including RCC and PCC) --------cum

- Earthwork in both excavation and embankment --------cum (combined quantities)*(usually 80% of the expected peak rate of construction)*

(d) Deleted

(e) Deleted

B. Each bidder should further demonstrate & confirm:

(a) Availability (either owned or leased or by procurement against mobilization advances) of the following key and critical equipment for this work:

Note : (To be included for bids valued over Rs. 5 Crores)

Based on the studies ,carried out by the Engineer the minimum suggested major equipment to attain the completion of works in accordance with the prescribed construction schedule are shown in the **Annexure-I**

The bidder should ,however, undertake the their own studies and furnish with their bid ,a detailed construction planning and methodology supported with layout and necessary drawing and calculations (detailed) as stated in clause 4.3 (I) above to allow the employer to review their proposals. The numbers, type and capacities of each plant/equipment shall be shown in the proposals along with the cycle time for each operation for the given production capacity to match the requirements.

(b) availability for this work of personnel with adequate experience as required as per Annexure-II

(c) liquid assets and/or availability of credit facilities of no less than amount indicated in Appendix

(Credit lines /Letter of credit/certificates from Banks for meeting the funds requirement etc.-usually the equivalent of the estimated cash flow for 3 months in peak construction period.)

C. To qualify for a package of contract made up of this and other contracts for which bids are invited in the IFB, the bidder must demonstrate having experience and resources sufficient to meet the aggregate of the qualifying criteria for the individual contracts.

4.6 Sub-contractor's experience and resources shall not be taken into account in determining the bidder's compliance with the qualifying criteria except to the extent stated in 4.5(A) above.

4.7 Bidders who meet the minimum qualification criteria will be qualified only if their available bid capacity is more than the total bid value. The available bid capacity will be calculated as under :

Assessed Available Bid capacity = (A*N*2 – B)

Where

A- Maximum value of civil engineering works executed in any one year during the last five years(updated to the current price level of the year indicated in Appendix) taking into account the completed as well as works in progress..

B- Value (updated to the price level of the year indicated in Appendix) of existing commitments and ongoing works to be completed during the next 1(one) year (period of completion of work for which bids are invited); and

N- Numbers of years prescribed for completion of the works for which bids are invited.

Note: *The statement showing the values of existing commitment and ongoing works as well as the stipulated period of completion remaining for each of works listed should be countersigned by the Engineer in charge, not below the rank of an Executive Engineer or equivalent.*

4.8 Even though the bidders meet the above qualifying criteria, they are subject to be disqualified if they have:-

- made misleading or false representations in the forms, statements, affidavits and attachments submitted in proof of the qualification requirement; and /or
- record of poor performance such as abandoning the works, not properly completing the contract ,inordinate delays in completion, litigation history or financial failure etc: and/or
- Participated in the previous bidding (if this is a re-bidding) for the same work and had quoted unreasonably high bid price and could not furnish rational justification to the employer.

5. One Bid per Bidder

5.1 Each bidder shall submit only one bid for one package. A bidder who submits or participates in more than on Bid (other than as a subcontractor or in cases of alternatives that have been permitted or requested) will cause all the proposals with the Bidder's participation to be disqualified.

6. Cost of Bidding

6.1 The bidder shall bear all costs associated with the preparation and submission of his Bid, and the Employer will in no case be responsible and liable for those costs.

7. Site Visit

7.1 The Bidder, at the Bidder's own responsibility and risk is encouraged to visit and examine the Site of Works and its surroundings and obtain all information that may be necessary for preparing the Bid and entering into a contract for construction of the works. The costs of visiting the Site shall be at the Bidder's own expense.

B. BIDDING DOCUMENTS

8. Content of Bidding Documents.

8.1 The set of bidding documents comprises the documents listed below and addenda issued in accordance with Clause 10 :

Section	Particulars	Volume No.
	Invitation for Bids	I

Section	Particulars	Volume No.
1	Instructions to Bidders	
2	Qualification Information, and other forms	
3	Conditions of Contract	
4	Contract Data	
5	Technical Specifications	II
6	Form of bid	III
7	Bill of Quantities	
8	Securities and other forms	
9	Drawings	IV
10	Documents to be furnished by bidder	V

8.2 One copy of each of the volumes I, II, III and IV will be issued to the bidder. Documents to be furnished by the bidder in compliance to section 2 will be prepared by him and furnished as Volume -V in two parts (refer clause 12)

8.3 The bidder is expected to examine carefully all instructions, conditions of contract, contract data, forms, terms, and technical specifications, bill of quantities, forms, Annexes and drawings in the Bid Document. Failure to comply with the requirements of Bid Documents shall be at the bidder's own risk. Pursuant to clause 26 hereof, bids which are not substantially responsive to the requirements of the Bid Documents shall be rejected.

9. Clarification of Bidding Documents

9.1 A prospective bidder requiring any clarification of the bidding documents may notify the Employer in writing or by cable (hereinafter "cable" includes telex and facsimile) at the Employer's address indicated in the invitation to bid. The Employer will respond to any request for clarification which he received earlier than 15 days prior to the deadline for submission of bids. Copies of the Employer's response will be forwarded to all purchasers of the bidding documents, including a description of the enquiry but without identifying its source.

9.2 Pre-bid meeting

9.2.1 The bidder or his official representative is invited to attend a pre-bid meeting which will take place at the address, venue, time and date as indicated in appendix.

9.2.2 The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

9.2.3 The bidder is requested to submit any questions in writing or by cable to reach the Employer not later than one week before the meeting.

9.2.4 Minutes of the meeting, including the text of the questions raised (without identifying the source of enquiry) and the responses given will be transmitted without delay to all purchases of the bidding documents. Any modification of the

bidding documents listed in Sub-Clause 8.1 which 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 Clause 10 and not through the minutes of the pre-bid meeting.

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

10. Amendment of Bidding Documents

10.1 Before the deadline for submission of bids, the Employer may modify the bidding documents by issuing addenda.

10.2 Any addendum thus issued shall be part of the bidding documents and shall be communicated in writing or by cable to all the purchase of the bidding documents. Prospective bidders shall acknowledge receipt of each addendum in writing or by cable to the Employer. The Employer will assume no responsibility for postal delays.

10.3 To give prospective bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer may, at his descretion, extend as necessary the deadline for submission of bids, in accordance with Sub-Clause 20.2 below.

C. PREPARATION OF BIDS

11. Language of the Bid

11.1 All documents relating to the bid shall be in the English language.

12. Documents Comprising the Bid

12.1 The bid to be submitted by the bidder as Volume V of the bid document (refer Clause 8.1) shall be in two separate parts.

Part - I shall be named "Technical Bid" and shall comprise.

(i) Bid Security in the form specified in Section 8.

(ii) Document Fee in the for DD as per Clause 6 of IFB.

(iii) Qualification Information and supporting documents as specified in Section 2.

(iv) Certificates, undertakings, affidavits as specified in Section 2.

(v) Any other information pursuant to Clause 4.2 of these instructions.

(vi) Undertaking that the bid shall remain valid for the period specified in Clause 15.1.

(vii) Acceptance/ non-acceptance of Dispute review expert proposed in clause 36.1.

Part - II shall be named "Financial Bid" and shall comprise.

(i) Form of Bid as specified in Section 6

(ii) Priced Bill of Quantities for items specified in Section 7.

Each part will be separately sealed and marked in accordance with the Sealing and Marking Instructions in Clause 19.

12.2 The bidder shall prepare two copies of the bid, marking them Original and Copy respectively

12.3 Following documents, which are not submitted with the bid, will be deemed to be part of the bid.

Section	Particulars	Volume No.
	Invitation for Bids (IFB)	Volume I
1	Instructions to Bidders	
2	Conditions of Contract	
3	Contract Data	
4	Specifications	Volume II
5	Drawings	Volume IV

13. Bid Prices

13.1 The contract shall be for the whole works as described in Sub Clause 1.1 based on the priced Bill of Quantities submitted by the Bidder.

13.2 The bidder shall fill in rates and prices and line item total (both in figures and words) for all items of the works described in the Bill of Quantities along with total bid price (both in figures and words) *Item for 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 other rates and prices in the Bill of Quantities.* Corrections, if any shall be made by crossing out, initialing, dating and rewriting.

13.3 All duties, taxes and other levies payable by the contractor under the contract, or for any other cause shall be included in the rates, prices and total Bid Price submitted by the Bidder.

13.4 The rates and prices quoted by the bidder are subject to adjustment during the performance of the Contract in accordance with the provisions of Clause 47 of the Conditions of Contract (For contracts more than 12 months period)

14. Currencies of Bid and Payment

14.1 The unit rates and the prices shall be quoted by the bidder entirely in Indian Rupees. All payments shall be made in Indian Rupees.

15. Bid Validity

15.1 Bids shall remain valid for a period not less than 120 days after the deadline date for bid submission specified in Clause 20. A bid valid for a shorter period shall be rejected by the Employer as non - responsive. In case of discrepancy in bid validity period between that given in the undertaking pursuant to Clause 12.1 (v) and the Form of Bid submitted by the bidder, the latter shall be deemed to stand corrected in accordance with the former and the bidder has to provide for any additional security that is required.

15.2 In exceptional circumstances, prior to expiry of the original time limit, the Employer may request that the bidders may extend the period of validity for a specified additional period. The request and the bidder's response shall be made in writing or by cable. A bidder may refuse the request without forfeiting his bid security. A bidder agreeing to the request will not be required or permitted to modify his bid except as provided in 15.3 hereinafter, but will be required to extend the validity of his bid security for a period of the extension, and in compliance with Clause 16 in all respects.

15.3 **(Deleted)**

15.4 Bid evaluation will be based on the bid prices without taking into consideration the above correction.

16. Bid Security

16.1 The Bidder shall furnish, as part of his Bid, a Bid security in the amount as shown in column 4 of the table of IFB for this particular work. This bid security shall be in favour of Employer as named in Appendix and may be in one of the following forms:

(a) Bank Guarantee from any scheduled Indian Bank, in the format given in Volume III.

16.2 Bank guarantees (and other instruments having fixed validity) issued as surety for the bid shall be valid for 45 days beyond the validity of the bid.

16.3 Any bid not accompanied by an acceptable Bid Security and not secured as indicated in Sub-Clauses 16.1 and 16.2 above shall be rejected by the Employer as non-responsive.

16.4 The Bid Security of unsuccessful bidders will be returned within 28 days of the end of the bid validity period specified in Sub-Clause 15.1.

16.5 The Bid Security of the successful bidder will be discharged when the bidder has signed the Agreement and furnished the required Performance Security.

16.6 The Bid Security may be forfeited

(a) if the Bidder withdraws the Bid after Bid opening during the period of Bid validity;

(b) if the Bidder does not accept the correction of the Bid Price, pursuant to Clause 27; or

(c) in the case of a successful Bidder, if the Bidder fails within the specified time limit to

(i) sign the Agreement; or

(ii) furnish the required Performance Security.

17. Alternative Proposals by Bidders

17.1 Bidders shall submit offers that fully comply with the requirements of the bidding documents, including the conditions of contract (including mobilization advance

or time for completion), basic technical design as indicated in the drawing and specifications. Conditional offer or alternative offers will not be considered further in process of tender evaluation.

18. Format and Signing of Bid

18.1 The Bidder shall prepare one original and one copy of the documents comprising the bid as described in Clause 12 of these Instructions of Bidders, bound with the volume containing the "Technical Bid" and "Financial Bid" in separate parts and clearly marked "**ORIGINAL**" and "**COPY**" as appropriate. In the event of discrepancy between them, the original shall prevail.

18.2 The original and copy of the Bid shall be typed or written in indelible ink and shall be signed by a person or persons duly authorized to sign on behalf of the Bidder, pursuant to Sub-Clause 4.3 All pages of the bid where entries or amendments have been made shall be initialed by the person or persons signing the bid.

18.3 The Bid shall contain no alternations or additions, except those to comply with instructions issued by the Employers, or as necessary to correct errors made by the bidder, in which case such corrections shall be initialed by the person or persons signing the bid.

D. SUBMISSION OF BIDS

19. Sealing and Marking of Bids

19.1 The Bidder shall seal the original and copy of the Bid in separate envelopes duly marking the envelopes as "ORIGINAL" and "COPY". These two envelopes (called as inner envelopes) shall then be put inside one outer envelope. Each set of the inner envelope marked "ORIGINAL" and "COPY" shall contain within it two separate sealed envelopes marked "Technical Bid" and "Financial Bid" with additional markings as follows.

- Original or Copy, as the case may be
- Technical Bid: To be opened on (date of Technical Bid opening Communicate later) in the presence of Evaluation Committee.
- Financial Bid: Not to be opened except with the approval of Evaluation Committee. (As Per tender Notice)

The contents of Technical and Financial Bids will be as specified in clause 12.1

19.2 The inner, outer, and separate envelopes containing Technical and Financial Bids shall.

(a) be addressed to the Employer at the address given in Appendix.

(b) bear the identification as indicated in Appendix.

19.3 In addition to the identification required in Sub-Clause 19.1 and 19.2, each of the envelopes shall indicate the name and address of the bidder to enable the bid to be returned unopened in case it is declared late, pursuant to Clause 21, or the Evaluation Committee declares the bid as non responsive pursuant to Clause 23.

19.4 If the outer envelope is not sealed and market as above the Employer will assume no responsibility for the misplacement or premature opening of the bid.

20. Deadline for Submission of the Bids

20.1 Complete Bids (including Technical and Financial) must be received by the Employer at the address specified above not later than the date indicated in appendix. In the event of the specified date for the submission of bids declared a holiday for the Employer, the Bids will be received up to the appointed time on the next working day.

20.2 The Employer may extend the deadline for submission of bids by issuing an amendment in accordance with Clause 10, in which case all rights and obligations of the Employer and the bidders previously subject to the original deadline will then be subject to the new deadline.

21. Late Bids

21.1 Any Bid received by the Employer after the deadline prescribed in Clause 20 will remain unopened.

22. Modification and Withdrawal of Bids

22.1 Bidders may modify or withdraw their bids by giving notice in writing before the deadline prescribed in Clause 20, or pursuant to Clause 23.

22.2 Each Bidder's modification or withdrawal notice shall be prepared, sealed, marked, and delivered in accordance with Clause 18 & 19, with the outer and inner envelopes additionally marked "**MODIFICATION**" or "**WITHDRAWAL**", as appropriate.

22.3 bid may be modified after the deadline for submission of Bids, except in pursuant of Clause 23.

22.4 Withdrawal or modification of a Bid between the deadline for submission of bids and the expiration of the original period of bid validity specified in Clause 15.1 above or as extended pursuant to Clause 15.2 may result in the forfeiture of the Bid security pursuant to Clause 16.

E. BID OPENING AND EVALUATION

23. Bid Opening

23.1 The Employer will open all the Bids received (except those received late), including modifications made pursuant to Clause 22, in the presence of the Bidders or their representatives who choose to attend at time, date and place specified in Appendix in the manner specified in Clause 20 and 23.3. In the event of the specified date of Bid opening being declared a holiday for the Employer, the Bids will be opened at the appointed time and location on the next working day.

23.2 Envelopes marked "**WITHDRAWAL**" shall be opened and read out first. Bids for which an acceptable notice of withdrawal has been submitted pursuant to Clause 22 shall not be opened.

23.3 The "Technical Bid" shall be opened. The amount, form and validity of the bid

security furnished with each bid will be announced. If the bid security furnished does not conform to the amount and validity period as specified in the Invitation for Bid (ref. Column 4 and paragraph 3), and has not been furnished in the form specified in Clause 16, the remaining technical bid and the financial bid will be not be opened.

23.4 (i) Subject to confirmation of the bid security by the issuing Bank, the bids accompanied with valid bid security will be taken up for evaluation with respect to the Qualification Information and other information furnished in Part I of the bid pursuant to Clause 12.1.

(ii) After receipt of confirmation of the bid security, the bidder will be asked in writing (usually within 10 days of opening of the Technical Bid) to clarify or modify his technical bid, if necessary, with respect to any rectifiable defects.

(iii) The bidders will respond in not more than 7 days of issue of the clarification letter, which will also indicate the date, time and venue of opening of the Financial Bid (usually on the 21st day of opening of the Technical Bid)

(iv) Immediately (usually within 3 or 4 days), on receipt of these clarifications the Evaluation Committee will finalize the list of responsive bidders whose financial bids are eligible for considerations.

23.5 If, as a consequence of the modifications carried out by the bidder in response to sub-clause 23.4, the bidders desire to modify their financial bid, they will submit the modification in separate sealed envelope so as to reach the Employer's address (refer sub-clause 19.2) before the opening of the Financial bid as intimated in the clarification letter (refer sub-clause 23.4). The envelope shall have clear marking "MODIFICATION TO FINANCIAL BID-Not to be opened except with the approval of the Evaluation Committee"

23.6 At the time of opening of "Financial Bid", the names of the bidders were found responsive in accordance with Clause 23.4(iv) will be announced. The bids of only those bidders will be opened. The remaining bids will be remain unopened. The responsive Bidders' names, the Bid prices, the total amount of each bid, and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening. Any Bid price which is not read out and recorded will not be taken into account in Bid Evaluation.

23.7 In case bids are invited in more than one package, the order for opening of the "Financial Bid" shall be that in which they appear in the "Invitation For Bid".

23.8 The Employer shall prepare minutes of the Bid opening, including the information disclosed to those present in accordance with Sub-Clause 23.6.

24. Process to be Confidential

24.1 Information relating to the examination, clarification, evaluation, and comparison of Bids and recommendations for the award of a contract shall not be disclosed to Bidders or any other persons not officially concerned with such process until the award to the successful Bidder has been announced. Any effort by a Bidder to influence the Employer's processing of Bids or award decisions may result in the rejection of his Bid.

25. Clarification of Financial Bids

25.1 To assist in the examination, evaluation, and comparison of Bids, the Employer may, at his discretion, ask any Bidder for clarification of his Bid, including breakdowns of unit rates. The request for clarification and the response shall be in writing or by cable, but no change in the price or substance of the Bid shall be sought, offered, or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Bids in accordance with Clause 27.

25.2 Subject to sub-clause 25.1, no Bidder shall contact the Employer on any matter relating to his bid from the time of the bid opening to the time the contract is awarded. If the Bidder wishes to bring additional information to the notice of the Employer, it should do so in writing.

25.3 Any effort by the Bidder to influence the Employer in the Employer's bid evaluation, bid comparison or contract award decisions may result in the rejection of the Bidders' bid.

26. Examination of Bids and Determination of Responsiveness

26.1 During the detailed evaluation of "Technical Bids", the Employer will determine whether each Bid (a) meets the eligibility criteria defined in Clause 3 and 4; (b) has been properly signed; (c) is accompanied by the required securities and; (d) is substantially responsive to the requirements of the Bidding documents. During the detailed evaluation of the "Financial Bid", the responsiveness of the bids will be further determined with respect to the remaining bid conditions, i.e., priced bill of quantities, technical specifications, and drawings.

26.2 A substantially responsive "Financial Bid" is one which conforms to all the terms, conditions, and specifications of the Bidding documents, without material deviation or reservation. A material deviation or reservation is one (a) which affects in any substantial way the scope, quality, or performance of the Works; (b) which limits in any substantial way, inconsistent with the Bidding documents, the Employer's rights or the Bidder's obligations under the Contract; or (c) whose rectification would affect unfairly the competitive position of other Bidders presenting substantially responsive Bids.

26.3 If a "Financial Bid" is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the non-conforming deviation or reservation.

27. Correction of Errors

27.1 "Financial Bids" determined to be substantially responsive will be checked by the Employer for any arithmetic errors. Errors will be corrected by the Employer as follows:

(a) where there is a discrepancy between the rates in figures and in words, the rate in words will govern; and

(b) where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will govern.

27.2 The amount stated in the "Financial Bid" will be corrected by the Employer in accordance with the above procedure and the bid amount adjusted with the concurrence of the Bidder in the following manner:

(a) If the Bid price increase as a result of these corrections, the amount as stated in the bid will be the 'bid price' and the increase will be treated as rebate;

(b) If the bid price decreases as a result of the corrections, the decreased amount will be treated as the 'bid price'

Such adjusted bid price shall be considered as binding upon the Bidder. If the Bidder does not accept the corrected amount the Bid will be rejected, and the Bid security may be forfeited in accordance with Sub-Clause 16.6 (b).

28. Deleted

29. Evaluation and Comparison of Financial Bids

29.1 The Employer will evaluate and compare only the Bids determined to be substantially responsive in accordance with Sub-Clause 26.2.

29.2 In evaluating the Bids, the Employer will determine for each Bid the evaluated Bid Price by adjusting the Bid Price as follows:

(a) making any correction for errors pursuant to Clause 27; or

(b) making an appropriate adjustments for any other acceptable variations, deviations; and

(c) making appropriate adjustments to reflect discounts or other price modifications offered in accordance with sub-clause 23.6.

29.3 The Employer reserves the right to accept or reject any variation, deviation. Variations and deviations and other factors which are in excess of the requirements of the Bidding documents or otherwise result in unsolicited benefits for the Employer shall not be taken into account in Bid evaluation.

29.4 The estimated effect of the price adjustment conditions under Clause 47 of the Conditions of Contract, during the period of implementation of the Contract, will not be taken into account in Bid evaluation.

29.5 If the Bid of the successful Bidder is seriously unbalanced in relation to the Engineer's estimate of the cost of work to be performed under the contract, the Employer may require the Bidder to produce detailed price analyses 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 analyses, the Employer may require that the amount of the performance security set forth in Clause 34 be increased at the expense of the successful Bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract.

29.6 A bid which contains several items in the Bill of Quantities which are unrealistically priced low and which cannot be substantiated satisfactorily by the bidder may be rejected as non-responsive.

30. Deleted

F. AWARD OF CONTRACT

31. Award Criteria

31.1 Subject to Clause 32, the Employer will award the Contract to the Bidder whose Bid has been determined

(i) to be substantially responsive to the Bidding documents and who has offered the lowest evaluated Bid Price; and

(ii) to be within the available bid capacity adjusted to account for his bid price which is evaluated the lowest in any of the packages opened earlier than the one under consideration.

In no case, the contract shall be awarded to any bidder whose available bid capacity is less than the evaluated bid price, even if the said bid is the lowest evaluated bid. The contract will in such cases be awarded to the next lowest bidder at his evaluated bid price.

32. Employer's Right to Accept any Bid and to Reject any or all Bids

32.1 Notwithstanding Clause 31, the Employer reserves the right to accept or reject any Bid, and to cancel the Bidding process and reject all Bids, at any time prior to the award of Contract, without thereby incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder or Bidders of the grounds for the Employer's action.

33. Notification of Award and Signing of Agreement

33.1 The Bidder whose Bid has been accepted will be notified of the award by the Employer prior to expiration of the Bid validity period by cable, telex or facsimile confirmed by registered letter. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") will state the sum that the Employer will pay the Contractor in consideration of the execution, completion, and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").

33.2 The notification of award will constitute the formation of the Contract, subject only to the furnishing of a performance security in accordance with the provisions of Clause 34.

33.3 The Agreement will incorporate all agreements between the Employer and the successful Bidder. It will be signed by the Employer and sent to the successful Bidder, within 28 days following the notification of award along with the Letter of Acceptance. Within 21 days of receipt, the successful Bidder will sign the Agreement and deliver it to the Employer.

33.4 Upon the furnishing by the successful Bidder of the Performance Security, the Employer will promptly notify the other Bidders that their Bids have been unsuccessful.

34. Performance Security

34.1 Within 21 days of receipt of the Letter of Acceptance, the successful Bidder shall deliver to the Employer a Performance Security in any of the forms given below for an amount equivalent to 5% of the Contract price plus additional security for unbalanced Bids in accordance with Clause 29.5 of ITB and Clause 52 of Conditions of Contract:

- a bank guarantee in the form given in Section 8; or
- Certified cheque/Bank draft as indicated in Appendix.

34.2 If the performance security is provided by the successful Bidder in the form of a Bank Guarantee, it shall be issued either (a) at the Bidder's option, by a Nationalized/Scheduled Indian bank or (b) by a foreign bank located in India and acceptable to the Employer .

34.3 Failure of the successful Bidder to comply with the requirements of Sub-Clause 34.1 shall constitute sufficient grounds for cancellation of the award and forfeiture of the Bid Security.

35. Advance Payment and Security

35.1 The Employer will provide an Advance Payment on the Contract Price as stipulated in the Conditions of Contract, subject to maximum amount, as stated in the Contract Data.

36. Dispute Review Expert

36.1 The Employer proposes that (name of proposed Dispute Review Expert as indicated in Appendix) be appointed as Dispute Review Expert under the Contract, at a daily fee as indicated in Appendix plus reimbursable expenses. If the Bidder disagrees with this proposal, the Bidder should so state in the Bid. If in the Letter of Acceptance, the Employer has not agreed on the appointment of the Dispute Review Expert, the Dispute Review Expert shall be appointed by the Council of Indian Roads Congress at the request of either party.

37. Corrupt or Fraudulent Practices

37.1 The employer will reject a proposal for award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question and will declare the firm ineligible, either indefinitely or for a stated period of time, to be awarded a contract with National Highways Authority of India / State PWD and any other agencies, if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for the contractor, or in execution.

37.2 Furthermore, Bidders shall be aware of the provision stated in Sub-Clause 23.2 and Sub-Clause 59.2 of the Conditions of Contract.

APPENDIX to ITB
Clause Reference
with respect to
Section-I.

1. Name of the Employer is — Managing Director , **[Cl. 1.1]**
National Highways and Infrastructure Development Corporation Limited
3rd Floor, PTI Building,
4, Parliament Street,
New Delhi – 110001

2. The Last Five years
2013 – 2014
2014 – 2015
2015 – 2016
2016 – 2017
2018 - 2019

3. This annual financial turn over amount is Rs 46.78 Cr. [Cl.4.5A(a)]

4. Value of the Work is Rs. 37.41 Cr. only [Cl.4.5A(b)]

5. Quantities of Work are: [Cl.4.5A(c)]

(i) Earthwork in excavation, embankment - 40% proposed quantity
(ii) Rock fall protection net with rock bolt - 40% proposed quantity
(iii) Rock bolt - 40% proposed quantity
(iv) Shotcrete - 40% proposed quantity
(v) Ground anchor work - 40% proposed quantity
(vi) Horizontal Drainage Boring - 40% proposed quantity

6. The cost of electric Work is Rs Nil [Cl.4.5A(d)]

7. The cost of water supply /sanitary works is Rs. Nil [Cl.4.5A(e)]

8. Liquid assets and /or availability of credit facilities is Rs.3.74 Cr. [Cl.4.5B(c)]

9. Price level of the financial year 2019-20 [Cl.4.7]

10. The pre-bid meeting will take place at NHIDCL,3rd Floor, PTI Building,4, Parliament Street, New Delhi – 110001 **– As per Tender Notice** [Cl.9.2.1]

11. The technical bid will be opened at NHIDCL,3rd Floor, PTI Building,4, Parliament Street, New Delhi – 110001 **– As per Tender Notice**

12. Address of the Employer: Managing Director, NHIDCL, 3rd Floor, PTI Building, 4, Parliament Street, New Delhi – 11000111. [Cl.4.5(a)]

13. Identification: [Cl.19.2(b)]

- Bid for "**Special Protection Work on Rehabilitation and restoration of Sinking/Sliding Zone from Km 70+900 to Km 71+100 and Km 71+550 to Km 71+850 with JICA Technical Assistance including widening of Narrow Zone from Km 53+775 to Km 54+100 and from Km 63+045 to Km 63+470 on NH-10 (Rangpo To Ranipool section) in the State of Sikkim."**

- Bid reference - **As per Tender Notice**
- Do not open before - **As per Tender Notice**

14. Bid should be submitted latest by **As per Tender Notice** [Cl.20.1(a)]

15. The bids will be opened at [Cl.34.1]

    NHIDCL, 3rd Floor, PTI Building,4, Parliament Street, New Delhi – 110001 – **As per Tender Notice**

16. The Bank Demand Draft in favour of Managing Director, [Cl.34.1]

    National Highways & Infrastructure Development Corporation Limited (NHIDCL) payable at New Delhi.

17. The Name of Dispute Review Expert is Communicate later [Cl.36.1]

18. Escalation factors (for the cost of works executed and financial figure to a common base value for works completed).

Year before	Multiply factor
One	1.1
Two	1.21
Three	1.33
Four	1.46
Five	1.61

ANNEXURE-I

List of Key Plant & Equipment to be deployed on Contract Work

[Reference Cl.4.5 (B) (a)]

Sl. No.	Equipment Type and Characteristics	Minimum Capacity	Max. age of equipment as on 01/12/2019 (years)	Minimum Number required
1	Jack hammer	120 cfm	5	4 No.
2	Grunting equipment along with accessories	5 cum/hr	5	3 No.
3.	Concrete Mixer with Integral Weigh Batching facility	0.25 cum	5	5 No.
4	Plate compactor	-	5	5 No.
5	Cranes	35 tonnes	5	2 Nos.
6	Hydraulic Rock bolt drill	1-boom	5	2 Nos.
7	Front end loader	1 cum	5	4 Nos.
8	Loader cum excavator	1 cum bucket size	5	2Nos.
9	Pneumatic Crawler Drill	48 - 75 mm	5	2 Nos
10	Pneumatic Crawler Drill	76 - 110 mm	5	4 Nos
11	Hydraulic excavator	0.9 cum bucket size	5	3 No.
12	Tipper/Dump Trucks	10-12 tones	5	5 Nos.
13	Water tanker	6 KL	5	2 No.
14	Air Compressor	250 cfm	5	1 No.
15	Mechanical broom	1250 sqm per hour	5	1 No.
16.	Pump concrete machine	38 cum/ hr	5	2 No.
17	Dozer	75 cum/hr	5	1 No
18	Shotcrete machine	6 cum/hr	5	2 No.

ANNEXURE-II

List of Key Personnel to be deployed on Contract Work

[Reference Cl.4.5 (B) (b)]

S.No.	Designation of Personnel	No.	Minimum Qualification	Minimum years of experience	Minimum experience in similar works
1	Project Manger	1	B.E Civil +10 years Experience in Bridge/Tunnel Construction Work	15	5
2	Materials Engineer	1	Degree/Diploma in Civil Engineering	10/12	5
3.	Quantity Surveyor	1	Degree/Diploma in Civil Engineering	8/10	5
4.	Geologist	1	Graduate/ preferably with post graduate degree	5	3
5	Hill road Engineer	1	B.E Civil +10 years Experience in Hill Road Work	15	5
6	Site Engineers Road & CD works	3	Degree/Diploma in Civil Engineering	5/7	2

SECTION-2: QUALIFICATION INFORMATION

QUALIFICATION INFORMATION

The information to be filled in by the Bidder in the following pages will be used for purposes of post qualification as provided for in Clause 4 of the Instructions to Bidders. This information will not be incorporated in the Contract.

1. **For Individual Bidders**

1.1 Constitution or legal status of Bidder

[Attach copy]

Place of registration: _____

Principal place of business: _____

Power of attorney of signatory of Bid

[Attach]

1.2 Total value of Civil Engineering construction work executed and payments received in the last five years[6] (in Rs. Millions)

2014-2015[5]
2015-2016
2016-2017
2017-2018
2018-2019

1.3.1. Work performed as prime contractor, work performed in the past as a nominated sub-contractor will also be considered provided the sub-contract involved execution of all main items of work described in the bid document, provided further that all other qualification criteria are satisfied (in the same name) on works of a similar nature over the last five years.[5]

Project Name	Name of the Employer*	Description of work	Contract No.	Value of contract (Rs. crore)	Date of issue of work order	Stipulated period of completion	Actual date of completion[7]	Remarks explaining reasons for delay and work completed

1.3.2. [8]Quantities of work executed as prime contractor, work performed in the past as a nominated sub-contractor, will also be considered provided the sub-contract involved execution of all main items of work described in the bid document, provided further that all other qualification criteria are satisfied (in the same name and style) in the last five years:[5]

[5] *Attach certificate from Chartered Accountant.*
[6] *Immediately preceding the financial year in which bids are received.*
[7] *Attach certificate(s) from the Engineer(s)-in-Charge*
[8] *Delete, if prequalification has been carried out*

Year	Name of the Work	Name of the Employer	Quantity of work performed (cum) @ Remarks					Remarks * (indicate contract Ref)
			RCC/PCC	Masonry	Earth Work	WMM	Bituminous Work	
2014-2015								
2015-2016								
2016-2017								
2017-2018								
2018-2019								

1.4 Information on Bid Capacity (works for which bids have been submitted and works which are yet to be completed) as on the date of this bid.

(A) Existing commitments and on-going works:

Description of works	Place & State	Contract No.	Name & Address of Employer	Value of Contract (Rs Cr)	Stipulated Period of Completion	Value of works[5] remaining to be completed (Rs Cr)	Anticipated date of completion
1	2	3	4	5	6	7	8

(B) Works for which bids already submitted:

1.5 Availability of key items of Contractor's Equipment essential for carrying out the Works [Ref. Clause 4.5(B)(a)]. The Bidder should list all the information requested below. Refer also to Sub Clause 4.3 (d) of Instructions to Bidders.

Item of Equipment	Requirement		Availability proposals			Remarks (from whom to be purchased)
	No.	Capacity	Owned/Leased to be procured	Nos./Capacity	Age / Condition	

1.6 Qualifications and experience of key personnel required for administration and execution of the Contract [Ref. Clause 4.5(B)(b)]. Attach biographical data. Refer also to Sub Clause 4.3(e) of instructions to Bidders and Sub Clause 9.1 of the Conditions of Contract.

Position	Name	Qualification	Year of Experience (General)	Years of experience in the proposed position
Project Manager				
Etc.				

1.7 Proposed sub-contracts and firms involved. [Refer ITB Clause 4.3 (k)]

Sanctions of the works	Value of Sub-contract	Sub-contractor (Name & Address)	Experience in similar work

Attach copies of certificates on possession of valid license for executing water supply / sanitary work / building electrification works [Reference Clause 4.5(d) & Clause 4.5(e)]

1.8 Financial report for the last five years: balance sheets, profit and loss statements, auditors' reports (in case of companies/corporation), etc. List them below and attach copies.

1.9 Evidence of access to financial resources to meet the qualification requirements: cash in hand, lines of credit, etc. List them below and attach copies of support documents.

1.10 Name, address, and telephone, telex, and fax numbers of the Bidders' bankers who may provide references if contacted by the Employer.

1.11 Information on litigation history in which the Bidder is involved.

Other Party(ies)	Employer	Cause of Dispute	Amount involved	Remarks showing Present status

1.12 Statement of compliance under the requirements of Sub Clause 3.2 of the instructions to Bidders.(name of consultant engaged for the project preparation is M/s **CM Engineering & Solution,Gurgaon**.

1.13 Proposed work method and schedule. The Bidder should attach descriptions, drawings and charts as necessary to comply with the requirements of the Bidding documents. [Refer ITB Clause 4.1 and 4.3 (l)].

1.14 Programme *(to be attached separately by the bidder)*

1.15 Quality Assurance Programme *(to be attached separately by the bidder)*

2. Deleted

3. Additional Requirements

3.1 Bidders should provide any additional information required to fulfill the requirements of Clause 4 of the Instructions to the Bidders, if applicable.

(i) Affidavit

(ii) Undertaking

(iii) Update of original pre-qualification application

(iv) Copy of original pre-qualification application

(v) Copy of pre-qualification letter

SAMPLE FORMAT FOR EVIDENCE OF ACCESS TO OR AVAILABILITY OF CREDIT FACILITIES

(CLAUSE 4.2 (i) OF ITB)

BANK CERTIFICATE

This is to certify that M/s. ……..…… is a reputed company with a good financial standing.

If the contract for the work, namely ……..…is awarded to the above firm, we shall be able to provide overdraft/credit facilities to the extent of Rs. …….. to meet their working capital requirements for executing the above contract during the contract period.

_____

(Signature)
Name of Bank
Senior Bank Manager
Address of the Bank

AFFIDAVIT

1. I, the undersigned, do hereby certify that all the statements made in the required attachments are true and correct.

2. The undersigned also hereby certifies that neither our firms M/s_____ have abandoned any work on MORTH/NHAI/NHIDCL/State PWDs nor any contract awarded to us for such works have been rescinded, during last five years prior to the date of this bid.

3. The undersigned hereby authorize(s) and requires(s) any bank, person, firm or corporation to furnish pertinent information deemed necessary and requested by the Department to verify this statement or regarding my (our) competence and general reputation.

4. The undersigned understand and agrees that further qualifying information may be requested and agrees to furnish any such information at the request of the Department/Project implementing agency.

(Signed by an Authorised Officer of the Firm)

_____

Title of Officer

_____

Name of Firm

_____

Date

UNDERTAKING

I, the undersigned do hereby undertake that our firm M/s_____ would invest a minimum cash up to 25 % of the value of the work during implementation of the Contract.

(Signed by an Authorised Officer of the Firm)

_____
Title of Officer

_____
Name of Firm

_____
Date

SECTION-3: CONDITIONS OF CONTRACT

CONDITIONS OF CONTRACT
A. GENERAL

1. Definitions

1.1 Terms which are defined in the Contract Data are not also defined in the Conditions of Contract but keep their defined meanings. Capital initials are used to identify defined terms.

The Adjudicator (Synonymous with **Dispute Review Expert**) is the person appointed jointly by the Employer and the Contractor to resolve disputes in the first instance, as provided for in Clauses 24 and 25. The name of the Adjudicator is defined in the Contract Data.

Bill of Quantities means the priced and completed Bill of Quantities forming part of the Bid.

Compensation Events are those defined in Clause 44 hereunder.

The **Completion Date** is the date of completion of the Works as certified by the Engineer in accordance with Sub Clause 55.1.

The **Contract** is the contract between the Employer and the Contractor to execute, complete and maintain the Works till the completion of Defects Liability Period. It consists of the documents listed in Clause 2.3 below.

The **Contract Data** defines the documents and other information which comprise the Contract.

The **Contractor** is a person or corporate body whose Bid to carry out the Works has been accepted by the Employer.

The **Contractor's Bid** is the completed Bidding document submitted by the Contractor to the Employer and includes Technical and Financial bids.

The **Contract Price** is the price stated in the Letter of Acceptance and thereafter as adjusted in accordance with the provisions of the Contract.

Days are calendar days; **months** are calendar months.

A **Defect** is any part of the Works not completed in accordance with the Contract.

The **Defects Liability Period** is the period named in the Contract Data and calculated from the Completion Date.

The **Employer** is the party who will employ the Contractor to carry out the Works.

he **Engineer** is the person named in the Contract Data (or any other competent person appointed and notified to the contractor to act in replacement of the Engineer) who is responsible for supervising the Contractor, administering the Contract, certifying payments due to the Contractor, issuing and valuing Variations to the Contract, awarding extensions of time, and valuing the Compensation Events.

Equipment is the Contractor's machinery and vehicles brought temporarily to the Site to construct the Works.

The **Initial Contract Price** is the Contract Price listed in the Employer's Letter of Acceptance.

The **Intended Completion Date** is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is specified in the Contract Data. The Intended Completion Date may be revised only by the Engineer by issuing an extension of time.

Materials are all supplies, including consumables, used by the contractor for incorporation in the Works.

Plant is any integral part of the Works which is to have a mechanical, electrical, electronic or chemical or biological function.

The **Site** is the area defined as such in the Contract Data.

Site Investigation Reports are those which were included in the Bidding documents and are factual interpretative reports about the surface and sub-surface conditions at the site.

Specification means the Specification of the Works included in the Contract and any modification or addition made or approved by the Engineer.

The **Start Date** is given in the Contract Data. It is the date when the Contractor shall commence execution of the works. It does not necessarily coincide with any of the Site Possession Dates.

A **Subcontractor** is a person or corporate body who has a Contract with the Contractor to carry out a part of the work in the Contract which includes work on the Site.

Temporary Works are works designed, constructed, installed, and removed by the Contractor which are needed for construction or installation of the Works.

A **Variation** is an instruction given by the Engineer which varies the Works.

The **Works** are what the Contract requires the Contractor to construct, install, and turn over to the Employer, as defined in the Contract Data.

2. Interpretation

2.1 In interpreting these Conditions of Contract, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Engineer will provide instructions clarifying queries about the Conditions of Contract.

2.2 If sectional completion is specified in the Contract Data, references in the Conditions of Contract to the Works, the Completion Date, and the Intended Completion Date apply to any Section of the Works (other than references to the Completion Date and Intended Completion date for the whole of the Works).

2.3 The documents forming the Contract shall be interpreted in the following order of priority:

(1) Agreement

(2) Letter of Acceptance, notice to proceed with the works

(3) Contractor's Bid

(4) Contract Data

(5) Conditions of Contract including Special Conditions of Contract

(6) Specifications

(7) Drawings

(8) Bill of quantities and

(9) any other document listed in the Contract Data as forming part of the Contract.

3. Language and Law

3.1 The language of the Contract and the law governing the Contract are stated in the Contract Data.

4. Engineer's Decisions

4.1 Except where otherwise specifically stated, the Engineer will decide contractual matters between the Employer and the Contractor in the role representing the Employer.

5. Delegation

5.1 The Engineer may delegate any of his duties and responsibilities to other people except to the Adjudicator after notifying the Contractor and may cancel any delegation after notifying the Contractor.

6. Communications

6.1 Communications between parties which are referred to in the conditions are effective only when in writing. A notice shall be effective only when it is delivered (in terms of Indian Contract Act).

7. Sub-contracting

7.1 The Contractor may sub-contract any portion of work, upto a limit specified in Contract in contract data with the approval of the Engineer but may not assign the Contract without the approval of the Employer in writing. Sub-contracting does not alter the Contractor's obligations.

8. Other Contractors

8.1 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Employer between the dates given in the Schedule of Other Contractors. The Contractor shall as referred to in the Contract Data, also provide facilities and services for them as described in the Schedule. The employer may modify the schedule of other contractors and shall notify the contractor of any such modification.

9. Personnel

9.1 The Contractor shall employ the key personnel named in the Schedule of Key Personnel as referred to in the Contract Data to carry out the functions stated in the Schedule or other personnel approved by the Engineer. The Engineer will approve any proposed replacement of key personnel only if their qualifications, abilities, and relevant experience are substantially equal to or better than those of the personnel listed in the Schedule.

9.2 If the Engineer asks the Contractor to remove a person who is a member of the Contractor's staff or his work force stating the reasons the Contractor shall ensure

that the person leaves the Site within seven days and has no further connection with the work in the Contract.

10. Employer's and Contractor's Risks

10.1 The Employer carries the risks which this Contract states are Employer's risks, and the Contractor carries the risks which this Contract states are Contractor's risks.

11. Employer's Risks

11.1 The Employer is responsible for the excepted risks which are (a) in so far as they directly affect the execution of the Works in India, the risks of war, hostilities, invasion, act of foreign enemies, rebellion, revolution, insurrection or military or usurped power, civil war, riot commotion or disorder (unless restricted to the Contractor's employees), and contamination from any nuclear fuel or nuclear waste or radioactive toxic explosive, or (b) a cause due solely to the design of the Works, other than the Contractor's design.

12. Contractor's Risks

12.1 All risks of loss of or damage to physical property and of personal injury and death which arise during and in consequence of the performance of the Contract other than the excepted risks are the responsibility of the Contractor.

13. Insurance

13.1 The Contractor shall provide, in the joint names of the Employer and the Contractor, insurance cover from the Start Date to the end of the Defects Liability Period, in the amounts and deductibles stated in the Contract Data for the following events which are due to the Contractor's risks:

(a) loss of or damage to the Works, Plant and Materials;

(b) loss of or damage to Equipment;

(c) loss of or damage of property (except the Works, Plant, Materials and Equipment) in connection with the Contract; and

(d) Personal injury or death.

13.2 Policies and certificates for insurance shall be delivered by the Contractor to the Engineer for the Engineer's approval before the Start Date. All such insurance shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.

13.3 If the Contractor does not provide any of the policies and certificates required, the Employer may effect the insurance which the Contractor should have provided and recover the premiums the Employer has paid from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due.

13.4 Alterations to the terms of insurance shall not be made without the approval of the Engineer.

13.5 Both parties shall comply with any conditions of the insurance policies.

14. Site Investigation Reports

14.1 The Contractor, in preparing the Bid, shall rely on any site Investigation Reports referred to in the Contract Data, supplemented by any information available to the Bidder.

15. Queries about the Contract Data

15.1 The Engineer will clarify queries on the Contract Data.

16. Contractor to Construct the Works

16.1 The Contractor shall construct and install the Works in accordance with the Specification and Drawings.

17. The Works to Be Completed by the Intended Completion Date

17.1 The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the program submitted by the Contractor, as updated with the approval of the Engineer, and complete them by the Intended Completion Date.

18. Approval by the Engineer

18.1 The Contractor shall submit Specifications and Drawings showing the proposed Temporary Works to the Engineer, who is to approve them if they comply with the Specifications and Drawings.

18.2 The Contractor shall be responsible for design of Temporary Works.

18.3 The Engineer's approval shall not alter the Contractor's responsibility for design of the Temporary Works.

18.4 The Contractor shall obtain approval of third parties to the design of the Temporary Works where required.

18.5 All Drawings prepared by the Contractor for the execution of the temporary or permanent Works, are subject to prior approval by the Engineer before their use.

19. Safety

19.1 The Contractor shall be responsible for the safety of all activities on the Site.

20. Discoveries

20.1 Anything of historical or other interest or of significant value unexpectedly discovered on the Site is the property of the Employer. The Contractor is to notify the Engineer of such discoveries and carry out the Engineer's instructions for dealing with them.

21. Possession of the Site

20.1 The Employer shall give possession of all parts of the Site to the Contractor. If possession of a part is not given by the date stated in the Contract Data the Employer is deemed to have delayed the start of the relevant activities and this will be Compensation Event.

22. Access to the Site

22.1 The Contractor shall allow the Engineer and any person authorized by the Engineer access to the Site, to any place where work in connection with the Contract is being carried out or is intended to be carried out and to any place where materials or plant are being manufactured / fabricated / assembled for the works.

23. Instructions

23.1 The Contractor shall carry out all instructions of the Engineer pertaining to works which comply with the applicable laws where the Site is located.

23.2 The Contractor shall permit the bank 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 Employer, if so required by the Employer.

24. Disputes

24.1 If the Contractor believes that a decision taken by the Engineer was either outside the authority given to the Engineer by the Contract or that the decision was wrongly taken, the decision shall be referred to the Dispute Review Expert within 14 days of the notification of the Engineer's decision.

25. Procedure for Disputes

25.1 The Dispute Review Expert (Board) shall give a decision in writing within 28 days of receipt of a notification of a dispute.

25.2 The Dispute Review Expert shall be paid daily at the rate specified in the Contract Data together with reimbursable expenses of the types specified in the Contract Data and the cost shall be divided equally between the Employer and the Contractor, whatever decision is reached by the Dispute Review Expert. Either party may refer a decision of the Adjudicator to an Arbitrator within 28 days of the Dispute Review Expert's written decision. If neither party refers the dispute to arbitration within the above 28 days, the Dispute Review Expert's decision will be final and binding.

25.3 The arbitration shall be conducted in accordance with the arbitration procedure stated in the Special Conditions of Contract.

26. Replacement of Dispute Review Expert

23.1 Should the Dispute Review Expert resign or die, or should the Employer and the Contractor agree that the Dispute Review Expert is not fulfilling his functions in accordance with the provisions of the Contract; a new Dispute Review Expert will be jointly appointed by the Employer and the Contractor. In case of disagreement between the Employer and the Contractor, within 30 days, the Dispute Review Expert shall be designated by the Appointing Authority designated in the Contract Data at the request of either party, within 14 days of receipt of such request.

B. TIME CONTROL

27. Program

27.1 Within the time stated in the Contract Data the Contractor shall submit to the Engineer for approval a Program showing the general methods, arrangements, order, and timing for all the activities in the Works along with monthly cash flow forecast.

27.2 An update of the Program shall be a program showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work including any changes to the sequence of the activities.

27.3 The Contractor shall submit to the Engineer, for approval, an updated Program at intervals no longer than the period stated in the Contract Data. If the Contractor does not submit an updated Program within this period, the Engineer may withhold the amount stated in the Contract Data from the next payment certificate and continue to withhold this amount until the next payment after the date on which the overdue Program has been submitted.

27.4 The Engineer's approval of the Program shall not alter the Contractor's obligations. The Contractor may revise the Program and submit it to the Engineer again at any time. A revised Program is to show the effect of Variations and Compensation Events.

28. Extension of the Intended Completion Date

28.1 e Engineer shall extend the Intended Completion Date if a Compensation Event occurs or a Variation is issued which makes it impossible for Completion to be achieved by the Intended Completion Date without the Contractor taking steps to accelerate the remaining work and which would cause the Contractor to incur additional cost.

28.2 The Engineer shall decide whether and by how much to extend the Intended Completion Date within 35 days of the Contractor asking the Engineer for a decision upon the effect of a Compensation Event or Variation and submitting full supporting information. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay by this failure shall not be considered in assessing the new Intended Completion Date.

28.3 The Engineer shall within 14 days of receiving full justification from the contractor for extension of Intended Completion Date refer to the Employer his decision. The Employer shall in not more than 21 days communicate to the Engineer the acceptance or otherwise of the Engineer's decision. If the Employer fails to give his acceptance, the Engineer shall not grant the extension and the contractor may refer the matter to the Dispute Review Expert under Clause 24.1.

29. Deleted

30. Delays Ordered by the Engineer

30.1 The Engineer may instruct the Contractor to delay the start or progress of any activity within the Works.

31. Management Meetings

31.1 Either the Engineer or the Contractor may require the other to attend a management meeting. The business of a management meeting shall be to review the plans for remaining work and to deal with matters raised in accordance with the early warning procedure.

31.2 The Engineer shall record the business of management meetings and is to provide copies of his record to those attending the meeting and to the Employer. The responsibility of the parties for actions to be taken is to be decided by the Engineer either at the management meeting or after the management meeting and stated in writing to all who attended the meeting.

32. Early Warning

32.1 The Contractor is to warn the Engineer at the earliest opportunity of specific likely future events or circumstances that may adversely affect the quality of the work, increase the Contract Price or delay the execution of works. The Engineer may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the Contract Price and Completion Date. The estimate is to be provided by the Contractor as soon as reasonably possible.

32.2 The Contractor shall cooperate with the Engineer in making and considering proposals for how the effect of such an event or circumstance can be avoided or

reduced by anyone involved in the work and in carrying out any resulting instruction of the Engineer.

C. QUALITY CONTROL

33. Identifying Defects

33.1 The Engineer shall check the Contractor's work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Engineer may instruct the Contractor to search for a Defect and to uncover and test any work that the Engineer considers may have a Defect

34. Tests

34.1 If the Engineer instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect the test shall be a Compensation Event.

35. Correction of Defects

35.1 The Engineer shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion and is defined in the Contract Data. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.

35.2 Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Engineer's notice.

36. Uncorrected Defects

36.1 If the Contractor has not corrected a Defect within the time specified in the Engineer's notice, the Engineer will assess the cost of having the Defect corrected, and the Contractor will pay this amount.

D. COST CONTROL

37. Bill of Quantities

37.1 The Bill of Quantities shall contain items for the construction, installation, testing, and commissioning work to be done by the Contractor.

37.2 The Bill of Quantities is used to calculate the Contract Price. The Contractor is paid for the quantity of the work done at the rate in the Bill of Quantities for each item.

38. Changes in the Quantities

38.1 If the final quantity of the work done differs from the quantity in the Bill of Quantities for the particular item by more than 25 percent provided the change exceeds 1% of initial Contract Price, the Engineer shall adjust the rate to allow for the change, duly considering,

(a) justification for rate adjustment as furnished by the contractor,

(b) economies resulting from increase in quantities by way of reduced plant, equipment, and overhead costs,

(c) entitlement of the contractor to compensation events where such events are caused by any additional work

38.2 The Engineer shall not adjust rates from changes in quantities if thereby the Initial Contract Price is exceeded by more than 15 percent, except with the Prior approval of the Employer.

38.3 If requested by the Engineer, the Contractor shall provide the Engineer with a detailed cost breakdown of any rate in the Bill of Quantities.

39. Variations

39.1 All Variations shall be included in updated Programs produced by the Contractor.

40. Payments for Variations

40.1 The Contractor shall provide the Engineer with a quotation (with breakdown of unit rates) for carrying out the Variation when requested to do so by the Engineer. The Engineer shall assess the quotation, which shall be given within seven days of the request or within any longer period stated by the Engineer and before the Variation is ordered.

40.2 If the work in the Variation corresponds with an item description in the Bill of Quantities and if, in the opinion of the Engineer, the quantity of work above the limit stated in Sub Clause 38.1 or the timing of its execution do not cause the cost per unit of quantity to change, the rate in the Bill of Quantities shall be used to calculate the value of the Variation. If the cost per unit of quantity changes, or if the nature or timing of the work in the Variation does not correspond with items in the Bill of Quantities, the quotation by the Contractor shall be in the form of new rates for the relevant items of work.

40.3 If the Contractor's quotation is unreasonable, the Engineer may order the Variation and make a change to the Contract Price which shall be based on Engineer’s own forecast of the effects of the Variation on the Contractor's costs.

40.4 If the Engineer decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no quotation shall be given and the Variation shall be treated as a Compensation Event.

40.5 The Contractor shall not be entitled to additional payment for costs which could have been avoided by giving early warning.

41. Cash flow forecasts

41.1 When the Program is updated, the contractor is to provide the Engineer with an updated cash flow forecast.

42. Payment Certificates

42.1 The Contractor shall submit to the Engineer monthly statements of the estimated value of the work completed less the cumulative amount certified previously.

42.2 The Engineer shall check the Contractor's monthly statement and within 14 days certify the amount to be paid to the Contractor after taking into account any credit or debit for the month in question in respect of materials for the works in the relevant amounts and under conditions set forth in sub-clause 51(3) of the Contract Data (Secured Advance).

42.3 The value of work executed shall be determined by the Engineer.

42.4 The value of work executed shall comprise the value of the quantities of the items in the Bill of Quantities completed.

42.5 The value of work executed shall include the valuation of Variations and Compensation Events.

42.6 The Engineer may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.

43. Payments

43.1 Payments shall be adjusted for deductions for advance payments, retention, other recoveries in terms of the contract and taxes, at source, as applicable under the law. The Employer shall pay the Contractor the amounts certified by the Engineer within 28 days of the date of each certificate. If the Employer makes a late payment, the Contractor shall be paid interest on the late payment in the next payment. Interest shall be calculated from the date by which the payment should have been made upto the date when the late payment is made at 12% per annum.

43.2 If an amount certified is increased in a later certificate as a result of an award by the Adjudicator or an Arbitrator, the Contractor shall be paid interest upon the delayed payment as set out in this clause. Interest shall be calculated from the date upon which the increased amount would have been certified in the absence of dispute.

43.3 Items of the Works for which no rate or price has been entered in will not be paid for by the Employer and shall be deemed covered by other rates and prices in the Contract.

44. Compensation Events

44.1 The following are Compensation Events unless they are caused by the Contractor:

(a) The Employer does not give access to a part of the Site by the Site Possession Date stated in the Contract Data.

(b) The Employer modifies the schedule of other contractors in a way which affects the work of the contractor under the contract.

(c) The Engineer orders a delay or does not issue drawings, specifications or instructions required for execution of works on time.

(d) The Engineer instructs the Contractor to uncover or to carry out additional tests upon work which is then found to have no Defects.

(e) The Engineer does not approve for a subcontract to be let, within 15 days.

(f) Ground conditions are substantially more adverse than could reasonably have been assumed before issuance of Letter of Acceptance from the information issued to Bidders (including the Site Investigation Reports), from information available publicly and from a visual inspection of the Site.

(g) The Engineer gives an instruction for dealing with an unforeseen condition, caused by the Employer, or additional work required for safety or other reasons.

(h) Other contractors, public authorities, utilities or the Employer does not work within the dates and other constraints stated in the Contract, and they cause delay or extra cost to the Contractor.

(i) The advance payment is delayed, beyond 28 days after receipt of application and Bank Guarantee.

(j) The effect on the Contractor of any of the Employer's Risks.

(k) The Engineer unreasonably delays issuing a Certificate of Completion.

(l) Other Compensation Events listed in the Contract Data or mentioned in the Contract.

44.2 If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date is extended. The Engineer shall decide whether and by how much the Contract Price shall be increased and whether and by how much the Intended Completion Date shall be extended.

44.3 As soon as information demonstrating the effect of each Compensation Event upon the Contractor's forecast cost has been provided by the Contractor, it is to be assessed by the Engineer and the Contract Price shall be adjusted accordingly. If the Contractor's forecast is deemed unreasonable, the Engineer shall adjust the Contract Price based on Engineer's own forecast. The Engineer will assume that the Contractor will react competently and promptly to the event.

44.4 The Contractor shall not be entitled to compensation to the extent that the Employer's interests are adversely affected by the Contractor not having given early warning or not having cooperated with the Engineer.

45. Tax

45.1 The rates quoted by the Contractor shall be deemed to be inclusive of the sales and other taxes that the Contractor will have to pay for the performance of this Contract. The Employer will perform such duties in regard to the deduction of such taxes at source as per applicable law.

46. Currencies

46.1 All payments shall be made in Indian Rupees.

47. Price Adjustment

47.1 Contract Price shall be adjusted for increase or decrease in rates and price of labour, materials, fuels and lubricants in accordance with the following principles and procedures and as per formula given in the contract Data:

(a) The price adjustment shall apply for the work done from the start date given in the contract data upto end of the initial intended completion date or extensions granted by the Engineer and shall not apply to the work carried out beyond the stipulated time for reasons attributable to the contractor.

(b) The price adjustment shall be determined during each month from the formula given in the contract Data.

(c) Following expressions and meanings are assigned to the work done during each month:

R =Total value of work done during the month. It would include the amount of secured advance granted, if any, during the month, less the amount of secured advance recovered, if any during the month. It will exclude value for works executed under variations for which price adjustment will be worked separately base on the terms mutually agreed.

47.2 To the extent that full compensation for any rise or fall in costs to the contractor is not covered by the provisions of this or other clauses in the contract, the unit rates and prices included in the contract shall be deemed to include amounts to cover the contingency of such other rise or fall in costs.

48. Retention

48.1 The Employer shall retain from each payment due to the Contractor the proportion stated in the Contract Data until Completion of the whole of the Works.

48.2 On Completion of the whole of the Works half the total amount retained is repaid to the Contractor and half when the Defects Liability Period has passed and the Engineer has certified that all Defects notified by the Engineer to the Contractor before the end of this period have been corrected.

48.3 On completion of the whole works, the contractor may substitute retention money with an "on demand" Bank guarantee.

49. Liquidated Damages

49.1 The Contractor shall pay liquidated damages to the Employer at the rate per day stated in the Contract Data for each day that the Completion Date is later than the Intended Completion Date (for the whole of the works or the milestone as stated in the contract data). The total amount of liquidated damages shall not exceed the amount defined in the Contract Data. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages does not affect the Contractor's liabilities.

49.2 If the Intended Completion Date is extended after liquidated damages have been paid, the Engineer shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate. The Contractor shall be paid interest on the over payment calculated from the date of payment to the date of repayment at the rates specified in Sub Clause 43.1.

49.3 If the contractor fails to comply with the time for completion as stipulated in the tender, then the contractor shall pay to the employer the relevant sum stated in the Contract Data as Liquidated damages for such default and not as penalty for everyday or part of day which shall elapse between relevant time for completion and the data stated in the taking over certificate of the whole of the works on the relevant section, subject to the limit stated in the contract data.

The employer may, without prejudice to any other method of recovery deduct the amount of such damages from any monies due or to become due to the contractor. The payment or deduction of such damages shall not relieve the contractor from his obligation to complete the works on from any other of his obligations and liabilities under the contract.

49.4 If, before the Time for Completion of the whole of the Works or, if applicable, any Section, a Taking – Over Certificate has been issued for any part of the Works or of a Section, the liquidated damages for delay in completion of reminder of the Works or of that Section shall, for any period of delay after the date stated in such Taking-Over Certificate, and in the absence of alternative provisions in the Contract, be reduced in the proportion which the value of the part so certified bears to the value of the whole of the Works or Section, as applicable. The provisions of this Sub-Clause shall only apply to the rate of liquidated damages and shall not affect the limit thereof.

50. Bonus

50.1 If the contractor achieves completion of the whole of the works prior to the Intended Completion Date prescribed in Contract Data The Employer shall pay to the contractor a sum stated in Contract Data as bonus for every completed month which shall elapse between the date of completion of all items of works as stipulated in the contract, including variations ordered by the Engineer and the time prescribed in Clause 17.

50.2 For the purpose of calculating bonus payments, the time given in the Bid for completion of the whole of the works is fixed and unless otherwise agreed, no adjustments of the time by reason of granting an extension of time pursuant to Clause 28 or any other clause of these conditions will be allowed. Any period falling short of a complete month shall be ignored for the purpose of computing the period relevant for the payment of bonus.

51. Advance Payment

51.1 The Employer shall make advance payment (not to be paid in less than two installments except in special circumstances for which the reasons to be recorded in writing) to the Contractor of the amounts stated in the Contract Data by the date stated in the Contract Data, against provision by the Contractor of an Unconditional Bank Guarantee in a form and by a bank acceptable to the Employer in amounts and currencies equal to be at least 110% of the advance payment. The guarantee shall remain effective until the advance payment has been repaid, but the amount of the guarantee shall be progressively reduced by the amounts repaid by the Contractor. The mobilisation advance would be deemed as interest bearing advance at an interest rate of 10% to be compounded quarterly.

51.2 The Contractor is to use the advance payment only to pay for Equipment, Plant and Mobilization expenses required specifically for execution of the Works. The Contractor shall demonstrate that advance payment has been used in this way by supplying copies of invoices or other documents to the Engineer.

51.3 The advance payment shall be repaid by deducting proportionate amounts from payments otherwise due to the Contractor, following the schedule of completed percentages of the Works on a payment basis. No account shall be taken of the advance payment or its repayment in assessing valuations of work done, Variations, price adjustments, Compensation Events, or Liquidated Damages.

51.4 Secured Advance:

The Engineer shall make advance payment in respect of materials intended for but not yet incorporated in the Works in accordance with conditions stipulated in the Contract Data.

52. Securities

52.1 The Performance Security (including additional security for unbalanced bids) shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in an amount and form and by a bank or surety acceptable to the Employer, and denominated in Indian Rupees. The Performance Security shall be valid until a date 28 days from the date of expiry of Defects Liability Period and the additional security for unbalanced bids shall be valid until a date 28 days from the date of issue of the certificate of completion.

53. Deleted

54. Cost of Repairs

54.1 Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the Defects Correction periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions.

E. FINISHING THE CONTRACT

55. Completion

55.1 The Contractor shall request the Engineer to issue a Certificate of Completion of the Works and the Engineer will do so upon deciding that the Work is completed.

56. Taking Over

56.1 The Employer shall take over the Site and the Works within seven days of the Engineer issuing a certificate of Completion.

57. Final Account

57.1 The Contractor shall supply to the Engineer a detailed account of the total amount that the Contractor considers payable under the Contract before the end of the Defects Liability Period. The Engineer shall issue a Defect Liability Certificate and certify any final payment that is due to the Contractor within 56 days of receiving the Contractor's account if it is correct and complete. If it is not, the Engineer shall issue within 56 days a schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the Engineer shall decide on the amount payable to the Contractor and issue a payment certificate, within 56 days of receiving the Contractor’s revised account.

58. Operating and Maintenance Manuals

58.1 If “as built” Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates stated in the Contract Data.

58.2 If the Contractor does not supply the Drawings and/or manuals by the dates stated in the Contract Data, or they do not receive the Engineer’s approval, the Engineer shall withhold the amount stated in the Contract Data from payments due to the Contractor.

59. Termination

59.1 The Employer or the Contractor may terminate the Contract if the other party causes a fundamental breach of the Contract.

59.2 Fundamental breaches of Contract include, but shall not be limited to the following:

(a) the Contractor stops work for 28 days when no stoppage of work is shown on the current Program and the stoppage has not been authorized by the Engineer;

(b) the Engineer instructs the Contractor to delay the progress of the Works and the instruction is not withdrawn within 28 days;

(c) the Employer or the Contractor is made bankrupt or goes into liquidation other than for a reconstruction or amalgamation;

(d) a payment certified by the Engineer is not paid by the Employer to the Contractor within 56 days of the date of the Engineer's certificate;

(e) the Engineer gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Engineer;

(f) the Contractor does not maintain a security which is required;

(g) the Contractor has delayed the completion of works by the number of days for which the maximum amount of liquidated damages can be paid as defined in the Contract data; and

(h) if the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in the executing the Contract.

For the purpose of this paragraph : "corrupt practice" means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in contract execution. "Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Borrower, and includes collusive practice among Bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the Borrower of the benefits of free and open competition."

59.3 When either party to the Contract gives notice of a breach of contract to the Engineer for a cause other than those listed under Sub Clause 59.2 above, the Engineer shall decide whether the breach is fundamental or not.

59.4 Notwithstanding the above, the Employer may terminate the Contract for convenience.

59.5 If the Contract is terminated the Contractor shall stop work immediately, make the Site safe and secure and leave the Site as soon as reasonably possible.

60. Payment upon Termination

60.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Engineer shall issue a certificate for the value of the work done less advance payments received up to the date of the issue of the certificate, less other recoveries due in terms of the contract, less taxes due to be deducted at source as per applicable law and less the percentage to apply to the work not completed as indicated in the Contract Data. Additional Liquidated Damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor the difference shall be a debt payable to the Employer.

60.2 If the Contract is terminated at the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Engineer shall issue a certificate for the value of the work done, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting and securing the Works and less advance payments received up to the date of the certificate, less other recoveries due in terms of the contract and less taxes due to be deducted at source as per applicable law.

61. Property

61.1 All materials on the Site, Plant, Equipment, Temporary Works and Works are deemed to be the property of the Employer, if the Contract is terminated because of a Contractor's default.

62. Release from Performance

62.1 If the Contract is frustrated by the outbreak of war or by any other event entirely outside the control of either the Employer or the Contractor the Engineer shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all work carried out before receiving it and for any work carried out afterwards to which commitment was made.

F. SPECIAL CONDITIONS OF CONTRACT

1. LABOUR:

The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all staff and labour, local or other, and for their payment, housing, feeding and transport.

The Contractor shall, if required by the Engineer, deliver to the Engineer a return in detail, in such form and at such intervals as the Engineer may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor on the Site and such other information as the Engineer may require.

2. COMPLIANCE WITH LABOUR REGULATIONS:

During continuance of the contract, the Contractor and his sub contractors shall abide at all times by all existing labour enactments and rules made thereunder, regulations, notifications and bye laws of the State or Central Government or local authority and any other labour law (including rules), regulations, bye laws that may be passed or notification that may be issued under any labour law in future either by the State or the Central Government or the local authority. Salient features of some of the major labour laws that are applicable to construction industry are given below. The Contractor shall keep the Employer indemnified in case any action is taken against the Employer by the competent authority on account of contravention of any of the provisions of any Act or rules made there under, regulations or notifications including amendments. If the Employer is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for non-observance of the provisions stipulated in the notifications/bye laws/Acts/Rules/regulations including amendments, if any, on the part of the Contractor, the Engineer/Employer shall have the right to deduct any money due to the Contractor including his amount of performance security. The Employer/Engineer shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Employer.

The employees of the Contractor and the Sub-Contractor in no case shall be treated as the employees of the Employer at any point of time.

SALIENT FEATURES OF SOME MAJOR LABOUR LAWS APPLICABLE TO ESTABLISHMENTS ENGAGED IN BUILDING AND OTHER CONSTRUCTION WORK.

(a) **Workmen Compensation Act 1923**:- The Act provides for compensation in case of injury by accident arising out of and during the course of employment.

(b) **Payment of Gratuity Act 1972**:- Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years service or more on death the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees.

(c) **Employees P.F. and Miscellaneous Provision Act 1952**: The Act Provides for monthly contributions by the employer plus workers @ 10% or 8.33%. The benefits payable under the Act are:

(i) Pension or family pension on retirement or death, as the case may be.

(ii) Deposit linked insurance on the death in harness of the worker.

(iii) payment of P.F. accumulation on retirement/death etc.

(d) **Maternity Benefit Act 1951**:- The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.

(e) **Contract Labour (Regulation & Abolition) Act 1970**:- The Act provides for certain welfare measures to be provided by the Contractor to contract labour and in case the Contractor fails to provide, the same are required to be provided, by the Principal Employer by Law. The Principal Employer is required to take Certificate of Registration and the Contractor is required to take license from the designated Officer. The Act is applicable to the establishments or Contractor of Principal Employer if they employ 20 or more contract labour.

(f) **Minimum Wages Act 1948**:- The Employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act if the employment is a scheduled employment. Construction of Buildings, Roads, and Runways are scheduled employments.

(g) **Payment of Wages Act 1936**:- It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.

(h) **Equal Remuneration Act 1979**:- The Act provides for payment of equal wages for work of equal nature to Male and Female workers and for not making discrimination against Female employees in the matters of transfers, training and promotions etc.

(i) **Payment of Bonus Act 1965**:- The Act is applicable to all establishments employing 20 or more employees. The Act provides for payments of annual bonus subject to a minimum of 8.33% of wages and maximum of 20% of wages to employees drawing Rs.3500/-per month or less. The bonus to be paid to employees getting Rs.2500/- per month or above upto Rs.3500/- per month shall be worked out by taking wages as Rs.2500/-per month only. The Act does not apply to certain establishments. The newly set-up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20 to 10 for the purpose of applicability of this Act.

(j) **Industrial Disputes Act 1947**:- The Act lays down the machinery and procedure for resolution of Industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment.

(k) **Industrial Employment (Standing Orders) Act 1946**:- It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the States and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the Employer on matters provided in the Act and get the same certified by the designated Authority.

(l) **Trade Unions Act 1926**:- The Act lays down the procedure for registration of trade unions of workmen and employers. The Trade Unions registered under the Act have been given certain immunities from civil and criminal liabilities.

(m) **Child Labour (Prohibition & Regulation) Act 1986**:- The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of Child Labour is prohibited in Building and Construction Industry.

(n) **Inter-State Migrant workmen's (Regulation of Employment & Conditions of Service) Act 1979**:- The Act is applicable to an establishment which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The Inter-State migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, travelling expenses from home upto the establishment and back, etc.

(o) **The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act 1996 and the Cess Act of 1996** :- All the establishments who carry on any building or other construction work and employs 10 or more workers are covered under this Act. All such establishments are required to pay cess at the rate not exceeding 2% of the cost of construction as may be modified by the Government. The Employer of the establishment is required to provide safety measures at the Building or construction work and other welfare measures, such as Canteens, First-Aid facilities, Ambulance, Housing accommodations for workers near the work place etc. The Employer to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government.

(p) **Factories Act 1948** :- The Act lays down the procedure for approval at plans before setting up a factory, health and safety provisions, welfare provisions, working hours, annual earned leave and rendering information regarding accidents or dangerous occurrences to designated authorities. It is applicable to premises employing 10 persons or more with aid of power or 20 or more persons without the aid of power engaged in manufacturing process.

3. ARBITRATION (GCC Clause 25.3)

The procedure for arbitration will be as follows:

(a) In case of Dispute or difference arising between the Employer and a domestic contractor relating to any matter arising out of or connected with this agreement, such disputes or difference shall be settled in accordance with the Arbitration and Conciliation Act, 1996. The parties shall make efforts to agree on a sole arbitrator and only if such an attempt does not succeed and the Arbitral Tribunal consisting of 3 arbitrators one each to be appointed by the Employer and the Contractor and the third Arbitrator shall be chosen by the two Arbitrators so appointed by the Parties to act as Presiding Arbitrator shall be considered. In case of failure of the two arbitrators appointed by the parties to reach upon a consensus within a period of 30 days from the appointment of the arbitrator appointed subsequently, the Presiding Arbitrator shall be appointed by the * Council, Indian Road Congress.

(b) The Arbitral Tribunal shall consist of three Arbitrators one each to be appointed by the Employer and the Contractor. The third Arbitrator shall be chosen by the two Arbitrators so appointed by the Parties, and shall act a presiding arbitrator. In case of failure of the two arbitrators appointed by the parties to reach upon a consensus within a period of 30 days from the appointment of the arbitrator appointed subsequently, the Presiding arbitrator shall be appointed by the * Council, Indian Road Congress.

(c) If one of the parties fails to appoint its arbitrator in pursuance of sub-clause (a) and (b) above within 30 days after receipt of the notice of the appointment of its arbitrator by the other party, then the * Council, Indian Road Congress, shall appoint the arbitrator. A certified copy of the order of the Council, Indian Road Congress, making such an appointment shall be furnished to each of the parties.

(d) Arbitration proceedings shall be held in India, and the language of arbitration proceedings and that of all documents and communications between the parties shall be English.

(e) The decision of the majority of arbitrators shall be final and binding upon both parties. The cost and expenses of Arbitration proceedings will be paid as determined by the arbitral tribunal. However, the expenses incurred by each party in connection with the preparation, presentation, etc. of its proceedings as also the fees and expenses paid to the arbitrator appointed by such party or on its behalf shall be borne by each party itself.

(f) Performance under the contract shall continue during the arbitration proceedings and payments due to the contractor by the owners shall not be withheld, unless they are the subject matter of the arbitration proceedings.

Additional Condition of Contract

Confirmatory boring at all foundation location shall be done by the contractor before start of the work in accordance with the MoRT&H Specification for the Road and Bridge (Works 5th Revision) .This shall be incidental to work and nothing shall be paid on this account to the contactor. If any change in the design in the design is required due to change in the soil parameters as per actual site condition, the contractor shall submit design/working drawings establishing the stability of the structure to suit the conditions for approval.

SECTION-4: CONTRACT DATA

CONTRACT DATA

Clause Reference with respect to section-3

Items marked "N/A" do not apply in this Contract.

1. The employer is — Managing Director ,NHIDCL — [Cl.1.1]

   Name:

   Address: National Highways and Infrastructure Development Corporation Limited
   3rd Floor, PTI Building,
   4, Parliament Street,
   New Delhi – 110001

   Name of the Authorized Representative (will be intimated later)

2. The Engineer is — General Manager (Project) , Branch Office Sikkim

   Name of Authorized Representative: — General Manager (Project) , Branch Office Sikkim

3. The Dispute Review Expert appointed jointly by the Employer and Contractor is: To be Notified later — [Cl.1.1]

   *Name:_____

   *Address:_____

4. The Defects Liability Period is 3 (three) years from the date of completion. — [Cl.1.1&35]

5. The start date shall be 15 days for the date of issue of the notice to proceed with the work. — [Cl.1.1]

6. The Intended Completion Date for the whole of the Works is 24 months after start of work with the following milestones — [Cl.1.1, 17&28]

Milestone dates (including non-working season): — [Cl.2.2 & 49.1]

Physical works to be completed		Period from the date of start
Milestone 1	20% of the contract Price	4 months
Milestone 2	60% of the contract Price	16 months
Milestone 3	100% of the contract Price	24 months

7. The site is located at Km 52/00 to 80/00 on NH-10 — [Cl. 1.1]

8. The name and identification number of the Contract is: — [Cl. 1.1]

9. The works consist of The works consist of "**Special Protection Work on Rehabilitation and restoration of Sinking/Sliding Zone from Km 70+900 to Km 71+100 and Km 71+550 to Km 71+850 with JICA Technical Assistance including widening of Narrow Zone from Km 53+775 to Km 54+100 and from Km 63+045 to Km 63+470 on NH-10 (Rangpo To Ranipool section) in the State of Sikkim**" The works shall, inter alia, include the following, as specified or as directed: [Cl. 1.1]

(A) Road Works

Site clearance; setting-out and layout; widening of existing carriageway and strengthening including camber corrections; rock cutting for approaches, bituminous pavements remodeling/construction of junctions, intersections, laybyes; supplying and placing of drainage channels, flumes, guard posts and guard other related items; construction /extension of cross drainage works, bridges, approaches and other related stones; road markings, road signs and kilometer/hectometer stones; protective works for roads/bridges; all aspects of quality assurance of various components of the works; rectification of the defects in the completed works during the Defects Liability Period; submission of "As-built" drawings and any other related documents; and other item of work as may be required to be carried out for completing the works in accordance with the drawings and provisions of the contract to ensure safety.

(B) Bridge Works

Site clearance; setting-out, provision of foundations, piers abutments and bearings; prestressed/reinforced cement concrete superstructure; wearing coat, hand railings, expansion joints, approach slabs, drainage spouts/down take pipes, arrangement for fixing light posts, water mains, utilities etc. provision of suitably designed protective works; proving wing/return walls; provision of road markings, road signs etc.; all aspects of quality assurance; clearing the site and handing over the works on completion; rectification of the defects during the Defects ts Liability Period; submission of "As built" drawings and any other related documents; and other item of work as may be required to be carried out for completing the works in accordance with the drawing and provisions of the contract to ensure safety.*

(C) Other Items [Cl. 1.1]

Any other items as required to fulfill at contractual obligations as per the Bid documents.

10. The following documents also form part of contract: [Cl. 2.3(9)]

"**Post qualification documents furnished by the bidder as per section 2 and Technical specification (Vol. III)**"

11. The law which applies to the Contract is the law of Union of India [Cl. 3.1]

12. The language of the Contract documents is English [Cl. 3.1]

13. Limit of subcontracting 50% of the Initial Contract Price [Cl. 7.1]

14.	The Schedule of Other Contractors		[Cl. 8]
15.	The Schedule of Key Personnel	As per Annex.-II to Section I	[Cl. 9]
16.	The minimum insurance cover for physical property, injury and death is Rs. 5 lakhs as per occurrence with the number of occurrences limited to four. After each occurrence, contractor will pay additional premium necessary to make insurance valid for four occurrences always.		[Cl. 13]
17.	Site Investigation Report		[Cl. 14]
18.	The Site Possession Dates shall be "**15 days after issue work order."**		[Cl. 21]
19.	Fees and types of reimbursable expenses to be paid to the Dispute Review Expert (To be inserted later)		[Cl. 25]
20.	Appointing Authority for the Dispute Review Expert – Council, Indian Roads Congress, New Delhi		[Cl. 26]
21.	The period for submission of the programme for approval of Engineer shall be 21 days from the issue of Letter of Acceptance.		[Cl. 27.1]
22.	The period between programme updates shall be **60 days.**		[Cl. 27.3]
23.	The amount to be withheld for late submission of an updates programme shall be 10.00(Ten) lakhs.		[Cl. 27.3]
24.	The following events shall also be Compensation Events:		[Cl. 44]

Substantially adverse ground conditions encountered during the course of execution of work not provided for in the bidding documents

(i) Removal of underground utilities detected subsequently
(ii) Removal of unsuitable material like marsh, debris dumps, etc not caused by the contractor
(iii) Artesian conditions
(iv) Seepage, erosion, landslide
(v) River training requiring protection of permanent work
(vi) Presence of historical, archeological or religious structures, monuments interfering with the works
(vii) Restriction of access to ground imposed by civil, judicial, or military authority

25.	The currency of the Contract is Indian Rupees.		[Cl. 46]
26.	The formula(e) for adjustment of prices are: R = Value of work as defined in Clause 47.1 of Conditions of Contract		[Cl. 47]

Adjustment for labour component

(i) Price adjustment for increase or decrease in the cost due to labour shall

be paid in accordance with the following formula.

V_L = 0.85 x P_l/100 x R x (L_i - L_o)/L_o

V_L = increase or decrease in the cost of work during the month under consideration due to changes in rates for local labour.

L_o = the consumer price index for industrial workers for the State on 28 days preceding the date of opening of Bid's as published by Labour Bureau, Ministry of Labour, Government of India.

L_i = The consumer price index for industrial workers for the State for the under consideration as published by Labour Bureau, Ministry of Labour, Government of India.

P_l = Percentage of labour component of the work.

Adjustment for cement component

(ii) Price adjustment for increase or decrease in the cost of cement procured by the contractor shall be paid in accordance with the following formula.

Vc = 0.85 x Pc/100 x R x (Ci - Co)/Co

Vc = increase or decrease in the cost of work during the month under consideration due to changes in rates for cement.

Co = The all India wholesale price index for cement on 28 days preceding the date of opening of Bids as published by the Ministry of Industrial Development, Government of India New Delhi

Ci = The all India average wholesale price index for cement for the month under consideration as published by Ministry of Industrial Development, Government of India, New Delhi

Pc = Percentage of cement component of the work

Adjustment for steel component

(iii) Price adjustment for increase or decrease in the cost of steel procured by the contractor shall be paid in accordance with the following formula.

Vs = 0.85 x Ps/100 x R x (Si - So)/So

Vs = increase or decrease in the cost of work during the month under consideration due to changes in rates for steel

So= The all India wholesale price index for steel (Bars and Rods) on 28 days preceding the date of opening of Bids as published by the Ministry of Industrial Development, Government of India New Delhi

Si= The all India average wholesale price index for steel (Bars and Road) for the month under consideration as published by Ministry of Industrial Development, Government of India, New Delhi

Ps = Percentage of steel component of the work

Note : For the application of this clause, index of Bars and Rods has been chosen to represent steel group.

Adjustment of bitumen component

(iv) Price adjustment for increase or decrease in the cost of bitumen shall be paid in accordance with the following formula.

V_b = 0.85 x P_b/100 x R x (B_i - B_o)/B_o

V_b = increase or decrease in the cost of work during the month under consideration due to changes in rates for bitumen Bo = The official retail price of bitumen at the IOC depot at nearest center on the day 28 days prior to date of opening of Bids

B_i = The official retail price of bitumen at the IOC depot at nearest center on the day 15 of the month of under consideration.

P_b = Percentage of bitumen component of the work

Adjustment of POL (fuel and lubricant) component

(v) Price adjustment for increase or decrease in the cost of POL (fuel and lubricant) shall be paid in accordance with the following formula.

Vf = 0.85 x Pf/100 x R x (Fi - Fo)/Fo

Vf = increase or decrease in the cost of work during the month under consideration due to changes in rates for fuel and lubricants.

Fo = The official retail price of High Speed Diesel (HSD) at the existing consumer pumps of IOC at nearest center on the day 28 days prior to date of opening of Bids

Fi = The official retail price of HSD at the existing consumer pumps of IOC at nearest center for the day 15 of the month of under consideration.

Pf = Percentage of fuel and lubricants component of the work

Note : For the application of this clause, the price of High Speed Diesel Oil has been chosen to represent fuel and lubricants group.

Adjustment for Plant and Machinery Spares component [Cl. 49]

(vi) Price adjustment for increase or decrease in the cost of plant and machinery spares procured by the contractor shall be paid in accordance with the following formula.

Vp = 0.85 x Pp/100 x R x (Pi - P0)/P0

Vp = increase or decrease in the cost of work during the month under consideration due to changes in rates for plant and machinery spares.

Po = The all India wholesale price index for heavy machinery and parts on 28 days preceding the date of opening of Bids as published by the Ministry of Industrial Development, Government of India New Delhi

Pi = The all India average wholesale price index for heavy machinery and parts for the month under consideration as published by Ministry of Industrial Development, Government of India, New

Delhi

Pp = Percentage of plant and machinery spares component of the work

Note : For the application of this clause, index of Heavy Machinery and Parts has been chosen to represent the Plant and machinery Spares group.

Adjustment of Other materials Component

(vii) Price adjustment for increase or decrease in the cost of local materials other than cement, steel, bitumen and POL procured by the contractor shall be paid in accordance with the following formula. [Cl. 49]

Vm = 0.85 x Pm/100 x R x (Mi - Mo)/Mo [Cl. 50]

Vm = increase or decrease in the cost of work during the month under consideration due to changes in rates for local materials other than cement, steel, bitumen and POL.

Mo = The all India wholesale price index (all commodities) on 28 days preceding the date of opening of Bids as published by the Ministry of Industrial Development, Government of India New Delhi [Cl. 50]

Mi = The all India average wholesale price index (all commodities) for the month under consideration as published by Ministry of Industrial Development, Government of India, New Delhi [Cl. 51 &52]

Pm = Percentage of local material component (other than cement, steel bitumen and POL) of the work

The following percentages will govern the price adjustment for the entire contract:

1.	Labour - Pl	25%
2.	Cement - Pc	05%
3.	Steel - Ps	05%
4.	Bitumen - Pb	10%
5.	POL - Pf	05%
6.	Plant & Machinery Spares -Pp	05%
7.	Other materials - Pm	45%
	Total	100%

27. The proportion of payments retained (retention money) shall be 6% from each bill subject to a maximum of 5% of final contract price [Cl. 48]

28. Amount of liquidated damages for delay in completion of works — For whole of work (1/2000)th of the initial contract Price, rounded off to the nearest thousand, per day. For sectional completion (1/200)th of initial contract price for 5km section, rounded off to the nearest thousand, per day [Cl. 49]

29. Maximum limit of liquidated damages for delay in completion of work — 10 per cent of the Initial Contract Price rounded off to the nearest thousand. [Cl. 49]

30.	Amount of Bonus for early completion of whole of works	1 per cent of the Initial Contract Price (part of a month to be excluded) rounded off to the nearest thousand ,per month	[Cl. 50]
31.	Maximum limit of Bonus for early Completion of works	6 percent of the Contract Price rounded off to the nearest thousand	[Cl. 50]
32.	The amount of the advance payment are:		[Cl. 51 & 52]

Nature of Advance	**Amount (Rs.)**	**Conditions to be fulfilled**
i. Mobilization	10% of the Contract price	On submission of un-conditional Bank Guarantee. (to be drawn before end of 20% of Contract period). The contractor may furnish four bank guarantees of 2.5% each, valid for full period.
ii. Equipment	90% for new and 50% of depreciated value for old equipment. Total amount will be subject to a maximum of 5% of the Contract price.	After equipment is brought to site (provided the Engineer is satisfied that the equipment is required for performance of the contract) and on submission of unconditional Bank Guarantee for amount of advance.
iii. Secured advance for non- perishable materials brought to site	75% of Invoice value.	a) The materials are in-accordance with the specification for Works; b) Such materials have been delivered to site, and are properly stored and protected against damage or deterioration to the satisfaction of the Engineer. The contractor shall store the bulk material in measurable stacks.; c) The Contractor's records of the requirements, orders, receipt and use of materials are kept in a form approved by the Engineer and such records shall be available for inspection by the Engineer; d) The contractor has submitted with his monthly statement the estimated value of the materials on site together with such documents as may be required by the Engineer for the purpose of valuation of the materials and providing evidence of

ownership and payment thereof;

e) Ownership of such materials shall be deemed to vest in the Employer for which the Contractor has submitted an Indemnity Bond in an acceptable format; and

f) The quantity of materials are not excessive and shall be used within a reasonable time as determined by the Engineer.

(The advance payment will be paid to the Contractor no later than 28 days after fulfillment of the above conditions).

33. Repayment of advance payment for mobilization and equipment: [Cl. 51.3]

The advance load shall be repaid with percentage deductions from the interim payments certified by the Engineer under the Contract. Deductions shall commence in the next Interim Payment Certificate following that in which the total of all such payments to the Contractor has reached not less than 20 per cent of the Contract Price or 6 (Six) months from the date of payment of first installment of advance, whichever period concludes earlier, and shall be made at the rate of 20 per cent of the amounts of all Interim Payment Certificates until such time as the loan has been repaid, always provided that the loan shall be completely repaid prior to the expiry of the original time for completion pursuant to Clauses 17 and 28.

34. Repayment of secured advance: [Cl. 51.4]

The advance shall be repaid from each succeeding monthly payments to the extent materials [for which advance was previously paid pursuant to Clause 51.4 of G.C.C.] have been incorporated into works.

35. The Securities be for the following minimum amounts equivalent as percentage of the Contract Price: [Cl. 52]

Performance Security of 5 per cent of contract price plus Rs. …… (to be decided after evaluation of the bid) as additional security in terms of ITB Clause 29.5.

The standard form of Performance Security acceptable to the Employer shall be an unconditional Bank Guarantee of the type as presented in Section 8 of the Bidding Documents.

36. The Schedule of Operating and Maintenance Manuals shall be within one month of completion of work. Final Payment shall be released on receipt of O & M documents. [Cl. 58]

37. The data by which "as-built" drawings (in scale as directed) in 2 sets are required is within 28 days of issue of certificate of completion of whole of [Cl. 58]

section of the works, as the case may be.

38. The amount to be withheld for failing to supply "as built" drawings by the date required is Rs. **20.00** Lakhs. [Cl. 58]

39. The following events shall also be fundamental breach of contract: "The Contract has contravened Sub-clause 7.1 and Clause 9 of GCC." [Cl. 59.2]

40. The percentage to apply to the value of the work not completed representing the Employer's additional cost for completing the Works shall be 20 per cent. [3, Cl. 60]

SECTION-5: TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATIONS

The technical specifications shall be the specifications detailed in the publication – SPECIFICATIONS FOR ROAD AND BRIDGE WORKS" (Fifth Revision, 2013) of the Ministry of Road Transport and Highway's published by the Indian Roads Congress with the latest amendments. Te provisions/stipulations for various item of woks as may be relevant to the job/work package are as detailed at Annexure-A.

Note:

The technical specification contain herein shall be read in conjunction with the various other documents forming the bid. These specifications shall apply to all the works as are required to be executed under the contract.

Unless otherwise stipulated, all the works will have to executed conforming to the clauses of MORT&H's specification for road & bridge works (5th Revision, 2013). In the absence of any definite clauses/Provisions/specifications on any particular issue/item of works in the MORT&H's specification, reference may be made to the IRC Code (Updated). IS Codes are silent, the International specifications are to be followed. If none of the above can be applied, the construction of works will have to be executed conforming to the sound Engineering practice as approved by the Engineer-in-charge. In case of any disputes arising out of the interpretations on the above, the decision of the Engineer-in-charge shall be final and binding on the contractor.

The words like contract, contractor, Engineer, (Synonymous, with Engineer-in-charge), Employer, works and worksite used in the specification shall be considered to have the meaning as understood from the definitions of these terms given in the condition of the contract.

The following abbreviations shall have the meaning as given below:

ASSHTO	American Association of State Highway and Transportation Officials
ASTM	American Society for Testing and Materials
BS	British Standard Published by the British Standards Institution
CBR	California Bearing Ratios
IRC	Indian Road Congress
IS	Indian Standard Published by the Bureau of Indian Standards
MOS, RT&H	Ministry of Shipping, Road Transport and Highways

Section -5: TECHNICAL SPECIFCATION

1. HORIZONTAL DRAINAGE BORINGS

1.1 Description

This work shall consist of drilling holes which are inclined to the horizontal direction by not more than 10 degrees and providing and installing perforated pipes and protective pipes into the holes so drill. The work shall be performed in open space or inside the drainage well as the case may be .The work shall be carried out in accordance with these specifications and lines, levels and grades ,dimensions and cross sections shown in the drawing or as directed by engineer.

1.2 Design

(a) General

The horizontal drainage borings shall be so designed through investigation of the site that the works should conform to the conditions of the targeted slope and dully exercise its function.

(b) Purpose

The purpose of the works is to drain ground water above slip surface so that pore water pressure affecting slip surface can be reduced. Arrangement of drainage pipe shall be, therefore, so planed that pore water pressure should be reduced to a maximum extent. Drainage pipe shall have, therefore, enough length to penetrate slip surface. The works are also planned to ease effects of seepage pressure of unconfined groundwater.

(c) Topographic Survey

Topographic survey shall be so executed that plan view and profile of landslides could be prepared.

(d) Investigation

Investigation to understand the depth and extent of slip surface as well as groundwater level shall be executed prior to design of the works. Borehole investigations at the targeted landslides shall be done while obtaining core samples, performing in-situ tests, and installing monitoring wells. Borehole investigation shall be so planned that slip surface and ground water level should be understood as much as possible.

(e) Necessary Length of Borings

<u>To ease pore water pressure</u>

- A section of 5 meters or more shall be secured after penetrating the deepest slip surface.

<u>To ease seepage pressure of unconfined groundwater</u>

- In debris or colluvium or terrace deposit: more than 25 meters
- In loosened zone of bedrock: more than 40 meters

(f) Arrangements of Borings

Horizontal drainage borings shall be arranged in the following manner:

- The borings shall be arranged parallel or in a fan shape.
- The ends in the ground of drainage borings shall have a horizontal distance of 5 meters or more from the neighboring borings.
- The borings shall have an angle of elevation between 5 and 10 degrees from the horizontal level.

(g) Effect on Slope Stability Analysis

As the effects of the works, reduction of groundwater level in slope stability analysis shall be not more than 3 meters deep.

(h) Drainage System to Lead Drained Water to the Nearest Stream or Drainage Ditches

Along with horizontal drainage borings, drainage system shall be so designed that groundwater flowing from the outlet of the borings is duly collected and lead to the nearest stream or drainage ditches which has enough capacity to accommodate additional flow from the drainage borings.

1.3 Materials

Materials shall comply with the IRC's prescribed standards, Indian Standards, Japanese Industrial Standards, other international standards, or equivalent, and have approvals from the Authority's Engineer.

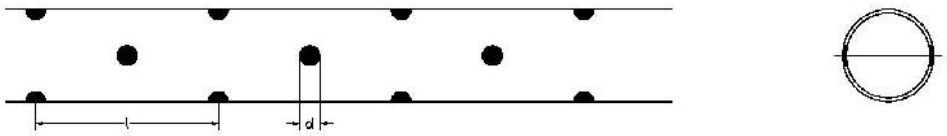
(a) Perforated Pipes

Perforated pipes shall be vinyl chloride pipes (VP) and shall conform to the following requirements and JIS K 6741 or ISO 3633:2002 or an equivalent standard:

Nominal Diameter	External Diameter	Tolerance of External Diameter	Thickness	Tolerance of Thickness
50mm	60mm	±0.4 mm	**4.1** mm	+ 0.8 mm

The pipes shall have provisions for male-female joints conforming to JIS K 6739 or ISO 1452-1:2009 & ISO 1452-2:2009 & ISO 3633:2002 & ISO 4435:2003 or an equivalent standard. The sleeve length of the joints shall be at least 50 mm and the thickness of the sleeve shall be 2 mm. The external diameter of the joint shall be the same as the external diameter of the pipe.

The pipes shall be perforated as shown on the Drawings. The Contractor's Method Statement shall show how the perforations will be made.



l is approximately 125 mm
d is approximately 5 mm

The ends placed in the ground of perforated pipes should be so protected by caps or covers that clogging by soil or algae is prevented.

(b) Filter Material

Filter material of geotextile shall conform to the general filter requirements as per Specifications for Road and Bridge Works of MoRTH.

(c) Protective Pipes

The protective pipes shall be PVC pipes and conform to the following requirements:

Nominal Diameter	Nominal Pressure	External Diameter	Internal Diameter
90 mm	Type 400 kPa	90 mm	85 mm
75 mm	Type 400 kPa	75 mm	71 mm

1.4 Construction Requirements

(a) Method Statements, Working Drawings / Shop Drawings

The Contractor shall submit the Methods Statements, Working Drawings / Shop Drawings to the Engineer, for his approval, at least 28 days prior to the commencement of the relevant activity. The Engineer has the authority to relax or do away with this requirement, if he chooses to do so, on a written request made by the Contractor.

The above documents shall clearly spell out the method the Contractor proposes to carry out the construction / fabrication of the Permanent Works and Temporary Works, carrying out the quality control tests and their frequency. They shall also further give details of safety measures and the equipment and personnel to be deployed to carry out the works. No payment will be made for preparing the above documents.

(b) Drilling the holes

The contractor shall clear the face around the drilling location.

The contractor shall use appropriate equipment for drilling the holes, taking into consideration of the factors such as soil properties, ground conditions, design requirements, site conditions etc. The design requirements include, among other things, the diameter of the perforated pipe, the diameter of the protective pipe etc.

Samples of material encountered shall be collected at every 1.0m of the drill hole and at places the type of material changes. These samples shall be neatly packed in transparent polythene and appropriately labelled for easy identification and interpretation. The label shall include information such as identification number, location within the drill hole where the sample was collected etc.

Within 14 days of the completion of the drilling of each hole, the Contractor shall submit a drilling report to the Engineer, accurately describing the boundaries of the geological formations, water level in the drill-hole etc. The format of the drilling report shall have the prior approval of the Engineer.

The Contractor shall pull out the drilling rods, in the presence of the Engineer and the length of the drilling rods shall be measured by the Engineer and the Contractor, which shall form the basis of deciding the depth of the drill-hole. The drill holes shall be within the following tolerances:

Category	Tolerance (mm)
Length	Design length or more
Displacement	100.0

Clearing the face around the drilling location, collection of samples and submission of drilling reports shall not be measured nor paid for and deemed to be included in the rate for drilling.

(c) Installation of the perforated pipes

Before the commencement of the installation, the Contractor shall obtain permission from the Engineer to do so.

The perforated section of the pipes should be protected by filter material of geotextile. The filter should be neatly fixed to the pipes by vinyl tapes or wires in a manner any slack or loosening of filter is avoided

The perforated pipes shall be installed into the whole length of the drill hole. If the pipes are to be connected, the connections shall be sturdy so that there will be no loosening of connections. The connections shall be of male-female type and conform to JIS K 6739 or ISO 1452-1:2009 & ISO 1452-2:2009 & ISO 3633:2002 & ISO 4435:2003 or an equivalent standard.

(d) Installation of protective pipe

The protective pipe shall be installed as shown in the Drawings or as instructed by the Engineer. It shall be installed after the completion of the installation of the perforated pipe. The protected pipe shall be placed through the gabion wall and bounded to the gabion boxes as shown in the Drawings.

(e) Gabion Wall

A gabion wall shall be constructed at the outlet of the perforated pipe, as per Specifications for Road and Bridge Works of MoRT&H in order to protect the slope at such outlet.

1.5 Record

(a) Record

The necessary data for maintenance and management shall be recorded and preserved.

1.6 Measurement and Payment

(a) Measurement

The depth of drilling completed in measured in linear meters by length of the drill rods used for such drilling .The length of drill through various types of soil/boulders /rock will be based on the drilling report submitted by the contractor and accepted by the Engineer.

The perforated pipes shall be measured in linear meters, by the length of pipes installed. The overlap of pipes at joints shall not be measured.

The protective pipe shall be measured in linear meters , by the length of the pipes installed .The overlap of pipes at joints shall not be measured.

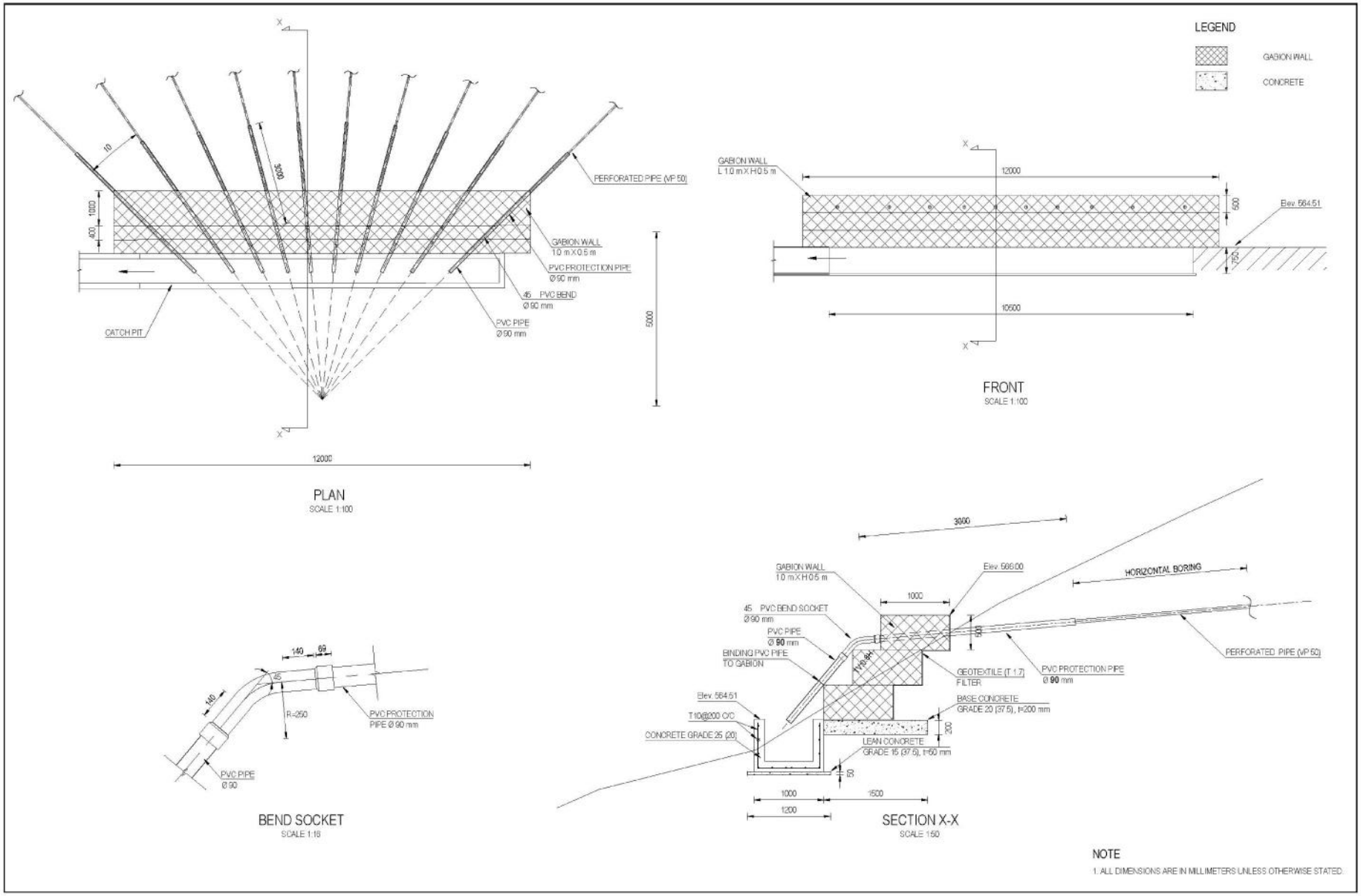
(b) Payment

The accepted quantities of the drilling shall be paid for at the contract unit price per linear meter of the size of the drill hole. This rate shall include the cost for preparing the face of the drill hole and protection of the outlets.

The accepted quantities of pipe shall be paid for at the Contract unit price per linear meter of the type and size of pipe as specified, complete in place. Cost of providing

and installing connections, branch connections end connections, elbows shall be deemed to be included in the rate of pipes.

The rates shall include all that has to be carried out to drill and place pipes .The rate shall be full compensation for all labour, material, equipment and incidentals required to complete the works.


LEGEND
GABION WALL
CONCRETE
PERFORATED PIPE (VP 50)
GABION WALL
1.0 m X 0.5 m
PVC PROTECTION PIPE
Ø 90 mm
45 PVC BEND
Ø 90 mm
PVC PIPE
Ø 90 mm
CATCH PIT
5000
12000
PLAN
SCALE 1:100
GABION WALL
L 1.0 m X H 0.5 m
12000
500
Elev. 564.51
750
10500
FRONT
SCALE 1:100
140
63
45
140
R=250
PVC PROTECTION
PIPE Ø 90 mm
PVC PIPE
Ø 90
BEND SOCKET
SCALE 1:10
3000
GABION WALL
1.0 m X H 0.5 m
Elev. 566.00
HORIZONTAL BORING
1000
45 PVC BEND SOCKET
Ø 90 mm
PVC PIPE
Ø 90 mm
BINDING PVC PIPE
TO GABION
500
GEOTEXTILE (T.1.7)
FILTER
PVC PROTECTION PIPE
Ø 90 mm
PERFORATED PIPE (VP 50)
Elev. 564.51
T10@200 C/C
CONCRETE GRADE 25 (20)
BASE CONCRETE
GRADE 20 (37.5), t=200 mm
200
LEAN CONCRETE
GRADE 15 (37.5), t=50 mm
50
1000
1500
1200
SECTION X-X
SCALE 1:50
NOTE
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED.

2. CAST-IN-SITUCONCRETE CRIB WORKS

2.1 Description

This work shall consist of construction of cast in-situ concrete crib works on the slopes. The crib works is a structure aimed at stabilizing the slope by creating a continuous lattice frame on cutting surfaces or natural slopes. The work shall be carried out in accordance with these Specifications and lines, levels and grades, dimensions and cross-sections shown in the Drawings or as directed by the Engineer.

2.2 Design

(a) General

The concrete crib works shall be so designed through investigation of the site that the works should conform to the conditions of the targeted slope and duly exercise its function.

In case the crib works are intended to work as bearing members of rock bolts or ground anchors, relevant consideration including slope stability analysis shall be done.

In case the crib works are intended to work against earth pressure, relevant calculation shall be executed.

(b) Load

The following loads shall be considered in the design:

- The own weight of the crib works including filling material within the frames and possible accumulation of snow and ice, if applicable.
- The resistance force to be loaded by ground anchors or rock bolts,
- The load from the ground reaction force.

The design load shall be calculated by multiplying working load by load coefficient.

(c) Verification

Design of the crib works shall be verified on the following items:

- Bending moment under ultimate limit state
- Shearing stress under ultimate limit state
- Cracks induced by bending under serviceability limit state
- Cracks induced by shearing stress under serviceability limit state

2.3 Materials

Materials shall comply with the IRC's prescribed standards, Indian Standards, Japanese Industrial Standards, other international standards, or equivalent, and have approvals from the Authority's Engineer.

(a) Cement

Cement shall be Ordinary Portland Cement and conform to Section 1000 of the Specifications for Road and Bridge Works of MoRTH.

(b) Aggregate

Aggregate shall conform to Section 1000 of the Specifications for Road and Bridge Works of MoRTH.

Fine aggregate shall have dry density of 2.5 g/cm3 or more and a water absorption rate of 3.5% or less.

(c) Admixture

Aggregate shall conform to Section 1000 of the Specifications for Road and Bridge Works of MoRT&H or JIS A 6204 or equivalent.

(d) Reinforcement bars

Reinforcing bars shall conform to Section 1000 of the Specifications for Road and Bridge Works of MoRT&H or BS4449 Grade 460 or JIS G 3112 or equivalent.

(e) Water

Water shall conform to Section 1000 of the Specifications for Road and Bridge Works of MoRT&H.

(f) Wire net (or Rath Net)

Wire nets shall conform to JIS G 3552 or effective standards for rhombus shaped chain link wire netting or equivalent. Galvanized coatings for wire nets shall conform to JIS H 8641 HDZ 45 or ISO1461:1999 Steel ≥ 3 mm to < 6mm or equivalent.

Wire nets shall meet the requirements in the following table.

Requirement of Wire Net

Diameter of Wire (mm)	Mesh Size (mm)	Width (m)	Length (m)	Unit Weight (kg/m²)	Zinc Coating (g/m²)	Tensile Strength (N/mm²)
2.0	50×50	1.0	10.0	1.0	Not less than 23	290 540

(g) Anchor Pins / Anchor Bars

Anchor bars and anchor pins shall conform to BS 4449 Grade 460 or equivalent. Galvanized coatings for anchor pins and anchor bars shall conform to JIS H 8641 HDZ 45 or ISO1461:1999 Steel ≥ 3 mm to < 6mm or equivalent.

(h) Soil

Soil use for necessary filling shall not be detrimental for vegetation growth and shall be to the satisfaction of the Engineer.

2.4 **Construction Requirements**

(a) Method Statements, Working Drawings / Shop Drawings

The Contractor shall submit the Methods Statements, Working Drawings / Shop Drawings to the Engineer, for his approval, at least 28 days prior to the commencement of the relevant activity. The Engineer has the authority to relax or do away with this requirement, if he chooses to do so, on a written request made by the Contractor.

The above documents shall clearly spell out the method the Contractor proposes to carry out the construction / fabrication of the Permanent Works and Temporary Works, carrying out the quality control tests and their frequency. They shall also

further give details of safety measures and the equipment and personnel to be deployed to carry out the works. No payment will be made for preparing the above documents.

(b) Preparation of Slopes

(i) Trimming and clearing

The Contractor shall trim and clear a slope by hand and/or construction machinery. Where water is encountered due to seepage, springs, and other reasons on a slope, the Contractor shall take adequate measures after reporting to the Engineer for his direction. The Contractor shall notify the Engineer of the completion of slope trimming and clearing for his approval.

(ii) Removal of Rock and Boulders

Unstable rocks on a slope shall be removed by hand as much as possible. Unstable rocks to be removed shall be selected and reported to the Engineer for his approval.

(iii) Removal of trees and shrubs

Trees and shrubs which may obstruct the work shall be removed prior to the commencement of the works. Trees and shrubs to be removed shall be selected by the Contractor and approved by the Engineer.

(iv) Disposal of surplus soil and removed trees and shrubs

Disposal method of surplus soil and removal of trees and shrubs shall conform to laws and regulation, the Specifications or the Engineer's direction

(v) Payment for slope trimming and clearing, removal of surplus soil, boulders, and rock, removal of trees and shrubs, disposal of surplus soil, rock, and boulders, and disposal of trees and shrubs shall be deemed to be included in the unit rates for crib works.

(c) Treatment of Uneven Surface to Place Frames of Crib Works

Uneven surface of the slopes where frames of crib works are placed shall be so treated that the frames of crib works can closely contact with the surface of the slope.

Unevenness shall be treated by a method satisfactory to the Engineer. Spraying mortar using a shotcreting machine may be used to ease unevenness of the surface to place frames, excluding the areas within the frames unless shotcreting is specified in the drawings for such areas.

Unless otherwise indicated in this Specification, mortar shall conform to Section 1700 of the Specifications for Road and Bridge Works of MoRTH and the following table:

Mortal for Treatment for Unevenness

Type of work	Design Strength	Unit Cement Content	Cement-Sand Proportion	Water-Cement Ratio
Shotcrete works	18 N/mm2	Not less than 400 kg/cm3	Cement : Sand = 1 : 4	Not more than 60 %

The consistency of the mortar shall be suitable to be used with shotcreting machine.

Payment for smoothing the surface shall be deemed to be included in the unit rates for crib work.

(d) Fixing Reinforcing Bars, Anchor Bars, Anchor Pins, and Wire Net, and Placing Temporary Formwork

Wire nets shall be spread over and firmly fixed to a slope, including the areas within the frames of crib works. Reinforcing bars, anchor bars, and anchor pins as well as temporary formwork shall be arranged and firmly fixed to the ground to avoid any vibration and displacement until the concrete to be casted into frames becomes hardened. The Contractor shall notify the Engineer of the completion of arrangements of reinforcing bars and wire nets as well as formwork for his approval.

Payment for smoothing the surface by mortar, arrangement of wire nets, reinforcing bars, anchor bars, anchor pins and temporary formwork shall be deemed to be included in the unit rates for crib work.

(e) Casting Concrete to Crib Frames

Unless otherwise indicated in this Specification, concrete shall conform to Section 1700 of the Specifications for Road and Bridge Works of MoRTH.

The concrete used in the work shall conform to the following table and shall have suitable consistency for pneumatic transport and casting:

Grade of Concrete

Type of work	Type of concrete	Grade of concrete	Max. size of aggregate (mm)
Cast-in-situ concrete crib works	Standard	M20	20

Curing of the concrete cast in frames shall be duly performed. Joint of concrete shall be adequately cleaned so as to prevent cold joints. Joints shall not be placed at vertical frames. Casting of concrete for upper frames should be done only after strength of concrete for lower frames achieves enough strength to support the weight of the upper frames. After enough period for curing is secured, temporary formwork shall be removed and the Contractor shall clear the area within frames.

(f) Filling with Soil above the Horizontal Beams of the Crib

Water may collect and pool in prismatic sections above the horizontal beams of the crib. In order to prevent this, and to facilitate the surface water to easily drain off, the prismatic sections shall be filled with soil which is not detrimental to vegetation growth.

No payment will be made for this work and shall be deemed to be included in the unit rates.

(g) Treatment for the Areas within Frames

The Contractor shall perform the required works for the areas within the frames specified in the drawings.

2.5 **Record**

(a) Record

The necessary data for maintenance and management shall be recorded and preserved.

2.6 **Measurement and Payment**

(a) Measurement

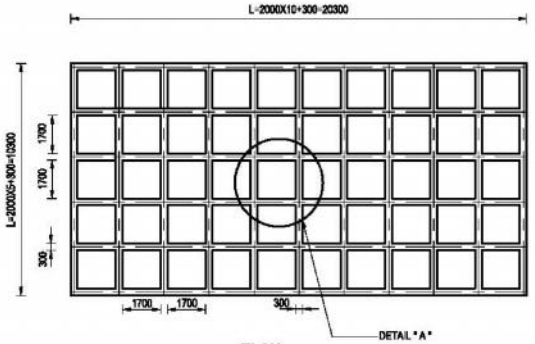
The crib shall be measured in linear meters along each row. The length of each row shall be added to arrive at the final quantity of the crib.

(b) Payment

The quantity of crib as measured above shall be paid in the Contract unit rate of linear meters. The rates shall include all that has to be carried out to place the crib in place. The rate shall be full compensation for all labour , material ,equipment and incidentals required to complete the work.

Representative drawing of crib works

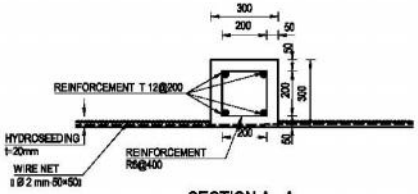
A-133



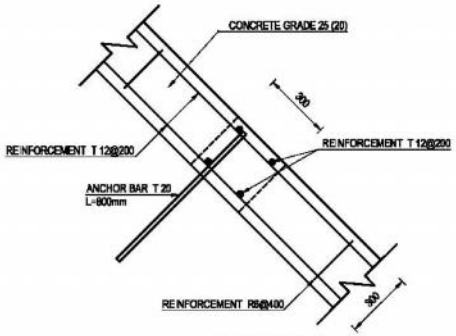
PLAN
SCALE 1:200

QUANTITY CALCULATIONS FOR CRIB WORK AREA OF 210 m^2 (20.3 m x 10.3 m)

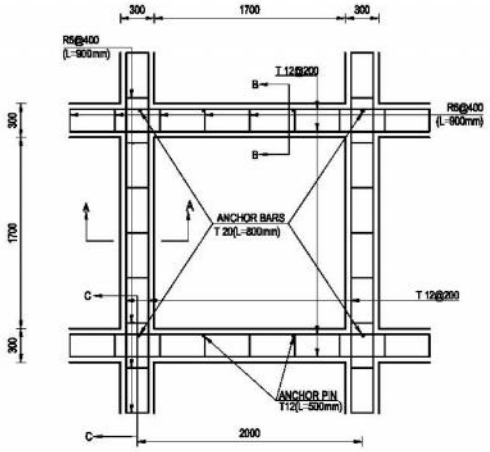
TYPE		UNIT	QUANTITY	CALCULATION FORMULA (Kg)	
FRAME LENGTH		m	215.3	10.3x11+1.7x10x6	
ANCHOR BAR (T20, 800 mm)		nos	66 @15.30	11x5	66.00
ANCHOR PIN (T12 500mm)		nos	120.0	2x(10x6)	120.00
REINFORCEMENT WEIGHT	T	t	0.84	20.3x6x4x0.888	432.63
				10.3x11x4x0.888	402.44
	R		0.11	0.90x5x55x0.222	54.85
				0.90x5x60x0.222	59.94
				TOTAL	949.86
CONCRETE GRADE 25(20)		m^3	19.4	215.3x0.30x0.30	19.38
AREA WITHIN THE CRIB		m^3	144.5	1.70x1.70x50	144.50



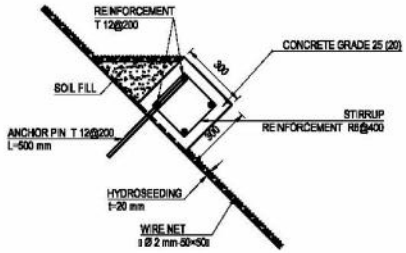
SECTION A - A
SCALE 1:20



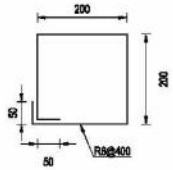
SECTION C - C
SCALE 1:20



DETAIL " A "
SCALE 1:40



SECTION B - B
SCALE 1:20



STIRRUP DETAIL
SCALE 1:10

NOTE
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED.
2. ALL QUANTITIES GIVEN IN THE TABLE ARE ONLY FOR REFERENCE USE.

3. PERMANENT GROUND ANCHOR

3.1 GENERAL

- This specification deals with permanent ground anchors and shall be read in conjunction with the Technical Specification. The Contractor shall comply fully with the requirements of this specification in the design, erection and installation of ground anchors.
- All ground anchor described in this section, unless otherwise noted on the drawings of herein specified, shall be in accordance with BS 8081 : 1989; British Standard Code of practice for Ground Anchorages.
- Soil investigation information and all information from borings and penetration test are available for inspection at the Engineer's offices. The information of the soil investigation reports are believed to be correct, but are not guaranteed and are supplied for guidance purposes. The contractor is responsible for obtaining such additional information as he consider necessary covering such matters as nature of the soil, water levels, physical features of the site etc. at his own cost

3.2 SCOPE OF WORKS

The contract comprises the provision of all labour, tools, plants, materials, transportation and all necessary equipment for the following works:

- Design, supply, install (including all material, stressing, grouting) and test ground anchors as part of a permanent ground anchor system.
- Setting out anchor positions.
- Mobilization and demobilization of required equipment and crew.
- Drilling inserting of tendon, and grouting provide ground anchors which capable to support the specified design loads with safety factor not less than 2.0 .
- Ground anchor testing.
- Stressing to provide pre-stressing force of 100% design loads.
- Any other incidental works necessary to ensure the safety and satisfactory performance of the permanent ground anchor system.

3.3 RESPONSIBILITY OF THE SPECIALISED CONTRACTOR

The Contractor shall be experienced in permanent ground anchor design (Tension anchorage) and Execution and shall have equipment and manpower suitable for the work and available for the entire operation of the work. The Contractor shall be wholly responsible at all times for the safety of works. He shall instruct his workers and all other personnel about the danger zones during the stressing of the anchors and others.

3.4 REFERENCE STANDARDS

- Britain Standards Institution: BS 8081
- IS 10270 (1982): Guidelines for design and construction of pre-stressed rock anchors

3.5 SUBMITTALS

The following submittals shall be performed by the Contractor in accordance with the agreed schedule for submission and with such promptness as to cause neither delay in his own work nor in that of any other contractor or subcontractor.

A) Manufacturer's Data:

Manufacturer's product data on related materials should be submitted to the Engineer.

B) Shop Drawing :

The shop drawing shall be submitted to the Engineer at least two weeks before execution for their review.

C) Test Certificates for the followings :

- Tendon
- Anchorages details such as anchor head

D) Trial mix for the grout with past successful evidence which includes bleed, flow, shrinkage or expansion, and setting time.

E) Construction methods which includes the followings :

- Method of drilling length , diameter of hole and Casing removal
- Method of grouting.
- Details of the tendon.
- Details of proposed installation and stressing

F) Record and report of the ground anchors.

G) Anchor layout

H) Percent of tendon ultimate load at working load

I) Method and details of anchor fabrication

J) Details of triple layer of corrosion protection for permanent applications (Epoxy paint, Grout and HDPE corrugated duct) for fixed length

K) Details of layer of corrosion protection for permanent applications (Epoxy paint, grease, HDPE sleeve, Grout and HDPE corrugated duct) for Free length

L) Method and details of proposed installation, stressing and grouting procedure

M) Method and details of drilling, Casing removal method to be adopted for drilling and grouting.

N) Any other information required by the Engineer in his review of the Contractor's design.

O) Permanent Anchor head protection.

The Contractor's execution and specifications shall comply fully with the relevant recommendations of BS 8081: 1989: British Standard Code of Practice for Ground Anchorages, the requirements of the Engineer's specifications and conditions of contract. In matters not specifically covered by the BSI, DIN, ASTM and the Engineer's specifications, the Contractor's design shall be in accordance with accepted principles of good engineering practice. It shall be the Contractor's responsibility to clearly itemise those matters.

3.6 METHOD STATEMENT FOR CONSTRUCTION OPERATIONS

Prior to commencement of works, the Contractor shall submit to the Engineer a detailed method statement, for the installation of ground anchors. For the purpose of this Clause, a method statements shall be a document containing

(a) A detailed construction sequence

(b) Proposed drilling method

(c) Proposed installation method

(d) Proposed stressing method and equipment

(e) Proposed provisions for stressing or distressing

(f) Material, plant and labour requirements at each construction stage.

(g) Rate of production output based on resources allocated, such as the average output in linear metres of installed anchors per drilling frame per normal working day of 8 working hours per day.

(h) Shop drawings showing, among other things, details of all special requirements for the construction activities.

(i) Methods of testing.

The Engineer shall during the execution of the works require the Contractor to submit detailed method of statements and other construction operation. If requested by the Engineer, the Contractor shall submit, within such times and in such detail as the Engineer may reasonably require, such information pertaining to the methods of construction (including the use of construction plant) which the Contractor proposes to use, and such calculations of the stresses and deflections that will arise in the permanent works or any part thereof during construction from the use of such methods, as will enable the Engineer to decide whether the permanent works can be executed with safety and in accordance with the contract if the methods are adhered to, and without detriment to the permanent works when completed.

The Engineer shall inform the Contractor in writing within 14 days after receipt of the Contractor's method statement either

(a) that the Contractor's proposed methods have the consent of the Engineer; or

(b) in what respect, in the opinion of the Engineer, the proposed methods fail to meet the requirements of the contract

3.7 EQUIPMENT & LABOUR

The Contractor shall provide all frames, equipment, lifting devices and labour necessary for the installation and grouting of anchors.

The Contractor shall satisfy the Engineer regarding the suitability, efficiency and operational capability of the anchor installation equipment. The Contractor shall be required to provide adequate numbers of operational drilling Rigs to ensure that the works are completed within the time period stipulated in the approved construction programme. The Contractor is deemed to have made provision for the availability of standby plant at all times to allow for the contingency of equipment failure.

The Engineer shall order the removal or replacement of any equipment or staff whenever he is of the opinion that such equipment and staff are not suitable for the

works. Equipment found to have a consistent record of breakdowns shall be removed from the site

3.8 INSPECTION & TESTING

The Engineer shall inspect the installation of anchors and will monitor anchor stressing acceptance tests to ensure that the Contractor's anchor design and construction method will produce the suitable anchorage system in the soil/rock conditions encountered on site.

The testing of concrete and grout shall be in accordance with the provisions for works concrete in the General Concrete Specification.

3.9 COMPLIANCE INSPECTION

The Engineer shall carry out inspection to ensure that the Contractor follows the approved shop drawings and good engineering practice.

3.10 ACCEPTABILITY

Acceptance test shall be carried out on all permanent ground anchors; in accordance to BS 8081. Failure of any anchor to meet acceptance test criteria will result in rejection of the anchor in question. Consistent failure of a given anchor type require reassessment of the anchor design and installation practices. Only mechanical based connection system shall be allowed, no other connection system shall be allowed to ensure the overall stability and integrity of the structure.

3.11 MATERIALS

3.11.1 GENERAL REQUIRMENTS

The requirements listed in the following clauses shall apply, wherever relevant, to materials used in all anchors except when otherwise agreed by the Engineer. The handling, storage and use of materials shall comply with manufacturers' instructions.

An anchor shall not contain materials that are mutually incompatible with each other and the surrounding environment. All anchors shall have a triple corrosion protection in the fixed length.

3.11.2 TENDONS

Pre-stressing tendons shall comply with the following:

(a) High tensile steel wire and wire strand with a diameter of 15.7mm and minimum tensile strength of 1860 N/mm^2 and c/s area of 150mm^2 confirming to Pr EN10138-3-2005.

(b) Steel wire strand shall be in coils of sufficiently large diameter to ensure that the strand pay off straight.

A certificate shall be submitted to the Engineer containing the following particulars on the pre-stressing tendons :

(a) The manufacturer's name and the date and place of manufacture.

(b) Cast analysis.

(c) Diameter, cross sectional area and unit mass.

(d) Results of test for mechanical properties, including the characteristic breaking load, characteristic 0.1% proof load, elongation at maximum load, relaxation and modulus of elasticity.

(e) Results of tests for ductility of pre-stressing wires.

3.11.3 CEMENT GROUT

Grout shall consist of ordinary Portland cement and water with a water/cement ratio of not more than 0.40. Sand, PFA and High alumina cement shall not be used unless approved by the Engineer.

Admixtures shall comply with the requirements of BS 5075: Part 1: 1982 and BS 5075: Part 3: 1985 and shall only be used with the prior agreement of the Engineer.

Grout cubes of 100mm size shall be prepared and cured in accordance with BS 1881: Part 3 : 1970, and the strength of grout cubes shall be tested in accordance with BS 1881 : Part 4 : 1970. The grout shall have a minimum compressive strength measured on 100mm cubes 20 N/mm^2 at 3 days and 35 N/mm^2 at 28 days. Collection of grout shall be from the grout overflowing from the drill hole unless otherwise agreed by the Engineer.

Admixture, if used, shall be provided at the Contractor's own expense. Admixtures shall impart to the grout the properties of low water content, good flow ability, minimum bleeding and controlled expansion. Its formulation shall contain no chlorides or other chemicals in quantities that may have harmful effects on the cement or pre-stressing steel. The Contractor shall submit to the Engineer the manufacturer's literature indicating the type of admixture and the manufacturer's recommendations for mixing the admixture with the grout. All admixtures shall be used in accordance with the instructions of the manufacturer.

3.11.4 GREASE

The greases used shall be formulated and manufactured for the specific purpose of corrosion protection and to provide lubrication to pre-stressed high tensile steel tendons. Greases shall be water displacing, self-healing, thixotropic and shall be resistant to microbiological degradation. The properties of the grease shall be such that, voids are filled and intimate contact is established between the grease and all the steel surfaces of a strand or tendon. Grease shall be of grade NLGI of reputed make.

(a) Product identification details (including name of manufacturer, brand name, type and date of manufacture of product), and

(b) Nature of the soap used (if any).

Any grease to be used in the Contract shall be accompanied by manufacturer test certificates which show that it complies with the requirements stated herewith. Grease shall be used in accordance with the manufacturer's instructions. Different types of grease shall not be allowed to come into contact with each other in any part of the anchor.

Grease: The grease to be used as bond breaker and for protection of the strands in the free portion shall have the following minimum properties:

CHARACTERISTICS	**Standards**
Composition	: Paraffin oils, Lithium, soaps, antioxidants and Anticorrosion agents
Dropping Point	: >180°CASTM D 566-82
Flash point of the base oil	: >210°C ASTM D-92

Aniline point of the oil	:	>90°C ASTM D-611
ASTM penetration at 25°C		ASTM D-217-73
normal	:	265/295
at 60 strokes	:	265/295
at 105 strokes	:	255/340
at -20°C and 60 strokes Oil bleeding	:	>150 NFT 60-132
50 h at 100°C	:	<3% INTA 150283 A
72 h at 40°C	:	<2.5% IP-121
Oil separation at 40°C, 7 days	:	<4.5% IP-121
Soap type	:	12 Lithium Hydroxystearate
Oxidation stability, Hoffman test		
100 h at 100°C	:	<0.03 MPa ASTM D 942
500 h at 100°C	:	<0.02 MPa
Sulphur, chlorine, chlorides	:	none
Nitrates, sulphates		
Water	:	<0.5% ASTM D 1264
Rust protection	:	
168 h at 35°C		no corrosion NFX4 1002 Modify
Cooper plate corrosion	:	1a/1b
100 h at 100°C		
Wheel Bearing Test		<3g INTA 150744

3.11.5 PLASTICS

- **HDPE DUCT – UNBONDED LENGTH**

A HDPE sleeve, 2.3 ±0.3mm thick encasing individual strands shall be used as part of the corrosion protection system for the un-bonded length of the tendon. HDPE sleeve shall be pulled or pushed over the greased pre-stressing strand. The strand shall be slightly uncoiled/unwound, passed through a grease bath and coiled back before inserting in the tightly fitting sleeve. The sleeve shall also be filled with grease before strand insertion. Grease coated strands individually encased in HDPE sleeve, shall be encased into larger pain HDPE sheath, minimum 4mm to 5mm thick, with cement grout protection between HDPE sleeve and the HDPE sheathing. In the fixed length portion, the strands shall be housed in corrugated sheathing of minimum 2.3 ± 0.3mm thickness with cement grout between strands and the sheathing. Continuity of corrosion protection shall be ensured at the transition from bonded length to unbonded length of the tendon. The HDPE tube shall be conforming to DIN 8074 & DIN 8075 and IRC:112-2011. The ends of the sleeve shall be sealed with neutral mastic to prevent grease from oozing out. The strands so inserted in the grease-filled tube shall be coated with 1 coat of epoxy paint applied over 1 coat of epoxy primer. In case machine / factory extruded PE coated strands are used, epoxy coating may be waived for the free length. The tendons in the fixed (bonded) length shall be coated with 3

coats of epoxy protective paint applied over a priming coat. During last coat of epoxy fine silica sand shall be sprayed for improving the bond.

- **Anchor Encapsulation:**

Corrugated Sheath: A corrugated sheath shall be used as part of the corrosion protection system for the bonded length portion of the anchor. The sheath shall be 4mm thick HDPE tube. The HDPE shall be conforming to DIN 8074 & DIN 8075 and the sheath shall be tested as per fib recommendations and IRC:112-2011. The lower ends of the Corrugated Sheath shall be sealed with a suitable HDPE cap with ultra high molecular weight polyethylene tape.

3.11.6 METAL DUCTING

Metal ducting shall only be used with the agreement of the Engineer.

Metal ducting shall be suitably protected against corrosion, resistant to slip in the region of the fixed anchor length, and capable of withstanding the effect of load transfer.

The information specified in Clause 3.5 shall also be provided for metal ducting.

3.12 CORROSION PROTECTION

Recommendations concerning some commonly used protective systems for anchorage components as stated in Clause 8.2.4.2 to Clause 8.2.4.5 of BS 8081 : 1989 shall be followed in the Contractor's proposal on the corrosion protection unless otherwise agreed by the Engineer.

The tendon shall be given adequate corrosion protection which shall remain effective throughout the design service life of the anchorage. The effectiveness of the protection shall not be impaired during storage, transport, installation and stressing of the anchorage. The steel shall not suffer mechanical damage when the plastic sheathing is removed.

In the zone defined by the free tendon length, the corrosion protection shall not affect the freedom of the tendon to move.

Before the corrosion protection is applied, any substances (e.g. dirt, grease, ice or loose rust particles) likely to impair the serviceability of the tendon (e.g. bond or corrosion resistance) shall be removed from its surface.

Prestressing steel tendons shall not develop more than rust bloom up to the time the anchorage is installed. Prestressing steel and preassembled anchorages shall be stored in a dry place.

Note: Rust bloom is defined as a uniform layer of rust without wide pitting, visible to the naked eye and removable by wiping with a dry cloth.

Three layers of corrosion protection shall be provided as follows –

Layer 1. Epoxy coating for the entire length of tendon

Layer 2. Grease for Free length, cement grout for fixed length prior to stressing

Layer 3. HDPE pipe for free length, Corrugated HDPE duct for fixed length

The corrosion protective system applied to the joint assembly shall be at least equivalent to that given to the free tendon length and shall not hinder deformation of the tendon.

The anchor head, end cap and bearing plate shall be protected against corrosion. These shall be galvanised or made of stainless steel. The corrosion protection between anchor head and the proximal end of the plastic sheathing in the zone defined by the free tendon length shall include the seal at the proximal end. If anchorages require restressing or inspection during the service life, care shall be taken to ensure that regrouting at the anchor head is possible.

Proof of suitability of the corrosion protection system shall be provided for permanent anchorages. This proof shall, among other things,

(a) provide information on whether the components of the corrosion protection system are compatible;

(b) state that the system provides a degree of corrosion protection equivalent to that of proven systems;

(c) state that the corrosion-protective agent will not adversely affect the properties of the tendon neither during its application nor subsequently under service conditions;

(d) state that the protection of the tendon extends over the full length of the sheathing, and the tendon is tightly sealed;

(e) state that in the anchored zone the corrosion protection does not affect the freedom of the tendon to expand.

Cementitious grout shall be deemed adequate corrosion protection if in close contact with the tendon and if enclosed in a sheath that, under service conditions, resists corrosion and does not permit the penetration of water. Normally, the minimum grout cover shall be 10mm; anchorage design and type of sheath may require a thicker cover.

Where a corrugated sheath is used, the grout cover in the anchorage zone shall be 10mm minimum, the same thickness being required in the case of compression anchorages.

If the anchorage or part of it is protected against corrosion after installation (e.g. corrosion protection of anchor head after grouting), this work shall be supervised to ensure that proper workmanship is maintained.

If plastic compounds are used for corrosion protection, spacers shall be fitted to ensure an adequate thickness of the compound enclosing the tendon. Where the corrosion protection is applied in the form of a coating, a material shall be introduced into the space between the tendon and sheath so as to fill it completely and permanently unless it has been verified that the seals fitted between tendon and sheath are capable of maintaining their function after stressing of the anchorage. Where grouting material is used for corrosion protection purposes, the sheath shall be deemed adequate mechanical protection if it is made of a material that does not permit penetration of water.

3.13 SYSTEM COMPENENTS

3.13.1 GENERAL

The anchor shall be designed to provide an ultimate load holding capacity of not less than specified. The anchor shall be designed and constructed so that compressive forces within the free length will not damage the corrosion protection. The contractor shall have experience of at least one project in hills for drilling, installation and grouting of ground anchors at different angle to the horizontal including vertical anchors drilled and grouted upward against gravity.

3.13.2 FREE AND FIXED ANCHOR LENGTH

The free anchor length is the distance between the anchor head and the proximal end of the grout. The fixed anchor length is the length of anchorage over which the tensile load is capable of being transmitted to the surrounding ground. The fixed anchor length shall not be less than 3m for all anchors subjected to acceptance tests.

3.13.3 SPACERS & CENTRALIZERS

Spacers shall be provided on multi-tendon anchors to ensure separation between the individual components, and to ensure individual tendons are positioned uniformly over the cross-section of the drill hole.

Centralisers shall be provided on multi-tendon anchors to ensure separation between the individual components, and to ensure individual tendons are positioned uniformly over the cross-section of the drill hole.

Centralisers and spacers shall be provided on the tendon at 1.o metre intervals to meet the following requirements:

(a) Within the fixed anchor length, the tendon shall be positioned in the grout column so that a minimum grout cover to the tendon of 10 mm is maintained.

(b) Within the design free anchor length, there shall be a minimum clearance of 10 mm between the tendon and the sides of the drill hole or casing.

3.13.4 ANCHOR HEAD COMPONENTS

The anchor head components which retain the force in the stressed tendon shall comply with the requirements of BS 4447: 1973.

The anchor head shall be designed so as not to induce secondary stresses in the tendon. Wedges (or spherical washers) should be fitted between anchor head and support plinth, unless the anchor head permits compensation for angular deviations of the tendon from the axial position.

A check shall be made whether, in addition to protection against corrosion, anchor heads should be given mechanical protection. Proof of the suitability of the anchor head design shall be provided (e.g. by submitting an agreement). The anchor head design for permanent anchorages shall permit in-service tests to be made as long as such tests are required.

3.14 EQUIPMENT

All stressing equipment must be used in accordance with the specifications of the manufacturer and Clause 9 of BS 8081:1989 and must at all times be maintained in good condition.

The pumps, jacks and all tensioning equipment shall be calibrated. All calibrations must be conducted by an approved laboratory with the necessary equipment and must be certified. The calibrations shall be carried out no longer than 3 months prior to using the equipment on site. If any incident occurs during transportation, handling or

tensioning which may have caused damage, the equipment must be recalibrated. The Engineer will direct the use of load cell to recalibrate stressing equipment or reject the equipment if the calibration submitted is not acceptable.

Anchor stressing shall be in the manner specified in the approved shop drawings. Stressing shall not be carried out until the grout has reached its specific strength.

All equipment used for fabrication, handling and placing shall be such that it will not damage the anchor tendons.

The grouting equipment shall be capable of continuous mechanical mixing to produce a grout free of lumps and undispersed cement. A manifold system with a series of valves and calibrated pressure gauge with a capacity of 10 N/mm2 shall permit continuous circulation and pumping of grouting with accurate control of grout pressure.

Stressing equipment shall be capable of applying at least the specified test load to the anchor tendon. A calibrated pressure gauge indicating the hydraulic jack pressure should, as a minimum requirement, comply with class 2 of BS 1780. They should be supplied with a calibration certificate and shall read to an accuracy of at least ±3% of the load applied.

3.15 ANCHOR FABRICATION

Anchors shall be either shop fabricated or field fabricated in accordance with approved shop drawings, using personnel trained and qualified in this type of work.

Anchors shall be free of dirt, detrimental rust or any other deleterious substance.

Anchors shall be handled and protected prior to installation in such a manner as to avoid corrosion and physical damage thereto. All field joints of the corrosion protection shall be made watertight by an epoxy bonding compound or equivalent.

3.16 DRILLING

Holes for anchors may be formed by drilling method. The drilling method used shall be subjected to the agreement of the Engineer. Full temporary casing shall be installed to maintain a clean and open shaft and prevent wash out of fines outside the casing in all holes. Grouting shall be carried out with the temporary casing inside the hole and after fresh grout emerge from the hole, then only the temporary casing can be slowly retrieved while grouting continue. Any alternative method shall be approved by the Engineer.

Drill holes for ground anchors shall be provided in accordance with the Drawings. The drill hole entry point shall be positioned within a tolerance of ±75mm. Deviation in alignment shall not exceed 1 in 30. Deviation from straight shall not exceed 20mm in any 3m length of drill hole.

The Contractor shall keep a record of all drilling procedures and times, which shall be made available to the Engineer.

3.17 ANCHOR INSTALLATION

The installation of the tendons shall be supervised by suitably qualified personnel familiar with this type of work. The curricular vitae of the personnel shall be submitted to the Engineer before commencement of work. All equipment used for handling and insertion of the anchor shall be such that it will not damage the anchor tendon and corrosion protection.

Grout tubes shall be flushed with water or compressed air to ensure that they are clear.

The anchor bonded lengths as indicated in the approved design submissions shall be considered the minimum bonded lengths, and shall be located within the specified bond zone of the anchorage stratum.

All anchors shall be installed through the casing to avoid damage to the corrosion protection.

The Contractor shall maintain a record showing the anchor type, length, position and installation date for each anchor. The installation of anchor should be inspected or witnessed by the Engineer on the following stages

- End of bore
- Insertion of tendon
- Grouting
- Completion of installation

❖ **Water Testing and Pre-grouting**

The drill hole shall be subjected to a water test to determine the likelihood of grout loss around the fixed length. However, the Engineer may agree to omit this test in exceptional ground conditions and/or where the Anchor System installation method statement provides an alternative.

Subject to the agreement of the Engineer, the Contractor may pre-grout the fixed length prior to the water testing.

The test shall be carried out by the application of a net water pressure of one atmosphere (100 kPa), or a lower pressure agreed by the Engineer, at the proximal end of the fixed length which shall be maintained for a period of ten minutes. The water loss in this period shall not exceed 50 litres. The net water pressure shall be the difference between the applied test pressure and the existing water pressure in the drill hole.

The test may be undertaken using a drill hole packer to seal off the section under test. Alternatively, it may be carried out by using the net pressure defined above through filling the drill hole with water. The volume of water required to maintain a constant head shall then be measured and shall not exceed 50 litres over ten minutes.

Should the test fail, the fixed anchor length shall be grouted under a pressure not exceeding a pressure agreed by the Engineer. The drill hole shall then be flushed or drilled out, and the water test re-applied.

A full record of the water test shall be submitted to the Engineer. Normally this test is carried out in rock anchors, to be checked in the soil anchor.

❖ **Insertion of Anchor**

The Engineer shall be given assistance in his inspection of the drill hole and shall be provided with the records for drilling and water testing prior to the Contractor seeking his approval.

If the drill hole proves unacceptable, the Contractor shall seek instruction from the Engineer as to whether the hole is to be grouted and redrilled, re-provided as a drainage hole or grouted and abandoned. Once the drill hole has been accepted, the Contractor shall proceed to insert the anchor.

The anchor shall be inserted within 24 hours of completion of the drilling except where otherwise agreed by the Engineer. The anchor shall be handled with care. During insertion, it shall be installed at a controlled rate to avoid damage to itself and the drill hole.

The anchor shall be positioned in accordance with the requirements of Clause 3.11.4 and shall be secured to prevent further movement.

3.18 GROUTING

3.18.1 GENERAL

Grout shall consist of materials specified in Clause 3.11.3.

The grout shall not remain in the mixer for a period exceeding 45 minutes, failing which it shall be rejected.

Pressure grouting to the bonded section of the anchor is required to ensure the grout will not be washed away from the tendon.

The primary grout shall be pumped into the anchor hole through a grout pipe provided for that purpose until the hole is filled to the top of the anchorage zone. The grout shall always be injected at the lowest point on the bond length. Provisions shall be made for determining the level of the top of the primary grout to assure adequate anchorage. After grouting, the hydrostatic pressure due to gravity of the grout body will be 0.02 N/mm2 per vertical metre and this shall be considered when assessing the effective grout pressure at the lowest point of the bond length.

The free stressing length shall be flushed-out to remove any access grout above the bond length with specially provided flushing tubes. The void of the free-stressing length shall be filled with a low strength bentonite cement grout.

After grouting, the anchors shall remain in an undisturbed condition until the necessary grout strengths have been achieved.

3.18.2 BLEEDING, FREE EXPANSION and FLUIDITY

The grout shall not be subjected to bleeding in excess of 0.5% by volume three hours after mixing or 1% maximum when measured at 20°C in a covered glass or metal cylinder of 100mm internal diameter and with a grout depth of approximately 100mm. In addition the water shall be re-absorbed within 24 hours. Free expansion of the grout shall not exceed 10% at the ambient temperature.

Fluidity of the grout shall be tested in accordance with methods agreed by the Engineer. Except with the prior agreement of the Engineer, for grouts containing admixtures, the afflux time of the grout shall not be less than 15 seconds.

3.18.3 SAMPLING FOR TESTS ON BLEEDING, FREE EXPANSION, FLUIDITY and STRENGTH

At least one sample of grout shall be obtained for each Acceptance Test anchor. In the case of Acceptance Test anchors, at least one sample shall be taken from each fresh grout batch used to grout the first five anchors. Thereafter, another sample shall be taken for every five additional anchors grouted with the same batch. The samples shall be taken not more than one hour after the grout has been mixed. If directed by the Engineer, the grout may have to be sampled from the fresh grout flow out from the drillhole when the grouting process is near completion. Each sample of grout taken shall be divided into three specimens. Each specimen shall be tested to determine the amount of bleeding, free expansion and fluidity.

A set of three grout cubes shall be prepared for cube strength determination in accordance with Clause 3.11.3 from each sample of grout taken.

3.18.4 TRIAL GROUT MIXES

A trial grout mix shall be carried out in accordance with Clause 3.20.5 using the designed water-cement ratio and admixtures (if any) and the proposed grouting equipment to be used for the Contract.

One sample of the grout from the trial mix shall be divided into three specimens and each specimen shall be tested to show compliance with the bleeding, free expansion and fluidity requirements stated in Clause 20.2.One sample of the grout from the trial mix shall be taken for determination of the grout cube strength to show compliance with the requirements in Clause 11.3.One sample of the grout from the trial mix shall be divided into three specimens and each specimen shall be tested to show compliance with the total sulphate (SO3), chloride and nitrate contents requirements stated in Clause 3.11.3.

Results of the trial grout mix tests showing the degree of compliance with the Specification shall be submitted to the Engineer at least two weeks before the commencement of grouting.

3.18.5 GROUT MIXING

Batching of the dry materials shall be by weight. The amount of water used shall be measured by a calibrated flow meter or a measuring tank.

The procedure to be followed for mixing the grout shall be that approximately two-thirds of the cement shall be added to the water, followed by the admixtures, if any, followed by the remaining third of cement.

The grout shall be mixed in a mechanical mixer capable of imparting a high shear action to the grout components so that a colloidal grout of uniform consistency is produced in a mixing time of less than five minutes.The grout mixing process shall utilise a recirculating system where the grout is continuously discharged and recharged into the mixing unit during the mixing period. After mixing, the grout shall be kept continuously agitated.

The grout shall be passed through a nominal 1.2mm sieve prior to injection. The grout shall be used as soon as possible after mixing and in any case within 30 minutes of adding cement unless otherwise agreed by the Engineer.

3.18.6 GROUT INJECTION EQUIPMENT

The pump used for grout injection shall be of the positive displacement type, i.e. it shall be actuated by a piston or screw. A flow meter and a pressure gauge shall be provided. The Engineer's approval of the equipment shall be obtained prior to its use.

3.18.7 GROUTING PROCEDURES

The grouting operation shall be undertaken within 24 hours of the anchor being inserted except where otherwise agreed by the Engineer. The procedure adopted shall ensure that there are no air or water inclusions left in the grouted zone.

The grouting pressure adopted shall be the minimum consistent with undertaking the operation and shall avoid damage to surrounding buildings, land, structure, street and services.

Grouting shall proceed at a slow, steady rate and shall continue until injected grout of the same composition and consistency as that mixed has been emerging from the outlet for at least one minute.

3.18.8 GROUTING RECORDS

A record giving full details of the grouting operation for each anchor shall be supplied to the Engineer prior to a request seeking his acceptance of the anchor.

3.19 FITTING ANCHOR HEAD

The anchor head and its associated components shall be fitted concentrically to the tendon within a tolerance of ± 5mm and perpendicular to the tendon within a tolerance of ±3. Any leakage of water/fluid from the anchor hole or anchor head shall be sealed by approved method.

3.20 ANCHOR TESTING

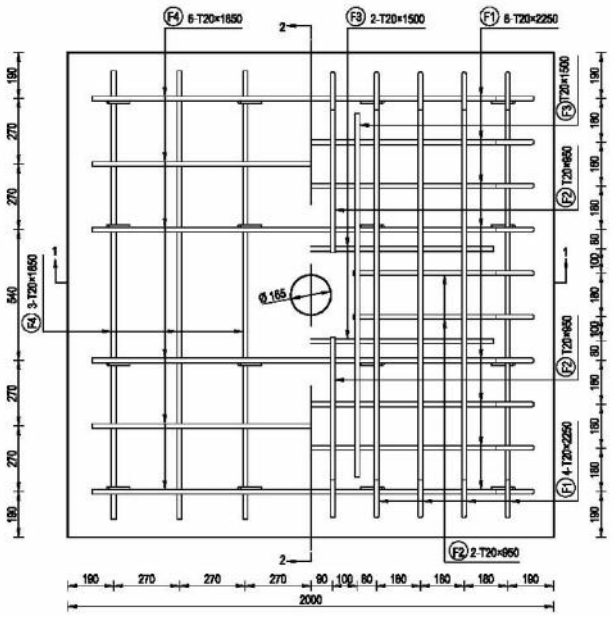
Refer BS 8081

3.21 MEASUREMENT AND PAYMENT

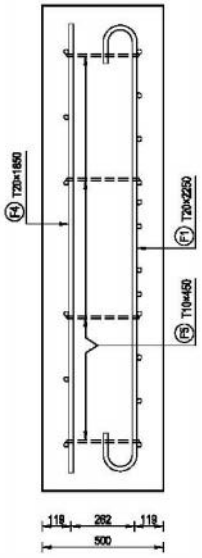
The Ground Anchor works shall be measured in running meter of the Ground Anchor and payment shall be made as per Price BOQ.

1.

Representative drawing of ground anchor pillow and anchor plate



PLAN
SCALE 1:20



SECTION 2-2
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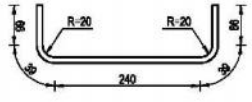
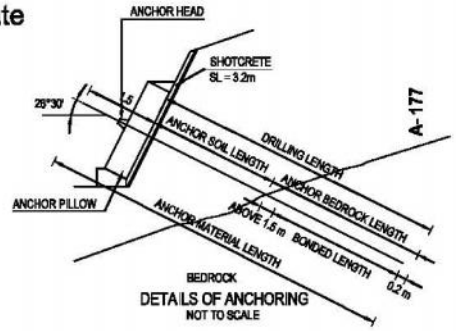
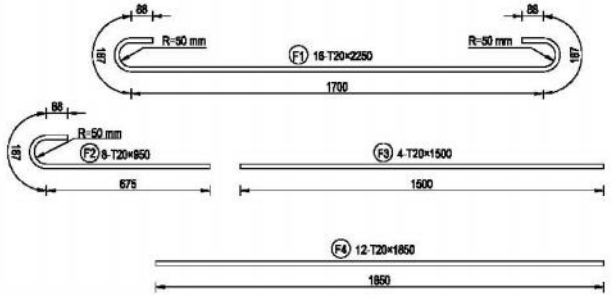


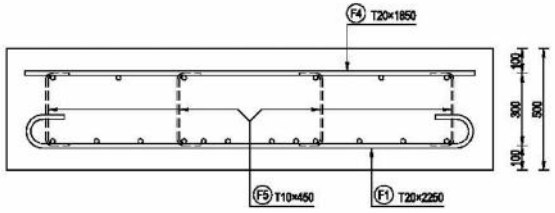
SPACER BAR
SCALE 1:8



DETAILS OF ANCHORING
NOT TO SCALE

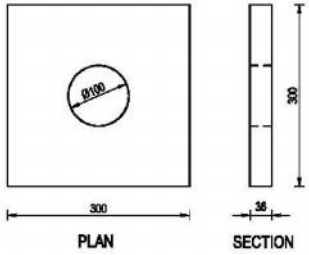


REINFORCEMENT BAR
SCALE 1:20



SECTION 1-1
SCALE 1:20

ANCHOR PILLOW



PLAN SECTION

ANCHOR PLATE
SCALE 1:8

DETAILS OF CONSTRUCTION MATERIALS

1.	STEEL BAR		SD295A	
2.	ANCHOR PLATE		SS 400	
3.	CONCRETE	DESIGN STANDARD STRENGTH	25	kgf / cm
		SLUMP	8	cm
		MAXIMUM COARSE AGGREGATE SIZE	25	mm

WEIGHT OF STEEL

BAR MARK	BAR SIZE (mm)	LENGTH (mm)	NUMBERS (Nos)	UNIT WEIGHT (kg/m)	WEIGHT PER BAR (kg)	WEIGHT ∑ kgf
F1	T20	2250	16	2.25	5.06	80.96
F2	T20	950	8	2.25	2.14	17.12
F3	T20	1500	4	2.25	3.38	13.52
F4	T20	1850	12	2.25	4.16	49.92
F5	T10	450	16	0.56	0.25	4.00
TOTAL 20mm STEEL BAR WEIGHT						161.52
TOTAL 10mm STEEL BAR WEIGHT						4.00
TOTAL STEEL BAR WEIGHT						165.52
ANCHOR PLATE						25.43

NOTE
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED.
2. THE QUANTITIES GIVEN IN THE TABLE ARE ONLY FOR REFERENCE USE.

4. ROCK FALL PROTECTION NET

Supplying and placing of Mechanically Woven Double Twisted Hexagonal Shaped Wire Mesh netting roll, Mesh Type 10x12, (Zn+10%Al alloy) + PVC coated Mesh Wire dia. 2.7/3.7mm (ID/OD), end of roll mechanically edged / selvedged, with galvanization as per IS 16014:2012 and MoRTH (Fifth Revision) 2013, Clause 2500.

4.1 Scope:

This specification covers the use of mechanically woven hexagonal shaped double twisted(DT)wire mesh rock fall netting for surface rock fall protection including the scope of furnishing and installation as per the special provisions mentioned in the specifications, instructions from the manufacturer/supplier of the rock fall protection system and as directed by the Engineer- In-Charge.

4.2 General Requirements:

4.2.1 The DT wire mesh rock fall netting shall meet the minimum requirements of mechanically woven DT hexagonal shaped (zinc+10%Al alloy) and PVC coated wire mesh mainly mesh wire diameter, mesh type, zinc+10%Al alloy coating, PVC coating, wire tensile strength and mesh panel tensile strength as specified in this document.

4.2.2 System Technology:

The DT wire mesh rock fall netting shall be made up of mechanically woven hexagonal DT wire mesh. The steel wire shall be soft temper steel heavily coated with Zn+10%Al alloy. PVC coating shall be applied for added protection, to use in corrosive environment. Nominal PVC thickness of 0.50mm shall be applied. The hexagonal shape of the mesh provides a better distribution of the working tensions along the wires that form the mesh.

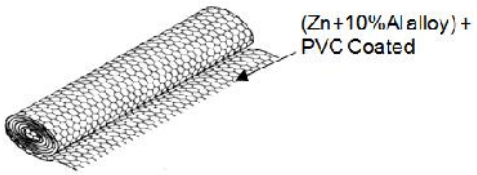


Fig 4.1 Typical Wire Mesh Rock fall Netting

4.3 Material Specifications:

4.3.1 Mechanically Woven Double Twisted Hexagonal shaped (Zn+10%Al alloy) + PVC coated wire mesh:

All steel wires used in the manufacturing of wire mesh rock fall netting shall conform to IS 16014:2012. The wire used for the manufacture of mesh shall have a tensile strength between 350-550N/mm^2 and elongation shall not be less than 10%. Test shall be carried out on a sample of at least 20 cm length. All tests on the mesh wire, selvedging wire & lacing wire shall be performed prior to manufacturing the mesh. The DT wire mesh shall have peak tensile strength of 40 kN/m tested as per procedure outlined in clause 6 of this specification.

4.3.2 Selvedge wire:

The diameter of the selvedging shall be bigger than the wires in the mesh. The diameter of selvedge wire shall be 3.4mm and shall have same characteristics as the mesh wire.

4.3.3 Lacing wire:

The diameter of the lacing wire shall be 2.2 mm and shall have same characteristics as the mesh wire and shall have same characteristics as the mesh wire.

4.3.4 Zinc+10%Al alloy coating

- Zinc+10%Al alloy coating: Minimum quantities of Zinc+10%Al alloy shown at Table 1 shall meet the requirements of IS 4826:1979.
- Adhesion of zinc+10%Al alloy coating: The adhesion of the zinc+10%Al alloy coating to the wire shall be such that, when the wire is wrapped ten turns around a mandrel having four times the diameter of the wire, it does not flake or crack when rubbing it with the bare fingers in accordance with IS 4826:1979.

4.3.5 PVC (Polyvinyl Chloride) coating

- **PVC coating thickness:** Nominal – 0.5 mm, Minimum – 0.4 mm
- **Specific weight:** 1.3 kg/dm3– 1.35 kg/dm3 in accordance with IS 13360, Part3, section 1.
- **Hardness:** between 50 and 60 Shore D, according to IS 13360, Part5, section 11
- **Tensile strength:** Higher than 20.6 MPa, according to IS 13360, Part5, section 1
- **Elongation at break:** not less than 200% in accordance with IS 13360, Part5, section 1.

Wire diameter, tolerances, zinc+10%Al alloy coating shall conform to values indicated in Table :

Table: 4.1 Characteristics of Mesh wire, Selvedge wire and Lacing wire

Characteristics of 10x12 mesh	Mesh wire	Selvedge wire	Lacing wire
Mesh Wire Dia mm	2.7	3.4	2.2
Tolerance (+/-) mm	0.06	0.07	0.06
Zn +10%Al alloy Coating Min (gm/sq.m)	245	265	230

The wire mesh shall have nominal opening of 100mm as shown in Figure 4.2. The mesh opening tolerances are indicated in Table 2.

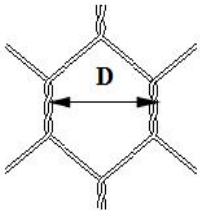


Fig 4.2 Mesh Details

Tolerances in Mesh Opening size: - 2% to +2%

DT mesh shall have minimum 10 numbers of mesh openings per meter of mesh perpendicular to twist of mesh.

Procedure for verification of mesh opening

- Rockfall netting shall be unfolded on the plain ground.
- Any shrink in the unfolded netting shall be removed, by stretching the Mesh panel.
- Marking on the ground shall be made from the Centre of the twist of one mesh and the second. Marking shall be done at 1 m distance.
- The number of mesh Openings in the 1 m shall be counted & verified.

Table: 4.2 Standard Mesh

Mesh type	"D"(mm)	Tolerance	Mesh Panel Strength (parallel to twist)	(Zinc+10%Al alloy) +PVC coated		
				Diameter of wire (Inner / Outer wire)		
				Mesh wire(mm)	Selvedge wire (mm)	Lacing wire(mm)
10X12	100mm	- 2% to +2%	40kN/m	2.7/3.7	3.4/4.4	2.2/3.2

4.3.6 Dimensions of DT wire mesh rock fall netting

DT wire mesh rock fall netting shall be manufactured in a standard width of 4m and length of 25 or 50m with tolerance of ±5% .Table 3 indicates standard sizes of DT wire mesh rock fall netting.

Other roll sizes may be required as per site conditions subject to the Engineer's approval. For non-standard roll lengths there may be some variation outside the tolerance limit from the nominal size shown in the contract drawings.

Table: 4.3 Standard sizes of DT wire mesh rock fall netting

Type	Length (m)	Width (m)
DT wire mesh rock fall netting(Mesh 10x12)	25	4
	50	4
	100	4

4.4 Installation:

Vegetation, debris and loose soils and other deleterious matter shall be cleared to the satisfaction of Engineer. Reference benchmarks, line and levels shall be marked at site. The materials, tools and tackles shall be shifted to site without damaging system.

The rolls of DT wire mesh rock fall netting should be rolled down the surface from top anchoring system as per the contract drawings. New roll shall be placed in the same manner directly overlapping the adjacent roll such that longitudinal ropes of both the rolls can be laced together by hand. Lacing shall commence by twisting end

of the lacing wire tightly to the wire mesh. It shall then pass round the two edges being joined using alternate single and double loops at approximately 100mm intervals. The lacing wire shall be securely tied off at the bottom of the roll. The bottom anchoring shall be done as per the drawings.

Manufacturer's installation guideline shall be referred for details.

4.5 Testing and Acceptance criteria:

Testing shall be done on raw material as per codes specified in Table 4. Approval for the material shall be obtained in the writing from the Engineer before actual start of supply. The manufacturer of the DT wire mesh rock fall netting shall provide manufacturers test certificate for the material with every lot/shipment. The manufacturers test certificate for DT wire mesh rock fall netting shall be provided for certifying that rock fall protection system conforms to all the technical and special requirements.

4.6.1 DT wire mesh tensile strength test procedure

A tensile test on DT wire mesh sample shall be carried out in order to estimate tensile strength parallel to twist. The test shall be carried out as per procedure outlined below. The DT wire mesh tensile strength shall be minimum 40 KN/m.

(a) Take a DT wire mesh of approximately 1.0 m width. The sample shall have edge wire on both the sides.

(b) The height of the sample shall be such that after selvedging on both the sides, effective height of the sample shall be more than 300 mm. Sample shall be loaded on the UTM in a direction parallel to twist, with the samples being gripped as shown in the figure 3.

(c) The effective height of sample (gauge length) shall be the distance measured between the two rows of inner gripping pins on two grips.

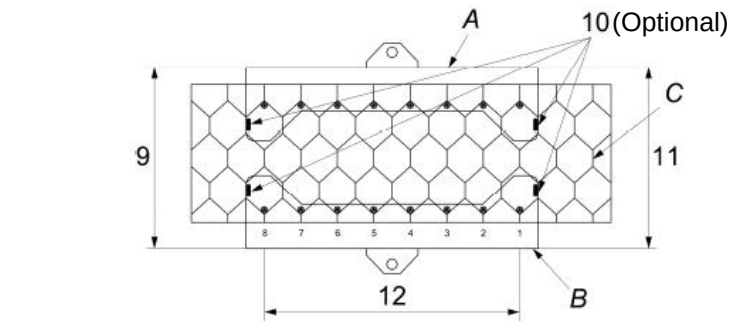
(d) Distance between the two end gripping points (pins) along the width of the sample shall be recorded as the unit width under test. The width shall be at least 700 mm.

(e) The load shall be applied gradually to the sample and the test be continued till the break point.

(f) The peak load and the % elongation shall be recorded.

(g) The strength of the DT wire mesh shall be (peak load/unit width under test) expressed in kN/m.

NB. If the sample slips at any of the gripping point during the test, such a test shall be discarded and a new sample shall be taken.



Key

1 to 8	Steel hooks	12	Effective width
9	Left reading	A	Upper steel plate
10	Lateral hooks	B	Underneath steel plate
11	Right reading	C	Mesh sample

Fig4.3 Tensile strength of mesh panel

4.6.2 PVC coating thickness test procedure:

The thickness of the PVC coating shall be determined on a randomly chosen individual piece of wire removed from the coil at 3 places 1 metre apart.

Measure with a micrometer the diameter of the galvanized steel wire with PVC coating. Determine the thickness of the PVC coating by stripping the PVC coating from the wire and measure the reduced diameter with a micrometer. The thickness of the coating is the difference between the diameter of the galvanized steel wire with PVC coating and the measured diameter of the galvanized steel wire divided by two. The thickness values should be as per clause 3.e. While removing the PVC coating by stripping, take care not to remove any of the metallic surfaces.

Table:4 Testing Plan

Sr No	Test	Reference	Frequency of Testing	Sample size	Remarks
	MESH WIRE				
1	Tensile strength & Elongation%	IS 16014:2012	Once	Three	At DT wire mesh rock fall netting manufacturer's lab
2	Mass of Zinc+10%Al alloy & adhesion	IS 4826:1979	Once	Three	At DT wire mesh rock fall netting manufacturer's lab
3	DT wire mesh panel strength	Clause 1.6	Once	Three	At DT wire mesh rock fall netting manufacturer's lab
4	Physical dimension of Wire mesh rock fall netting	TDS, Visual checking			At DT wire mesh rock fall netting manufacturer's lab
5	PVC coating thickness	Clause 1.3.5	Once	Three	At DT wire mesh rock fall netting manufacturer's

Sr No	Test	Reference	Frequency of Testing	Sample size	Remarks
					lab
Note: Testing of wire shall be done on samples from raw material					

4.6 Method of Measurement:

Quantity of DT wire mesh rock fall netting shall be determined from cross sections and the linear distance, and paid for under the appropriate bid items

4.7 Basis of Payment

Accepted DT wire mesh rock fall netting shall be paid for at the unit price (per square metre area) for each pay item included in the contract.

5. GABION WALL

Supplying and placing of Mechanically Woven Double Twisted Hexagonal Shaped Wire Mesh Gabion Boxes of required sizes, Mesh Type 10x12, (Zn+ 10%Al alloy) + PVC coated, Mesh Wire dia. 2.7/3.7mm (ID/OD), mechanically edged / selvedged with galvanization, with partitions at every 1m interval.

5.1. Description

This work shall consist of furnishing, assembling, and filling mechanically woven double twist hexagonal wire mesh gabions with rock as specified in the contract to the dimensions, lines and grades shown on the plans, or as determined by the engineer. These specifications are mainly in accordance with Indian Standards IS 16014 and MoRT&H (Fifth Revision) 2013, Clause 2500.

5.2. Material- Gabions

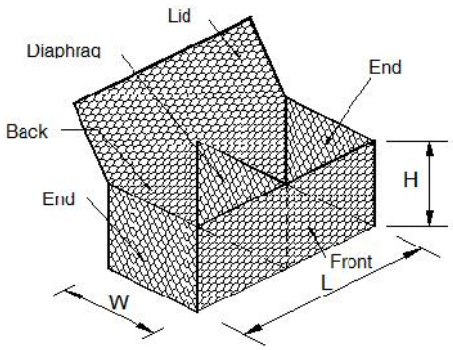


Fig. 5.1

5.2.1. Wire:

All tests on the mesh, lacing wire and selvedge wire must be performed prior to manufacturing the mesh.

Tensile strength: The wire used for the manufacture of Mesh shall have a tensile strength minimum 350 N/mm^2 in accordance with IS 280. Wire tolerances (Table 1) shall be in accordance with IS 16014:2012 (Class T1).

Elongation: Elongation shall not be less than 10%, in accordance with IS 16014:2012 and MoRT&H(Fifth Revision) Clause 3100. Test must be carried out on a sample at least 20 cm long.

5.2.2. Internal Connecting Wires:

Cross Ties/ stiffener wire: Diameter 2.2 mm, Zn+ 10% Al alloy coated wire with PVC coating, 3.2mm when measured with PVC coating.

5.2.3. Zn+ 10% Al alloy Coating

- **Zn+ 10% Al alloy coating:** Minimum quantities of Zn+ 10% Al alloy shall be as shown in table in clause 1.2.6
- **Adhesion of Zn+ 10% Al alloy coating:** The adhesion of the Zn+ 10% Al alloy coating to the wire shall be such that, when the wire is wrapped ten turns around a mandrel having four times the diameter of the wire, it does not flake or crack when rubbing it with the bare fingers in accordance with IS 4826:1979.

5.2.4. PVC (Polyvinyl Chloride) Coating

PVC coating thickness: Nominal – 0.5 mm, Minimum – 0.4 mm;

Specific weight: 1.3 kg/dm3–1.35 kg/dm3 in accordance with IS 13360, Part3, section 1.

Hardness: between 50 and 60 Shore D, according to IS 13360, Part5, section 11

Tensile strength: Higher than 20.6 MPa, according to IS 13360, Part5, section 1

Elongation at break: not less than 200% in accordance with IS 13360, Part5, section 1.

5.2.5. Wire mesh (10x12 mesh type):

Mesh type	"D"(mm)	Zn+ 10% Al alloy +PVC coated		
		Diameter of wire (Inner / Outer wire)		
		Mesh wire(mm)	Selvedge wire (mm)	Lacing wire(mm)
10X12	100mm	2.7/3.7	3.4/4.4	2.2/3.2

Mesh opening: Nominal Dimension D = 100, as per Fig. 2

Tolerances in Mesh Opening size: - 2% to +2%

DT mesh shall have minimum 10 numbers of mesh openings per meter of mesh perpendicular to twist of mesh.

Procedure for verification of mesh opening

a) Gabion Box/Mattress shall be unfolded on the plain ground.

b) Any shrink in the unfolded Gabion Mesh shall be removed, by stretching the Mesh panel.

c) Marking on the ground shall be made from the Centre of the twist of one mesh and the second. Marking shall be done at 1 m distance.

d) The number of mesh Openings in the 1 m shall be counted & verified.

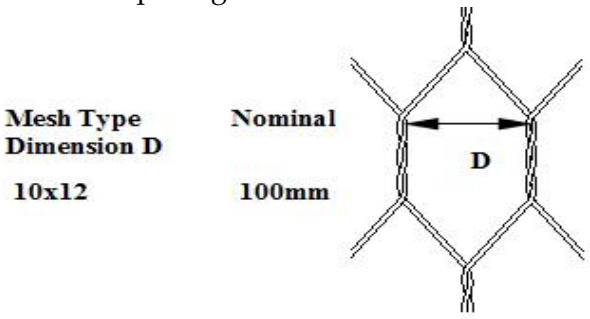


Fig:5.2

5.2.6. Tolerances

Wire: wire diameter tolerance and minimum Zn+ 10% Al alloy coating requirement shall be as per following table

Wire Diameter mm	2.2 mm	2.7 mm	3.4 mm
Wire Tolerance(+)mm	0.06	0.06	0.07
Minimum Qty. of Zn+ 10% Al alloy (gm/m2)	230	245	265

5.2.7. Standard Sizes

Standard sizes (Length x Breadth x Height) of gabions are 4mx1mx1m, 3mx1mx1m, 2mx1mx1m, 1.5mx1mx1m, 4mx1mx0.5m, 3mx1mx.5m and 2mx1mx0.5m

5.2.8. Tolerance in gabion dimensions

+ 5% in all dimensions (length, breadth and height) shall be allowed as tolerance for Gabion units.

5.2.9. Fabrication

Gabions shall be manufactured with all components mechanically connected at the production facility. The front, base, back and lid of the gabions shall be woven into a single unit. The ends and diaphragm(s) shall be factory connected to the base. The lid may be a separate piece made of the same type mesh as the basket. All perimeter edges of the mesh forming the basket and top, or lid, shall be selvedged with wire having a larger diameter.

Gabion is divided into cells by means of diaphragms positioned at approximately 1m centers. The diaphragms shall be secured in position to the base so that no additional lacing is necessary at the jobsite.

Table (2) Typical Gabion sizes (10 X 12 -mesh type)

Length, m	Width, m	Height, m	Number of Diaphragms
4.0	1.0	1.0	3
3.0	1.0	1.0	2
2.0	1.0	1.0	1
1.5	1.0	1.0	0
4.0	1.0	0.5	3
3.0	1.0	0.5	2
2.0	1.0	0.5	1

5.3. Construction Requirements

Gabion filling and lacing and erection at site should be strictly as per the instruction of approved (by engineer) manufacturer's instructions as per the site specific requirements.

5.3.1. Assembly

Gabions are supplied folded flat and packed in bundles. Larger units may be supplied in rolls. The units are assembled individually by erecting the sides, ends, and diaphragms, ensuring that all panels are in the correct position, and the tops of all sides are satisfactorily aligned. The four corners shall be connected first, followed by the internal diaphragms to the outside walls.

The procedure for using lacing wire consists of cutting a sufficient length of wire, and first looping and/or twisting the lacing wire to the wire mesh. Proceed to lace with alternating double and single loops through every mesh opening, pulling each loop tight and finally securing the end of the lacing wire to the wire mesh by looping and/or twisting. Refer figure 5.3.

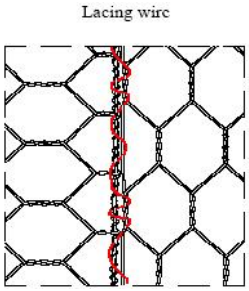


Fig 1.3

5.3.2. Installation

After initial assembly, the gabions are carried to their final position and are securely joined together along the vertical and top edges of their contact surfaces using the same connecting procedure(s) described earlier. Whenever a structure requires more than one layer, the upper empty baskets shall also be connected to the top of the lower layer along the front and back edges of the contact surface using the same connecting procedure(s) described in Section 1.3.1.

5.3.3. Filling

Rock for the Gabion facia shall be hard, angular to round, durable and of such quality that they shall not disintegrate on exposure to water or weathering during the life of the structure. The rocks shall range between 150 mm to 250 mm for 10x12 type mesh. Each range of sizes may allow for a variation of 5% oversize rock by number of particles, or 5% undersize rock by number of particles, or both. The size of any oversize rock shall allow for the placement of minimum of three layers of rock must be achieved when filling the 1 m high units and a minimum of two layers for the 0.50 m high units. The rock used for filling the gabion facia shall have a minimum density of 24kN/m3 and Los Angeles abrasion value not more than 45.

The facing section shall be filled with rock in a careful way to get good horizontal and vertical alignment. During the filling operation skilled manual stone placement is required to minimize voids. The maximum permitted porosity of stone filling shall be 40%. For vertical or near vertical structures the exterior of the basket may be carefully hand placed to give a neat, flat, and compact appearance. Care shall be taken when placing fill material to ensure that the sheathing on the PVC coated baskets is not damaged. The facing stones should orient in such a way to get their flat surfaces facing to the front.

The cells shall be filled in stages so that local deformation may be avoided. At no time shall any cell be filled to a depth exceeding 0.30 m higher than the adjoining cell. It is also recommended to slightly overfill the baskets by 25mm to 50 mm to allow for settlement of the rock.

5.3.4. Internal Connecting Wires installation

Internal connecting wires shall connect the exposed face of a cell to the opposite side of the cell. An exposed face is any side of a gabion cell that will remain exposed or unsupported after the structure is completed. Lacing wire or prefabricated internal connecting wires shall be used as internal connecting wires.

5.3.4.1 1meter High Gabions

1meter high gabions shall be filled in three layers, 300 mm at a time. Connecting wires shall be installed after the placement of each layer, that is, at 300 mm high.

5.3.4.2 0.5m High Gabions

0.5 meter high gabions do not require connecting wires unless the baskets are used to build vertical structures. These units shall be filled in two layers 250mm at a time. Connecting wires shall be installed after the placement of the first layer, which is at 250mm high.

5.3.5. Lid Closing

Once the gabion baskets are completely full, the lids will be pulled tight until the lid meets the perimeter edges of the basket. The lid must then be tightly laced and/or fastened along all edges, ends and tops of diaphragm(s) in the same manner as described in earlier sections.

5.3.6 Mesh cutting and folding

Where shown on the drawings or otherwise directed by the engineer, the gabions shall be cut, folded and fastened together to suit existing site conditions. The mesh must be cleanly cut and surplus mesh either folded back or overlapped so that it can be securely fastened together with lacing wire or fasteners in the manner described in earlier Section. Any reshaped gabions shall be assembled, installed, filled and closed as specified in the previous sections.

5.4. Method of Measurement

The payment quantities for excavation shall be determined by the outside limits of the gabion structure. Quantities will be determined from cross sections and the linear distance, and paid for under the appropriate bid items.

The quantity to be paid for "In place gabions" shall be the number of cubic meters of gabions. Project conditions and material availability will determine the actual size of gabions to be used.

Excavated material beyond the limits of the gabions shall be backfilled with gravel, crushed rock or other material approved by the engineer.

5.5. Basis of Payment

Accepted gabions will be paid for at the unit price for each pay item included in the contract.

5.6. Testing and Acceptance criteria

The material should get approval from the client before the actual supply start. The manufacturer of the Gabion facing unit should provide "Manufacturers Test Certificate' and Quality Conformity Certificate for the material with every lot/shipment. Tensile strength test, and Zn+10%Al alloy coating test on basic wire shall be done on one sample per every 10,000 numbers of units supplied. The tests shall be conducted in an accredited lab with proper testing facility or alternatively the tests shall be conducted in Manufacturer's facility witnessed by an expert authorized by the client.

PVC Coating Thickness: The thickness of the PVC coating shall be determined on a randomly chosen individual piece of wire removed from the coil at 3 places 1 metre apart.

Measure with a micrometer the diameter of the galvanized steel wire with PVC coating. Determine the thickness of the PVC coating by stripping the PVC coating from the wire and measure the reduced diameter with a micrometer. The thickness

of the coating is the difference between the diameter of the galvanized steel wire with PVC coating and the measured diameter of the galvanized steel wire divided by two. The thickness values should be as per clause 1.2.4. While removing the PVC coating by stripping, take care not to remove any of the metallic surfaces.

The punch strength test results shall be 17.8 kN in accordance with MoRT&H section 2500 and test specified therein.

5.6.1. Selvedge strength test:

A tensile test on mesh sample shall be carried out in order to estimate selvedge strength test. The test shall be carried out as per procedure outlined below. The selvedge strength shall be minimum 25 KN/m.

(a) Take a DT mesh of approximately 1.0 m width.

(b) The height of the sample shall be such that after selvedging on both the sides (1m), there shall be at least two mesh repetitions between the two selvedged wires, so that effective height of the sample shall be more than 300 mm.

(c) Sample shall be loaded on the UTM in a direction parallel to twist, with the samples being gripped at the two selvedged wires & not mesh twist.

(d) The distance between the two selvedge wires shall be recorded as Initial gauge length.

(e) Distance between the two end gripping points (pins) along the width of the sample shall be recorded as the unit width under test. The width shall be at least 700 mm.

(f) The load shall be applied gradually to the sample and the test be continued till the break point.

(g) The peak load and the % elongation shall be recorded.

(h) The strength of the selvedge connection shall be (peak load/unit width under test) expressed in kN/m.

NB. If the sample slips at any of the gripping point during the test, such a test shall be discarded and a new sample shall be taken.

6. ROCK BOLTS and GROUTED ANCHOR BARS / BOLTS.

6.1 Scope of Work

(i) The Specification described herein under relate to the Work which includes all labour, materials, equipments and services required for the supply, installation, testing and maintenance of rock bolts and grouted anchor bars /bolts and providing and installing of fore poles as also the supply and installations of wire mesh and mesh anchor is specified herein or as shown on the drawings.

(ii) Rock bolts shall be furnished complete with all accessories and other materials necessary for their installation, stressing and grouting.

(iii) If directed or approved by the Engineer-in-charge, the Contractor shall supply and install flat steel plates or rolled steel sections to connect together two or more rock bolt.

6.2 Submittals

(i) At least 30 days prior to the commencement of excavation works, the Contractor shall submit, to the Engineer-in-charge, the details of equipments to be used for testing and installation of rock bolts.

(ii) The Engineers –in-charge reserve the right to require any additional information deemed necessary to be included in the submitted documents.

6.3 General

(i) For the sake of convenience, the term used in this Chapter are defined as follows:

(a) Reinforcement Element is a general term for rock bolts, Achor bars and rock anchors (tendons).

(b) Rock bolt is a stressed (or tensioned) reinforcement element consisting of a rod, a mechanical of grouted anchorage, and a plate and a nut for stressing by torquing the nut for relating tension applied by direct pull. It is synonymous with "active rock anchor".

(c) Grouted Anchor Bar is an unpensioned reinforcement element consisting of a rod embedded in a mortar or grout filled hole. It is synonymous with "passive rock anchor" and "rock dowel".

(d) Individual 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".

(e) Pattern Rock bolting refers to the installation of reinforcement elements in a regular pattern over the excavation surface.

(f) Prestressed Rock Anchor or Tendon

These are tensioned reinforcing elements generally of higher capacity than a rock bolt, consisting of high strength steel tendon (made up one or more wires, strands or bars) fitted with a stressing anchorage at one end and the means permitting force transfer to the grout and rock at the other end.

(ii) The following types of reinforcing elements are proposed to be used.

(a) Expansion –shell type
(b) Resin-grouted type
(c) Grouted anchor bars

(iii) The type, length, diameter, inclination and pattern of the rock bolts shall be as shown on the drawings or as approved by the Engineer- in-Charge. The Contractor shall provide manufacturer's test certificate for all batches of rock bolts supplied. At least 5 samples shall have been tested for tensile strength until failure from each individual batch of rock bolts which is marked with the same manufacture's identification number. All the results of the tensile tests shall comply with the specified data of the manufacturer.

(iv) Bearing plates shall be flat or dished steel plates minimum dimensions of 150x150x10mm. The washers to be used shall be bevel or hemispherical. 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, with a coating mass not less than 0.6kg per sqm.

(v) All surfaces of the bearing plates, nuts, washers and wedges and threads on the projecting ends of rock bolts shall be protected and lubricants with rust preventive compound.

(vi) When rock bolts are used in conjunction with wire mesh, the mesh shall be connected firmly to be bolts by means of extra steel plates and nuts; Wire mesh shall not be placed between rock and the bearing plate of the rock bolt.

6.4 Testing and Monitoring of Rock bolts

(i) The Contractor shall furnish at least two sets of testing equipment including hydraulic jacks, fixing device, hydraulic pump with manometer, extensimeter and all necessary accessories. The testing equipments shall be capable of stressing the large diameter rock bolt to the yields stress of the bolt.

(ii) Prior to the installation of rock bolts in the Works, a series of pull-out test, both the load applied and movement undergone shall be carried out in different rock types designated by the Engineer –in –charge, and which will be representative of the rock expected to be encountered during the excavation , to prove the suitability of the rock bolts. During the pull-out test, both the load applied and movement undergone shall be measured. At least five tests shall be required for each combination of rock type / installation condition to be able to assess the suitability of the rock bolt. The maximum pulling load may be limited to 3 Toner per one (1) meter length of rock bolt or 80% of elastic limit whichever is smaller. The pull-out tests shall be carried out sufficiently in advance of the installation of the rock bolts in the works so that, in the event that the proposed rock bolts do not meet load strain requirements, the Contractor shall have time to furnish the tests rock bolts of a different type as directed by the Engineer-in-Charge. The Contractor shall maintain detailed records of the pull out tests, the result of which will be used to establish relationships between rock quality and type of rock bolts and tensioning.

(iii) During Progress of the work, the Contractor shall perform pull-out tests, in the presence of the Engineer- in- Charge, on at least 1 per 50 rock bolts installed. The Engineer- in-Charge will determine the bolts to be tested. As per the pulling load increase step by step, deformation of the anchor plates shall be recorded for safety. Rock bolts which fail under the load less than 3 Tonnes per one (1) metre length of rock bolt or 80% of elastic limit which ever in smaller shall be reinstalled at locations

designed by the Engineer-in-charge. The Engineer-in-charge will instruct the Contractor to take necessary measures if the results of the pulling load tests are not satisfactory in the opinion of the Engineer-in-Charge.

(iv) Grouted expansion-shell type rock bolts shall be tested before grouting other type of rock bolts shall be tested after the mortar or resin type end anchorage have achieved their designated strength.

(v) If any rock bolt fails due to improper workmanship or defect in materials, the Engineer-in-Charge may order a test on all adjacent rock bolts and rock bolts so failing shall be rejected, replaced and retested.

6.5 Drilling Holes and Preparation for Installation

(i) Holes for rock bolts and ground anchor bars shall be drilled as specified herein and in accordance with the provisions set out in Section-7 "Drilling and Grouting".

(ii) The diameter of each hole in accordance with manufacturer's recommendations and Engineer-in-charge's approval except for grouted anchor bars where the whole diameter shall be at least 1.5 times that of the rod specified for the hole.

(iii) The length of drill hole shall be such as to receive the specified rock bolt and to provide for its satisfactory anchorage.

(iv) 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 tend to swell or are 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.

(v) Prior ton installing the rock bolts 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.

(vi) 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.

(vii) Fresh holes, as directed by the Engineer-in-Charge, shall be drilled by the Contractor at his expense to substitute such holes as have been drilled out of place of alignment.

(viii) The rock surface around the drilled holes to receive the bearing plate shall be chipped smooth or be covered with a smooth quick set cement pad.

6.6 Expansion Shell Type

(i) Expansion shell type rock bolt consist of a threaded solid bar fabricated from deformed steel bar of diameter 25 mm or 32mm. The rock bolts shall confirm to IS: 8266-1976 (Reaffirmed 1990) or as shown on the drawings.

(ii) The rock bolts to be used shall be grouted as entered in the Bill of Quantities and as directed by Engineer-in-Charge.

6.7 Resin-grouted Type

(i) Rock bolts shall consist of deformed steel bar 25mm or 32mm diameter with a yield stress of 415 N/mm^2 or as shown on the drawings. Each bolt shall have one end chamfered and the other end threaded with a coarse thread over a length of 200mm.

(ii) After the hole is drilled and cleaned, fast setting resin cartridges shall be placed and temped to the bottom of the hole. The remaining hole shall then be filled with slow setting resin cartridges or with mortar.

6.8 Grouted Anchor Bars/Anchor bolts

(i) Grouted anchor bars/anchor bolts shall be fabricated from a deformed reinforcing bar 25mm/32mm diameter with a yield stress of 415 N/mm^2 or as shown on the drawings.

(ii) Anchor bars/anchor bolts shall be thoroughly cleaned before being placed in the drill hole. The hole shall be filled with grout constituting 1:1 cement/sand mix with low water cement ration. Admixtures for fast setting and low shrinkage may also be required.

(iii) The anchor bars/anchor bolts shall be protected against disturbance for a minimum time of 48 hrs after installation or as required by the Engineer-in-charge.

(iv) Each anchor bolt shall be threaded over a length of at least 100mm and provided with a nut.

6.9 Wire mesh and Mesh Anchors

6.9.1. Chain Link Fabric

(i) Chain link fabric shall be installed on surface with shotcrete, to protect surfaces from which loose pieces of rock or cobbles may fall.

(ii) Chain link fabric shall conform to be requirements of IS: 2140-1978 (Re affirmed 1991) for galvanized steel chain link Fence fabric. The fabric shall have a mesh size of approximately 50mmx50mm and a wire diameter of 3mm or as shown on the drawings.

(iii) The fabric shall be clean of mud, grease, oil or other foreign material.

(iv) The fabric shall be placed against excavated surfaces and fastened to rock bolts, if present with extra steel plates of minimum size 100x100xmm and nuts. The fabric shall be securely fastened to the rock at intermediate points between the rock bolts with steel pins. Sufficient pins shall be provided to ensure that the fabric is held tightly to the rock surface.

(v) The installation of chain link fabric as reinforcement of shotcrete shall be permitted only when the excavated surface is so uneven and rough that placing of welded wire mesh is impractical. All such installation will be subject to approval by the Engineer-in-charge.

6.10 Measurement and Payment

6.10.1. General

(i) The Unit Rates entered in the Bill of Quantities shall be applicable.

6.10.2. Rock bolts and grouted anchor Bars

6.10.2.1 Testing and Monitoring of Rock bolts

(i) Payment will be made for the supply and installation of all rock bolts used in pull-out tests, provided always that the rock bolts tested comply with this Equipment and carrying out tests and the cost thereof shall be included in the Unit Rates provided in the Bill of Quantities.

6.10.2.1.1 Expansion- Shell type

(i) Measurement for payment for expansion shell type rock bolts will be made for grouted rock bolts and will be of the total length of bolts of the same bar diameter installed and approved by the Engineer-in-Charge.

(ii) Payment linear meter entered in Bill of Quantities which shall include the entire cost of:

(a) Furnishing and installation of expansion shell type rock bolts with all accessories.
(b) Stressing and load/pull out testing.
(c) Furnishing of grout materials and grouting.

6.10.2.3 Resin Grouted Type

(i) Measurement for payments for resin grouted type bolts will be of the total length of bolts of the same bar diameter installed and approved by the Engineers-in- charge.

(ii) Payment will be made separately for each bar diameter at the unit rate per linear meter entered in the Bill of Quantities, which shall include the entire cost of:

(a) Furnishing and installation of quickset resin cartridges.
(b) Furnishing and filling the, hole with the mortar or slow set resin.
(c) Furnishing and installation of reinforcing steel bars, and bearing places and all other accessories.
(d) Stressing and load/pull out testing.

6.10.2.4 Grouted Anchor Bars/Anchor bolts

(i) Measurement for payment for grouted anchor bar/anchor bolts will be of the total length of the bars of the same diameter installed and approved by the Engineer-in-charge.

(ii) Payment will be made separately for each bar diameter at the Unit Rate per meter entered in the Bill of Quantities, which shall include the entire cost:

(a) Furnishing, cutting, bending and installing reinforcing steel bars with or without welded hooks.
(b) Furnishing of grout materials (cement mortar including admixtures for quick setting) and filling the drill holes.
(c) Providing threads and nuts for anchor bolts.

6.10.2.5 Miscellaneous Metal Pieces Used in Conjunction with Rock bolts

(i) Measurement for payment for miscellaneous metal pieces such as small steel beams, steel plates, steel cables, etc., will be of the weight of steel actually installed.

(ii) Payment will be made at the Unit Rate per metric ton entered in the Bill of Quantities, which shall include the entire cost of supply and installations.

6.10.2.6 Exclusions

No extra measurement for payment will be made for the following

(a) Drilling of holes for all types of rock bolts which will be paid separately as set out in Section-7 "Drilling and Grouting ".

(b) Loose and rejected rock bolts which fall out during trimming, excavation and rock bolts which are otherwise damaged, or displaced as a result of

Contractor's operations. The Contractor shall replace such rock bolts at his own expense.

(c) Difference between the theoretical length of the grouted anchor bars and the effective length required due to over excavation or over break.

6.10.3. Wire Mesh

6.10.3.1 Chain Link Fabric

(i) Measurement for payment for chain link fabric will be of the net-area (without overlaps) actually installed. The weight will be computed using the nominal unit weight per square metre as stated on the certified copies of manufacturer's reports, which the contractor shall submit to the Engineers-in-Charge, or, in absence of such reports, by direct weighing on the site.

(ii) Payment will be made at the Unit Rate per metric ton entered in the Bill of Quantities, which shall include the entire cost of supply and installation of chain link fabric including overlaps, and the provision of all necessary accessories for fixing, such as steel pins and extra plates and nuts for fastening to rock bolts.

7. SHOTCRETE

7.1. Scope of work

(i) The Specification describe herein under relate to the work which include all labour, materials, equipment and services required for the shotcrete work to be carried out by the Contractor under this Contract.

(ii) The Shotcrete work shall be performed to the dimension as shown on the drawings or as otherwise directed by the Engineer-in-charge.

(iii) The approval given by the Engineer-in-charge to the Contractor's equipment or their operation of any construction method shall not relieve the Contractor of his full responsibility for the proper and safe execution of Shotcrete Work or any obligations under this contract

7.2. Submittals

(i) Within 30 days from the date of issue of the letter of Acceptance, but before procuring or mobilizing to the Site, the equipment, the Contractor will submit to the Engineer-in -charge updated and detailed plans and descriptions the following:

(a) Bathing and mixing equipment

Description and details of the equipment, which the contractor intends to use to determine and control the quantity of shotcrete ingredients and mixing thereof into uniform mixture.

(b) Placing Equipment

Full details of the equipment to be used for placement of shotcrete and details of standby equipment

(c) Details of methods and equipment which the Contractor proposes to use to control the temperature of aggregates and water during extreme hot and cold weather conditions.

(ii) Atleast 30 days in advance of any shotcrete work being carried on 1 m pile, the contractor shall to submit to the Engineer-in –charge, the following

(a) Notification of any admixture pozzolane, which the contractor proposes use manufacturers there end information about the chemical name of the principal ingredients and the effect of under or over dosage.

(b) Description and details of method which the contractor proposes to adopt for shotcreting

(iii) The Engineer-in –charge reserves the right to require any additional information demand necessary to be included in the submitted documents

7.3. Standards

(i) The shotcrete material, production, methods of application tasting and admixture shall conform to the following Indian standards or, where not covered by these standards, to the equivalent international standards

IS 456-2000

IS 5269-1987

IS 1489-2015

IS 383-1970

IS 516- 1959. (Reaffirmed 1999)

IS 9012-1978 [Reaffirmed 1991]

IS 2645-1975 [Reaffirmed 1991]

IS 9103-1979

IS 12269-1987

IS 8112-1989

ACT 506 R – 90

ASTM A 820 – 90

ASTM C 955 – 91

ISCE – SF2. SF3. SF4 SF5

CAN / CSA – A 235 –86

(ii) In case of conflict between the above Standards and the Specification given herein, Specification shall take precedence

7.4. Definitions

Shotcrete

Shotcrete, for the purpose of this work, is defined as wetmix of cement concrete (plain) applied from a spray nozzle by means of compressed air. The Engineer-in-charge may, in exceptional cases, allow use of dry mix for plain shotcreting. Shotcrete shall contain on approved admixture suitable to attain quick set and high early strength specified herein.

7.5. Materials

(i) Materials for shotcrete shall comprise cement, aggregates and water and approved admixtures, micro-silica as specified herein.

(ii) Cement shall be ordinary Portland cement or Portland pozzolana cement conforming to the requirement of relevant Standards or as specified on the drawings.

(iii) Aggregates shall conform to the requirements of relevant Indian standards. The aggregate size for plain shotcrete shall not exceed 10mm. The contents of the crushed non cubical material shall not exceed 10%.

Aggregates shall be furnished by the Contractor from a source accepted by the Engineer-in the charge, but acceptance of source by the Engineer-in-charge shall not be construed as constituting the acceptance of all aggregate to be taken from the source or grading of aggregate to be in conformance with contract.

(iv) Air used for spraying shotcrete and water used for mixing shall be clean and free of oil.

(v) Admixtures

Admixtures shall be used develop quick set and high early strength to ensure good workability, low pumping pressure, adequate slump retention and loe rebound, as approved by the Engineer-in change, conforming to the requirement of the relevant Standards

(a) Super Plasticizers

Super Plasticizers/water reducing agents shall be added at the Batching plant to keep the shotcrete mix workable during transportation and to ensure good pumpability at an acceptable low water cement ratio. The super plasticizers shall be free of chlorides.

(b) Accelerators

Aproven accelerator shall be added for providing a quick setting time. It shall have silicate base and shall be environment friendly. Only liquid accelerators shall have a Ph value less than 12. The accelerator shall be added at the nozzle and doses shall be minimum but not to exceed 5% of the weight of cement and microsilica. The chemical composition and technical details of the accelerators along with performance report/certificate from the manufacturer/supplier shall be submitted for prior approval of the Engineer-in-charge.

(vi) Micro-silica

Micro-silica shall be added in the mix at the batching plan for facilitating the mixing and distribution of fibres. The dose of silica fumes shall be 5-7% (of cement weight) subject to site trials. Silica fumes shall have a bulk density between 500-700 kg/cum. Test certificates from approved to satisfy that the silica fume complies with Canadian Standard CAN/CSA-A 23.5 M86. The important Requirement of the codes are reproduced below:

(a) Chemical Requirement

Property	Percentage	Min-frequency of testing or as desired by Engineer-in-change.
Sio_2 (Min.%)	85	Lot or 500 tonne
*So_3 (max.%)	1	Lot or 500 tonne
Loss on ignition(Maximum %)	6	Lot or 500 tonne

When sufficient test data have been accumulated showing, to the satisfaction of Engineer-in-change, that a source consistently complies requirements, the test frequency may be reduced.

*Limit of maximum %age of SO_3 may be exceeded, provided that micro silica when tested in combination with that particular Portland cement with which it is to be used, exhibits expansion not in excess of 0.02% at 14 days when tested. (In the test mix, a mass of Portland cement shall be replaced by on equal mass of micro silica in the amount of 10% of the anticipated maximum field replacement percentage, whichever is greater).

(b) Physical requirement

Property	**%age**	**Minimum frequency of Testing of Desired by Engineer-in-charge**
Accelerated Pozzolanic Activity index: with Portland Cement at 7 days. (Minimum percentage of control)	85	Lot or 500 tonne
Soundness autoclave Expansionor contraction (maximum %)	0.2	Lot or 500 tonne
Fitness (when wet sieved on 45 micro sieve) Maximum %age retained	10	Lot or 500 tonne
Density Uniformity requirements: TheDensity fineness of individual Samples shallnot vary from the average established by the 10 preceding samples or by all preceding sample if lass than 10,By more than:		
-density, maximum variation from average	5	
-percentage retained on the 45 micro sieve, maximumVariation from average %age point (If average is equal to 20% then allowable variation = 15 to 25%.	5	
	0.03	Lot or 1000 tonne
Increase of drying shrinkage of mortar bars at 28 days(max percentage points Uniformity requirement when air entrained concrete is specified, the quantity ofAir entrained admixtures required to produce on air content of 18.0 volume %age of mortar shall not very from the average established by the 10 preceding tests, or by all preceding tests if less than 10, by more than: %age	20	Lot or 1000 tonne
Reactivity with cement alkalies reduction Or mortar expansion at 14 days (min. percentage)	80	Lot or 1000 tonne

The test for reactivity with cement alkalies shall not be required unless the material is to be used with on aggregate that is regarded deleteriously reactive with alkalies in cement

Methods of tests

Chemical Test	**Reference Standards**
- Silica (sio_2)	ASTMC
- Sulphur Trioxide (SO_3)	CSA CAN3-A5
- Moisture content	ASTMC311
- Loss in Ignition Physical Test	ASTMC311
(a) Pozzolanic activity Index, 7	ASTMC311 (Section29 to 32)

Chemical Test	Reference Standards
days	
(b) Pozzolanic activity Index, 28 days	ASTMC311 (Section29 to 32)
(c) Slag activity index	Clause 6
(d) Soundness	ASTM C 311 (section 25)
(e) Drying Shrinkage	ASTM C 311 (section 22 to 24), except that for testingSilica fume use 500gm ofPortland cement, 50gm of Silica fume 1325gm of sand in the text mixture.
(f) Reactivity with cement Alkalies	ASTM C 441
(g) Fineness	CSA CAN 3-A5
(h) Relative density	ASTM C311 (Section 20)
(i) Uniformity of air content	ASTM C311 (Section 27and 28)

7.6. Mix Design and Proportioning

7.6.1. Plains Shotcrete

(i) The type/class of shotcrete to be used in a particular location shall be as per drawings and as directed by the Engineer in charge.

(ii) The mix proportions of cement, aggregate, and permitted admixtures in each class shall be determined by the contractor and shall be subject to the approval of the engineer-in change. The mixes shall be such as to permit placement without excessive rebound and segregation.

(iii) The admixtures shall have proven compatibility with the cement make type so as to ensure initial and final setting as 3 and12 minutes respectively. The contractor shall supply, to the Engineer-in-change, all the necessary test result and reports to confirm compatibility.

(iv) The water content of the mixes shall be limited to prevent sloughing. The water-cement ratio of fresh shotcrete in place shall be between 0.32 and 0.45.

(v) The mixes shall be such that aggregate gradation and cement content after placing are as those obtained from samples taken from test panels produced from approved trial mixes. All constituents shall be uniformly dispersed throughout the mix.

(vi) The proportion of admixture shall vary between 2% and 7% of the weight of Cement or as determine by testing prior to any shotcrete work.

(vii) Proportioning of aggregate and cement shall be only by weight batching.

(viii) The shotcrete meet the following compressive strength requirement or as shown on the drawings.

(a) 45kgs. per sq. cm at 8 hours.

(b) 125kgs. per sq. cm at 72 hours.

(c) 250kgs. per sq. cm at 28 days.

The compressive strength after 7 days shall be 70% of the specified Strength of 28 days.

(ix) Mixed material shall be used within 90 minutes after adding cement

(x) The super-plasticizer admixture shall be added at batching plan and shall be accurately proportioned thoroughly mixed with other ingredients' the accelerating admixture shall be accurately proportioned into the water supply at the application nozzle.

(xi) Mix proportions shall be varied, when required by the Engineer-in-charge, to obtain required strength of shotcrete, to maintain rebound to the minimum and to meet other requirements of the contract. The contractor shall notify to the Engineer–in-charge of all variations to the mixes.

7.7. Quality Control and Testing

The quality control and testing of shotcrete will be carried out by the department. The Contractor shall however prepare test panels, determine mix proportion as set out in para 7.6 hereof and render all necessary assistance required for testing. The following procedure or any other procedure approved by the Engineer-in-charge for designing and testing the shotcrete mix shall be followed.

7.7.1. Making test Panels for plain shotcrete

(i) At least 60 days prior to the placing of any shotcrete in the work, the contractor shall undertake preparation of the trial mixes, in the presence of the Engineer-in-charge using the method described below.

(ii) The contractor shall prepare three test panels of minimum size 75 cm ×75cm and 80mm thick, for each mix design and for each type of plant. They shall be sprayed for each position required in the Works, one down-hand, one horizontal and one overhead with a layer thickness appropriate to that Position and with reinforcement as directed by the Engineer-in-charge. Panel moulds shall be formed from plywood, at least 20 mm thick, be adequately braced and be held rigidly in position.

(iii) For the purpose of routine quality control during the execution of Work, control test panels of the same size as for the trial mix testing shall be sprayed. For the first 5 cum of shotcrete applied. In each underground excavation heading, one test panel shall be prepared. Further, the test panels will be limited to one per nozzle-man per week or one 100 cum of material placed, as directed by the Engineer-in charge. The test panels shall be constructed along the area of placement and at some angle and shall be sprayed by each nozzle-man inrotation so that the tests shall represent the quality of the shotcrete being placed by each nozzle-men. The test panels shall be stored and cured alongside and under similar conditions to the shotcrete placed in the works,

(iv) The pressure at which the Shotcrete shall be applied to the test panels shall be the same as will be used in actual works at the place of application.

(v) Shotcrete from both the trial mix and the routing quality control test panels shall be tested by the Engineer-in-charge as described hereunder.

7.7.2. Testing for strength

7.7.2.1 Plain shotcrete

(i) Four, 50 mm diameter cores, shall be cut by the Contractor from each testpanels at eight angle to the plane of the panel approximately 48 hours after the panel has been sprayed. Cured shall not be taken within 10 cm of the edges of the panel.

(ii) First core shall be compression tested at 3 days. Second core at 7 days, and the remaining two cores at 28 days. The core capping and testing will be carried out by the Engineer-in-charge in a laboratory.

(iii) The cores shall be stored, cured and tested in accordance with relevant Standards. All cores shall be suitably labelled to identify them with the panels from which they have been taken, and the location in the works to which they relate.

(iv) The appropriate compressive strength requirement for each set of two, 28 day Cores, shall be satisfied if:

(a) Each core has a compressive strength equal to or greater than that specified, or

(b) The average compressive strength of the two cores equal to or greater than that specified and the difference between the strength is less than 20% of the average.

(v) In case any of the cores reveal defects such as lack of compaction, dry patches, voids or sand pockets, the Engineer-in charge may require further cores to be taken from the remainder of the panel(s) or hi may reject the procedure used to make the defective test panel and required that a replacement test panel be made with a modified procedure.

7.7.3. Conducting other Routing Test during the works

(i) When directed the at specified location selected by the engineer-in-charge, the contractor shall make 25 mm diameter probe holes to determine the thickness of the shotcrete.

(ii) When directed, and location indicated by the engineer-in-charge, the Contractor shall cut sets of 50 mm diameter cores from the finished Shotcrete, which shall be tested by the Engineer-in-charge using the same procedure as on cores taken from the test panels.

(iii) Core holes shall be filed by hand with will remind dry-pack mortar of a similar mix to that used for shotcrete.

(iv) Where directed by the Engineer-in-charge, the compressive strength of the shotcrete shall be assessed non-destructive testing using the "Schmidt Concrete Test Hammer", calibrated by reference reading taken on the shotcrete at location where cores are to be taken. At least ten reading shall be taken for each strength assignment.

(v) Soundness shall be tested by the hand hammer. A hollow response indicates a possible lack of bond or other defect.

(vi) The measurement of in-situ penetration resistance shall be carried out by using a spring loaded penetrometer or similar suitable equipment.

(vii) During the progress of the work, the Contractor under the Engineer-in-charge's Supervision, shall perform tests for the determination of rebound volume. The Engineer-in-charge will determine the number of such test as needed to obtain reliable result.

7.8. Proficiency of Workmen

(i) Nozzle-man shall have has sufficient previous experience in the application of coarse aggregate shotcrete work under the immediate supervision of foreman or instructor having such experience.

(ii) Each crew shall demonstrate acceptable proficiency in the application of shotcrete to test panels as set out in para 8.7.1 hereof before beginning production work.

7.9. Surface Preparation

(i) When shotcrete is to be applied to excavated surface immediately after blasting, the surface shall be prepared by minimum of scaling, as required by the Engineer-in-charge, followed by washing with clean water. All surface Shall be wet, clean and free of rebound, at the time of application of shotcrete. For all other shotcretr application, the surfaces to be treated shall be thoroughly sluiced with air and water jet under pressure through nozzle or cleaned by other means approved by Engineer-in-charge to remove all traces or dirt, mud, debris,oil, loose particles, rebound or loose rock and any other deleterious material.

(ii) When water flows from the rock against which shotcrete is to be placed and when water cannot be sealed off by shotcreting along, the water shall be excluded from the area by caulking or diverted by pipes, pans or other approved means in such a manner that the shotcrete will be unaffected by action of the water through percolation, by hydrostatic pressure or erosion.

(iii) A layer of shotcrete, which is to be covered by a succeeding layer , shall first be allowed to tack its initial set and shall have all laitance, loose material, dirt or other deleterious material and rebound removed by brooming, sluicing or other means acceptable to the engineer-in charge.

(iv) At any time during surface preparation, the Engineer-in-charge may order the Contractor to apply shotcrete to isolated areas before proceeding with surface preparation.

7.10. Mixing and Application

(i) Shotcrete material shall be accurately weight-batched before mixing. Aggregate shall be thoroughly mixed without the adding of water before being deposited in the placing equipment. Cement shall be added not more than 1-1/2 hours before application. Mixes which are not applied within 1.1/2 hours of adding cement shall be discarded. Additives shall be accurately proportioned.

(ii) Shotcrete shall not be applied to any surface without the acceptance of the Engineer-in-charge should Contractor consider that any surface requires shotcreting urgently, he shall immediately inform the Engineer-in-charge, who will give a decision as soon as possible.

(iii) In general, the minimum thickness of shotcrete in any one layer shall be 25 mm. The maximum thickness of shotcrete applied in any one layer at any location shall be 50 mm to avoid gliding of fresh concrete. Before laying the second layer of shotcrete, the first layer shall be allowed to take its initial set and have all loose material removed.

(iv) Shotcreting above ground shall not be carried out when, in the opinion of the Engineer-in charge, shotcrete cannot be placed effectively because of adverse weather conditions, unless adequate cover is provided over the working area until the shotcrete has been cured sufficiently to prevent damage.

(v) When cold weather conditions prevail on Site and the temperature of aggregates and water to be used in shotcrete is below 10 degrees Centigrade, it may be necessary to hear the aggregate and water obtain shotcrete meeting the specified 8 hours and 28 days compressive strength criteria for plain shotcrete

(vi) The contractor shall develop operating procedures and operations to the satisfaction of the Engineer-in-charge to give:

- (a) Minimum rebound
- (b) As smooth a finished surface as possible
- (c) No hollow area in the shotcrete
- (d) A minimum of shrinkage cracks
- (e) Good adherence of the shotcrete to rock or other surface.

(vii) The flow of the material at the nozzle shall be continuous and uniform and the rate of application over any given area shall be uniform sluge , sand sport, wet areas or other defects shall be cut and corrected as specified herein.

(viii) At the start of shortcrete operation in any area, the Contractor shall, in close co-operation with the Engineer-in charge and as part of the initial placement, establish procedures for the application of shotcrete which will produce the best quality product with the minimum of rebound. Such establishment of procedures shall include minor variation in Mixes, if required, and variations acceptable finishes and thickness and quantities to be discharged at the nozzle shall be determined on the basis of average thickness of shotcrete shown on the drawings or as directed by the Engineer-in-charge. Once procedures for the placement of shotcrete are established, subsequent Work shall be carried out accordingly.

(ix) The optimum distance between the nozzle and surface and the angle of nozzle shall be established by field trials to minimize rebound and achieve optimum compaction. This distance shall not exceed 2 metres. The nozzle shall point to the surface at a right angle to ensure optimal compaction.

(x) When required by the Engineer-in-charge, the thickness of a layer in any area shall be checked by either probing immediately after the shotcrete has been applied, by placing pins of known length in rock spaced at about 0.5 m to 1 m part before shotcreting or by any other means approved by Engineer - in-charge.

(xi) In shotcreting vertical or steeply inclined surface, other than roofs of underground cavities, application shall begin at the lowest point to avoid rebound material getting locked in and the shotcrete layer shall be built up in horizontal strips the unlit the entire surface is covered.

(xii) In area against which no further shotcrete is to be placed and where required by the Engineer-n-charge, the edges of shotcrete shall be formed to regular lines and sloped at 45 degrees to the adjasent surface, all to the approval of the engineer in charge.

(xiii) Where drain holes have been drilled and instruments have been installed into rock on which shotcrete is to be placed, the Contractor shall take all necessary precautions to prevent such holes from being plugged or instruments from being damaged.

(xiv) When shotcreting is to be performed near existing structures, the Contractor shall ensure that no damage results to the structures and shall protect the surfaces of structures before shotcreting.

(xv) Application of shotcrete in any area shall be considered complete when the shotcrete has been built up to the thickness specified time period.

(xvi) Where shotcrete is placed over wire-mesh and supporting bolts, it shall be covered with shotcrete to a depth of at-least 30 mm as specified.

(xvii) While applying shotcrete, the nozzle shall be held steady at a predetermined distance approximately one metre from the surface to be covered and positioned so that the stream of flowing water and material shall be applied as nearly as possible at right angle to the surface to be covered. Nozzle shall be held steady position so that the shotcrete is applied uniformly to build up the required thickness of layer. Acceptable shotcrete shall consist of dense and uniform concrete, segregation or discemible weakness of bond between layers.

(xviii) The nozzle-man shall apply shotcrete with a uniform consistency in other to maximize binding, cohesion and density and minimize rebound and segregation, and prevent sagging of the applied shotcrete.

(xix) Care shall be taken to ensure that no air pockets are formed beind the shotcret during the application of shotcrete.

(xx) All applied shotcrete shall be kept wet for at least 7 days to ensure proper curing of the shotcrete.

7.11. Rebound

(i) The rebound shall be removed and disposed off, as required by the Engineer-in-charge before any adjacent area is shotcreted. Rebound shall not be reused. Special care shall be taken that rebound does not build up at the junction of wall and floors both underground.

(ii) The contractor shall make every effort to keep rebound to a minimum. If the opinion of the Engineer-n-charge, the rebound is excessive he may require the contractor to revise the mix design for shotcrete or its application procedures or tack such other measures as the Engineer-n-charge, deems necessary to reduce the rebound to a reasonable level.

7.12. Construction joints

Construction joints or stop joint shall be provided, as directed by the Engineer-n-charge, and shall be sloped at 45 degree to the adjacent work, the sloped portion and adjacent shotcrete shall be prepared as specified in para 8.9 hereof.

7.13. Repair

(i) Before a succeeding layer of shotcrete is placed, the preceding layer shall be checked for drumminess to the satisfaction of the Engineer-in-charge,

(ii) The contractor shall repair all drummy, sandy, crocked or spalled areas and any other areas where, in the opinion of the Engineer-in-charge. The shotcrete is faulty by removing the shotcrete up to the sound area of rock or shotcreting that area to the satisfaction of Engineer-in-charge.

7.14. Safety Measure

(i) Alkali hydroxides and other chemicals contained in shotcrete admixtures are moderately toxic and can cause skin and respiratory irritation unless adequate safety measures are taken. In applying shotcrete containing toxic admixture and nozzle-

man and helpers shall wear appropriate hoods to protect them against toxic or objectionable material.

(ii) Gloves and necessary protective clothing shall be worn to protect against dermatitis.

7.15. Measurement and payments

7.15.1. General

(i) Measurement for payments for shotcrete will be made of the volume in cubic meter in the shotcrete placed. 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 pay line as shown on the drawings or as directed by the Engineer-in-charge,

(ii) Payment will be made at the Unit rates per cubic meter for thickness of shotcrete entered in the Bill of Quantities which shall include the entire cost of but not be limited to the following:

a. All labour plant and materials including admixtures.

b. Storage, batching and mixing of all material, water supply preparation and cleaning of surfaces.

c. Placing of plug gauges for control of layer's thickness.

d. Placing of shotcrete and removel of rebound

e. Temporary protection and curing.

f. Making test panels and conducting tests required for design and quality assurance.

7.15.2. Exclusions

No extra measurement for payment or payment will be made for the following:

(i) Removing the defective shotcrete, carrying out surface preparation and re-shotcreting the area where the shotcrete has been found to be faulty by the Engineer-in-charge.

(ii) Taking out of cores from the finished shotcrete the filling the core holes with dry pack mortar.

(iii) Shotcrete placed by the contractor is excess of the thickness shown on the drawings or as directed by the Engineer-in-charge.

SECTION-6: FORM OF BID

FORM OF BID

Description of the Works:

Special Protection Work on Rehabilitation and restoration of Sinking/Sliding Zone from Km 70+900 to Km 71+100 and Km 71+550 to Km 71+850 with JICA Technical Assistance including widening of Narrow Zone from Km 53+775 to Km 54+100 and from Km 63+045 to Km 63+470 on NH-10 (Rangpo To Ranipool section) in the State of Sikkim

To:

Mr. Shashank Kumar
General Manager (Technical)
National Highways and Infrastructure
Development Corporation Limited
3rd Floor, PTI Building,
4, Parliament Street,
New Delhi – 110001
Tele Phone: 011-23461659
E-mail Address – Shashank.kr@gov.in

1. We offer to execute the Works described above and remedy any defects therein in conformity with the conditions of Contract, specification, drawings, Bill of Quantities and Addenda for the sum(s) of

   _____

   _____

   (_____)

2. We undertake, if our Bid is accepted, to commence the Works as soon as is reasonably possible after the receipt of the Engineer's notice to commence, and to complete the whole of the Works comprised in the Contract within the time stated in the document.

3. We agree to abide by this Bid for the period of* _____ days from the date fixed for receiving the same, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

4. Unless and until a formal Agreement is prepared and executed this Bid, together with your written acceptance thereof, shall constitute a binding contract between us.

5. We understand that you are not bound to accept the lowest or any tender you may receive.

6. We accept the appointment of Shri_____ as the Dispute Review Expert.

   (OR)

   We do not accept the appointment of Shri _____ as the Dispute Review Expert and propose instead that Shri _____ be appointed as Dispute Review Expert, whose BIO-DATA is attached.

   Dated this _____ day of _____20…….

Signature _____in the capacity of _____ duly authorized to sign bids for and on behalf of _____

_____

(in block capitals or typed)

Address

_____

_____

Witness

_____

_____

Address

_____

_____

Occupation

_____

_____

SECTION-7: BILL OF QUANTITIES

Section -7: BILL OF QUANTITIES

A. PREAMBLE

1. The Bill of Quantities shall be read in conjunction with the Instruction to Bidders, Bidding Data, Conditions of Contract, Particular Conditions of Contract, Special Specifications, Standard 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 as measured by the Contractor and verified by the Engineer and valued at the rates and prices tendered 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. All items are measured and paid for in accordance with the measurement and payment clauses in the special Specifications and standard specifications. 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 tendered in the priced Bill of Quantities shall, except in so far as it is otherwise provided under the Contract, include all constructional plant, labour, supervision, surveying and setting out, traffic control, materials, erection, maintenance, testing, commissioning, insurance, profit, taxes and duties, together with all general risks, liabilities and obligations set out or implied in the Contract. For aggregates and items containing aggregates, the rate shall include any royalties or payments to whosoever shall hold the right of extraction of aggregate. The cost adhering and complying with the above requirements is to be included in respective BOQ items and no separate payment shall be made on this account.

5. The rates and prices shall be quoted entirely in Indian Currency.

6. A rate or price shall be entered against each item in the 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.

7. The whole cost of complying with the provisions of the Contract shall be included in the items provided in the prices 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.

8. The method of measurement of completed work payment shall be in accordance with the Technical specification and Road & Bridge works published by the Ministry of Surface Transport 5th Edition,

9. Errors will be corrected by the Employer for any arithmetic errors pursuant to Clause 29 of the Instructions to Bidder.

10. All disposal/tipping and quarry sites shall be identified and managed by the Contractor but must have prior approval of the Engineer before starting of the

construction. The sites provided in this Preamble is tentative probable sites and contractor shall identify make his own assessment in identifying suitable sites for the satisfactory execution of the contract prior to bidding. In case of any change in sites due to any cause shall not affect the contract price except for the provisions made in the contract.

11. General directions and descriptions of work and materials are not necessarily repeated or summarized in the Bill of Quantities. Where summaries of the work covered by the items are given in the bill of quantities they are indicative only and the rates entered shall include for all ancillary work or materials not specifically stated but implicit in the item of work. References to the relevant sections of the contract documentation shall be made before entering rates or prices against each item in the Bill of Quantities. The Standard Specification/Special Provision Section and Clause references given in each item of the Bills of Quantities are for the convenience of bidders and generally refer to the principal relevant specification clause but do not necessarily represent the whole of the specification requirements for the work required within the item. The presence of a Specification clause reference shall not in any way reduce the Bidders obligation to complete work in accordance with all the requirements of the Specifications.

12. Rock is defined as all materials which, in the opinion of the Engineer, require blasting, or the use of metal wedgese and sledgehammers, or the use of compressed air drilling for its removal, and which cannot be extracted by ripping with a tractor of at least 150 kw with a single rear mounted heavy duty ripper.

13. "As per site conditions, if diversion road is required for construction of culverts. The same shall be constructed and maintained by the contractor. Nothing extra shall be paid on this account. The cost of diversion road shall be demand to be covered by other rates and prices entered in the Bill of quantities."

BILL OF QUANTITIES

Sl. No.	Description of item (with brief specification and reference to Book of specification)	Quantity	Unit	Rate		Amount
				In figures	In words	

Note:

1. Item for which no rate or price has been entered in will not be paid for by the Employer when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities (refer: ITB Clause 13.2 and GCC Clause 43.3).

2. Unit rates and prices shall be quoted by the bidder in Indian rupee [ITB Clause 14.1].

3. Where there is a discrepancy between the rate in figures and words, the rates in words will govern. [ITB Clause 27.1(a)]

4. Where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by quantity, the unit rate quoted shall govern [ITB Clause 27.1 (b)].

B. NON SCHEDULE WORKS (NSW)

The contractor shall carryout Non Schedule Works for the work items in the contract at the instruction of the Engineer which are incidental to the site condition. The contract work item rates and prices shall be applicable for the payment of NSW carried out by the contractor. However, the total cost of NSW shall not exceed 5% of the contract cost.

(i) Day works Schedule

(a) **General**

Provision of Day Works is aimed for the incidental and non schedule works not covered by work item rates. Day Work shall not be executed on a day work basis except by written order of the Engineer. Bidders shall enter basic rates for day work items in the Schedules. These rates shall apply to any quantity of day work ordered by the Engineer. Nominal quantities have been indicated against each item of day work, and the extended total for day work shall, be carried forward as a priced sum to the Summary Total Bid Amount. Unless otherwise adjusted, payments for day work shall be subject to price adjustment in accordance with the provisions in the Conditions of Contract.

(b) **work Labour**

1. In calculating payments due to the Contractor for the execution of day works, the hours for labour will be reckoned from the time of arrival of the labour at the job site to execute the particular item of day work to the time of departure from the job site, but excluding meal breaks and rest periods. Only the time of classes of labour directly doing work ordered by the Engineer and are competent to perform such work 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.

2. The Contractor shall be entitled to payment in respect of the total time that labour is employed on day work, calculated at the basis rates entered by it in the " SCHEDULE OF DAYWORK RATES: 4.04 LABOUR". The rates for labour shall be deemed to cover all costs to the Contractor including (but not limited to) the amount of wages paid to such labour, transportation time, overtime, subsistence allowances, and any sums paid to or on behalf of such labour for social benefits in accordance with prevailing law, as well as Contractor's profit, overheads, superintendence, liabilities and insurance and allowance to labour, timekeeping and clerical and office work, the use of consumable stores water lighting and power; the use and repair of staginess, 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. The rates shall be stated in the Indian Rupees.

(c) **Day work Equipment**

1. The Contractor shall be entitled to payments in respect of Construction Plant/Equipment already on site and employed on day work at the basis

rental rates entered by him in the "SCHEDULE OF DAYWOR RATES: 4.03 EQUIPMENT ". The said rates shall be deemed to include due and complete allowance for depreciation, interest, indemnity and insurance, repairs, maintenance, supplies, fuel, lubricant, and other consumables and all overhead, profit and administrative costs related to the use of such equipment. The cost of drivers, operators and assistants also shall be included in the rate of the equipment and no separate payment shall be made for it.

2. In calculating the payment due to the Contractor for Constructional Plant employed on day work, only the actual number of working hours will be eligible for payment.

3. The basic rental rates for Constructional Plant/Equipment employed on day work shall be stated in Indian Rupees and payments to the Contractor will be made in the same currency.

(d) **Day work Materials**

The Contractor shall be entitled to payment in respect of materials used for day work (except for materials for which the cost is included in the percentage addition to labour costs as detailed heretofore), at the rates entered by him in the "SCHEDULE OF DAYWORK RATES: 4.04 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. The rates shall be stated in Indian Rupees and payment will be made in the same currency.

b. The cost of hauling materials for use on work ordered to be carried out as day work, from the store or stockpile on the Site to the place where it is to be used also shall be included in the same rate.

C. QUALITY ASSURANCE AND PHOTOGRAPH

Providing digital photographs with GPS coordinates, date and time (password locked by the supervision consultant) and synchronised in Google earth each week through internet services in concise form to the Employer and the Supervision Consultant as the following:

- Earthwork Progress 1 photo every 20 m
- Scarification and compaction test: 1 photo every test location with a view covering at least 30 m.
- Rock fall protection Net progress: 1 photo every location
- Crib Work progress: 1 photo every location
- Shotcrete Work progress: 1 photo every location
- Ground Anchor Work progress: 1 photo every location
- Rock Bolting Work progress: 1 photo every location
- Retaining wall Work progress: 1 photo every location

D. PUBLICLY AND PRIVATELY OWNED SERVICES

The Contractor shall ascertain the location of all access paths, watercourses, irrigation channels, sewers, drains, water pipes, electricity and telecommunication cables and other services and structures which may be encountered during the execution of the works. He shall temporarily support or divert and subsequently reinstate all such services and structures as necessary and to the satisfaction or the Engineer. As soon as any such service or structure is encountered on, over, under, in or through the Site during the performance of the Contract, the contractor shall make a record of the location and description of such service or structure and shall send the same forthwith to the Engineer.

Where permanent diversion or support of such service or structure is rendered necessary as an unavoidable result of the execution and maintenance of the Works in accordance with the Contract, the Engineer after consultation with the Employer will instruct the Contractor as to the diversion or support to be provided. All operations necessary for the execution of the Works shall be carried out so as not to interfere unnecessarily or improperly with the convenience of the public, or the access to, use and occupation of public or private roads and footpaths or of properties whether in the possession of the Government or any other person.

No separate measurement and payment shall be made for the work of temporarily supporting, protecting, diverting and subsequently reinstating the publicly and privately owned services. But measurement and payment shall be made for the construction of permanent new structures/services in lieu of existing structures/services and removal or shifting of services/utilities after getting approval from the Engineer at the item rate and prices of similar work items in the contract. If similar work item is not available in the contract prices, the Dayworks shall be used.

E. SURVEY AND SETTING OUT

If at any time the contractor believes that there exists a discrepancy between the location of the works as defined by the setting out and the apparent location of the works as shown in the plans or required by the site conditions he shall immediately inform the Engineer and request clarification.

F. NOTICE BOARD

The Contractor shall erect where directed by the Engineer signboards in accordance with the Appendices: Project Signboard.

Project signboards shall be satisfactorily provided, installed, maintained throughout the Contract period and subsequently removed.

No separate payment shall be made for compliance with the requirements of this clause. The payment shall be deemed to be included in the Contractor's tendered rates of other items.

G. ENVIRONMENTAL MANAGEMENT WORKS

- Environmental Management
- Disposal Area
- Slide management
- Bio Engineering
- Quarry Area
- Contractors office/site and labour camps

The Contractor shall take all precautions for safeguarding the environment during the course of construction of the works. He shall abide by all prevailing laws, rules and regulations governing pollution and environmental protection. In particular, the Contractor shall fully comply with the environmental protection mitigation measures specified in the latest guidline provision made by Govt of India , as provided by the Engineer. If any activity of the Contractor may cause damage to the environment in ways not envisaged under project-specific documents, then he shall comply with the measures specified in the latest publication of "Environmental Management Guidelines" published by the Govt of India.

The Contractor shall prohibit employees from any use of explosives, poaching of wildlife and cutting of trees or branches. The Contractor shall be responsible for the action of his employees.

H. BORROW/QUARRY SITES

The contractor shall obtain approval from the Engineer of all material sources before extraction. All sources of materials used under the Contract shall require such approval regardless of whether the material is obtained directly by the Contractor or supplied indirectly by others. The Contractor is not allowed to use the right of way for the borrow pit.

The Contractor shall not deposit excavated material on land in Government or private ownership except where approved by the Engineer in writing or by leave in writing of the authority responsible for such land in Government ownership or of the owner or responsible representative of the owner of such land in private ownership and only then in those places and under such conditions as the authority, owner or responsible representative may prescribe.

Any quarry operated as part of this Contract shall be maintained and at the end of the Contract left in a stable condition without steep slopes and be either refilled or drained and be landscaped by appropriate planting. Rock or gravel won from a river shall be removed over some distance so as to limit the depth of material removed at any one location and not to disrupt the river flow or damage or undermine river banks.

I. DISPOSAL OF SPOIL AND CONSTRUCTION WASTE

Disposal of surplus materials from excavation, slides and debris:

Under no circumstances whatsoever shall the Contractor allow spoil from any excavation or cut to fall or be pushed down the slope below. In any situation where this occurs by accident or by purpose, the Contractor shall, at his own cost, remove the debris to a location approved by the Engineer and make good the affected area through appropriate structures and re-vegetation as specified by the Engineer and following guidelines published by the GOI/State Govenment. Failure in compliance with the Engineer's instruction in respect of spoil disposal will lead to a reduction or with-holding of payment.

Any construction waste that includes bitumen products, unused cement, fuel, oil or plastics shall be disposed of in a Government-approved landfill site. If this is not practical then it may be disposed of by burial in a specially excavated pit at a site approved by the Engineer. Land compensation shall be paid by the Contractor for the area occupied by the pit as if for permanent construction. If the land is owned by the Government, then the Contractor must obtain written permission from the appropriate authority for its use in this manner, and must pay any royalties due. The pit shall be located at least 100 metres from any seasonal or permanent water course or spring. A hole shall be excavated below ground level so that, when the original surface profile is regained through backfilling, the disposed waste is covered by at least two metres of soil. Following the closure of the waste disposal site, the Contractor shall provide any structures necessary to prevent erosion and shall revegetate the topsoil with appropriate plants.

J. PROVISION AND MAINTENANCE OF CAMPS, OFFICES, STORES, EQUIPMENT YARDS AND WORKSHOPS

The Contractor shall provide and maintain such accommodation and amenities as necessary for all his staff and labour, employed for the purposes of or in connection with the Contract, including all fencing, water supply (both for drinking and other purposes), electricity supply, sanitation, cookhouses and other requirements in connection with such accommodation or amenities. On completion of the Contract, unless otherwise agreed with the Employer, all the temporary camps/housing provided by the Contractor shall be removed and the site(s) reinstated to its (their) original condition, all to the approval of the Engineer.

All accommodation facilities of whatsoever nature provided by the Contractor shall be provided with adequate sewage and wastewater collection and treatment facilities to a design and of a capacity approved by the Engineer. Under no circumstances shall untreated sewage or wastewater be discharged to the natural environment.

- **Provision of First Aid/Medical Facilities**

The Contractor shall provide information to his workers on methods of avoiding sexually transmitted diseases and infection by HIV/AIDS.

- **Hazardous Materials**

The Contractor shall not store hazardous materials such as cement, lime, bitumen and emulsion, paint, fuels, oils, battery acids, pesticides and herbicides within 100 metres of seasonal or permanent water courses or springs. They must be housed in secured weather-proof buildings and protected against attacks by vermin and accidental contact by children.

- **Provision of Safety Clothing and Equipment**

The Contractor shall provide all labourers, supervisors and site staff with suitable basic safety helmets, boots, clothing, etc.

All workers and supervisory staff when on any site shall wear the basic safety clothing specified. Where additional safety equipment is required by nature of the site, then all workers and supervisory staff when on any part of that site shall use the additional equipment in addition to the basic safety clothing specified.

In hot weather the Contractor shall provide appropriate lightweight safety equipment, such as cotton gloves in place of rubber gloves and canvas boots in place of rubber boots.

The Contractor shall be responsible for ensuring that all his employees and the employees of any Subcontractor and any visitor to the site complies with the Engineer's requirement to use safety clothing and equipment at all times. Failure in compliance with the Engineer's instruction in respect of safety clothing and equipment may lead to a suspension of works and a reduction or with-holding of payment until the Contractor complies.

- **Dust Nuisance**

The Contractor shall avoid creating any high concentration of airborne dust or smoke within 100 metres of a house or other occupied building, or in situations likely to affect people, animals, crops or natural vegetation.

Dust from moving construction plant and road traffic shall be controlled by the regular spraying of water on to road surfaces. The Contractor is responsible for all water spraying and the erection and maintenance of adequate speed bumps. The Engineer may instruct additional measures at his discretion.

Where earthwork excavations cause dust to blow into areas where it causes a nuisance, the Contractor is responsible for altering the schedule of works to minimise the nuisance. This may involve restricting the timing of work to certain hours of the day or completing works and restoring a dust-free surface as rapidly as possible. The Engineer may instruct additional measures at his discretion.

- **Noise Pollution**

The Contractor shall take every precaution to control excessive noise resulting in disruption to the local population and to wildlife. All static plant shall be located at least 100 metres from occupied buildings and at least 800 metres from sites deemed by the Engineer to have sensitive wildlife. The Engineer

may require the construction of baffles or bunds around noisy plant in order to reduce the pollution caused.

- **Special Provisions for Sensitive Ecology**

In addition to the provisions of other clauses, the Engineer may require the Contractor to undertake special provisions to protect any plant or animal deemed to be environmentally sensitive or otherwise worthy of unusual protection.

- **Reinstatement of Environment**

The Contractor shall reinstate the environment of areas polluted by the use or spillage of hazardous materials as defined in sub-clause. All such materials and polluted soil will be removed to a safe disposal site as described in sub-clause. Disposal of Spoil and Construction Waste. The site will then be restored and revegetated as described above. This provision applies in particular to all areas affected by bitumen.

The contractor shall reinstate the quarry site at the completion of the works as mentioned in Sub clause and/or instructed by the Engineer.

- **Protection of the Environment**

The Contractor shall ensure that Site Offices, depots and particularly storage areas for diesel and bitumen are not located near watercourses and are operated so that no pollutants enter watercourses, either overland or through groundwater seepage especially during periods of heavy rain.

The Contractor shall, to the satisfaction of the Engineer, take all necessary precautions for the efficient protection of all surface and subsurface watercourses against all kinds of pollution arising from the execution of the work.

The Contractor shall not be allowed to discharge water containing silt, sand, cement or any other polluting materials such as sewage or hazardous materials into flowing or stagnant water bodies.

The Contractor shall ensure that at all locations where his labour force are living or working, other than labour living in their own homes, adequate facilities are provided to collect and treat all sewage and wastewater and to ensure that the outflows from such treatment facilities comply with recognised national or international standards for sewage treatment discharges.

The Contractor shall ensure that fuel wood is not used as a means of heating during the preparation or processing of any materials forming part of the Works.

The Contractor shall take special precautions in connection with the establishment of storage facilities for diesel fuel, petrol, lubricants, bitumen and bituminous materials. Storage facilities shall not be placed in rock-fall prone areas nor shall they be located within 500 metres of existing watercourses. They shall have barriers and impervious surfaces preventing

leakages of spilt material outside the storage area or into the underlying soils. The Contractor shall present his plans for such facilities to the Engineer for his approval prior to their establishment. Such approval shall not reduce the Contractor's responsibility to prevent all such leakage nor his liability to remedy the damages which may be caused should such incidents occur. The Contractor shall ensure that all spoil or material removed from drains is disposed of to designated stable tipping areas approved by the Engineer.

The Contractor shall ensure that any cut or fill slopes are planted in grass or other approved plant cover as soon as possible to protect them from erosion, as directed by the Engineer.

The water used in road construction shall not be allowed to affect water availability in the local communities. Where a scarcity of water is expected to arise, the contractor shall explore and tap alternative sources of safe water. In case of interference with the water supply of a settlement, the contractor is liable to provide the affected population with potable drinking water from alternative sources at no extra cost to the contract or the local people.

K. CONTRACTOR'S ESTABLISHMENT ON SITE OFFICE, EQUIPMENT TESTING FACILITIES ETC.

It is the Contractor's responsibility to acquire land for the sitting of all his offices, accommodation, stores, testing facilities, equipment yards and workshops and for all temporary works and for the reinstatement of such land on completion of the Contract to the satisfaction of the owners and of the Engineer. The Contractor shall obtain the approval of the Engineer to the sitting of offices, accommodation, stores, testing facilities, equipment yards and workshops before such land is acquired and he shall indemnify the Employer against all claims and charges in respect of the occupation, use and reinstatement of the land.

The Contractor is solely responsible for the satisfactory accommodation of all his employees and for complying with all regulations and requirements in this respect.

L. OTHER SPECIFICATIONS

Any item of work not covered by the MoRTH Specification shall confirm to the international standard specifications acceptable to the Engineer.

Special Protection Work on Rehabilitation and restoration of Sinking/Sliding Zone from Km 70+900 to Km 71+100 and Km 71+550 to Km 71+850 with JICA Technical Assistance including widening of Narrow Zone from Km 53+775 to Km 54+100 and from Km 63+045 to Km 63+470 on NH-10 (Rangpo To Ranipool section) in the State of Sikkim.

Name of Road :NH-10 within Sikkim (KM 52+00 TO KM- 80+000)

Length of road : 28.00 Km

BILL OF QUANTITY

Sr.No	Decription	Unit	Quantity	Rate in Rs.		Amount in Rs.
				In figures	In words	
A	**SLIDING ZONE**					
1.01	**Site clearance** (Clearing and grubbing road land including uprooting rank vegetation, grass, bushes, shrubs, saplings and trees girth up to 300 mm, removal of stumps of trees cut earlier and disposal of unserviceable materials and stacking of serviceable material to be used or auctioned up to a lead of 50 metres including removal and disposal of top organic soil not exceeding 150 mm in thickness complete in accordance with Technical Specifications of MoRT&H and as per direction of the Engineer-in- Charge (By Manual	Ha	5.20			
1.02	**Excavation of natural slope along the hill side** (Earthwork in excavation for foundation of structures as per drawing and technical specification including setting out, removing, spreading or stacking of spoils within a lead of 150 m. as directed and including trimming the sides of the trenches, levelling, dressing and ramming the bottom, complete in accordance with Technical Specifications of MoRT&H and as per direction of the Engineer-in- Charge in all sorts of soil excluding marshy soil & rocks	Cum	21000.00			
1.03	Scrubbing loose boulders on the surface, collecting the loose boulder at the bottom of slope and disposal at a dumping place within a lead of 150 meter including all lift and machinery etc. complete in accordance with Technical Specifications of MoRT&H and as per direction of the Engineer-in- Charge	Cum	14000.00			
1.04	**Backfilling Material** (Providing suitable material behind the wall as purpose of backfill with Locally available materials having PI < 6 and having good angle of internal friction ,including cost of all materials, labour, machinery, and all other ancillary operations etc., complete in accordance with Technical Specifications of MoRT&H and lines, levels and grades, dimensions and cross-sections shown in the Drawings or as directed by the Engineer)	Cum	2500.00			

Special Protection Work on Rehabilitation and restoration of Sinking/Sliding Zone from Km 70+900 to Km 71+100 and Km 71+550 to Km 71+850 with JICA Technical Assistance including widening of Narrow Zone from Km 53+775 to Km 54+100 and from Km 63+045 to Km 63+470 on NH-10 (Rangpo To Ranipool section) in the State of Sikkim.

Name of Road :NH-10 within Sikkim (KM 52+00 TO KM- 80+000)

Length of road : 28.00 Km

BILL OF QUANTITY

Sr.No	Decription	Unit	Quantity	Rate in Rs.		Amount in Rs.
				In figures	In words	
1.05	**Horizontal Drainage Borings** (Providing ,Supply and Installation, construction and drilling holes which are inclined to the horizontal direction by not more than 10 degrees and providing and installing perforated pipes and protective pipes into the holes so drillng, including cost of all materials, labour, machinery, ,drainage and all other ancillary operations etc., complete with lead upto 1 km and all lifts.,in accordance with Technical Specifications and lines, levels and grades, dimensions and cross-sections	Rm	1272.00			
1.06	**Cast-in-situ Concrete Cribs Works** (Providing ,Supply and Installation, construction of cast in-situ concrete crib works on the slopes including reinforcement and formwork complete as per drawing and Technical specification and lines, levels and grades, dimensions and cross-sections shown in the Drawings or as directed by the Engineer)	Rm	6575.00			
1.07	**Permanent Ground Anchor** (Supply and Installation of 70 Ton Wire anchors with a strand dia of 12.7/15.2 mm and yield strength more than 1770 N/mm2, with 2.0 c/c spacing horiontal and vertical with 35m length in soil zone and 20m rock zone , including all accessories for stressing, stressing operations and grouting , RCC M30 Grade End Block ,including reinforcement and formwork complete as per drawing and Technical specification and lines, levels and grades, dimensions and cross-sections	Rm	350.00			
1.08	**Rock fall protection Net** (Supplying and placing of Mechanically Woven Double Twisted Hexagonal Shaped Wire Mesh netting roll, Mesh Type 10x12, (Zn+10%Al alloy) + PVC coated Mesh Wire dia. 2.7/3.7mm (ID/OD), end of roll mechanically edged / selvedged, with galvanization as per IS 16014:2012 and MoRTH (Fifth Revision) 2013, Clause 2500.) including fixing of Wire rope anchor,Nail with system spike plate complete as per drawing and Technical specification and Drawings or as directed by the Engineer)	Sqm	9190.00			

Special Protection Work on Rehabilitation and restoration of Sinking/Sliding Zone from Km 70+900 to Km 71+100 and Km 71+550 to Km 71+850 with JICA Technical Assistance including widening of Narrow Zone from Km 53+775 to Km 54+100 and from Km 63+045 to Km 63+470 on NH-10 (Rangpo To Ranipool section) in the State of Sikkim.

Name of Road :NH-10 within Sikkim (KM 52+00 TO KM- 80+000)

Length of road : 28.00 Km

BILL OF QUANTITY

Sr.No	Decription	Unit	Quantity	Rate in Rs.		Amount in Rs.
				In figures	In words	
1.09	**Rock Bolts** (Providing and fixing 25 mm diameter and 5.0 m long steel rock bolts with mechanical/ wedge type anchorage including drilling 46 mm dia holes, providing 150 mm long 20 mm thick steel tapered wedge, 10 mm thick 150 x150 mm plate washer and nuts, tightening bolt by torque wrench,grouting , cost of all materials, machinery, labour, ventilation, lighting, drainage and all other ancillary operations etc., complete with lead upto 1 km and all lifts in accordance with Technical Specifications	Nos	3575.00			
1.1	**Shotcreting** (Providing specified thick shortcrete on the slopesas per the mixed proporation of 10 mm size aggregate ,cement admixture determinded by contractor & approved by Engineer in Charge including cost of all materials, labour, machinery, ,drainage and all other ancillary operations etc., complete with lead upto 1 km and all lifts.,in accordance with Technical Specifications and lines, levels and grades, dimensions and cross sections shown in the Drawings or as directed by the Engineer)	Cum	495.00			
1.11	**Shotcrete work chainlink wire mesh** (Providing specified thick shortcrete to sides and arch of tunnel as per the mixed proporation of 10 mm size aggregate ,cement admixture determinded by contractor & approved by Engineer in Charge including cost of all materials, labour, machinery, drainage and all other ancillaryoperations & excluding steel fibre etc., complete with lead upto 1 km and all lifts.)	Cum	275.29			
1.12	**Chain link wire mesh** (Providing ,Supply and Installation, conform to be requirements of IS: 2140-1978 (Re affirmed 1991) for galvanized steel chain link wire mesh , mesh size of approximately 50mmx50mm and a wire diameter of 2mm including cost of all materials, labour, machinery, and all other ancillary operations etc., complete in accordance with Technical Specifications and lines, levels and grades, dimensions and cross sections shown in the Drawings or as directed by the Engineer)	Sqm	2752.93			
1.13	**Gabian Structure for Retaining Earth** (Providing ,Supplying, construction and placing of Mechanically Woven Double Twisted Hexagonal Shaped Wire Mesh Gabion Boxes of required sizes, Mesh Type 10x12, (Zn+ 10%Al alloy) + PVC coated, Mesh Wire dia. 2.7/3.7mm (ID/OD), mechanically edged / selvedged with galvanization, with partitions at every 1m interval including cost of all materials, labour, machinery, and all other ancillary operations etc. complete in accordance with Technical Specifications	Cum	30.00			

Special Protection Work on Rehabilitation and restoration of Sinking/Sliding Zone from Km 70+900 to Km 71+100 and Km 71+550 to Km 71+850 with JICA Technical Assistance including widening of Narrow Zone from Km 53+775 to Km 54+100 and from Km 63+045 to Km 63+470 on NH-10 (Rangpo To Ranipool section) in the State of Sikkim.

Name of Road :NH-10 within Sikkim (KM 52+00 TO KM- 80+000)

Length of road : 28.00 Km

BILL OF QUANTITY

Sr.No	Decription	Unit	Quantity	Rate in Rs.		Amount in Rs.
				In figures	In words	
1.14	**Surface Drains in all type soil and rock** (Construction of lined surface drain of M20 Grade of average cross sectional area 0.6 sqm including cost of all materials, labour, machinery, and all other ancillary operations etc., complete in accordance with Technical Specifications and lines, levels and grades, dimensions and cross-sections shown in the Drawings or as directed by the Engineer).	Rm	900.00			
1.15	**Hydroseeding 20 mm thick** ((Providing ,Supply and Installation on hill slope including cost of all materials, labour, machinery,and all other ancillary operations etc., complete with lead upto 1 km and all lifts.,in accordance with Technical Specifications and lines, levels and grades, dimensions and cross-sections shown in the Drawings or as directed by the Engineer)	Sqm	2752.93			
B	**NARROW ZONE**					
2.01	Excavation for Structures (Earth work in excavation of foundation of structures as per drawing and technical specification, including setting out, construction of shoring and bracing, removal of stumps and other deleterious matter, dressing of sides and bottom, backfilling the excavation earth to the extent required and utilising the remaining earth	Cum	3927.15			
2.02	Providing and laying of PCC M 15 levelling course 100 mm thick below the foundation	Cum	328.40			
2.03	Furnishing and Placing Reinforced/Prestressed cement concrete in super-structure as per drawing and Technical Specification RCC Grade M 30	Cum	**5033.65**			
2.04	Supplying, fitting and placing uncoated HYSD bar reinforcement in foundation complete as per drawing and Technical specifications	MT	830.55			
2.05	Providing and laying of Filter media with granular materials/stone crushed aggregates satisfying the rerquirements laid down in clause 2504.2.2 of MOSRT&H specifications to a thickness of not less than 600mm with smaller size towards the soil and bigger size towards the wall and provided over the enire surface behind abutment, wing wall and	Cum	1054.69			
2.06	Providing and fixing 25 mm diameter steel rock bolts with mechanical/ wedge type anchorage including drilling 65 mm dia holes, providing150 mm long 20 mm thick steel tapered wedge, 10 mm thick 150 x150 mm plate washer and nuts, tightening bolt by torque wrench, cost of all materials, machinery, labour, ventilation, lighting,	Rm	6750.00			
2.07	Drainage Spouts complete as per drawing and Technical specification	Nos	150.00			

Special Protection Work on Rehabilitation and restoration of Sinking/Sliding Zone from Km 70+900 to Km 71+100 and Km 71+550 to Km 71+850 with JICA Technical Assistance including widening of Narrow Zone from Km 53+775 to Km 54+100 and from Km 63+045 to Km 63+470 on NH-10 (Rangpo To Ranipool section) in the State of Sikkim.

Name of Road :NH-10 within Sikkim (KM 52+00 TO KM- 80+000)

Length of road : 28.00 Km

BILL OF QUANTITY

Sr.No	Decription	Unit	Quantity	Rate in Rs.		Amount in Rs.
				In figures	In words	
2.08	Providing & fixing 20 mm thick compressible fibre board in expansion joint complete as per drawing & Technical Specification	Rm	750.00			
2.09	Mastic Asphalt (Providing and laying 12 mm thick mastic asphalt wearing course on top of deck slab excluding prime coat with paving grade bitumen meeting the requirements given in table 500-29, prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with bitumen precoated fine grained hard stone chipping of 9.5 mm nominal size at the rate of 0.005cum per 10 sqm and at an approximate spacing of 10 cm center to center in both directions, pressed into surface when the temperature of surfaces not less than 100 deg.	Sqm	6750.00			
2.1	Bituminous Concrete (Providing and laying bituminous concrete with 100-120 TPH batch type hot mix plant producing an average output of 75 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.4 to 5.6 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per	Cum	270.00			
2.11	Construction of M20 grade lined surface drains specified lines, grades, levels and dimensions as per drawing or technical specification section 309 and 1700	Rm	750.00			
C	**OTHER WORKS**					
3.01	**Wet Mix Macadam** (Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density.)	Cum	400.00			

Special Protection Work on Rehabilitation and restoration of Sinking/Sliding Zone from Km 70+900 to Km 71+100 and Km 71+550 to Km 71+850 with JICA Technical Assistance including widening of Narrow Zone from Km 53+775 to Km 54+100 and from Km 63+045 to Km 63+470 on NH-10 (Rangpo To Ranipool section) in the State of Sikkim.

Name of Road :NH-10 within Sikkim (KM 52+00 TO KM- 80+000)

Length of road : 28.00 Km

BILL OF QUANTITY

Sr.No	Decription	Unit	Quantity	Rate in Rs.		Amount in Rs.
				In figures	In words	
3.02	**Prime Coat** (Providing and applying primer coat with Bitumen emulsion (SS-1) on prepared surface of granular base including cleaning of road surface and spraying primer at the rate of 0.70- 1.0 kg/sqm using mechanical means as per Technical Specification Clause 502.)	Sqm	1400.00			
3.03	**Dense Graded Bituminous Macadam** (Providing and laying dense bituminous macadam with 100-120 TPH batch type HMP producing an average output of 75 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.0 to 4.5% by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in all respects) Case-II for Grading II (10 mm nominal size)	Cum	84.00			
3.04	**Tack Coat** ((i) Providing and applying tack coat with Bitumen emulsion (RS-1) using emulsion distributor at the rate of 0.25 to 0.30 kg per sqm on the prepared Normal Bituminous Surface with primer and cleaned with Hydraulic broom as per Technical Specification Clause 503. (Normal Bituminous Surface)	Sqm	1400.00			
3.05	**Bituminous Concrete** (Providing and laying bituminous concrete with 100-120 TPH batch type hot mix plant producing an average output of 75 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.4 to 5.6 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects) Case-I Using Bitumen 60/70 grade (i)for Grading I (13 mm nominal size)	Cum	56.00			

Special Protection Work on Rehabilitation and restoration of Sinking/Sliding Zone from Km 70+900 to Km 71+100 and Km 71+550 to Km 71+850 with JICA Technical Assistance including widening of Narrow Zone from Km 53+775 to Km 54+100 and from Km 63+045 to Km 63+470 on NH-10 (Rangpo To Ranipool section) in the State of Sikkim.

Name of Road :NH-10 within Sikkim (KM 52+00 TO KM- 80+000)

Length of road : 28.00 Km

BILL OF QUANTITY

Sr.No	Decription	Unit	Quantity	Rate in Rs.		Amount in Rs.
				In figures	In words	
3.06	Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing					
	90 cm equilateral triangle	each	12.00			
	60 cm equilateral triangle	each	25.00			
	60 cm circular	each	32.00			
	80 mm x 60 mm rectangular	each	28.00			
	60 cm x 45 cm rectangular	each	22.00			
	60 cm x 60 cm square	each	30.00			
3.07	Direction and Place Identification signs upto 0.9 sqm size board. (Providing and erecting direction and place identification retro-reflectorised sign asper IRC:67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area not exceeding 0.9 sqm supported on a mild steel single angle iron post 75 x 75 x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 x 45 x 60 cm, 60 cm below ground level as per approved drawing)	Sqm	7.50			
3.08	Road Marking with Hot Applied Thermoplastic Compound with Reflectorising Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35 .The finished surface to be level, uniform and free from streaks and holes.)	Sqm	4000.00			

Special Protection Work on Rehabilitation and restoration of Sinking/Sliding Zone from Km 70+900 to Km 71+100 and Km 71+550 to Km 71+850 with JICA Technical Assistance including widening of Narrow Zone from Km 53+775 to Km 54+100 and from Km 63+045 to Km 63+470 on NH-10 (Rangpo To Ranipool section) in the State of Sikkim.

Name of Road :NH-10 within Sikkim (KM 52+00 TO KM- 80+000)

Length of road : 28.00 Km

BILL OF QUANTITY

Sr.No	Decription	Unit	Quantity	Rate in Rs.		Amount in Rs.
				In figures	In words	
3.09	**Road Delineators** (Supplying and installation of delineators (road way indicators, hazard markers, object markers), 80-100 cm high above ground level, painted black and white in 15 cm wide stripes, fitted with 80 x 100 mm rectangular or 75 mm dia circular reflectorised panels at the top, buried or pressed into the ground and confirming toIRC-79 and the drawings.)	each	14.00			
3.1	**Street Furniture** (Road Markers/Road Stud with Lense Reflector (Providing and fixing of road stud 100x 100 mm, die cast in aluminium, resistant to corrosive effect of salt and grit, fitted with lense reflectors, installed in concrete or asphaltic surface by drilling hole 30 mm upto a depth of 60 mm and bedded in a suitable bituminous grout or epoxy mortar, all as per BS 873 part 4:1973)	each	1200.00			
3.11	Type - A, "W" : Metal Beam Crash Barrier (Providing and erecting a "W" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 70 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 1.8 m high, 1.1 m below ground/road level, all steel parts and fitments to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a spacer of channel section 150 x 75 x 5 mm, 330 mm long complete as per clause 810)	Rm	3000.00			
3.12	**Repair of RCC Railing** (Carrying out repair of RCC M30 railing to bring it to the original shape.)	Rm	300.0			
3.13	**Painting Two Coats on New Concrete Surfaces** (Painting two coats after filling the surface with synthetic enamel paint in all shades on new plastered concrete surfaces)	Sqm	573.20			
3.14	**Mastic Asphalt** (Providing and laying 25 mm thick mastic asphalt wearing course with paving grade bitumen meeting the requirements given in table 500-29, prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with bitumen precoated fine-grained hard stone chipping of 13.2 mm nominal size at the rate of 0.005cum per 10 sqm and at an approximate spacing of 10 cm center to center in both directions, pressed into surface [illegible]	Sqm	1125.00			

Special Protection Work on Rehabilitation and restoration of Sinking/Sliding Zone from Km 70+900 to Km 71+100 and Km 71+550 to Km 71+850 with JICA Technical Assistance including widening of Narrow Zone from Km 53+775 to Km 54+100 and from Km 63+045 to Km 63+470 on NH-10 (Rangpo To Ranipool section) in the State of Sikkim.

Name of Road :NH-10 within Sikkim (KM 52+00 TO KM- 80+000)

Length of road : 28.00 Km

BILL OF QUANTITY

Sr.No	Decription	Unit	Quantity	Rate in Rs.		Amount in Rs.
				In figures	In words	
3.15	**Excavation in Hilly Areas in all type of Soil/rock for side drain By Mechanical Means** (Excavation in soil in hilly area by mechanical means including cutting and trimming of side slopes and disposing of excavated earth with all lifts and lead .)	Cum	5000.00			
3.16	Construction of M20 grade lined surface drains specified lines, grades, levels and dimensions as per drawing or technical specification section 309 and 1700	Rm	10000.00			
3.17	Excavation for Structures (Earth work in excavation of foundation of structures as per drawing and technical specification, including setting out, construction of shoring and bracing, removal of stumps and other deleterious matter, dressing of sides and bottom and backfilling with approved material.) I. Ordinary soil A Manual Means (i). upto	Cum	5093.64			
3.18	Plain/Reinforced cement concrete in open foundation complete as per drawing and technical specifications, placed in foundation and compacted by vibration including curing for 14 days.. I. PCC grade M15 Nominal mix 1 : 2 : 4 (hand mixing)	Cum	375.47			
3.19	Providing & laying Plum concrete in 1:2:4 c.c. (1cement, 2coarse sand, 4clean hard graded stone chips of 20 mm down nominal gauge) with 50% clean hard stone of sizes not exceeding 15cm including shuttering, compacting and curing complete.	Cum	4081.3			
3.2	Back filling behind abutment, wing wall and return wall complete as per drawing and Technical specification (a) Granular material	Rm	678.6			
3.21	**Gabian Structure for Retaining Earth** (Providing and construction of a gabain structure for retaining earth with segments of wire crates of size 7 m x 3 m x 0.6 m each divided into 1.5 m compartments by cross netting, made from 4 mm galvanised steel wire @ 32 kg per 10sqm having minimum tensile strength of 300 Mpa conforming to IS:280 and galvanizing coating conforming to IS:4826, woven into mesh with double twist, mesh size not exceeding 100 x 100 mm, filled with boulders with least dimension of 200 mm,	Cum	1800.00			
D	**NON SCHEDULED WORKS**					

Special Protection Work on Rehabilitation and restoration of Sinking/Sliding Zone from Km 70+900 to Km 71+100 and Km 71+550 to Km 71+850 with JICA Technical Assistance including widening of Narrow Zone from Km 53+775 to Km 54+100 and from Km 63+045 to Km 63+470 on NH-10 (Rangpo To Ranipool section) in the State of Sikkim.

Name of Road :NH-10 within Sikkim (KM 52+00 TO KM- 80+000)

Length of road : 28.00 Km

BILL OF QUANTITY

Sr.No	Decription	Unit	Quantity	Rate in Rs.		Amount in Rs.
				In figures	In words	
4.01	Disposal of land slide material with all lifts and lead up to 1000 meters.Land Slide clearing MoRT&H 301.3.9	Cum	10,000			
4.02	Disposal of landslide material for additional haul involving beyond 1km and upto 6km	Cum	6,000			
4.03	**Dayworks**					
	Use of contractor's equipment inclusive of all costs for run time only					
	Cranes 3 tonnes	Hours	100			
	Dozer D - 50 - A 15	Hours	100			
	Hydraulic Excavator of 1 cum bucket	Hours	300			
	Front End loader 1 cum bucket capacity	Hours	300			
	Tipper - 5 cum	Hours	1,000			
	Generator 33 KVA	Hours	500			
	Concrete Mixer 1 cum	Hours	500			
	Needle Vibrator	Hours	500			
	Plate Compactor	Hours	500			
	Water Tank	Hours	500			
	Tractor	Hours	500			
4.04	Supply of Labor including tools and plants					
	Mason/Mistri	Mandays	300			
	Other skill labor/Electrician/Mechanics/carpenter etc	Mandays	100			
	Unskilled Labor	Mandays	1,000			
	Total Amount					

SECTION-8: SECURITIES AND OTHER FORMS

BID SECURITY (BANK GUARANTEE)

WHEREAS, _____ [name of Bidder] (hereinafter called "the Bidder") has submitted his Bid dated _____ [date] for the construction of _____ [name of Contract] (hereinafter called "the Bid").

KNOW ALL PEOPLE by these presents that We _____ [name of bank] of _____ [name of country] having our registered office at _____ (hereinafter called "the Bank") are bound unto _____[name of Employer] (hereinafter called "the Employer") in the sum of _____* for which payment well and truly to be made to the said Employer the Bank binds itself, his successors and assigns by these presents.

SEALED with the Common Seal of the said Bank this_____ day of _____, 20____.

THE CONDITIONS of this obligation are:

(1) If after Bid opening the Bidder withdraws his bid during the period of Bid validity specified in the Form of Bid;

OR

(2) If the Bidder having been notified of the acceptance of his bid by the Employer during the period of Bid validity:

(a) fails or refuses to execute the Form of Agreement in accordance with the Instructions to Bidders, if required; or

(b) fails or refuses to furnish the Performance Security, in accordance with the Instruction to Bidders; or

(c) does not accept the correction of the Bid Price pursuant to Clause 27;

We undertake to pay to the Employer up to the above amount upon receipt of his first written demand, without the Employer having to substantiate his demand, provided that in his demand the Employer will note that the amount claimed by him is due to him owing to the occurrence of one or any of the three conditions, specifying the occurred condition or conditions.

This Guarantee will remain in force up to and including the date _____** days after the deadline for submission of Bids as suchdeadline 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 later than the above date.

This guarantee shall also be operatable at our ……Branch at New Delhi,from whom, confirmation regarding the issue of this guarantee or extension / renewal thereof shall be made available on demand. In the contingency of this guarantee being invoked and payment thereunder claimed, the said branch shall accept such invocation letter and make payment of amounts so demanded under the said invocation.

The guarantor/bank hereby confirms that it is on the SFMS (Structural Finance Messaging System) platform & shall invariably send an advice of this Bank Guarantee to the designated bank of NHIDCL, details of which is as under:

Sl.no.	Particulars	Details
1	Name of Beneficiary	National Highways & Infrastructure Development Corporation Limited
2	Beneficiary Bank Account No.	90621010002659
3	Beneficiary Bank Branch	IFSC SYNB0009062
4	Beneficiary Bank Branch Name	Transport Bhawan, New Delhi
5	Beneficiary Bank Address	Syndicate Bank transport Bhawan, 1st Parliament Street, New Delhi-110001

DATE _____ SIGNATURE _____

WITNESS _____ SEAL _____

_____

[Signature, name, and address]

* The Bidder should insert the amount of the guarantee in words and figures denominated in Indian Rupees. This figure should be the same as shown in Clause 16.1 of the Instructions to Bidders.

** 45 days after the end of the validity period of the Bid. Date should be inserted by the Employer before the Bidding documents are issued.

PERFORMANCE BANK GUARANTEE

To: _____ [name of Employer]

_____ [address of Employer]

_____

WHEREAS _____ [name and address of Contractor] (hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute _____ [name of Contract and brief description of Works] (hereinafter called "the Contract").

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee;

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you on behalf of the Contractor, up to a total of _____ [amount of guarantee]* _____ [in words], such sum being payable in the types and proportions of currencies in which the Contract Price is payable, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of _____ [amount of guarantee] as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed thereunder or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall be valid until 28 days from the date of expiry of the Defects Liability Period.

This guarantee shall also be operatable at our ……Branch at New Delhi, from whom, confirmation regarding the issue of this guarantee or extension / renewal thereof shall be made available on demand. In the contingency of this guarantee being invoked and payment thereunder claimed, the said branch shall accept such invocation letter and make payment of amounts so demanded under the said invocation.

The guarantor/bank hereby confirms that it is on the SFMS (Structural Finance Messaging System) platform & shall invariably send an advice of this Bank Guarantee to the designated bank of NHIDCL, details of which is as under:

Sl.no.	Particulars	Details
1	Name of Beneficiary	National Highways & Infrastructure Development Corporation Limited
2	Beneficiary Bank Account No.	90621010002659
3	Beneficiary Bank Branch	IFSC SYNB0009062
4	Beneficiary Bank Branch Name	Transport Bhawan, New Delhi
5	Beneficiary Bank Address	Syndicate Bank transport Bhawan, 1st Parliament Street, New Delhi-110001

Signature and seal of the guarantor _____
Name of Bank _____
Address _____
Date _____

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* An amount shall be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract including additional security for unbalanced Bids, if any and denominated in Indian Rupees.

BANK GUARANTEE FOR ADVANCE PAYMENT

To: _____ [name of Employer]

_____ [address of Employer]

_____[name of Contract]

Gentlemen:

In accordance with the provisions of the Conditions of Contract, sub-clause 51.1 ("Advance Payment") of the above-mentioned Contract, _____ [name and address of Contractor] (hereinafter called "the Contractor") shall deposit with _____ [name of Employer] a bank guarantee to guarantee his proper and faithful performance under the said Clause of the Contract in an amount of _____ [amount of guarantee]* _____ [in words].

We, the _____ [bank or financial institution], as instructed by the Contractor, agree unconditionally and irrevocably to guarantee as primary obligator and not as Surety merely, the payment to _____ [name of Employer] on his first demand without whatsoever right of objection on our part and without his first claim to the Contractor, in the amount not exceeding _____ [amount of guarantee]* _____ [in words].

We further agree that no change or addition to or other modification of the terms of the Contract or of Works to be performed thereunder or of any of the Contract documents which may be made between _____ [name of Employer] and the Contractor, shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall remain valid and in full effect from the date of the advance payment under the Contract until _____ [name of Employer] receives full repayment of the same amount from the Contractor.

This guarantee shall also be operatable at our ……Branch at New Delhi,from whom, confirmation regarding the issue of this guarantee or extension / renewal thereof shall be made available on demand. In the contingency of this guarantee being invoked and payment thereunder claimed, the said branch shall accept such invocation letter and make payment of amounts so demanded under the said invocation.

The guarantor/bank hereby confirms that it is on the SFMS (Structural Finance Messaging System) platform & shall invariably send an advice of this Bank Guarantee to the designated bank of NHIDCL, details of which is as under:

Sl.no.	**Particulars**	**Details**

1	Name of Beneficiary	National Highways & Infrastructure Development Corporation Limited
2	Beneficiary Bank Account No.	90621010002659
3	Beneficiary Bank Branch	IFSC SYNB0009062
4	Beneficiary Bank Branch Name	Transport Bhawan, New Delhi
5	Beneficiary Bank Address	Syndicate Bank transport Bhawan, 1st Parliament Street, New Delhi-110001

Yours truly,

Signature and seal: _____

Name of Bank/Financial Institution: _____

Address: _____

Date: _____

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* An amount shall be inserted by the bank or financial institution representing the amount of the Advance Payment, and denominated in Indian Rupees.

INDENTURE FOR SECURED ADVANCES

FORM 31

(for use in cases in which the contract is for finished work and the contractor has entered into an agreement for the execution of a certain specified quantity of work in a given time)

This indenture made the _____ day of _____, 20____ BETWEEN _____ (hereinafter called the contractor which expression shall where the context so admits or implies be deemed to include his executors, administrators and assigns) or the one part and the Employer of the other part.

Whereas by an agreement dated _____ (hereinafter called the said agreement) the contractor has agreed.

AND WHEREAS the contractor has applied to the Employer that he may be allowed advanced on the security of materials absolutely belonging to him and brought by him to the site of the works the subject of the said agreement for use in the construction of such of the works as he has undertaken to executive at rates fixed for the finished work (inclusive of the cost of materials and labour and other charges)

AND WHEREAS the Employer has agreed to advance to the Contractor the sum of Rupees _____ on the security of materials the quantities and other particulars of which are detailed in Accounts of Secured Advances attached to the Running Account bill for the said works signed by the Contractor on _____ and the Employer has reserved to himself the option of making any further advance or advances on the security of other materials brought by the Contractor to the site of the said works.

Now THIS INDENTURE WITNESSETH that in pursuance of the said agreement and in consideration of the sum of Rupees _____ on or before the execution of these presents paid to the Contractor by the Employer (the receipt where of the Contractor doth hereby acknowledge) and of such further advances (if any) as may be made to him as a for said the Contractor doth hereby covenant and agree with the President and declare as follows:

(1) That the said sum of Rupees _____ so advanced by the Employer to the Contractor as aforesaid and all or any further sum of sums advanced as aforesaid shall be employed by the Contractor in or towards expending the execution of the said works and for no other purpose whatsoever.

(2) That the materials details in the said Account of Secured Advances which have been offered to and accepted by the Employer as security are absolutely the Contractor's own propriety and free from encumbrances of any kind and the contractor will not make any application for or receive a further advance on the security of materials which are not absolutely his own property and free from encumbrances of any kind and the Contractor indemnified the Employer against all claims to any materials in respect of which an advance has be made to him as aforesaid.

(3) That the materials detailed in the said account of Secured advances and all other materials on the security of which any further advance or advances may hereafter be made as aforesaid (hereafter called the said materials) shall be used by the Contractor solely in the execution of the said works in accordance with the directions of the Engineer.

(4) That the Contractor shall make at his own cost all necessary and adequate arrangements for the proper watch, safe custody and protection against all risks of the said materials and that until used in construction as aforesaid the said materials shall remain at the site of the said works in the Contractor's custody and on his own responsibility and shall at all times be open to inspection by the Engineer or any officer authorized by him. In the event of the said materials or any part thereof being stolen, destroyed or damaged or becoming deteriorated in a greater degree than is due to reasonable use and wear thereof the Contractor will forthwith replace the same with other materials of like quality or repair and make good the same required by the Engineer.

(5) That the said material shall not be any account be removed from the site of the said works except with the written permission of the Engineer or an officer authorized by him or that behalf.

(6) That the advances shall be repayable in full when or before the Contractor receives payment from the Employer of the price payable to him for the said works under the terms and provisions of the said agreement. Provided that if any intermediate payments are made to the Contractor on account of work done than on the occasion of each such payment the Employer will be at liberty to make a recovery from the contractor's bill for such payment by deducting there from the value of the said materials than actually used in the construction and in respect of which recovery has not been made previously, the value for this purpose being determined in respect of each description of materials at the rates at which the amounts of the advances made under these presents were calculated.

(7) That if the Contractor shall at any time make any default in the performance or observance in any respect of any of the terms and provisions of the said agreement or of these presents the total amount of the advance or advances that may still be owing of the Employer shall immediately on the happening of such default be repayable by the Contractor to be the Employer together with interest thereon at twelve per cent per annum from the date or respective dates of such advance or advances to the date of repayment and with all costs, charges, damages and expenses incurred by the **Employer** in or for the recover thereof or the enforcement of this security or otherwise by reason of the default of the Contractor and the Contractor hereby covenants and agrees with the **Employer** to reply and pay the same respectively to him accordingly.

(8) That the Contractor hereby charges all the said materials with the repayment to the Employer of the said sum of Rupees _____ and any further sum of sums advanced as aforesaid and all costs, charges, damages and expenses payable under these presents PROVIDED ALWAYS and it is hereby agreed and declared that notwithstanding anything in the said agreement and without prejudice to the power contained therein f and whenever the covenant for payment here-in-before contained shall become enforceable and the money owing shall not be paid in accordance there with the **Employer** may at any time thereafter adopt all or any of the following courses as he may deem best:

(a) Seize and utilize the said materials or any part thereof in the completion of the said works on behalf of the contractor in accordance with the provisions in that behalf contained in the said agreement debiting the contractor with the actual cost of effecting such completion and the amount due to the contractor with the value of work done as if he had carried it out in accordance with the said agreement and at the rates thereby provided. If the balance is against the contractor, he is to pay same to the **Employer** on demand.

(b) Remove and sell by public auction the seized materials or any part there of and out of the moneys arising from the sale retain all the sums aforesaid repayable or payable to the **Employer** under these presents and pay over the surplus (if any) to the Contractor.

(c) Deduct all or any part of the moneys owing out of the security deposit or any sum due to the Contractor under the said agreement.

(9) That except in the event of such default on the part of the contractor as aforesaid interest on the said advance shall not be payable.

(10) That in the event of any conflict between the provisions of these presents and the said agreement the provisions of these presents shall prevail and in the event of any dispute or difference arising over the construction or effect of these presents the settlement of which has not been here-in-before expressly provided for the same shall be referred to the Employer whose decision shall be final and the provision of the Indian Arbitration Act for the time being in force shall apply to any such reference.

Letter of Acceptance

(Letterhead paper of the Employer)

_____ (Date)

To

_____ [name and address pf the Contractor]

_____

_____

Dear Sirs,

This is to notify you that your Bid dated _____ for execution of the _____ (name of the contract and identification number, as given in the Instructions to Bidders) for the Contract Price of Rupees figures), as corrected and modified in accordance with the Instructions to Bidder[1] is hereby accepted by our agency.

We accept / do not accept that _____ be appointed as the Adjudicator[2]. You are hereby requested to furnish Performance Security, in the form detailed in Para 34.1 of ITB for an amount equivalent to Rs. _____ within 21 days of the receipt of this letter of acceptance valid up to 28 days from the date of expiry of defects Liability period i.e. up to _____ and sign the contract, failing which action as stated n Para 34.3 of ITB will be taken.

Yours faithfully,

Authorized Signature

Name and title of Signatory
Name of Agency

_____

1 Delete "corrected and" or "and modified" if only one of these actions applies. Delete as corrected and modified in accordance with the Instructions to Bidders, if corrections or modifications have not been affected.

2 To be used only if the Contractor disagrees in his Bid with the Adjudicator proposed by the Employer in the "Instructions to Bidders".

Issue of Notice to proceed with the work

(Letterhead of the Employer)

_____ (Date)

To

_____ [name and address of the Contractor]

_____

_____

Dear Sirs,

Pursuant to your furnishing the requisite security as stipulated in ITB Clause 34.1 and signing of the Contract for the construction of _____
_____
_____at a Bid Price of Rs. _____.

You are hereby instructed to proceed with the execution of the said works in accordance with the contract documents.

Yours faithfully,

(Signature, name and title of signatory
authorized to sign on behalf of Employer)

Agreement Form

Agreement

This agreement, made the _____ day of _____between _____ (name and address of Employer) [hereinafter called "the Employer] and _____ (name and address of contractor) hereinafter called "the Contractor" of the other part.

Whereas the Employer is desirous that the Contractor execute_____(name and identification number of Contract) (hereinafter called "the Works") and the Employer has accepted the Bid by the Contractor for the execution and completion of such works and the remedying of any defects therein, at a cost of Rs. _____

NOW THIS AGREEMENT WITNESSETH as follows:

1. In this Agreement, words and expression shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to, and they shall be deemed to form and be read and construed as part of this Agreement.

2. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any defects therein in conformity in all aspects with the provisions of the Contract.

3. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying the defects wherein the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

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

i) Letter of Acceptance
ii) Notice to proceed with the works
iii) Contractor's Bid
iv) Conditions of Contract: General and Special
v) Contract Data
vi) Additional condition
vii) Drawings
viii) Bill of Quantities and
ix) Any other documents listed in the Contract Data as forming part of the Contract

In witness whereof the parties thereto have caused this Agreement to be executed the day and year first before written.

The Common Seal of _____
was hereunto affixed in the presence of:

Signed, Sealed and Delivered by the said_____ in the presence of:

Binding Signature of Employer _____
Binding Signature of Contractor _____

UNDERTAKING

I, the undersigned do hereby undertake that our firm M/s _____ agree to abide by this bid for period _____ days for the date fixed for receiving the same and it shall be binding on us and may be accepted at any time before the expiration of that period.

_____

(Signed by an Authorised Officer of the Firm)

_____

Title of Officer

_____

Name of Firm

_____

DATE

SECTION-9: DRAWINGS

R E V I S I O N S			
DATE	ISSUED AND/OR REFERENCES	DEALT	CHECKED

CLIENT: NATIONAL HIGHWAY & INFRASTRUCTURE DEVELOPMENT CORPORATION LTD. 3rd FLOOR PTI BUILDING, 4 PARLIAMENT STREET, NEW DELHI-110001

MINISTRY OF ROAD, TRANSPORT & HIGHWAYS, GOVERNMENT OF INDIA

Manager (NHIDCL) Gangtok,Sikkim	General Manager (NHIDCL) Gangtok,Sikkim

CONSULTANT: CM ENGINEERING & SOLUTION
MARUTI VIHAR, HOUSE NO. 1473A,
GURGAON,HARYANA -122002
Email - cmesconsultancy@gmail.com
Phone: 9811406386, 9911052266, 01244255138

DEALT	CHECKED	APPROVED
SM	DK	DK

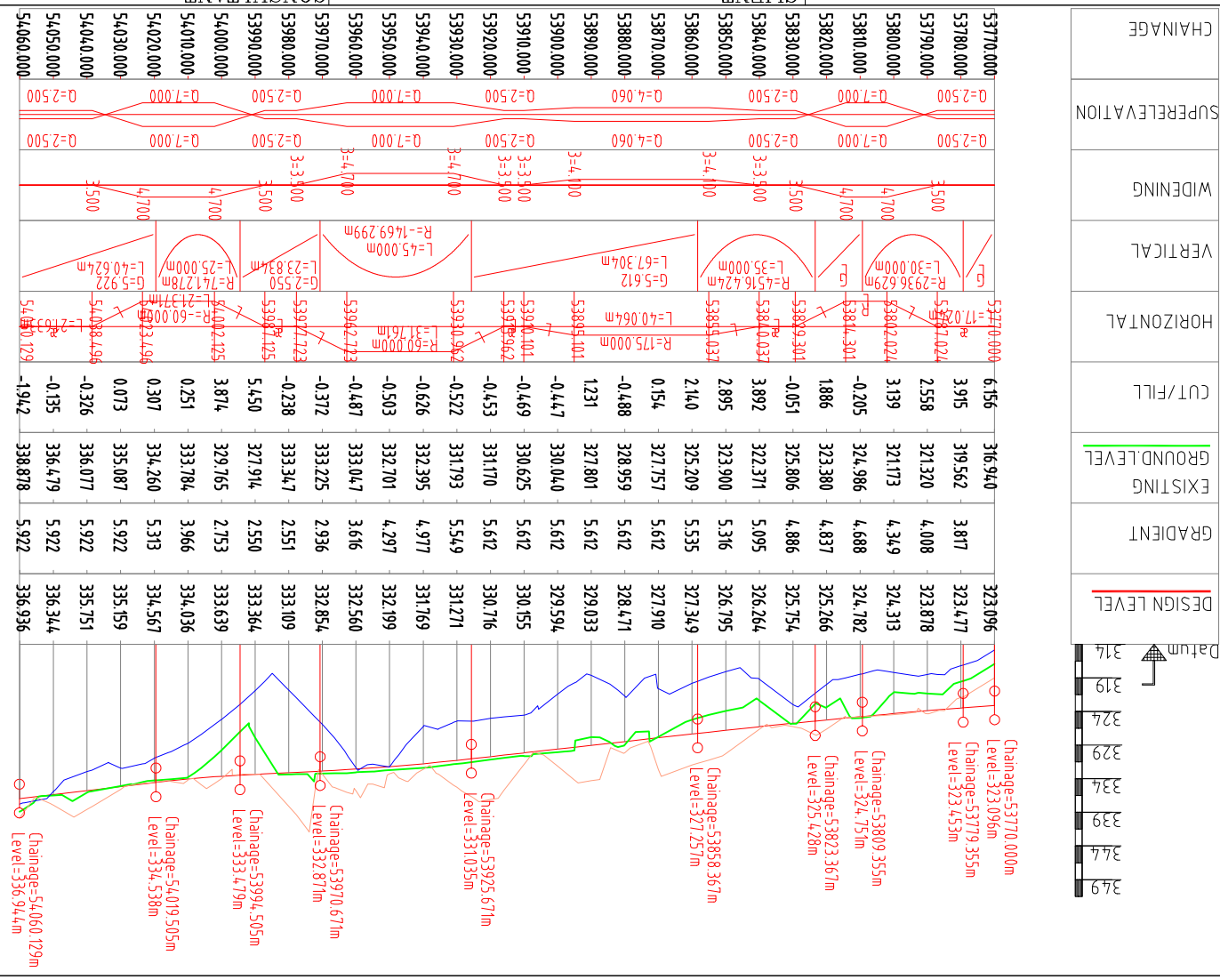
PROJECT: SPECIAL PROTECTION WORK ON NH-10 FROM KM 54+000 TO KM 80+000 (RANGPO TO RANIPOOL) IN THE STATE OF SIKKIM

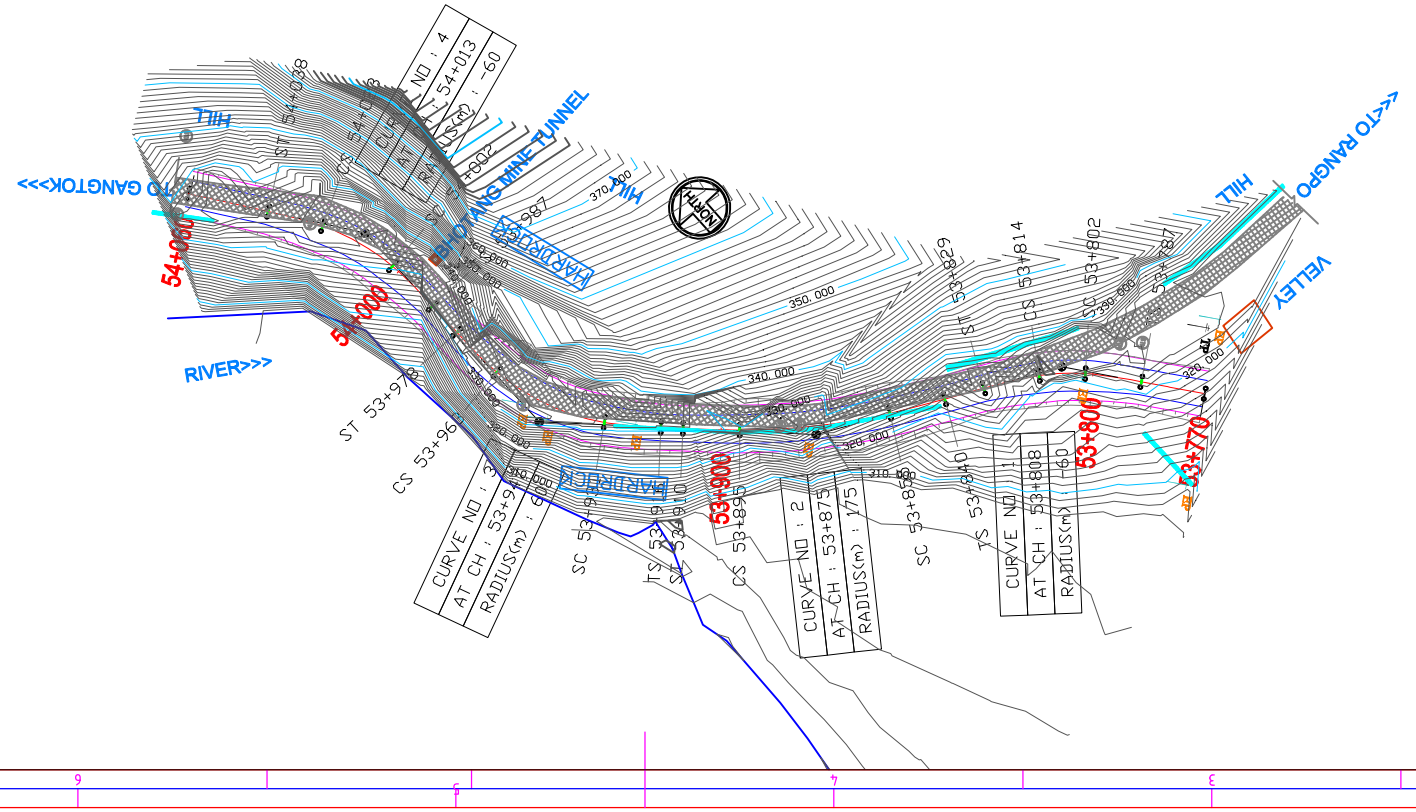
TITLE: PLAN & PROFILE (KM 53+770 TO KM54+050)

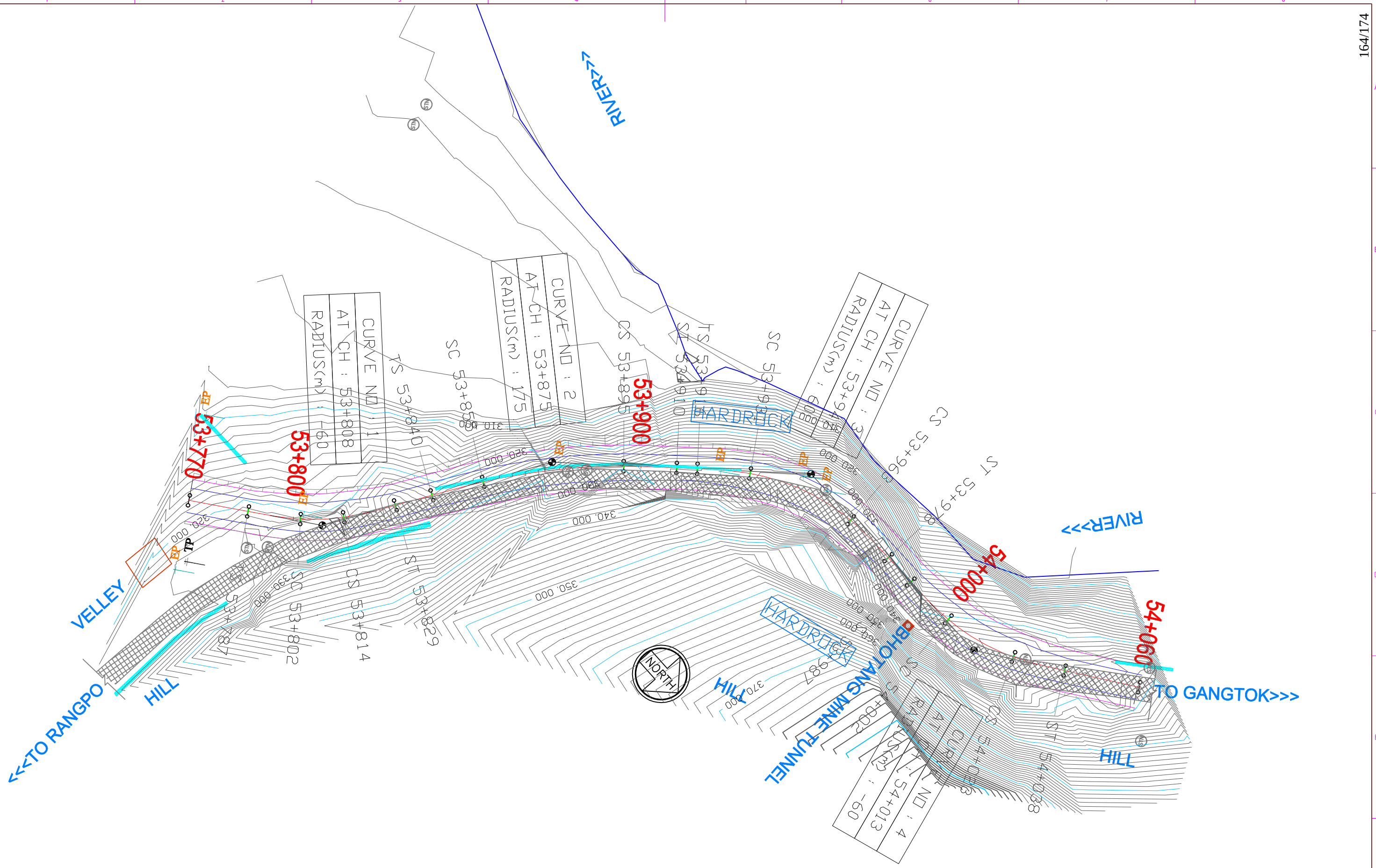
STATUS: OPTION STUDY DRAWING | DATE: 07.01.19 | SCALE: | A3

CMES/NHIDCL/NH-10/ 02

REV. R0 | SHEET 1 of 1







DATE	ISSUED AND/OR REFERENCES	DEALT	CHECKED
REVISIONS			

CLIENT:
NATIONAL HIGHWAY & INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.
3rd FLOOR PTI BUILDING, 4 PARLIAMENT STREET, NEW DELHI-110001

MINISTRY OF ROAD, TRANSPORT & HIGHWAYS, GOVERNMENT OF INDIA

Manager (NHIDCL) Gangtok,Sikkim	Genaral Manager (NHIDCL) Gangtok,Sikkim

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Email - cmesconsultancy@gmail.com
Phone: 9811406386, 9911052266, 01244255138

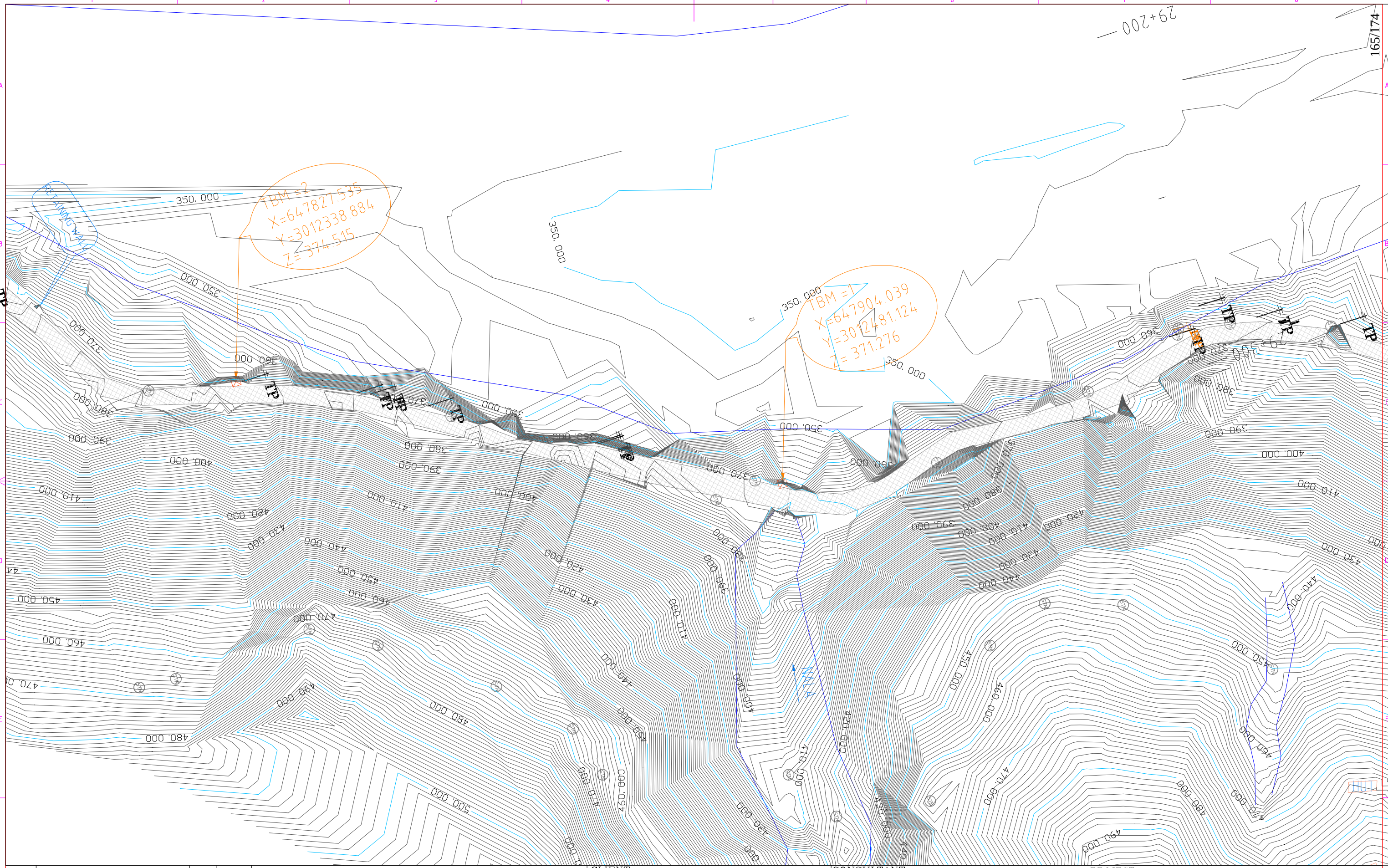
SM	DK	DK
DEALT	CHECKED	APPROVED

PROJECT: SPECIAL PROTECTION WORK ON NH-10 FROM KM 54+000 TO KM 80+000 (RANGPO TO RANIPOOL) IN THE STATE OF SIKKIM

TITLE: WIDENING OF NARROW ZONE (KM 53+770 TO KM54+050)

STATUS: OPTION STUDY DRAWING | DATE 07.01.19 | SCALE | A3

CMES/NHIDCL/NH-10/ 01 | REV. R0 | SHEET 1 of 1



DATE	ISSUED AND/OR REFERENCES	DEALT	CHECKED

REVISIONS

CLIENT:

NATIONAL HIGHWAY & INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.
3rd FLOOR PTI BUILDING, 4 PARLIAMENT STREET,
NEW DELHI-110001

MINISTRY OF ROAD, TRANSPORT & HIGHWAYS, GOVERNMENT OF INDIA

Manager (NHIDCL) Gangtok,Sikkim	Genaral Manager (NHIDCL) Gangtok,Sikkim

CONSULTANT:

CM ENGINEERING & SOLUTION
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GURGAON,HARYANA -122002
Email - cmesconsultancy@gmail.com
Phone: 9811406386, 9911052266, 01244255138

SM	DK	DK
DEALT	CHECKED	APPROVED

PROJECT: SPECIAL PROTECTION WORK ON NH-10 FROM KM 54+000 TO KM 80+000 (RANGPO TO RANIPOOL) IN THE STATE OF SIKKIM

TITLE: WIDENING OF NARROW ZONE (KM 63+045 TO KM63+470)

STATUS: OPTION STUDY DRAWING	DATE 07.01.19	SCALE 1:1000	A3
CMES/NHIDCL/NH-10/ 02		REV. R0	SHEET 1 of 1

Horizontal drainage borings

HILL Concrete crib works

<<< NALA

Concrete crib works with rock bolt

Drainage ditch

BV1-1

Concrete crib works with rock bolt

Drainage ditch

Horizontal drainage borings

Concrete crib works with rock bolt

Drainage ditch

Slide -2

BV2-1

Loosen slope A

Slide -1

Loosen slope B

Concrete crib works with rock bolt

Concrete crib works

Concrete crib works

<TO SINGTAM

TO GANGTOK >>

HILL

560, 000
550, 000
540, 000
530, 000
520, 000
510, 000
500, 000
490, 000
480, 000
470, 000

SECTION-01
SECTION-02
SECTION-03
SECTION-04
SECTION-05
SECTION-06

EP
TP
KM
STN

0 50m

Slide-1 & 2

horizontal drainage borings:

L=30m,25m, Angle of drilling =10degrees

Concrete crib work:

Cross section=0.3m*0.3m, Interval=2.00m*2.00m

Filling material between beams: Cobble

Rock bolt:

σsa=200N/mm2(SD345), D=25mm

DATE	ISSUED AND/OR REFERENCES	DEALT	CHECKED
	REVISIONS		

LEGEND

EXISTING ROAD EDGE
NALAH
TREE
ELECTRIC POST/TRANS.
TELEPHONE POST
PILLAR
HUT
BUILDING
ROCK AREA
SECTION CHAINAGE 0+000
SINKING BOUNDARY
BREAST WALL
RETAINING WALL

CLIENT: NATIONAL HIGHWAY & INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.
3rd FLOOR PTI BUILDING, 4 PARLIAMENT STREET, NEW DELHI-110001
MINISTRY OF ROAD, TRANSPORT & HIGHWAYS, GOVERNMENT OF INDIA

Manager (NHIDCL) Gangtok,Sikkim | Genaral Manager (NHIDCL) Gangtok,Sikkim

CONSULTANT: CM ENGINEERING & SOLUTION
MARUTI VIHAR, HOUSE NO. 1473A, GURGAON,HARYANA -122002
Email - cmesconsultancy@gmail.com
Phone: 9811406386, 9911052266, 01244255138

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DEALT	CHECKED	APPROVED

PROJECT: SPECIAL PROTECTION WORK ON NH-10 FROM KM 54+000 TO KM 80+000 (RANGPO TO RANIPOOL) IN THE STATE OF SIKKIM

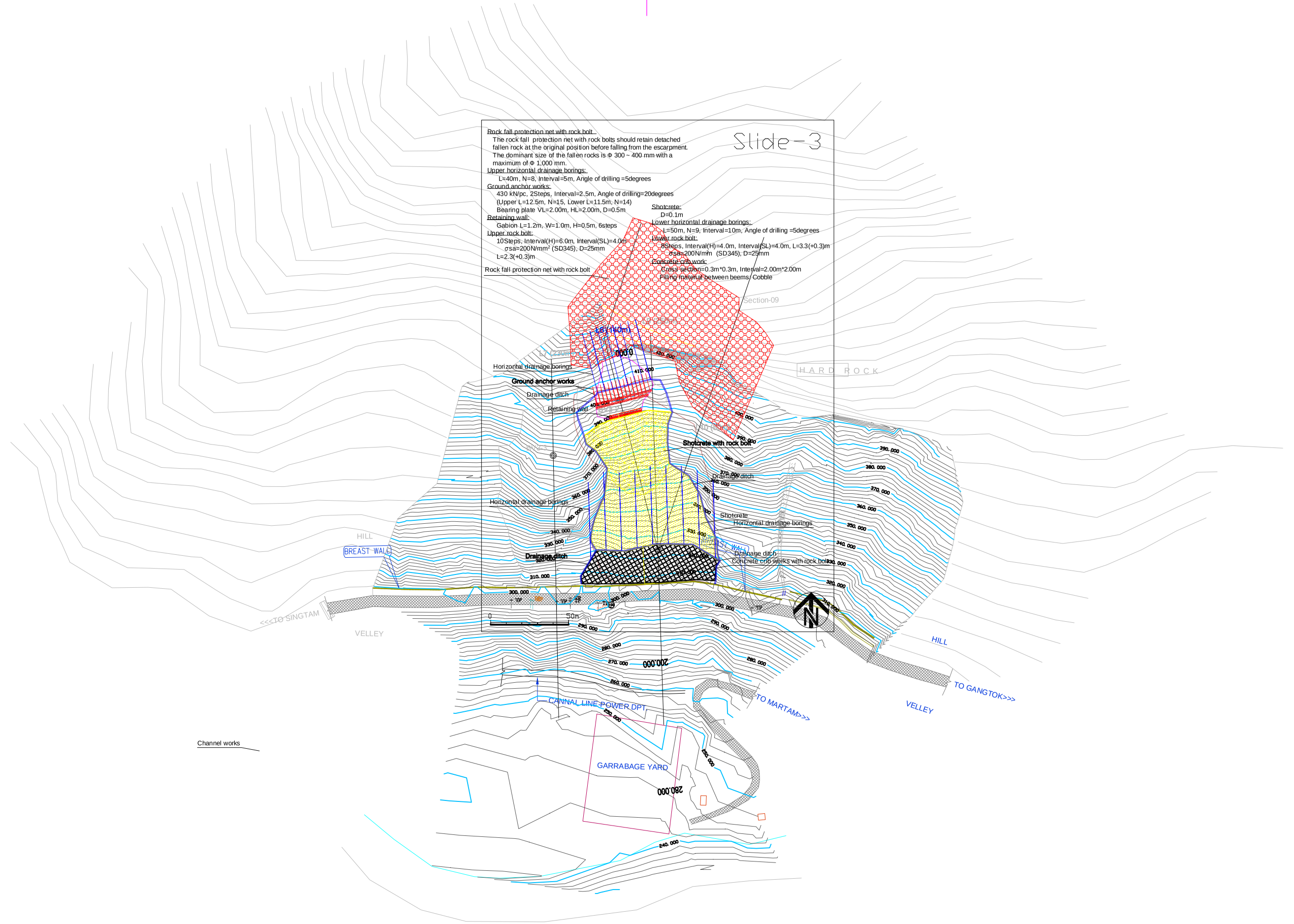
TITLE: REHABILITATION & RESTORATION OF SLIDING/SINKING ZONE (KM 70+900+045 TO KM71+100)

STATUS: SURVEY DRAWING | DATE 08.04.19 | SCALE | A3

CMES/NHIDCL/NH-10/ 05 | REV. R0 | SHEET 1 of 1

Rock fall protection net with rock bolt
The rock fall protection net with rock bolts should retain detached fallen rock at the original position before falling from the escarpment. The dominant size of the fallen rocks is Φ 300 ~ 400 mm with a maximum of Φ 1,000 mm.
Upper horizontal drainage borings:
L=40m, N=8, Interval=5m, Angle of drilling =5degrees
Ground anchor works:
430 kN/pc, 2Steps, Interval=2.5m, Angle of drilling=20degrees
(Upper L=12.5m, N=15, Lower L=11.5m, N=14)
Bearing plate VL=2.00m, HL=2.00m, D=0.5m
Retaining wall:
Gabion L=1.2m, W=1.0m, H=0.5m, 6steps
Upper rock bolt:
10Steps, Interval(H)=6.0m, Interval(SL)=4.0m
σsa=200N/mm² (SD345), D=25mm
L=2.3(+0.3)m

Shotcrete:
D=0.1m
Lower horizontal drainage borings:
L=50m, N=9, Interval=10m, Angle of drilling =5degrees
Lower rock bolt:
8Steps, Interval(H)=4.0m, Interval(SL)=4.0m, L=3.3(+0.3)m
σsa=200N/mm (SD345), D=25mm
Concrete crib work:
Cross section=0.3m*0.3m, Interval=2.00m*2.00m
Filling material between beems: Cobble



DATE	ISSUED AND/OR REFERENCES	DEALT	CHECKED

REVISIONS

LEGEND

EXISTING ROAD EDGE ---
NALAH ------
TREE ------
ELECTRIC POST/TRANS.- EP
TELEPHONE POST - TP
PILLAR --- P
HUT----
BUILDING-
ROCK AREA
SECTION CHAINAGE------ 0+000
SINKING BOUNDARY----
BREAST WALL-
RETAINING WALL-

CLIENT:
NATIONAL HIGHWAY & INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.
3rd FLOOR PTI BUILDING, 4 PARLIAMENT STREET, NEW DELHI-110001
MINISTRY OF ROAD, TRANSPORT & HIGHWAYS, GOVERNMENT OF INDIA

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SM	DK	DK
DEALT	CHECKED	APPROVED

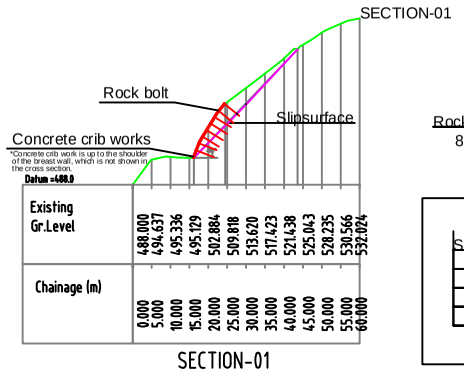
PROJECT: SPECIAL PROTECTION WORK ON NH-10 FROM KM 54+000 TO KM 80+000 (RANGPO TO RANIPOOL) IN THE STATE OF SIKKIM

TITLE: REHABILITATION & RESTORATION OF SLIDING/SINKING ZONE (KM 71+550 TO KM 71+850)

STATUS: SURVEY DRAWING | DATE 08.04.19 | SCALE | A3

CMES/NHIDCL/NH-10/ 06 | REV. R0 | SHEET 1 of 1

Loosen slope A

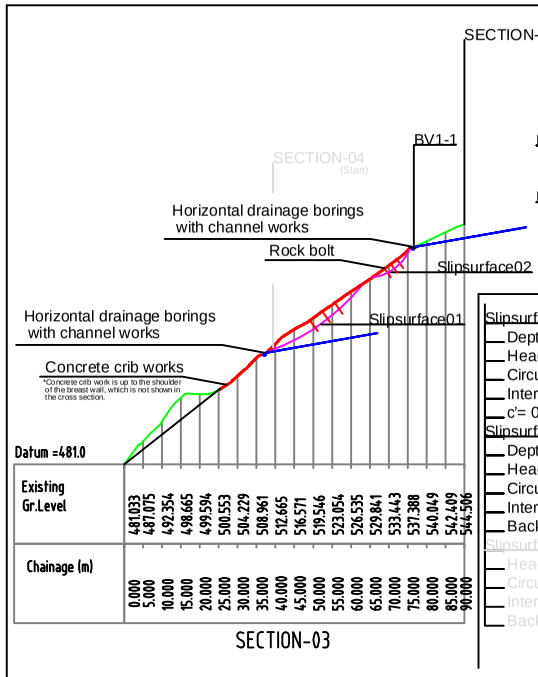


Rock bolt:
8Steps, Interval(H)=2.0m, Interval(SL)=2.0m, L=4.9(+0.3)m
σsa=200N/mm² (SD345), D=25mm

Slipsurface:
- Head & Toe: Knick point
- Circular slip, Average tilt angle of slipsurface α =46 degrees
- Internal friction angle Φ'= α =38 degrees(refer to Slide-1 SS1)
- Backanalysis c'= 7.21 kN/m² (Fs=1.0)

Slide-1

SECTION-03



Rock bolt (Slipsurface01):
3Steps, Interval(H)=4.0m, Interval(SL)=4.0m, L=3.4(+0.3)m
σsa=200N/mm² (SD345), D=25mm
Rock bolt (Slipsurface02):
3Steps, Interval(H)=4.0m, Interval(SL)=2.0m, L=2.7(+0.3)m
σsa=200N/mm² (SD345), D=25mm

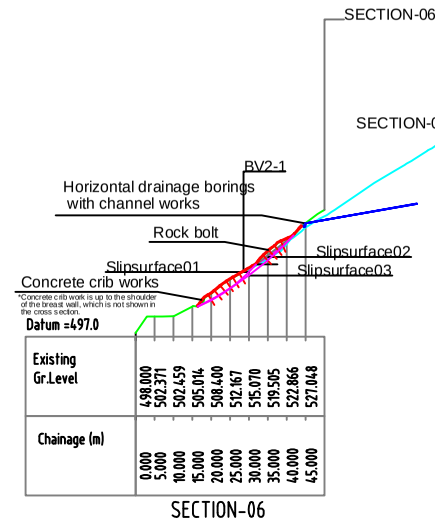
Slipsurface01(SS1):
- Depth=Width(20m)/7=2.857m
- Head & Toe: Knick point
- Circular slip, Average tilt angle of slipsurface α =38 degrees
- Internal friction angle Φ'= α =38 degrees
- c'= 0.10kN/m² (refer to SS2) *Backanalysis 0.68 kN/m ² (Fs=1.0)

Slipsurface02(SS2):
- Depth=Width(11m)/7=1.5714m
- Head & Toe: Knick point
- Circular slip, Average tilt angle of slipsurface α =38 degrees
- Internal friction angle Φ'= α =38 degrees
- Backanalysis c'= 0.10 kN/m² (Fs=1.0)

Slipsurface03(SS3):
- Head & Toe: Knick point
- Circular slip, Average tilt angle of slipsurface α =37 degrees
- Internal friction angle Φ'= α =37 degrees
- Backanalysis c'= 0.00 kN/m (Fs=1.0)

Slide-2

SECTION-06



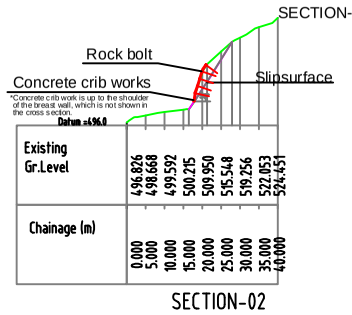
Rock bolt (Slipsurface01):
6Steps, Interval(H)=2.0m, Interval(SL)=2.0m, L=3.0(+0.3)m
σsa=200N/mm² (SD345), D=25mm
Rock bolt (Slipsurface02):
4Steps, Interval(H)=2.0m, Interval(SL)=2.0m, L=3.0(+0.3)m
σsa=200N/mm² (SD345), D=25mm
Rock bolt (Slipsurface03):
10Steps, Interval(H)=2.0m, Interval(SL)=2.0m, L=3.0(+0.3)m
σsa=200N/mm² (SD345), D=25mm

Slipsurface01(SS1):
- Head, Toe & cliff top: Knick point
- Circular slip, Average tilt angle of slipsurface α =36 degrees
- Internal friction angle Φ'= α =36 degrees
- Backanalysis c'= 0.92 kN/m² (Fs=1.0)

Slipsurface02(SS2):
- Head, Toe & cliff top: Knick point
- Circular slip, Average tilt angle of slipsurface α =38 degrees
- Internal friction angle Φ'= α =36 degrees(refer to SS1)
- c'= 0.92kN/m²(refer to SS1) *Backanalysis 1.21 kN/m ² (Fs=1.0)

Slipsurface03(SS3):
- Head, Toe & cliff top: Knick point
- Circular slip, Average tilt angle of slipsurface α =37 degrees
- Internal friction angle Φ'= α =36 degrees(refer to SS1)
- c'= 0.92 kN/m² (refer to SS1)

Loosen slope B

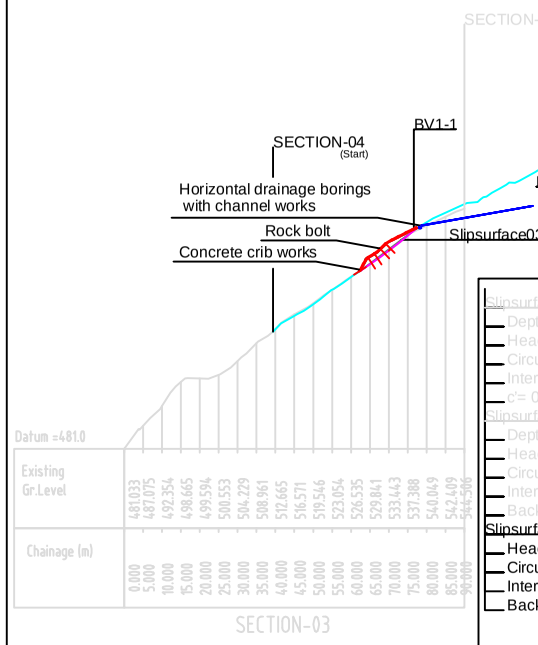


Brock bolt:
5Steps, Interval(H)=2.0m, Interval(SL)=2.0m, L=3.6(+0.3)m
σsa=200N/mm² (SD345), D=25mm

Slipsurface:
- Head & Toe: Knick point
- Circular slip, Average tilt angle of slipsurface α =58 degrees
- Internal friction angle Φ'= α =38 degrees(refer to Slide-1 SS1)
- Backanalysis c'= 9.93 kN/m² (Fs=1.0)

Slide-1

SECTION-04



Rock bolt (Slipsurface03):
4Steps, Interval(H)=4.0m, Interval(SL)=2.0m, L=3.3(+0.3)m
σsa=200N/mm² (SD345), D=25mm

Slipsurface01(SS1):
- Depth=Width(20m)/7=2.857m
- Head & Toe: Knick point
- Circular slip, Average tilt angle of slipsurface α =38 degrees
- Internal friction angle Φ'= α =38 degrees
- c'= 0.10kN/m² (refer to SS2) *Backanalysis 0.68 kN/m ² (Fs=1.0)

Slipsurface02(SS2):
- Depth=Width(11m)/7=1.5714m
- Head & Toe: Knick point
- Circular slip, Average tilt angle of slipsurface α =38 degrees
- Internal friction angle Φ'= α =38 degrees
- Backanalysis c'= 0.10 kN/m² (Fs=1.0)

Slipsurface03(SS3):
- Head & Toe: Knick point
- Circular slip, Average tilt angle of slipsurface α =37 degrees
- Internal friction angle Φ'= α =37 degrees
- Backanalysis c'= 0.00 kN/m (Fs=1.0)

DATE	ISSUED AND/OR REFERENCES	DEALT	CHECKED

REVISIONS

LEGEND

EXISTING ROAD EDGE ---
NALAH -----
TREE -----
ELECTRIC POST/TRANS.– EP
TELEPHONE POST – TP
PILLAR --- P
HUT----
BUILDING–
ROCK AREA
SECTION CHAINAGE------ 0+000
SINKING BOUNDARY----
BREAST WALL–
RETAINING WALL–

CLIENT:
NATIONAL HIGHWAY & INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.
3rd FLOOR PTI BUILDING, 4 PARLIAMENT STREET, NEW DELHI-110001
MINISTRY OF ROAD, TRANSPORT & HIGHWAYS, GOVERNMENT OF INDIA

Manager (NHIDCL) Gangtok,Sikkim	Genaral Manager (NHIDCL) Gangtok,Sikkim

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SM	DK	DK
DEALT	CHECKED	APPROVED

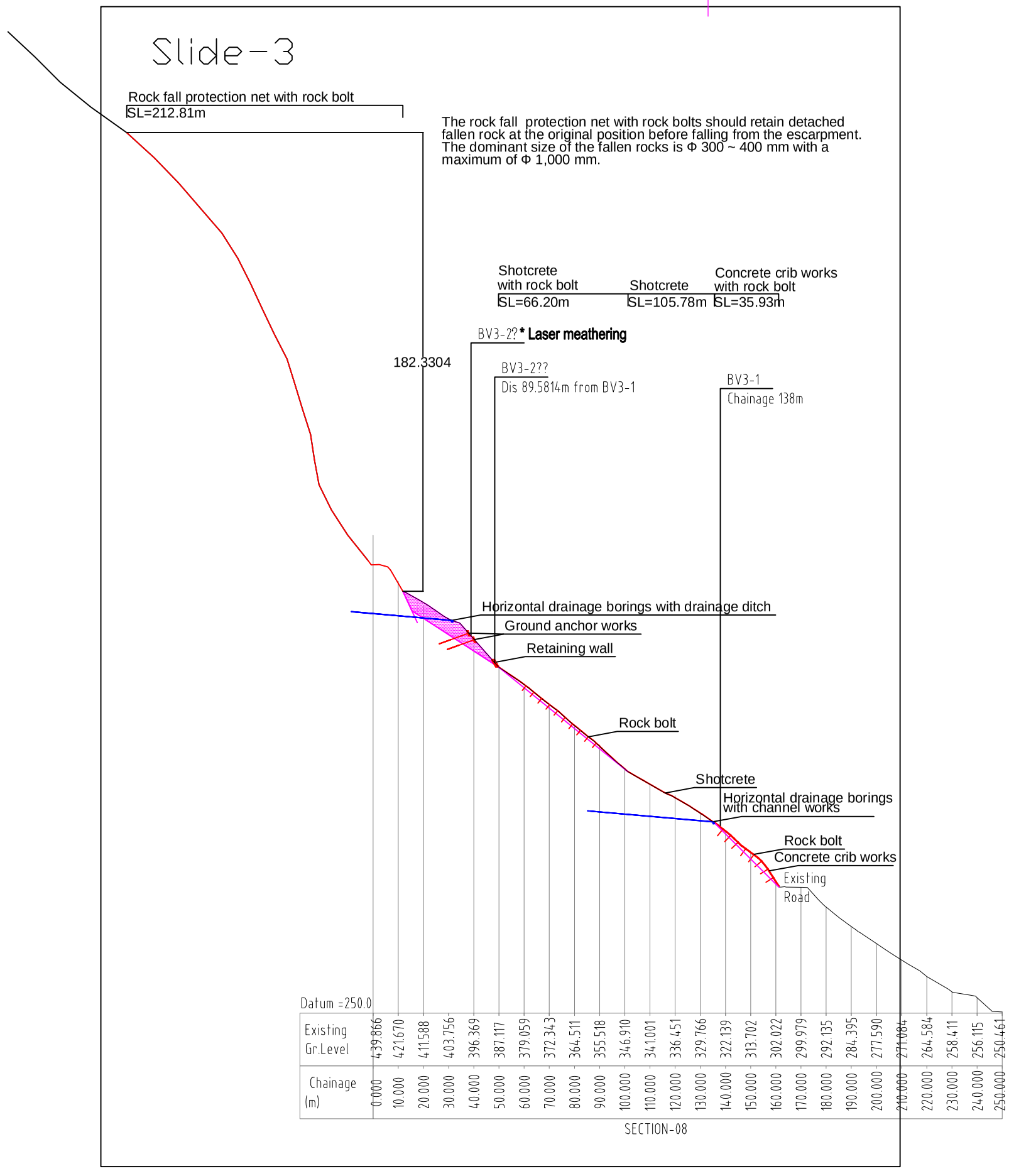
PROJECT: SPECIAL PROTECTION WORK ON NH-10 FROM KM 54+000 TO KM 80+000 (RANGPO TO RANIPOOL) IN THE STATE OF SIKKIM

TITLE: CROSS SECTION OF REHABILITATION & RESTORATION OF SLIDING/SINKING ZONE (KM 70+900+045 TO KM71+100)

STATUS: SURVEY DRAWING | DATE 08.04.19 | SCALE | A3

CMES/NHIDCL/NH-10/ 03 | REV. R0 | SHEET 1 of 1

Slide-3



SECTION-08

DATE	ISSUED AND/OR REFERENCES	DEALT	CHECKED

REVISIONS

LEGEND

EXISTING ROAD EDGE ---
NALAH -----
TREE -----
ELECTRIC POST/TRANS.- EP
TELEPHONE POST - TP
PILLAR --- P
HUT----
BUILDING-
ROCK AREA
SECTION CHAINAGE------ 0+000
SINKING BOUNDARY----
BREAST WALL-
RETAINING WALL-

CLIENT: NATIONAL HIGHWAY & INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.
3rd FLOOR PTI BUILDING, 4 PARLIAMENT STREET, NEW DELHI-110001

MINISTRY OF ROAD, TRANSPORT & HIGHWAYS, GOVERNMENT OF INDIA

Manager (NHIDCL) Gangtok,Sikkim | Genaral Manager (NHIDCL) Gangtok,Sikkim

CONSULTANT: CM ENGINEERING & SOLUTION
MARUTI VIHAR, HOUSE NO. 1473A, GURGAON,HARYANA -122002
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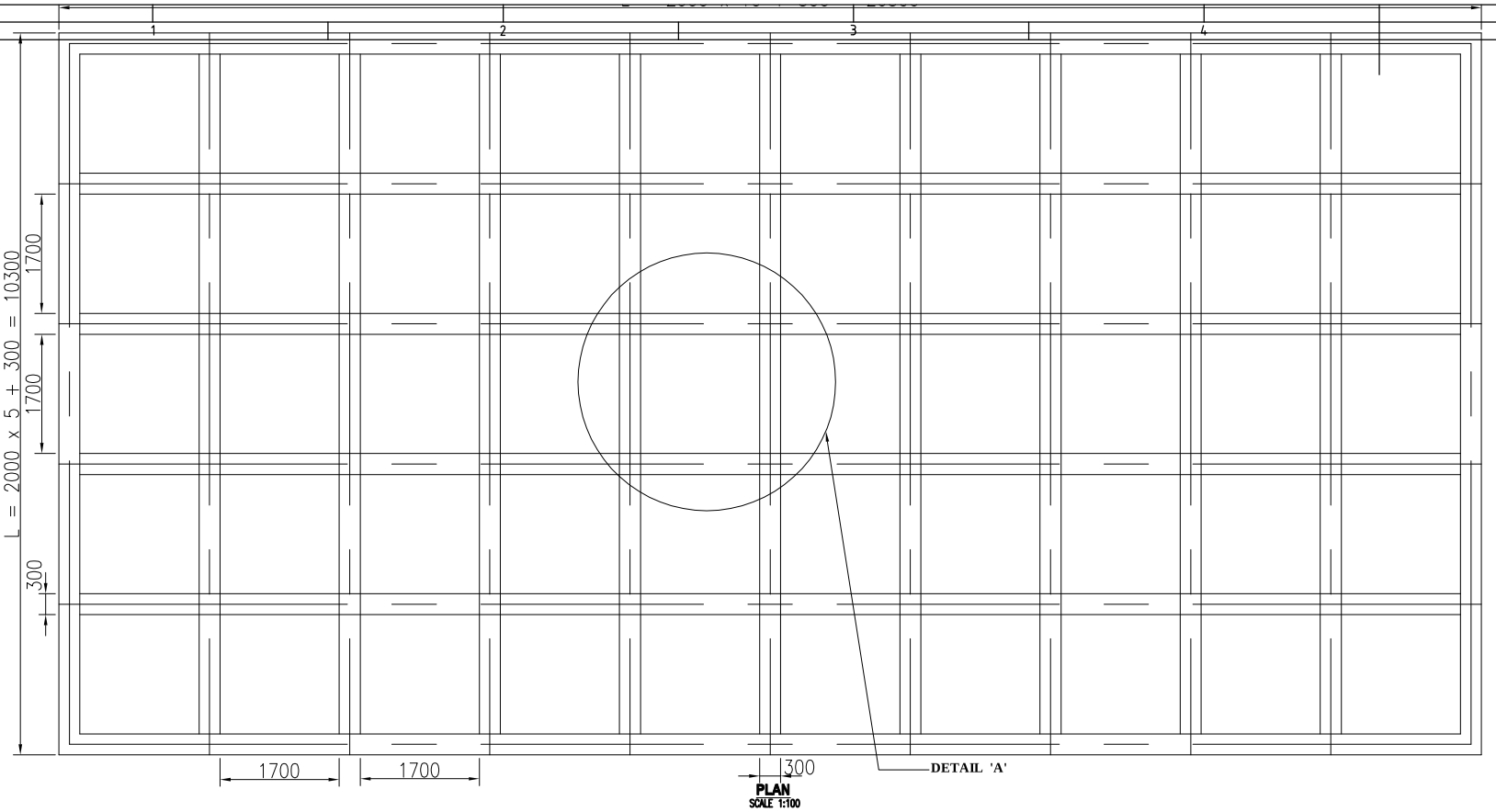
SM	DK	DK
DEALT	CHECKED	APPROVED

PROJECT: SPECIAL PROTECTION WORK ON NH-10 FROM KM 54+000 TO KM 80+000 (RANGPO TO RANIPOOL) IN THE STATE OF SIKKIM

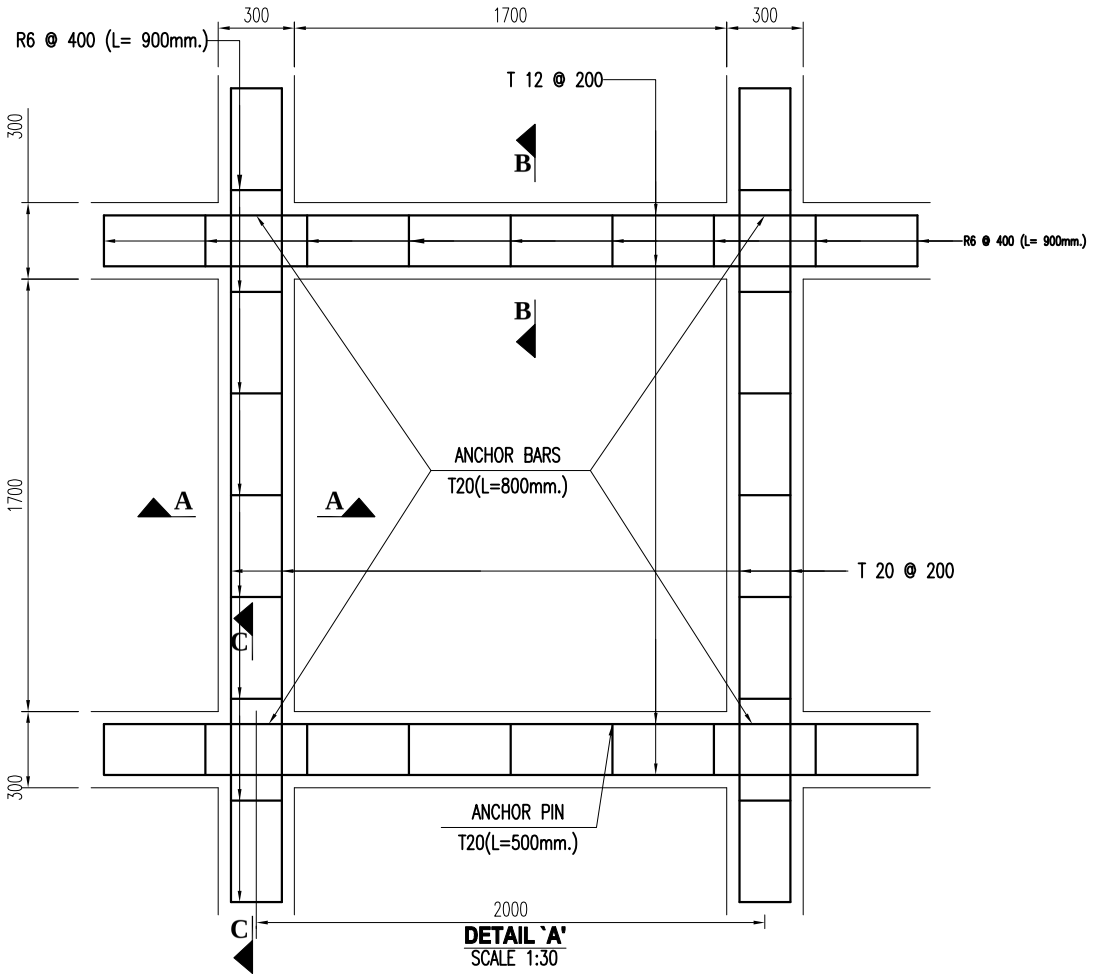
TITLE: CROSS SECTION REHABILITATION & RESTORATION OF SLIDING/SINKING ZONE (KM 71+550 TO KM 71+850)

STATUS: SURVEY DRAWING | DATE 08.04.19 | SCALE | A3

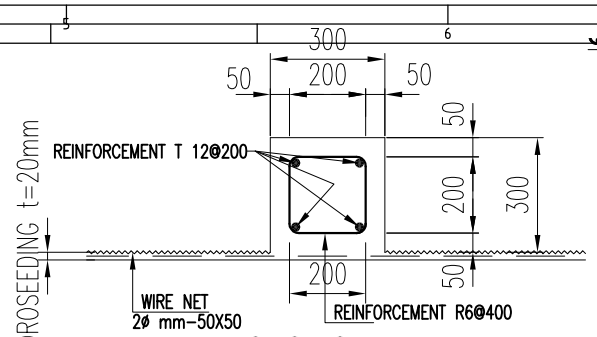
CMES/NHIDCL/NH-10/ 04 | REV. R0 | SHEET 1 of 1



PLAN
SCALE 1:100

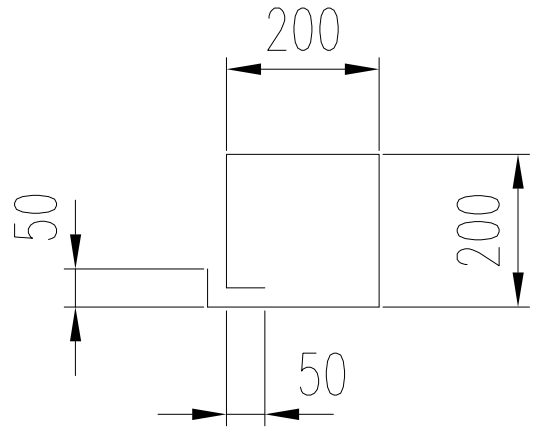


DETAIL `A'
SCALE 1:30

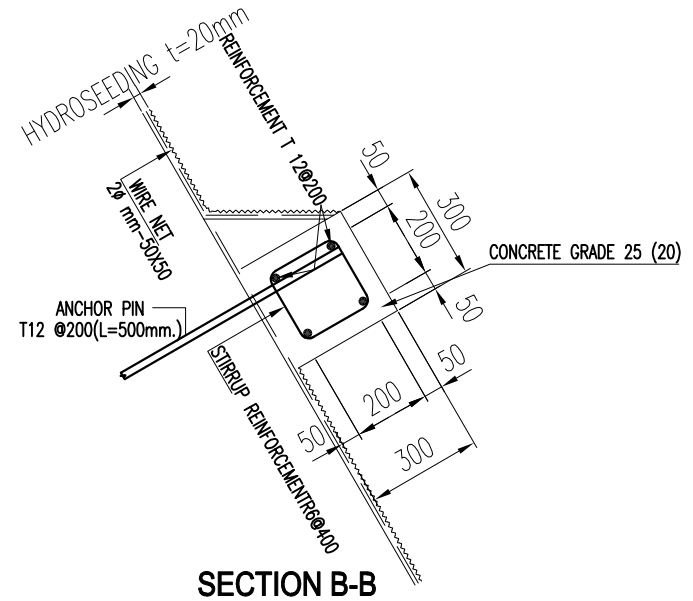


SECTION A-A
SCALE 1:20

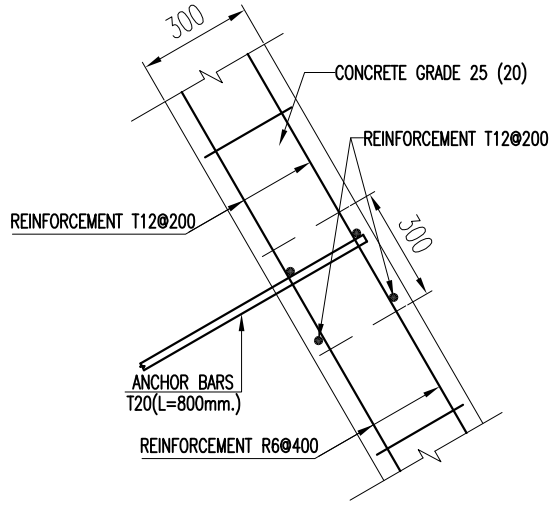
TYPE		UNIT	QUANTITY	CALCULATION FORMULA (Kg)	
FRAME LENGTH		m	2153	10.3X11+1.7X10X6	
ANCHOR BAR (T20. 800 mm)		NOS.		66ø15.8011x6	66.06
ANCHOR PIN (T12. 500 mm)		NOS.	120.0	2x(10x6) =	120.0
REINFORCEMENT WEIGHT	1	1	0.84	20.3x6x4x0.888 =	432.63
				10.3x11x4x0.888 =	402.44
	2		0.11	0.90x5x55x0.222 =	54.95
				0.90x5x60x0.222 =	59.94
				TOTAL	949.96
CONCRETE GRADE 25(20)		m3	19.4	215.3X0.30X0.30 =	19.38
AREA WITHIN THE CRIB		m2	144.5	1.70X1.70X50 =	144.50



STIRRUP DETAIL
SCALE 1:10



SECTION B-B
SCALE 1:20



SECTION C-C
SCALE 1:20

DATE	ISSUED AND/OR REFERENCES	DEALT	CHECKED
REVISIONS			

LEGEND

EXISTING ROAD EDGE ---
NALAH -----
TREE -----
ELECTRIC POST/TRANS.- EP
TELEPHONE POST - TP
PILLAR --- P
HUT----
BUILDING-
ROCK AREA
SECTION CHAINAGE------ 0+000
SINKING BOUNDARY----
BREAST WALL-
RETAINING WALL-

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Phone: 9811406386, 9911052266, 01244255138

SM	DK	DK
DEALT	CHECKED	APPROVED

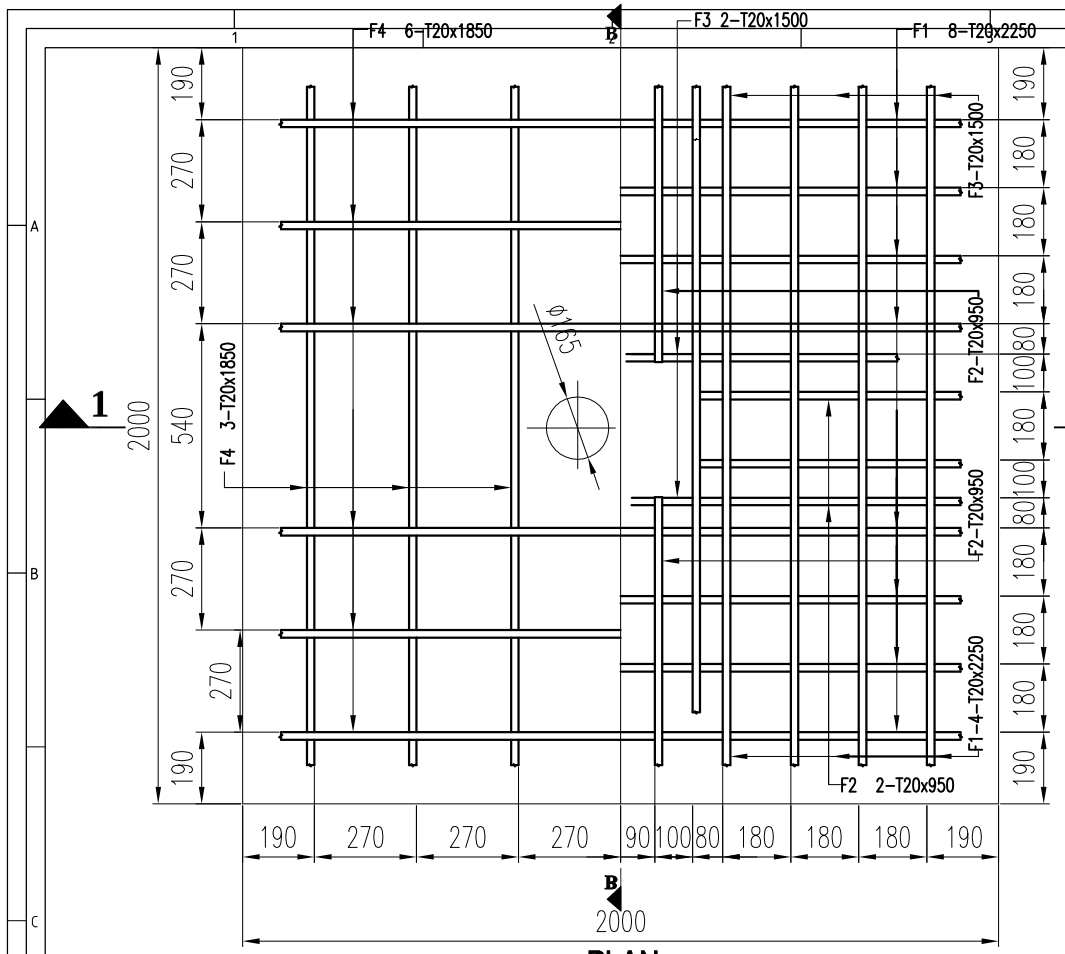
PROJECT: SPECIAL PROTECTION WORK ON NH-10 FROM KM 54+000 TO KM 80+000 (RANGPO TO RANIPOOL) IN THE STATE OF SIKKIM

TITLE: TYPICAL DETAILS OF CRIB WORK

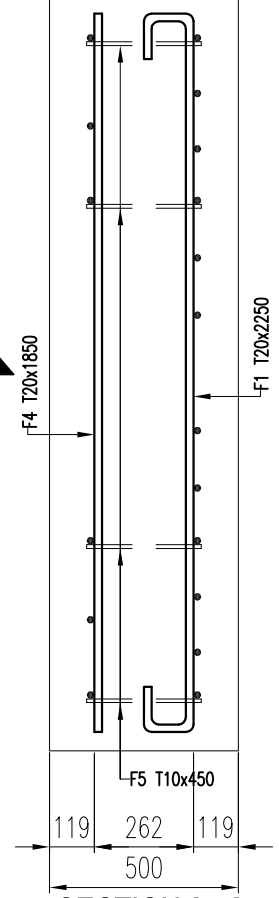
STATUS: **SURVEY DRAWING** | DATE **08.04.19** | SCALE AS SHOWN | **A3**

CMES/NHIDCL/NH-10/08 | REV. **R0** | SHEET **1 of 1**

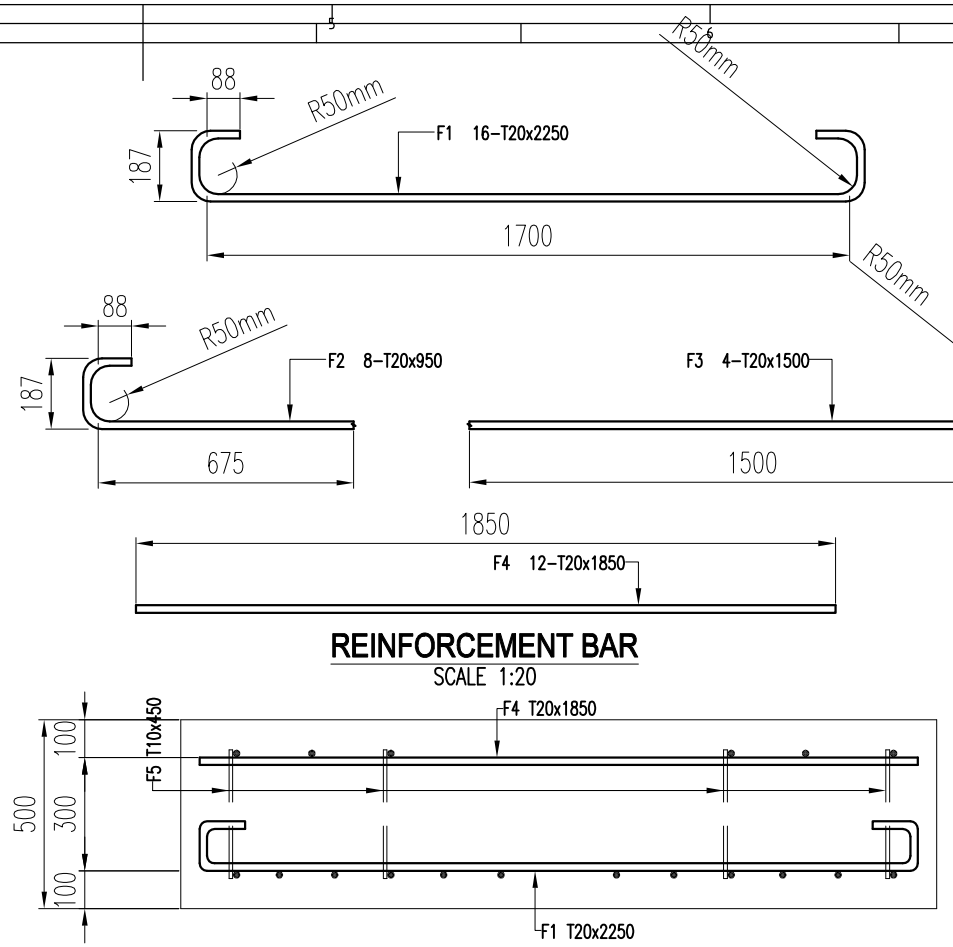
1701174



PLAN
SCALE 1:20

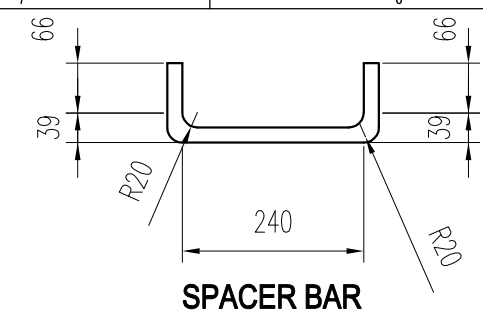


SECTION 2 - 2
SCALE 1:20

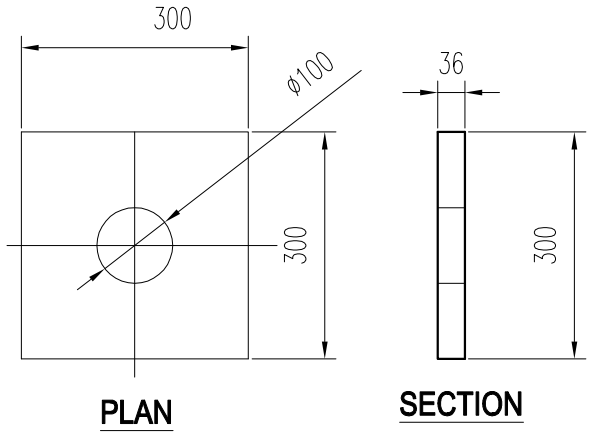


REINFORCEMENT BAR
SCALE 1:20

SECTION 1 - 1
SCALE 1:20



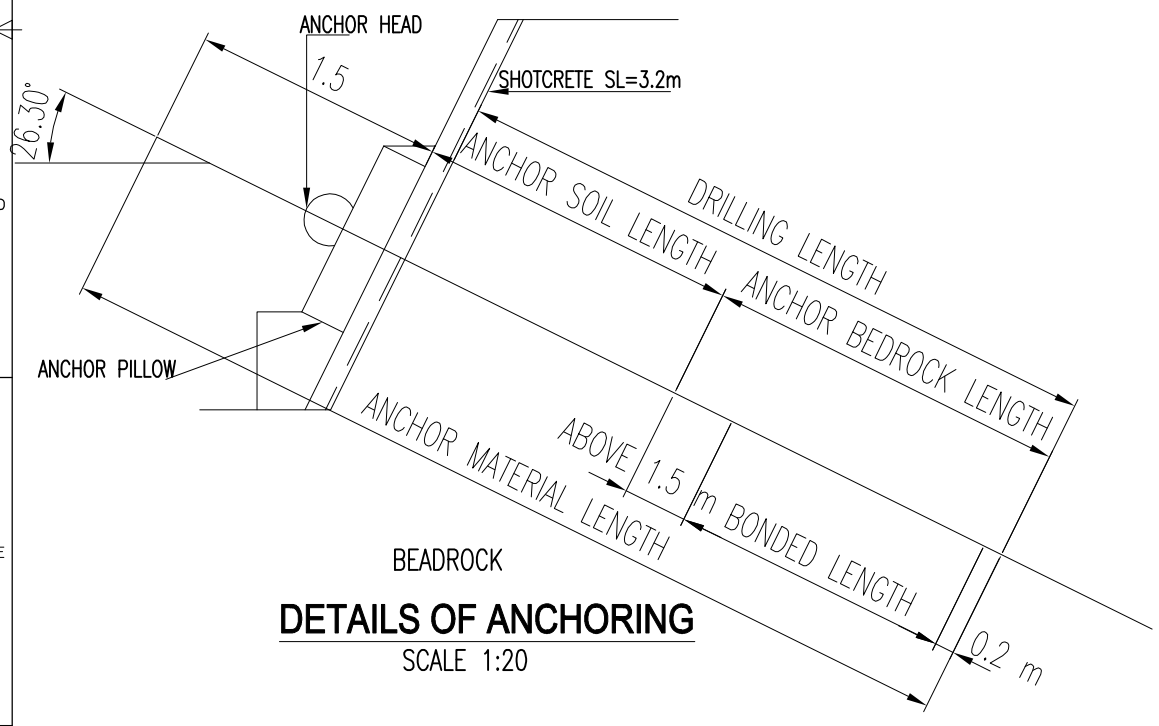
SPACER BAR
SCALE 1:10



PLAN SECTION

ANCHOR PLATE
SCALE 1:10

ANCHOR PILLOW



DETAILS OF ANCHORING
SCALE 1:20

1.	STEEL BAR		SD295A	
2.	ANCHOR PLATE		SS 400	
3.	CONCRETE	DESIGN STANDARD STRENGTH	25	KGF/CM
		SLUMP	8	CM
		MAXIMUM COARSE AGGREGATE SIZE	25	MM.

WEIGHT OF STEEL

BAR MARK	BAR SIZE (mm)	LENGTH (mm)	NUMBERS (Nos)	UNIT WEIGHT (kg/m)	WEIGHT PER BAR (kg)	WEIGHT (KG.)
F1	T20	2250	16	2.25	5.06	80.96
F2	T20	950	8	2.25	2.14	17.12
F3	T20	1500	4	2.25	3.38	13.52
F4	T20	1850	12	2.25	4.16	49.92
F5	T10	450	16	0.56	0.25	4.00
TOTAL 20mm STEEL BAR WEIGHT						161.52
TOTAL 10mm STEEL BAR WEIGHT						4.00
TOTAL STEEL BAR WEIGHT						165.52
ANCHOR PLATE						25.43

NOTE:-

ALL DIMENSIONS ARE IN MM. UNLESS OTHERWISE STATED.

THE QUANTITIES GIVEN IN THE TABLE ARE ONLY FOR REFERENCE USE.

DATE	ISSUED AND/OR REFERENCES	DEALT	CHECKED

REVISIONS

LEGEND

EXISTING ROAD EDGE ---
NALAH -----
TREE -----
ELECTRIC POST/TRANS.- EP
TELEPHONE POST - TP
PILLAR --- P
HUT----
BUILDING-
ROCK AREA
SECTION CHAINAGE------ 0+000
SINKING BOUNDARY----
BREAST WALL-
RETAINING WALL-

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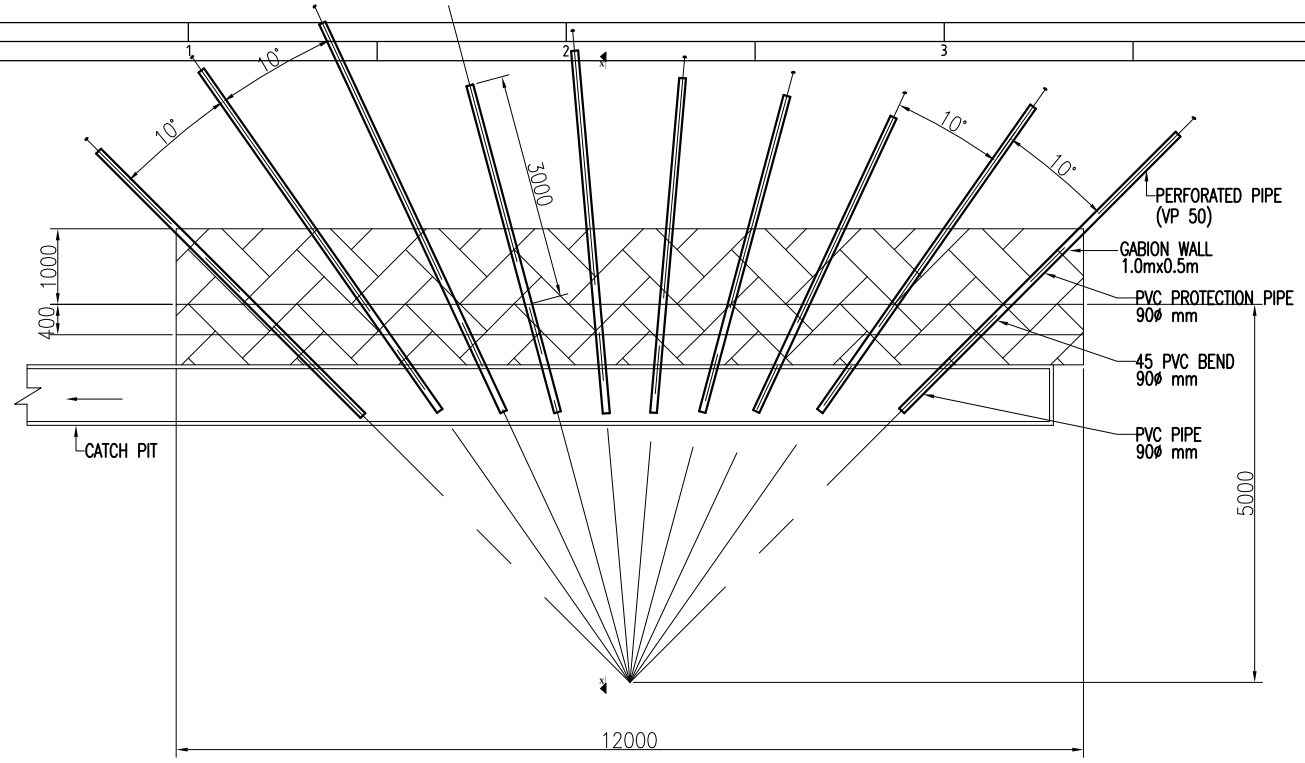
PROJECT: SPECIAL PROTECTION WORK ON NH-10 FROM KM 54+000 TO KM 80+000 (RANGPO TO RANIPOOL) IN THE STATE OF SIKKIM

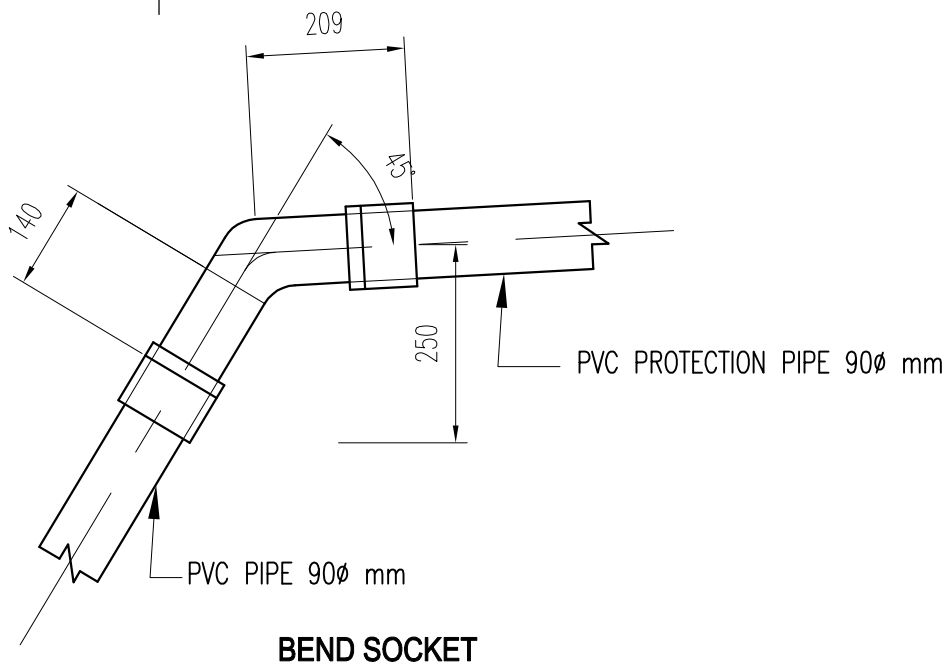
TITLE: TYPCAL DETAILS OF GROUND ANCHOR

STATUS: **SURVEY DRAWING** | DATE **08.04.19** | SCALE AS SHOWN | A3

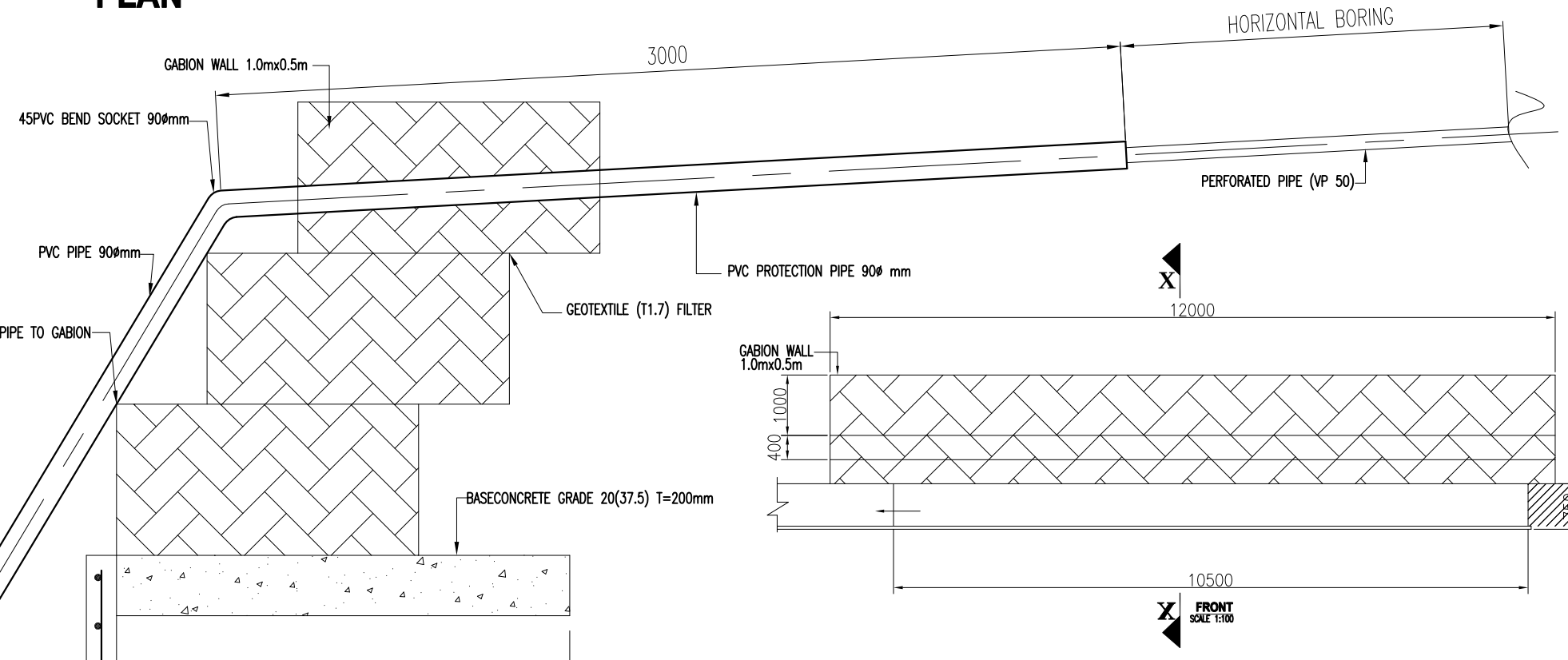
CMES/NHIDCL/NH-10/08 | REV. **R0** | SHEET **1 of 1**



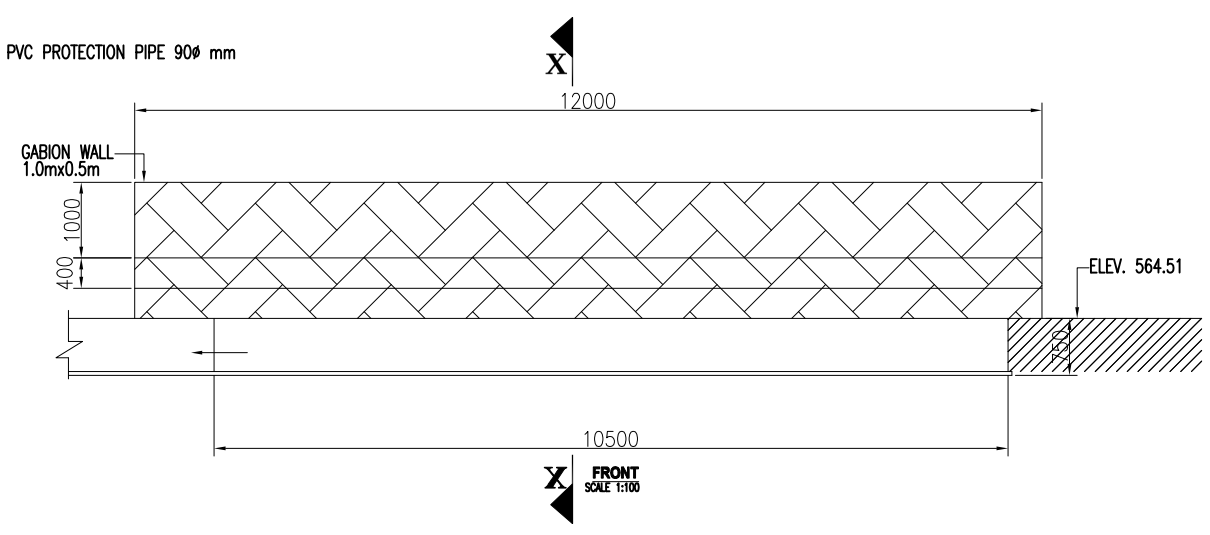
PLAN



BEND SOCKET
SCALE 1:10



SECTION X-X
SCALE 1:20



FRONT
SCALE 1:100

LEGEND
GABION WALL
CONCRETE

NOTE :-
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DATE	ISSUED AND/OR REFERENCES	DEALT	CHECKED
	REVISIONS		

LEGEND

EXISTING ROAD EDGE ---
NALAH -----
TREE -----
ELECTRIC POST/TRANS.- EP
TELEPHONE POST - TP
PILLAR --- P
HUT----
BUILDING-
ROCK AREA
SECTION CHAINAGE------ 0+000
SINKING BOUNDARY----
BREAST WALL-
RETAINING WALL-

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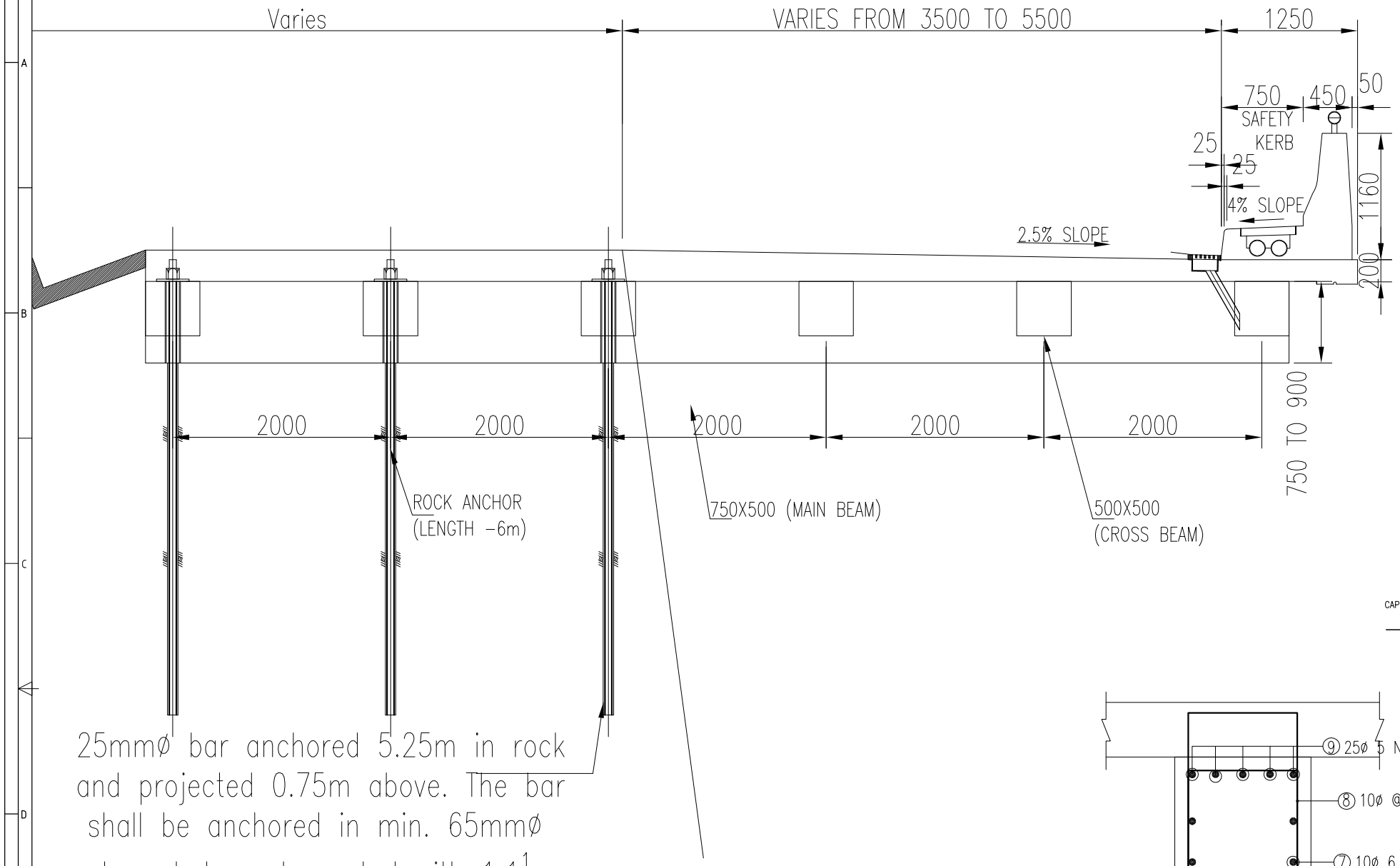
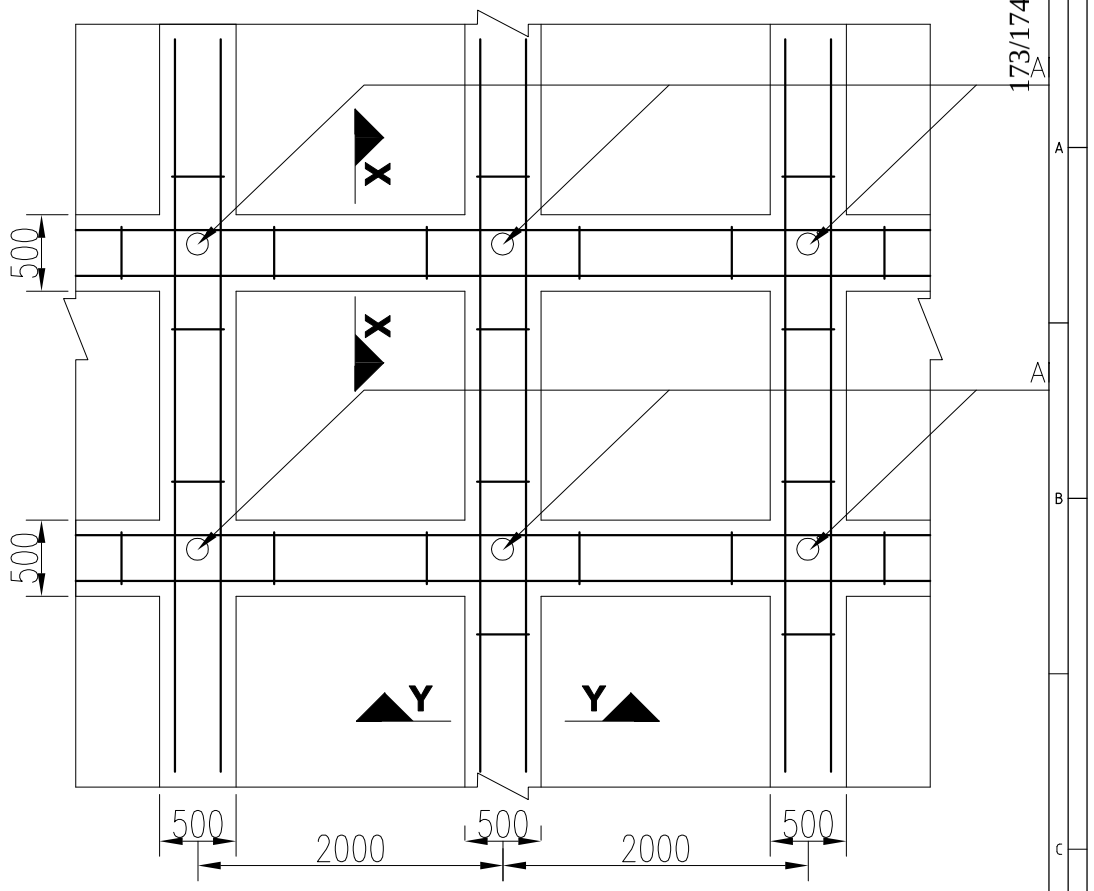
PROJECT: SPECIAL PROTECTION WORK ON NH-10 FROM KM 54+000 TO KM 80+000 (RANGPO TO RANIPOOL) IN THE STATE OF SIKKIM

TITLE: TYPCAL DETAILS OF HORIZONTAL DRAINAGE BORING

STATUS: **SURVEY DRAWING** | DATE 08.04.19 | SCALE AS SHOWN | A3

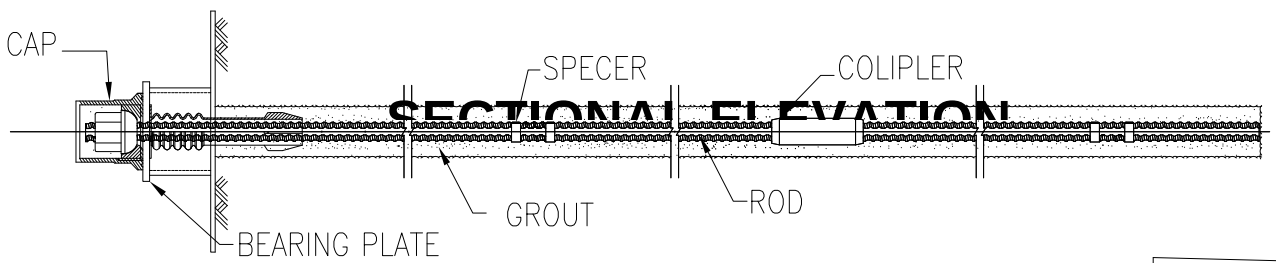
CMES/NHIDCL/NH-10/10 | REV. R0 | SHEET 1 of 1





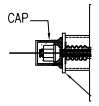
BEAM PLAN DETAILS

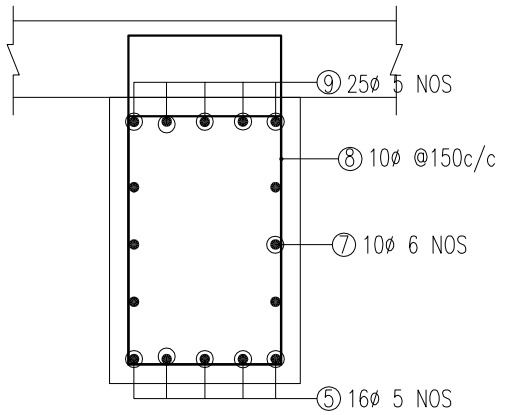
SCALE 1:25



ROCK ANCHOR DETAILS

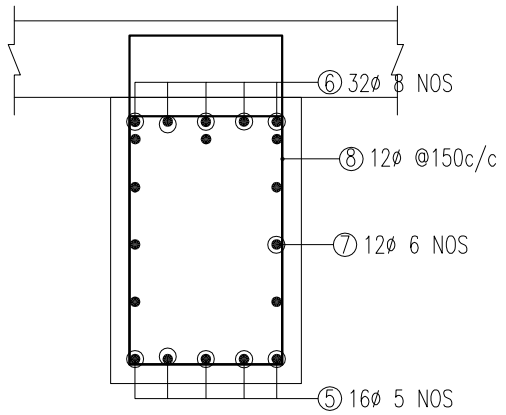
SCALE 1:25





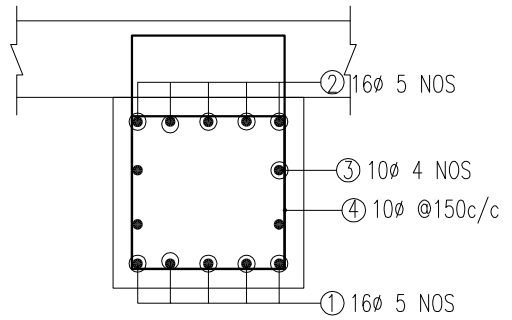
MAIN BEAM

SCALE 1:25



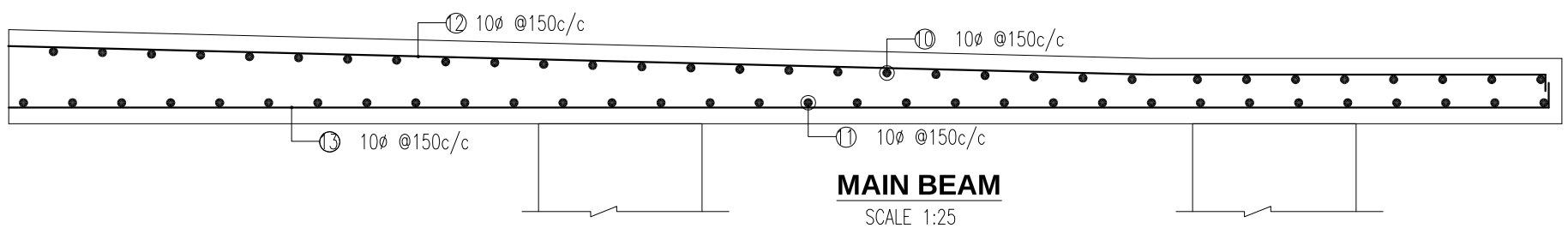
MAIN BEAM CANTILEVER PART

SCALE 1:25



CROSS BEAM

SCALE 1:25



MAIN BEAM

SCALE 1:25

DATE	ISSUED AND/OR REFERENCES	DEALT	CHECKED

REVISIONS

LEGEND

EXISTING ROAD EDGE ---
NALAH -----
TREE -----
ELECTRIC POST/TRANS.– EP
TELEPHONE POST – TP
PILLAR --- P
HUT----
BUILDING–
ROCK AREA
SECTION CHAINAGE------ 0+000
SINKING BOUNDARY----
BREAST WALL–
RETAINING WALL–

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PROJECT: SPECIAL PROTECTION WORK ON NH-10 FROM KM 54+000 TO KM 80+000 (RANGPO TO RANIPOOL) IN THE STATE OF SIKKIM

TITLE: **TYPICAL DETAILS OF CANTILEVER SECTION**

STATUS: SURVEY DRAWING	DATE 08.04.19	SCALE AS SHOWN	A3
CMES/NHIDCL/NH-10/12		REV. R0	SHEET 1 of 1

SECTION-10: DOCUMENT TO BE FURNISHED BY BIDDER
(As Attached and Required)