



Ropeways and Rapid Transport System Development Corporation HP Ltd.

प्रदूषण मुक्त यातायात के लिए हिमाचल की पहल



“Design, Supply, Construction, Installation, Testing, Commissioning and Operation & Maintenance for 5 (five) years of Seamless Innovative Urban Transportation (Ropeways, Lifts & Escalators Etc.) Network in Shimla City (Himachal Pradesh) on Engineering Procurement and Construction (EPC) Mode.”

REQUEST FOR PROPOSAL (RFP)

Volume I

October – 2024

Externally Aided Project

(Under Consideration for funding by New Development Bank)

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ROPEWAYS AND RAPID TRANSPORT SYSTEM DEVELOPMENT CORPORATION H.P LIMITED
(RTDC) (Address US Club- Shimla -1)

NOTICE INVITING BID

Bid Notification No: -----

Dated: -----

“Design, Supply, Construction, Installation, Testing, Commissioning and Operation & Maintenance for 5 (five) years of Seamless Innovative Urban Transportation (Ropeways, Lifts & Escalators Etc.) Network in Shimla City (Himachal Pradesh) on Engineering Procurement and Construction (EPC) Mode.”

- 1) The Ropeways and Rapid Transport System Development Corporation H.P Limited (RTDC) invites proposals from reputed and experienced contractors for engaging as EPC Contractor on the basis of Open Competitive Bidding (OCB) for the following contract package in the State of Himachal Pradesh.

Name of Work	Estimated Cost (INR)	Completion Period	Total Length
“Design, Supply, Construction, Installation, Testing, Commissioning and Operation & Maintenance for 5 (five) years of Seamless Innovative Urban Transportation (Ropeways, Lifts & Escalators Etc.) Network in Shimla City (Himachal Pradesh) on Engineering Procurement and Construction (EPC) Mode.”	Capital Cost INR 13663.9 million ** (INR Thirteen Thousand Six Hundred Sixty-Three million and -Nine Hundred Thousand Only)	48 Months	13.79 km*
1. Red Line Between Taradevi – Chakkar – Tutikandi parking 2.10km. (3 Stations and 2 Sections)	(Including all Liabile Taxes, Excluding GST)		
2. Green Line Tutikandi Parking (ZPTH) – ISBT – Railway Station – Old Bus Stand – Lift Point – Secretariat 5.14km (5 Stations 5 Sections)	Operation Cost INR1307.3 million ** (INR One Thousand Three Hundred Seven Million and Three Hundred Thousand Only)	60 Months (after commercial operation date)	
3. Blue Line ISBT – 103 Tunnel – Victory Tunnel – ICR- IGMC- Sanjauli – Navbahar – Secretariat 6.55km (6 Stations and 7 Sections)	(Including all Liabile Taxes, and Excluding GST)		

*It's an indicative length and not binding on RTDC, bidders have to do their own due diligence for ascertaining the same.

**It's an indicative cost and not binding on RTDC, bidders have to do their own due diligence for ascertaining the same.

- 2) Bidders may download the bid documents from the official e-portal <https://hptenders.gov.in>. Entire bid process will be carried out online through above mentioned website. The RFP document can also be viewed and/or downloaded from RTDC's website i.e. www.rtdchp.org. The Bidder can also collect Bid documents from the office of RTDC.
- 3) At the time of procuring the Bid documents from RTDC, the Bidder shall pay to RTDC a sum of INR 1,50,000.00/- (Indian Rupees One Lakh Fifty Thousand Only) + 18% GST as non-refundable cost of the Bidding documents (the "Document Fee"). In case, the Bidding document is downloaded from the website, then the Bidder will pay a sum of INR 1,50,000.00/- (Indian Rupees One Lakh Fifty Thousand Only) + 18% GST as non-refundable cost of the Bidding documents during the submission of the Bid.
- 4) Any clarification/corrigendum/addendum to the bid documents shall be uploaded on the official e-portal only <https://hptenders.gov.in>, without any obligation of press notification.
- 5) For any additional information & help for downloading & uploading, please contact undersigned at Ropeways and Rapid Transport System Development Corporation, US Club, Shimla, 171001 (H.P.), Email: dgm.rtdc@hpmail.in, & dgm.rtdchp@gmail.com Phone: 0177-2811001, 0177-2811003, 0177-2811004.
- 6) For any complaints, bidders may contact Director /RTDC at US Club, Shimla, 171001 (H.P.), Tel: 0177- 2811001, Email: dir.rtdc@hpmail.in and dgm.rtdchp@gmail.com

(Signature)

Deputy General Manager

Ropeways and Rapid Transport System Development Corporation H.P Limited

US Club- Shimla -1

DISCLAIMER

1. This request for proposal (“RFP Document”) contains brief information about the Project, qualification requirements and the selection process for the successful Bidder. The purpose of this RFP Document is to provide interested parties (“Bidder(s)”) with information in order to assist them in formulation of their bid application (the “Bid”).
2. The information contained in this Request for Proposal document (the “RFP”), or subsequently provided to Bidder(s) by or on behalf of the Authority or any of its employees or advisors, is provided to Bidder(s) under the terms and conditions outlined in this RFP and any other applicable terms and conditions under which such information is provided.
3. This RFP is not an Agreement and is neither an offer nor invitation by the Authority to the prospective Bidders or any other person. The purpose of this RFP is to provide interested parties with information that may be useful to them in making their financial offers (BIDs) pursuant to this RFP. This RFP includes statements, which reflect various assumptions and assessments arrived at by the Authority in relation to the Project. Such assumptions, assessments and statements do not purport to contain all the information that each Bidder may require. The assumptions, assessments, statements and information contained in the Bidding Documents may not be complete, accurate, adequate, or correct. Each Bidder should, therefore, conduct its own investigations and analysis and should check the accuracy, adequacy, correctness, reliability, and completeness of the assumptions, assessments, statements and information contained in this RFP and obtain independent advice from appropriate sources.
4. Information provided in this RFP to the Bidder(s) is on a wide range of matters, some of which may depend upon interpretation of law. The information given is not intended to be an exhaustive account of statutory requirements and should not be regarded as a complete or authoritative statement of law. The Authority accepts no responsibility for the accuracy or otherwise for any interpretation or opinion on law expressed herein. The Authority, its employees and advisors make no representation or warranty and shall have no liability to any person, including any Bidder under any law, statute, rules or regulations or tort, principles of restitution or unjust enrichment or otherwise for any loss, damages, cost or expense which may arise from or be incurred or suffered on account of anything contained in this RFP or otherwise, including the accuracy, adequacy, correctness, completeness or reliability of the RFP and any assessment, assumption, statement or information contained therein or deemed to form part of this RFP or arising in any way for participation in this BID Stage. The Authority also accepts no liability of any nature whether resulting from negligence or otherwise howsoever caused arising from reliance of any Bidder upon the statements contained in this RFP. The Authority may in its absolute discretion, but without being under any obligation to do so, update, amend or supplement the information, assessment or assumptions contained in this RFP.

5. RTDC reserves the right to accept or reject any or all Applications without giving any reasons thereof. RTDC will not entertain or be liable for any claim for costs and expenses in relation to the preparation of the documents to be submitted in terms of this RFP Document.
6. The Bidder shall bear all its costs associated with or relating to the preparation and submission of its BID including but not limited to preparation, copying, postage, delivery fees, expenses associated with any demonstrations or presentations which may be required by the Authority, or any other costs incurred in connection with or relating to its BID. All such costs and expenses will remain with the Bidder and the Authority shall not be liable in any manner whatsoever for the same or for any other costs or other expenses incurred by a Bidder in preparation or submission of the BID, regardless of the conduct or outcome of the Bidding Process.

ACRONYMS

ART	Arial Ropeway Transit
ASI	Archaeological Survey of India
BIS	Bureau of Indian Standards
CEN	Standards put forth by Comité Européen De Normalisation, European Committee for Standardization.
DPIIT	Department of Promotion of Industry and Internal Trade
EMD	Earnest Money Deposit
EPC	Engineering, Procurement and Construction
EQC	Eligibility cum Qualification Criteria
FDR	Fixed Deposit Receipt
GFRs	General Financial Rules
GST	Goods and Services Tax
IMPS	Immediate Payment Service
INR	Indian National Rupees
JV	Joint Venture
LOA	Letter of Acceptance
MDG	Monocable Detachable Gondola
MoU	Memorandum of Understanding
NDB	New Development Bank
NEFT	National Electronic Fund Transfer
OCB	Open Competitive Bidding
OEM	Original Equipment's Manufacturer
PPD	Procurement Policy Division
PPHPD	Passengers per hour per direction
PPP	Public-Private Partnership
PSU	Public Sector Undertakings
RFP	Request for Proposal
ROW	Right of way
RTDC	Ropeways and Rapid Transport System Development Corporation H.P. Limited
RTGS	Real-Time Gross Settlement

1.0 INFORMATION TO BIDDERS

1.1 Background

The “Authority” has decided to undertake development of the Ropeway Project (the “Project”) based on a world class (CEN Certified) cable car technology, with its unique safety features, through an Engineering, Procurement and Construction (EPC) Contract, and has decided to carry out the bidding process for selection of the bidder to whom the Project shall be awarded. The RFP can be viewed and/or downloaded from www.rtdchp.org.

1.2 Brief Particulars of the Project

SN	Particulars	Details
1.	Description of work	“Design, Supply, Construction, Installation, Testing, Commissioning and Operation & Maintenance for 5 (five) years of Seamless Innovative Urban Transportation (Ropeways, Lifts & Escalators Etc.) Network in Shimla City (Himachal Pradesh) on Engineering Procurement and Construction (EPC) Mode.” 1. Red Line Between Taradevi – Chakkar – Tutikandi parking 2.10km. (3 Stations and 2 Sections) 2. Green Line Tutikandi Parking (ZPTH) – ISBT – Railway Station – Old Bus Stand – Lift Point – Secretariat 5.14km (5 stations 5 sections) 3. Blue Line ISBT – 103 Tunnel – Victory Tunnel – ICR-IGMC- Sanjauli – Navbahar – Secretariat 6.55km (6 Stations and 7 Sections) The Civil Works shall conform to BIS, whereas Electromechanical Works shall conform to CEN Standards.
2.	Scope of Work	(i) Alignment Survey and Geotechnical Investigation, Design, Engineering, Procurement, Development, Construction, Manufacturing, Erection and Installation, Testing and Commissioning of a CEN Standard Ropeway System for Implementation of Innovative Urban Transportation (Ropeways, Lifts & Escalators etc.) Project in Shimla City on CEN Standards in Himachal Pradesh with approx., length of 13.79km on EPC Basis. (ii) Performance and fulfillment of all other obligations of the Contract in accordance with the provisions of this RFP, EPC & O&M Agreement and matters incidental thereto or necessary for the performance of any or all

SN	Particulars	Details
		the obligations of the Contractor of the Project during the Defect Notification Period, which shall be for period of 5 years (60 Months) from completion of Construction work and on issuance of Completion Certificate. (iii) Operate and maintain the Project for a period of 5 (five) years from the Commercial Operation Date of the Project.
3	Bid Document cost	INR 150,000/- (INR One Hundred Fifty Thousand Only) + 18% GST. Payment of Cost of Bid Document shall be made through RTGS and NEFT. No other mode of payment will be accepted. The Bidders are required to upload scanned copies of transaction of payment (clearly indicating bid number) of Bid Document cost at the time of online bid submission.
4.	Earnest Money Deposit (EMD)	INR INR150.00 Million (INR One Hundred Fifty Million only) payable in the form of Bank Guarantee or FDR duly pledged in favour of Deputy General Manager, Ropeways and Rapid Transport System Development Corporation H.P. Limited, Shimla, Himachal Pradesh or Amount of EMD may be deposited in the Account of RTDC through RTGS/NEFT detail as under :- Account Name: - ROPEWAYS & RAPID TPT SYS DEV CORP HP LTD. Account No. :- 50100701107529 IFSC :- HDFC0006405 Branch:- HDFC Bank The Mall Shimla. Valid for 120 days beyond the validity of the bid pursuant to clause 1.2.8.
5.	Estimated Project Cost	Capital Cost INR13663.9 million (INR Thirteen Thousand Six Hundred Sixty-Three million and Nine Hundred Thousand Only) (Including all Liable Taxes, excluding GST) Operation Cost INR1307.3 million ** (INR One Thousand Three Hundred Seven Million and Three Hundred Thousand Only (Including all Liable Taxes, excluding GST)) Note:

SN	Particulars	Details
		(i) The above Amount is Estimated Cost for Construction & Implementation of seamless Innovative Urban Transportation (Ropeways, Lifts & Escalators Etc.) Network in Shimla City (Himachal Pradesh) on Engineering, Procurement and Construction Mode. (ii) The Bidder shall quote separately for Annual Operation & Maintenance Cost for each year.
6.	Performance Security	5% of the total Project Cost payable in the form of Bank Guarantee or FDR duly pledged in favour of Deputy General Manager, Ropeways and Rapid Transport System Development Corporation H.P. Limited, Shimla” Himachal Pradesh or Amount of Performance Security may be deposited in the Account of RTDC through RTGS/NEFT. Note: (i) The Performance Guarantee for Quoted Capital Cost for “Design, Supply, Construction, Installation, Testing, Commissioning and Operation & Maintenance for 5 (five) years of Seamless Innovative Urban Transportation (Ropeways, Lifts & Escalators Etc.) Network in Shimla City (Himachal Pradesh) on Engineering Procurement and Construction (EPC) Mode.” shall be given within the period prescribed in the Particular Conditions of Contract Part B-Special Provisions Preamble, Clause No. PC 4.2 Performance Security. (ii) The Performance Guarantee for the quoted Operation and Maintenance Cost shall be submitted separately at least 90 days prior to the start of Operation and Maintenance works. As per the Particular Conditions of Contract Part B-Special Provisions Preamble, Clause No. PC 4.2 Performance Security.

1.2.1 The Authority shall receive bids according to the terms outlined in this RFP and other documents provided by the Authority under this RFP (collectively referred to as the "Bidding Documents"). All Bids shall be prepared and submitted in compliance with these terms by the “Bid Due Date”.

- 1.2.2 The proposal shall be submitted in English Language and all correspondence would be in the same language.
- 1.2.3 The statements and explanations contained in this RFP are intended to provide a proper understanding to the Bidders about the subject matter of this RFP and should not be construed or interpreted as limiting in any way or manner the scope of services and obligations or the Authority's rights to amend, alter, change, supplement or clarify the scope of work to be awarded pursuant to this RFP or the terms thereof or herein contained. Consequently, any omissions, conflicts or contradictions in the Bidding Documents including this RFP are to be noted, interpreted, and applied appropriately to give effect to this intent, and no claims on that account shall be entertained by the Authority and the Authority shall not be liable for any inconsistencies/omissions/conflicts or contradictions in this bid document in any manner whatsoever.
- 1.2.4 Bids are open to Bidders, who fulfil the criteria stipulated in Eligibility cum Qualification Criteria (EQC). A firm, who has paid cost of Bid document in their name, can submit the bid either as an individual firm or in JV/ Consortium.
- 1.2.5 All bidders are hereby cautioned that bids containing any material deviation or reservations as described in the "Instructions to Bidders" shall be considered as non-responsive and liable to be rejected. "No variant bids or alternative bids are allowed."
- 1.2.6 Bidders shall pay the cost of Bid Document, in the form of online payment only, without which bids will not be accepted. Service, gateway or other charges if any shall be borne by the Bidders. The Bidders are required to upload scanned copy of payment receipt/ transaction for Bid Cost during online submissions. Payment of Bid Cost of Bid Document is to be made only by RTGS and NEFT. No other mode of payment will be accepted.
- 1.2.7 The Authority has adopted a single-stage two-cover system, collectively known as the **"Bidding Process,"** to select the Bidder for the Project award. The First cover includes the **"Technical Bid,"** and the second cover includes the **"Financial Bid,"** together forming the **"Bid"** submitted by Bidders for undertaking the Project.
- 1.2.8 The Bid validity shall be 180 days (both days inclusive i.e. the date of submission of Bids and the last date of period of validity of the Bid) from date of bid submission.
- 1.2.9 The complete Bidding Documents for the Project is enclosed for the Bidders. The Bidders are expected to carry out their own surveys, investigations and other detailed examination of the Project before submitting their Bid. Any addenda issued subsequent to this RFP Document, will be deemed to form part of the Bidding Documents.
- 1.2.10 The Bidder shall furnish as part of its Proposal, a "Bid Security" in accordance with the **Clause 1.2** of this RFP. The Bid submitted without Bid Security will be summarily rejected.

The Bid Security of the successful Bidder will be returned when the Bidder has signed the Contract Agreement with the Authority and has furnished the required performance Guarantee.

- 1.2.11 Disqualified bidders would be informed regarding their non-qualification, without any explanation and thereafter Bid Security would be returned after the evaluation of the financial proposal of qualified bidders and signing the contract agreement with the successful bidder.

1.3 Bank Account Details

Customer Name: ROPEWAYS & RAPID TPT SYS DEV CORP HP LTD

The details of bank account of RTDC as mentioned below:

Name of the Bank	City of the Bank	Account Name and Number	IFSC Code
HDFC BANK LTD, THE MALL SHIMLA, HIMACHAL PRADESH	SHIMLA - 171001	50100701107529	HDFC0006405

1.4 The Bidding Schedule/Timeline

S. No.	Event Description	Date
1	Date of online Publication	30/10/2024 up to 5.00 P.M.
2	Downloading of bid start date & time	30/10/2024 from 5.00 P.M.
3	Last date for receiving pre bid queries	20/11/2024 till 5.00 P.M.
4	Pre-Bid Meeting	23/11/2024 at 11.00 A.M.
5	Authority response to pre bid queries latest by	09/12/2024 till 5.00 P.M.
6	Last date for Submission of bid	31/12/2024 till 11.00 A.M.
7	Physical submission of bid security/POA etc.	31/12//2024 till 12.00 P.M.
8	Date of opening of Technical Bids	31/12/2024 at 3.00 P.M.
9	Date & Time of opening of Financial Bid	Will be informed later on after the evaluation of technical bids (Only to the bidders who will successfully qualify the Technical Evaluation)

S. No.	Event Description	Date
10	Authority for seeking clarifications and submission of completed Bid documents	Dy. General Manager Ropeways And Rapid Transport System Development Corporation. (RTDC) US Club, Shimla, 171001 (H.P.) Email: dgm.rtdc@hpmail.in & dgmrtldchp@gmail.com Phone: 0177-2811001, 0177-2811003, 0177-2811004

2.0 INSTRUCTIONS TO BIDDERS

2.1 General Terms of bidding

- 2.1.1 No Bidder shall submit more than one BID for the Project. A Bidder bidding individually or as a Member of a Joint Venture shall not be entitled to submit another BID either individually or as a Member of any other Joint Venture, as the case may be.
- 2.1.2 Process of bidding is Open Competitive Bidding (OCB). All proprietorship firms, partnership firms, companies, consortium, or joint ventures engaged in the execution of work similar to that defined in this RFP, and meeting the financial criteria, work experience criteria, Bid Capacity and other requirements specified in the Eligibility cum Qualification Criteria and/or this document, are eligible to participate.
- 2.1.3 The minimum qualifying score for technical eligibility during the bidding process shall be 70%. Each responsive bid will be evaluated based on a technical score out of a maximum of 100 marks, as outlined in the RFP. Bidders meeting the technical evaluation criteria are deemed technically responsive, while others will be categorized as technically non-responsive and excluded from further consideration.

Financial proposals shall be opened for only technically eligible and responsive bidders and financial offers of technically non-responsive bidders will be returned unopened to them. The Financial Proposals shall be given Ranking based on relative ranking of prices, with First Rank for the lowest priced offers (L1) and pro-rated Ranking for higher priced offers. The Bidder obtaining the First Rank shall be selected (the “Selected Bidder”) for award while the second ranked Bidder will be kept in reserve, subject to offered price being acceptable to authority.

- 2.1.4 Bidder (sole firm or lead firm and any of the JV partners) who have been debarred by RTDC or any other central/state government/PSU organization and the debarment is in force as on last date of submission of proposal, need not apply as their RFP proposal will not be entertained.
- 2.1.5 The BID shall be furnished in the format exactly as per **Appendix-I** i.e., **Technical Bid** as per **Appendix IA** and **Financial Bid** as per **Appendix IB**, bid amount shall be indicated clearly in both figures and words, in Indian Rupees-INR in prescribed format of Financial Bid and it will be signed by the Bidder’s authorised signatory. In the event of any difference between figures and words, the amount indicated in words shall be taken into account.
- 2.1.6 The Bidder should submit a **Power of Attorney** as per the format at **Appendix-III**, authorising the signatory of the BID to commit the Bidder.

- 2.1.7 In case the Bidder is a Joint Venture, the Members thereof should furnish a **Power of Attorney** in favour of the **Lead Member** in the format at **Appendix-VII** and joint bidding agreement in the format at **Appendix -VIII**.
- 2.1.8 The bid and all communications in relation to or concerning the Bidding Documents and the BID shall be in English language.
- 2.1.9 In case of difference between the amount written in figures and words, the amount written in words shall be considered as correct.
- 2.1.10 This RFP is not transferable.
- 2.1.11 Any award of Project pursuant to this RFP shall be subject to the terms of Bidding Documents and also fulfilling the criterion as mentioned in **Clause 3.2**. The bidder is hereby informed that Award of contract for “Design, Supply, Construction, Installation, Testing, Commissioning and Operation & Maintenance for 5 (five) years of Seamless Innovative Urban Transportation (Ropeways, Lifts & Escalators Etc.) Network in Shimla City (Himachal Pradesh) on Engineering Procurement and Construction (EPC) Mode.”
- 2.1.12 In case the Bidder is a Joint Venture, it shall comply with the following additional requirements.
- a. Number of Members in a Joint Venture shall not exceed 2 (Two)
 - b. Subject to the provisions of clause (a) above, the Bid should contain the information required for each Member of the Joint Venture.
 - c. Members of the Joint Venture shall nominate one Member as the lead Member (the “**Lead Member**”). Joint Venture Members shall satisfy technical capacity jointly such that
 - i. **Lead Member** should fully satisfy criteria of Technical Capacity as per **Clause 3.2**.
 - ii. Any Member of Joint venture can satisfy Criteria as per **Clause 3.2** provided that given criteria to be fully satisfied by that particular Member.
 - d. Share of **Lead Member** in the joint venture shall not be less than 51%.
 - e. Share of **Other Member** in the joint venture shall not be less than 26%
 - f. **Lead Member** shall satisfy Financial Capacity as per **Clause 3.2**.
 - g. The Bid should include a brief description of the roles and responsibilities of individual Members, particularly with reference to financial, technical and notification obligations.
 - h. Members of the Joint Venture shall have entered into a binding Joint Bidding Agreement, in the form specified at **Appendix VIII** (the “Joint Bidding Agreement”), for the purpose of making the Application and submitting a Bid in the event of being qualified. The Joint Bidding Agreement, to be submitted along with the Application, shall, inter alia:
 - i. convey the commitment(s) of the **Lead Member** in accordance with this RFP, in case the contract to undertake the Project is awarded to the Joint Venture; and clearly outline the proposed roles & responsibilities, if any, of each Member.
 - ii. commit the approximate share of work to be undertaken by each Member.

- iii. include a statement to the effect that “all Members of the Joint Venture shall be liable jointly and severally for all obligations of the Contractor in relation to the Project in accordance with Contract”; and
- iv. except as provided under this RFP, there shall not be any amendment to the Joint Bidding Agreement.

2.2 Regulations/Instructions related to public procurement issued by Procurement Policy Division (PPD)

2.2.1 The Bidder including the Associate Partner shall follow the Instructions issued by the Procurement Policy Division (PPD) of the Department of Expenditure (Ministry of Finance) from time to time.

2.2.2 Procurement Policy Division (PPD) of the Department of Expenditure (Ministry of Finance) has placed instructions and directives issued by it on its website <https://doe.gov.in/procurementpolicy-> . some of the important instructions have been briefly referred as below:

2.2.2.1 To encourage ‘**Make in India**’ and promote manufacturing and production of goods and services in India with a view to enhancing income and employment, Department of Promotion of Industry and Internal Trade (DPIIT), Ministry of Commerce and Industry, Government of India, issued Public Procurement (Preference to Make in India), Order 2017.

2.2.2.2 The above Order is in line with Rule 153 (iii) of the General Financial Rules 2017, which provides that the Central Government may, by notification, provide for mandatory procurement of any goods or services from any category of bidders or provide for preference to bidders on the grounds of promotion of locally manufactured goods or locally provided services.

3.0 ELIGIBILITY and QUALIFICATION CRITERIA (EQC)

3.1 General requirements of Bidder

- 3.1.1 **The Bidder** shall apply either as a sole firm or forming Joint Venture with other firms. In case of Joint Venture, the maximum number of Joint Venture partners is limited to 2 (i.e., one lead + one JV Member). Formulation of more than one JV/Consortium with different partners for the same work is not allowed and all such proposal involving the firms shall be treated as non-responsive. If the Bidder submits bids as sole Bidder and also in JV/Consortium with another Bidder, both bids shall be summarily rejected. No Bidder shall submit more than one bid.

- 3.1.2 The lead partner and JV partner jointly should meet the eligibility criteria as per **Eligibility and Qualification Criteria (EQC)**.

Note: The weightage considered for experience of a firm would depend on the role of the firm in the respective assignments. The firm's experience would get full credit if it was the sole firm in the respective assignment. If the Bidder firm has completed Projects as JV with some other firms, weightage shall be given as per the JV share. For weightage of experience in any past assignment, experience certificate from the client (Government/State Government/PSU) shall be submitted.

- 3.1.3 The Bidder shall submit a **Power of Attorney** authorizing the signatory(ies) along with Board Resolution(s) to submit the bid or each Member of the joint venture/ consortium.

The Bidder, whether a sole Bidder or joint venture(s) shall include an **ASSOCIATE PARTNER** also, in case the bidder is not a CEN Ropeway Equipment Manufacturer. While computing the **Technical Capacity** of the Bidder, experience of respective Associate would also be considered.

“ASSOCIATE PARTNER” means technical tie up partner who must be CEN Ropeway Equipment Manufacturer & must satisfy the minimum eligibility criteria as per clause no. 3.2.1 & 3.2.2 (i).

The Bidder shall enter into agreement with ASSOCIATE PARTNER to ensure that the training is provided to its manpower by the ASSOCIATE PARTNER for Operation and Maintenance of the system.

- 3.1.1.4 The Bidder shall submit a Memorandum of Understanding (MoU) with the ASSOCIATE PARTNER regarding the roles and responsibilities of the ASSOCIATE PARTNER along with the proposal. The experience of the ASSOCIATE PARTNER in use of technology shall also be counted in the evaluation. The Bidder shall obtain the Bank Guarantee for EMD at bidding stage and Performance Security after awards of the work as case may be, from the ASSOCIATE PARTNER equivalent to his share as a guarantee of his commitment. The Bank Guarantee shall be duly pledged in favour of **Deputy General Manager, Ropeway and Rapid Transport System Development Corporation H.P. Limited, Shimla** Himachal Pradesh. RTDC may enter into separate MOU with ASSOCIATE PARTNER

for supply of spares and overall performance of works prior to issuance of performance certificate for successful completion of the project.

- 3.1.5 Experience requirement for the ASSOCIATE PARTNER shall be as per **Clause 3.2**, duly supported by acceptable documentary proofs, in respect of the Ropeway Projects in conformity with the provisions of the EPC Agreement:
- 3.1.6 The Bidder shall give an undertaking that in case the Project is awarded to it, the above technical tie up MoU shall be valid for the entire Project Duration. The Bidders shall as part of their technical bid, attach the MoU for their technical tie up and other relevant documents (such as client certificates, statutory auditor certificate, etc.) in respect of the Projects specified above so as to demonstrate the relevant technical experience of the Technical Tie Up Partner.
- 3.1.7 In case of Foreign Partners/ASSOCIATE PARTNER, please refer to **Clause 2.2.2.a** above regarding orders of PPD. In such case, Power of Attorney(ies) and Board Resolution(s) confirming authority on the persons issuing the Power of Attorney for such actions, shall be submitted duly notarised by the notary public in the country of origin and stamped by the Indian Embassy or High Commission. However, the Power of Attorney(ies) and Board Resolution(s) provided by the bidders from the countries that have signed the Hague Legislation Convention 1961, are not required to be legalised by the Indian Embassy, if it carries a confirming Apostille Certificate. If the documents are in foreign language the translation of the same in English shall be authenticated by Indian Embassy or High Commission.
- 3.1.8 Associate Partner shall associate with only one bidder, once a bidder submits their bid, they are not allowed to change their Associate Partner.
- 3.1.9 A Bidder or its Parent Company/Holding Company shall not have a conflict of interest ("**Conflict of Interest**") that affects the Bidding Process. Any Bidder found to have a Conflict of Interest shall be disqualified and liable for forfeiture of the bid Security or Performance Security as the case may be. A Bidder shall be deemed to have a Conflict of Interest affecting the Bidding Process, if:
 - (i) a constituent of such Bidder or its Parent Company/Holding Company is also a constituent of another Bidder; **or**
 - (ii) such Bidder or its Parent Company/Holding Company or any of its Joint Venture Member thereof has participated as a consultant to the Authority in the preparation of any documents, design, or technical specifications of the Project.

3.2 Technical Capacity

3.2.1 Minimum Eligibility Criteria

3.2.1.1 Work Experience: The Bidders will be qualified only if they have successfully completed or substantially completed similar works during last **7 (Seven)** years ending last day of the month before the month of Bid submission as given below.

- a) At least one “similar work” of value of **INR 10,930 million** (80% of Estimated Cost) or more

OR

- b) At least two “similar works” each of value of **INR 6,830 million** (50% of Estimated Cost) or more

OR

- c) At least three “similar works” each of value of **INR 5470 million** (40% of Estimated Cost) or more

3.2.2 Definition of similar work

“**Similar Work**” for this contract shall mean the work pertaining to

- i. Design and construction of at least one CEN Standard Seamless Passenger Ropeway Network having minimum 3 (three) boarding/deboarding stations and two section of at least 1.0km length each and minimum carrying capacity of 2000 PPHPD completed as PPP Project or EPC / Turnkey Project.

(OR)

- ii. Successfully executed and completed a Project within the Core Infrastructure Sector, including Highways (NH/SH only), Ports, Airports, Railways, Metro Rail, Dams, Irrigation, and Water supply. The Project must have been undertaken either as a PPP Project or on an EPC /Turnkey Project.

Notes:

- (i) The Bidder shall provide details of their previous Work Experience as a contractor or Member of a JV/Consortium to qualify for the criteria outlined in **Clause No. 3.3.1.1 (a), (b), or (c)** above.
- (ii) For documenting work experience, the Bidder must submit client completion certificates that clearly specify the nature and scope of work, PPHPD (if applicable), completion cost, actual completion date, and contractual completion date of the Project. Bids lacking this documentary proof will not be evaluated.
- (iii) The qualification criteria for work experience also include considering the value of works that are substantially completed (>80% of the original contract value) as

defined in **Clauses 3.2.2 i or ii**. The Bidder must provide a client certificate stating the value of these "substantially executed" works.

- (iv) If the work has been executed for a private client, the following documents must be submitted: a) Copy of the work order(s), b) Bill of quantities, c) Details of payments received, d) TDS (Tax Deducted at Source) certificates for all payments received, certified by a Statutory Auditor or Chartered Accountant, e) Attested copy of the final or last bill paid or notarized. These documents are necessary to substantiate the completion and financial aspects of the work executed for private clients.
- (v) In the case of a Joint Venture (JV) or Consortium, the following principles apply for considering the value of work done:
 - If the work was performed by the same JV/Consortium, the full value of the work will be considered.
 - If the qualifying work was executed by the Bidder in a JV/Consortium with different partners, the value of the work will be considered based on the Bidder's percentage participation in that JV/Consortium.

These details must be supported with documentary evidence to substantiate the participation and contribution of the Bidder in the JV/Consortium for the specified work.

- (vi) For completed works, value of work done shall be updated to the last day of the month previous to the month of Bid submission price level considering 5% inflation per year. The exchange rate of foreign currency shall be applicable 28 days before the submission date of Bid.
- (vii) In the case of a Joint Venture (JV) or Consortium, the lead partner must have successfully completed at least one similar work as described in **Clause 3.2.1.1 a) or b) or c)**. This requirement ensures that the Lead Partner has demonstrated the capability to undertake and successfully complete Projects of a comparable nature.
- (viii) If the Bidder is a Joint Venture (JV) or Consortium with foreign partner(s), and the qualifying works were executed by the foreign partner in their own country, an additional requirement applies. In addition to the specific works described, the foreign partner must have completed Projects (similar in nature) totalling at least INR 5,470 million (40% of Estimated Cost) or more outside their home country. This additional criterion ensures that the foreign partner has substantial experience and capacity beyond their domestic market, demonstrating their capability to undertake Projects of significant scale internationally. The documents in this regard shall be submitted as **Clause No. 3.1.8**.
- (ix) The bidders must have an **Associate Partner as per clause No. 3.1.4** having experience in Ropeways as per Clause no. 3.2.1 & 3.2.2 (i) of **"Similar works"**.

- (x) In case the bidder is CEN ropeway equipment manufacturer he/it must satisfy the minimum eligibility criteria as per clause no. 3.2.1 & 3.2.2 (i) of “**Similar works**”.

3.3 Financial Capacity

3.3.1 The Bidders will be qualified only if they have minimum financial capabilities as below:

- a) **Net Worth:** Net Worth of Bidder during last audited financial year should be > **INR 683 million**.

In Case of JV/Consortium - Net worth will be based on the percentage participation of each Member.

Example: Let Member-1 has percentage participation = M and Member-2 has percentage participation = N. Let the Net worth of Member-1 is ‘A’ and that of Member-2 is ‘B’, then the Net worth of JV/Consortium will be = $(AM+BN)/100$

- b) **Annual Turnover:** The average annual turnover from construction of last **5 (five)** financial years should be > **INR 2733million**.

In Case of JV/Consortium - The average annual turnover of JV/ Consortium will be based on percentage participation of each Member.

Example: Let Member-1 has percentage participation = M and Member-2 has = N. Let the average annual turnover of Member-1 is ‘A’ and that of Member-2 is ‘B’, then the average annual turnover of JV/Consortium will be = $(AM+BN)/100$.

Notes:

- (i) The Bidder must submit financial data for the last three financial years (excluding fiscal years 2020-21 and 2021-22 due to COVID-19, if opted by the Bidder), accompanied by audited financial statements. These documents should specifically pertain to the Bidder or, in the case of a JV/Consortium, to the respective Member and not to any sister, subsidiary, or parent company. Additionally, the Bidder is required to provide details of Works in Hand to demonstrate existing commitments. The financial data must be presented in the prescribed format, duly endorsed, signed, and stamped by a Chartered Accountant, including the CA’s Membership number and UDIN.
- (ii) If the Bidder is unable to provide the audited balance sheet for the last financial year, they must submit an affidavit confirming that "the balance sheet has not been audited as of now." In such circumstances, the financial data from the previous three audited financial years (excluding fiscal years 2020-21 and 2021-22 due to COVID-19, if opted by the Bidder) will be used for evaluation. It's crucial to note that if the audited balance sheet of any year other than the last year is not submitted, the Bidder will be deemed non-responsive.

The bidders will be qualified only if their available bid capacity is more than the Estimated cost of work as per NIT. Available bid Capacity should be minimum of **INR13660 million.**

- (i) Financial data for last five financial years (excluding two fiscal years 2020- 21 and 2021- 22 due to covid) has to be submitted by the bidder along with audited financial statements.
- (ii) Available bid capacity will be calculated based on the following formula:

Where:

N = No. of years prescribed for completion of this work (4 years)

B = Value of existing commitments, as on the Bid Due Date for on-going construction works for next 48 months period with effect from the next day of the Bid Due Date.

- (iii) The value of existing commitments for on-going construction works during the period 48 months' period with effect from the next day of the Bid Due date has to be submitted by the bidder. This data shall be certified by a Chartered Accountant with his stamp and signature in original and with his Membership number and UDIN.
- (iv) The Bidder should submit details of Bid Capacity in the specified format.
- (v) In Case of JV/Consortium - The average Bid Capacity of JV/ Consortium will be based on percentage participation of each Member.

Example in case of each partner of JV/Consortium: Member-1 has percentage participation = **M** and Member-2 has percentage participation = **N**. If minimum bid capacity required is “**W**” then bid capacity of Member-1 $\geq \mathbf{W * M / 100}$ and bid capacity of Member-2 $\geq \mathbf{W * N / 100}$.

Note: Lead Member shall meet at least 60% requirement of Technical, Financial and Bid Capacity required as per Clause 3.2, 3.3.1 (a) 3.3.1 (b) and 3.3.2. The other Member(s) shall meet at least 20% requirement of Technical, Financial and Bid Capacity required as per Clause 3.2, 3.3.1 (a) 3.3.1 (b) and 3.3.2 and the JV as a whole shall cumulatively/collectively fulfil the 100% requirement.

Submission of Bids

- 3.3.3 Interested bidders are requested to submit their proposal in Two Parts, in 2 separate envelopes/ packages and put together in one single outer envelope/package. The two parts shall be:

Part 1: Technical Proposal and

Part 2: Financial Proposal.

The proposal shall be written in the English language as specified in the Data Sheet. All pages of the Proposal shall be signed by an authorized representative. The representative's authorization shall be confirmed by written Power of Attorney duly notarized to be submitted with the proposal. In case of JV /Consortium, a MoU indicating the specific Projects, input and role of each Partner etc. shall be submitted with the proposal.

PART 1 - TECHNICAL PROPOSAL:

- a) Bidders are advised to thoroughly review all terms and conditions outlined in the documents. Any failure to comply or provide the requested information is at your own risk and shall lead to the rejection of your proposal.
- b) The Technical Proposal from bidders must include a concise description of the firm's organization and recent experience of the bidder for Joint Ventures, each partner should provide details on assignments of a similar nature. Specifically, bidders are required to furnish information on each assignment, including duration, contract amount, and the firm's role. Additionally, bidder and their JV partners must separately provide details of current assignments. Furthermore, bidders should include any feedback or recommendations on the Authority's Requirements and a description of the methodology (work plan) proposed to execute the Project, supported by activity bar charts.
- c) The Technical Proposal must include a Deployment Schedule for each key personnel Member. This schedule should detail the estimated total time effort (in person-months) allocated for the Project. Additionally, it should feature bar chart diagrams illustrating the proposed time allocation (in person-months) for each professional staff Member and sub-professional staff Member involved in the Project.
- d) The bidder shall also submit equipment's list with him for properly execution of the work.

Part 2: Financial Proposal

- a) The Financial Proposal should clearly indicate the costs quoted by the Bidder for executing and commissioning of the Ropeway Project.

- b) The Bidder shall quote separately for Annual Operation & Maintenance Cost for each year.
- c) The Bidder shall express the price of his works in the Indian Rupees only.
- d) GST as applicable shall be considered as excluded in the quoted sum and shall be paid to the contractor while making payment for the work done.

3.3.4 The two parts of the Proposal (Technical proposal and financial proposal) must be submitted on-line with all pages numbered serially, along with an index of submission as per procedure under e-bidding. The Financial proposal is to be submitted online only. Submission in any other form shall not be acceptable. In the event, any of the instructions mentioned herein have not been adhered to, the Authority may reject the Proposal.

3.3.5 The Submission of “EMD / Bid Security” and “Cost of Bid Document” after due date and time shall not be accepted and online bids of such bidders shall be rejected summarily.

3.4 Documents comprising technical and Financial BID

3.4.1 The Bidder shall first upload all the documents required in this RFP for technical qualification. The Bidder shall ensure that all the details are updated as on the due date of submission of this bid.

3.4.2 The Bidder shall submit on the website <https://hptenders.gov.in> by submitting the documents mentioned below along with the supporting documents which shall comprise of the

Technical BID:

- a) **Appendix-IA** (Letter comprising the Technical Bid) including **Annexure I-V** and supporting certificates / documents.
- b) Power of Attorney for signing the BID as per the format at **Appendix-III**.
- c) In case of Joint venture, Power of Attorney for **Lead Member** of Joint Venture as per the format at **Appendix VII**
- d) In case of Joint venture, Joint Bidding Agreement for Joint Venture as per the format at **Appendix VIII**
- e) Bidder shall comply with Integrity Pact (IP) as per **Appendix-IV** duly signed by Authorised signatory and shall be submitted by the Bidder with the RFP Bid. The same shall be part of the Contract Agreement.
- f) An undertaking from the person having PoA referred to in Sub. Clause-(b) above that they agree and abide by the Bid documents uploaded by RTDC and amendments uploaded, if any; and
- g) **Annexure-VII of Appendix - IA** showing details of all ongoing Project works (Ref Clause 10.3 (iv) of Document for EPC (Agreement)).
- h) Copy of Memorandum and Articles of Association, if the Bidder is a body corporate, and if a partnership then a copy of its partnership deed.
- i) Copies of duly audited complete annual accounts of the Bidder or of each Member (in case of Joint Venture) for preceding 5 years.

Financial Bid

Appendix-IB (Letter comprising the Financial Bid) shall be submitted online through e-procurement portal in accordance with the date specified in clause 1.4 of this RFP.

Physical Documents

The Bidder shall submit the following documents physically:

- (i) Original Power of Attorney for signing the BID as per format at **Appendix-III**.
- (ii) if applicable, Original Power of Attorney for **Lead Member** of Joint Venture as per the format at **Appendix VII**
- (iii) if applicable, Original Joint Bidding Agreement for Joint Venture as per the format at **Appendix VIII**
- (iv) An undertaking from the person having Power of Attorney (PoA) referred to in **Sub-Clause b(i)** above that they agree and abide by the Bid documents uploaded by RTDC amendments uploaded, if any

3.4.3 The documents listed at above clause shall be placed in an envelope, which shall be sealed and shall clearly indicate the name and address of the Bidder. In addition, the BID Due Date should be indicated on the right-hand top corner of the envelope.

3.4.4 The envelope shall be addressed to the following officer and shall be submitted at the respective address:

Deputy General Manager,

Ropeways and Rapid Transport System Development Corporation H.P. Limited

US Club - Shimla -1

3.4.5 If the envelope is not sealed and marked as instructed above, the Authority assumes no responsibility for the misplacement or premature opening of the contents of the BID submitted and consequent losses, if any, suffered by the Bidder.

3.4.6 BIDs submitted by fax, telex, telegram, or e-mail shall not be entertained and shall be summarily rejected.

3.5 Modifications/ Substitution/ withdrawal of BIDs

3.5.1 The Bidder shall modify, substitute, or withdraw its e- BID after submission prior to the BID Due Date. No BID can be modified, substituted, or withdrawn by the Bidder on or after the BID Due Date & Time.

3.5.2 For modification of e-BID, Bidder must detach its old BID from e-procurement portal and upload / resubmit digitally signed modified BID.

3.5.3 For withdrawal of BID, Bidder must click on withdrawal icon at e-procurement portal and can withdraw its e-BID. Before withdrawal of a BID, it shall specifically be noted that after withdrawal of a BID for any reason, Bidder cannot re-submit e-BID again.

3.6 BID Due Date

Financial bid comprising of the documents listed at above clause shall be submitted online through <https://hptenders.gov.in> in accordance with the date specified in clause 1.4 of this RFP.

- (i) Bids have to be submitted online on the e-bidding website.
- (ii) Submission of Bids shall be closed on the e-bidding website on the time and date stated in the NIT after which no bid shall be accepted.
- (iii) It shall be the responsibility of the Bidder to ensure that their bid is submitted online on website of procurement portal before the deadline of submission.
- (iv) The Bid submitted online will be taken as a final bid.

3.7 Proprietary data

All documents and other information supplied by the Authority or submitted by a Bidder to the Authority shall remain or become the property of the Authority and are transmitted to the Bidders solely for the purpose of preparation and submission of a bid in accordance herewith. Bidders are to treat all information as strictly confidential and shall not use it for any purpose other than for preparation and submission of their bid.

3.8 Cost of Bidding

The Bidders shall be responsible for all of the costs associated with the preparation of their bid and their participation in the Bidding Process. The Authority will not be responsible or in any way liable for such costs, regardless of the conduct or outcome of the Bidding Process.

3.9 Site visit and verification of information

3.9.1 Bidders are encouraged to submit their respective bid after visiting the Project site and ascertaining for themselves the site conditions, traffic, location, surroundings, construction, access to site, handling and storage of materials, weather data, applicable laws and regulations, and any other matter considered relevant by them. Bidders are advised to visit the site and familiarise themselves with the Project within the stipulated time of submission of the Bid. No extension of time is likely to be considered for submission of Bids.

3.9.2 It shall be deemed that by submitting a bid,

- a) The Bidder has made a complete and careful examination of the Bidding Documents, and received all relevant information requested from the Authority.
- b) Accepted the risk of inadequacy, error or mistake in the information provided in the Bidding Documents or furnished by or on behalf of the Authority relating to any of the matters.
- c) No claim shall be admissible at any stage on this account.
- d) Satisfied itself about all matters, things and information hereinabove necessary and required for submitting an informed bid, execution of the Project in accordance with the Bidding Documents and performance of all of its obligations thereunder.
- e) Acknowledged and agreed that inadequacy, lack of completeness or incorrectness of information provided in the Bidding Documents or ignorance of any of the matters

hereinabove shall not be a basis for any claim for compensation, damages, extension of time for performance of its obligations, loss of profits etc. from the Authority, or a ground for termination of the Agreement by the Contractor.

- f) Acknowledged that it does not have a Conflict of Interest; and
- g) Agreed to be bound by the undertakings provided by it under and in terms hereof.

3.9.3 The Authority shall not be liable for any omission, mistake, or error in respect of any of the above or on account of any matter or thing arising out of or concerning or relating to RFP, including any error or mistake therein or in any information or data given by the Authority.

3.10 Verification and Disqualification

3.10.1 The Authority reserves the right to verify all statements, information and documents submitted by the Bidder in response to the RFP and the Bidder shall, when so required by the Authority, make available all such information, evidence and documents as shall be necessary for such verification. Any such verification or lack of such verification, by the Authority shall not relieve the Bidder of its obligations or liabilities hereunder nor will it affect any rights of the Authority thereunder.

3.10.2 The Authority reserves the right to reject any bid and forfeit the BID Security if:

- a. at any time, a material misrepresentation is made or uncovered, or
- b. The Bidder does not provide, within the time specified by the Authority, the supplemental information sought by the Authority for evaluation of the bid. Such misrepresentation/ improper response shall lead to the disqualification of the Bidder. If the Bidder is a Joint Venture, then the entire Joint Venture and each Member of the Joint Venture shall be disqualified / rejected.

3.10.3 In case it is found during the evaluation or at any time before signing of the Agreement, that one or more of the eligibility and /or qualification requirements have not been met by the Bidder, or the Bidder has made material misrepresentation or has given any materially incorrect or false information, the Bidder shall be disqualified forthwith if not yet appointed as the contractor either by issue of the LOA or entering into of the Agreement, and if the Selected Bidder has already been issued the LOA or has entered into the Agreement, as the case may be, the same shall, notwithstanding anything to the contrary contained therein or in this RFP, be liable to be terminated, by a communication in writing by the Authority to the Selected Bidder or the Contractor, as the case may be, without the Authority being liable in any manner whatsoever to the Selected Bidder or the Contractor. In such an event, the Authority shall be entitled to forfeit and appropriate the Bid Security or Performance Security, as the case may be, as Damages, without prejudice to any other right or remedy that may be available to the Authority under the Bidding Documents and / or the Agreement, or otherwise.

3.10.4 A Bidder shall be liable for disqualification and forfeiture of bid Security, if any legal, financial or technical adviser of the Authority in relation to the Project is engaged by the Bidder, its Member or any Associate thereof, as the case may be, in any manner for matters related to or incidental to such Project during the Bidding Process or subsequent

to the (i) issue of the LOA or (ii) execution of the Agreement. In the event any such adviser is engaged by the selected Bidder or Contractor, as the case may be, after issue of the LOA or execution of the Agreement for matters related or incidental to the Project, then notwithstanding anything to the contrary contained herein or in the LOA or the Agreement and without Prejudice to any other right or remedy or the Authority, including the forfeiture and appropriation of the Bid Security or Performance Security, as the case may be, which the Authority shall have there under or otherwise, the LOA or the Agreement, as the case may be, shall be liable to be terminated without the Authority being liable in any manner whatsoever to the Selected Bidder or Contractor for the same. For the avoidance or doubt, this disqualification shall not apply where such adviser was engaged by the Bidder, its Member or Associate in the past but its assignment expired or was terminated 6 (six) months prior to the date of issue of this RFP. Nor will this disqualification apply where such adviser is engaged after a period of 3 (three) years from the date of commercial operation of the Project.

3.11 Contents of the Bid Document

This RFP comprises the Disclaimer set forth hereinabove, the contents as listed below and will additionally include any Addenda issued.

Sr. no.	Particulars	Description
1	Volume - I	Request for Proposal (RFP)
2	Volume - II	General Condition & Particular Condition (GC & PC)
3	Volume - III	Authority's Requirements
		Part-1: General, Functional, Design, Construction and Appendices.
		Part-2: Outline Construction Specifications for Civil Works)
		Part-3: Electromechanical works Including Outline Construction Specifications
4	Volume - IV	Tender Drawings (Drawings)
5	Volume - V	Operation and Maintenance (O & M) Requirements
6	Volume - VI	Environment & Social Management Plan (ESMP)
7	Volume - VII	Detailed Project Report (DPR) The DPR is for reference only & would not be the part of agreement. The bidders are expected to do their due diligence before bidding for the Project. No claim shall be entertained by the Authority for any lapses and errors in the data of the DPR.

3.12 Clarifications

3.12.1 Bidders requiring any clarification on the RFP shall notify the Authority in writing by e-mail. They should send in their queries on or before the date mentioned in the Schedule of Bidding Process. The Authority shall endeavour to respond to the queries within the period specified therein, the responses will be sent by fax or e-mail. The Authority will forward all the queries and its responses thereto, to all Bidders without identifying the source of queries.

3.12.2 The Authority shall endeavour to respond to the questions raised or clarifications sought by the Bidders. However, the Authority reserves the right not to respond to any question or provide any clarification, in its sole discretion, and nothing in this Clause shall be taken or read as compelling or requiring the Authority to respond to any question or to provide any clarification.

3.12.3 The Authority shall also on its own motion, if deemed necessary, issue interpretations & clarifications to all Bidders. All clarifications & interpretations issued by the Authority shall be deemed to be part of the Bidding Documents. Verbal clarifications and information given by Authority, or its employees or representatives shall not in any way or manner be binding on the Authority.

3.13 Amendment of RFP

3.13.1 At any time prior to the Bid Due Date, the Authority shall, for any reason, whether at its own initiative or in response to clarifications requested by a Bidder, modify the RFP by the issuance of Addenda.

3.13.2 Any Addendum issued hereunder will be hosted on the website <https://hptenders.gov.in>.

3.13.3 In order to afford the Bidders a reasonable time for taking an Addendum into account, or for any other reason, the Authority shall, in its sole discretion, extend the Bid Due Date.

3.14 Procedure for e-tendering

3.14.1 Accessing/ Purchasing of BID documents

3.14.1.1 It is mandatory for all the Bidders to have class-III Digital Signature Certificate (DSC) in the name of Authorized Signatory / Firm or Organization / Owner of the Firm or Organization) from any of the licensed Certifying Agency (Bidders can see the list of licensed CAs from the link www.cca.gov.in) to participate in e-tendering of MoRT&H/ NHAI/NHIDCL/BRO/State PWD.

3.14.1.2 DSC should be in the name of the authorized signatory as authorized in Appendix III of this RFP or person executing/delegating such Appendix III in favour of Authorized Signatory. It should be in corporate capacity (that is in Bidder capacity / in case of JV in the Lead Member capacity, as applicable). The Bidder shall submit a document in support of the class III DSC. In other cases, the bid shall be considered non-responsive.

3.14.1.3 To participate in the bidding, it is mandatory for the Bidders to get registered their firm / Joint Venture with e-tendering portal <https://hptenders.gov.in> to have user ID & password which has to be obtained free of cost. Following may kindly be noted:

(a) Registration with e-tendering portal should be valid at least up to the date of submission of BID.

(b) BIDs can be submitted only during the validity of registration.

3.14.1.4 It is also mandatory for the Bidders to get their firms registered with e-tendering portal. The Bidders shall update their project and other details on the portal on a regular basis and apply to the tenders via the portal.

3.14.1.5 If the firm / Joint Venture is already registered with e-tendering service provider, and validity of registration is not expired, then the firm / Joint Venture is not required to have a fresh registration.

3.14.1.6 The complete BID document can be viewed / downloaded by the Bidder from e-tendering portal <https://hptenders.gov.in> from 30/10/2024 5.00 P.M. to 31/12/2024 till 11.00 A.M. IST

3.14.2 Preparation & Submission of BIDs:

3.14.2.1 The Bidder may submit his Bid online following the instructions appearing on the screen. Detailed guidelines for e-tendering is also available on e-tendering portal.

3.14.2.2 The documents listed at Clause 3.5 shall be prepared and scanned in different files (in PDF or RAR format such that file size is not more than 30 MB) and uploaded during the on-line submission of BID.

3.14.2.3 Bid must be submitted online only through e-tendering portal <https://hptenders.gov.in> using the digital signature of authorized representative of the Bidder on or before 31/12/2024 till 11.00 A.M. IST

3.14.3 Modifications/ Substitution/ withdrawal of BIDs

3.14.3.1 For modification of e-BID, Bidder has to detach its old BID from portal and upload / resubmit digitally signed modified BID. For withdrawal of BID, Bidder has to click on withdrawal icon at e-tendering portal and can withdraw its e-BID. Before withdrawal of a BID, it may specifically be noted that after withdrawal of a BID for any reason, Bidder cannot re-submit e-BID again.

3.15 Online Opening of Bids:

3.15.1 **Opening** of BIDs will be done through online process.

3.15.2 The RTDC shall on-line open Technical BIDs in accordance with the date specified in clause 1.4 of this RFP first, in the presence of the authorized representatives of the Bidders, who choose to attend. The RTDC will subsequently examine and evaluate the Bids in accordance with the provisions of **Section 4** of RFP.

3.15.3 The Authority would display the result of technical evaluation on the web portal including reasons for non- responsiveness, if any, and the financial bid will be opened thereafter.

3.16.1 Notwithstanding anything contained in this RFP, the Authority reserves the right to reject any Bid and to annul the Bidding Process and reject all Bids at any time without any liability or any obligation for such acceptance, rejection, or annulment, and without assigning any reasons thereof. In the event that the Authority rejects or annuls all the bids, it shall, in its discretion, invite all eligible Bidders to submit fresh bids hereunder.

3.16.2 The Authority reserves the right not to proceed with the Bidding Process at any time, without notice or liability, and to reject any bid without assigning any reasons.

The Bids shall be valid for a period of not less than 180 (one hundred and eighty) days from the BID Due Date. The validity of BIDs shall be extended by mutual consent of the respective Bidders and the Authority.

Information relating to the examination, clarification, evaluation, and recommendation for the Bidders shall not be disclosed to any person who is not officially concerned with the process or is not a retained professional advisor advising the Authority in relation to, or matters arising out of, or concerning the Bidding Process. The Authority will treat all information, submitted as part of the bid, in confidence and will require all those who have access to such material to treat the same in confidence. The Authority shall not divulge any such information unless it is directed to do so by any statutory entity that has the power under law to require its disclosure or is to enforce or assert any right or privilege of the statutory entity and/ or the Authority or as shall be required by law or in connection with any legal process.

The Authority shall not entertain any correspondence with any Bidder in relation to acceptance or rejection of any bid. However, the Authority would display the result of technical evaluation on the web portal including reasons for non- responsiveness, if any, and the financial bid will be opened thereafter.

3.20 BID Security

- 3.20.1 The Authority shall be entitled to forfeit and appropriate the Bid Security as Damages inter alia in any of the events specified in **Clause 3.21.2** herein below. The Bidder, by submitting its Bid pursuant to this RFP, shall be deemed to have acknowledged and confirmed that the Authority will suffer loss and damage on account of withdrawal of its bid or for any other default by the Bidder during the period of bid validity as specified in this RFP. No relaxation of any kind on bid Security shall be given to any Bidder.
- 3.20.2 The Bid Security shall be forfeited and appropriated by the Authority as damages payable to the Authority for, inter-alia, time cost and effort of the Authority without prejudice to any other right or remedy that shall be available to the Authority under the bidding documents and / or under the Agreement, or otherwise, under the following conditions:
- a. If a Bidder engages in a corrupt practice, fraudulent practice, coercive practice, undesirable practice, or restrictive practice as specified in **Clause 5** of this RFP.
 - b. If a Bidder withdraws its BID after Bid due date.
 - c. In the case of Selected Bidder, if it fails within the specified/extended time limit by Authority -
 - (i) to sign and return the duplicate copy of LOA.
 - (ii) to furnish the Performance Security; or
 - (iii) to sign the EPC Agreement.

4.0 EVALUATION AND OPENING OF TECHNICAL & FINANCIAL BIDS

4.1 Opening of Technical Bids

- 4.1.1 The Technical Bid of all Bidders who have submitted a valid cost of bid document shall be opened in the presence of representatives of bidders who choose to attend on date & time as mentioned in bid document in the office of Deputy General Manager, Ropeways and Rapid Transport System Development Corporation H.P Limited, US Club- Shimla -1, India.
- 4.1.2 The Authority shall open the Bids received in accordance with the date specified in clause 1.4 of this RFP at the office of Authority and in the presence of the Bidders who choose to attend. The Authority shall prepare minutes of the bid opening, including information disclosed to those present at the time of bid opening.
- 4.1.3 Non-receipt of “EMD / Bid Security” and / or “Bid fee”: Bids of those bidders who have not submitted “Cost of Bid Documents” and EMD / Bid Security shall not be opened and rejected summarily.
- 4.1.4 The bidders name and such other details as the Authority or their authorized representative, at their discretion, shall consider appropriate will be announced and recorded in the Minutes of Bid Opening at the time of bid opening.
- 4.1.5 The Financial Bid(s) which bidder(s) have uploaded online will be opened on a subsequent date; **at least Ten (10) days** after the evaluation results of Technical Bids are published on eProcurement portal.
- 4.1.6 The bidders who have any complaint about the evaluation results of Technical Bids may send their complaints to Director /RTDC at US Club, Shimla, 171001 (H.P.), Tel: 0177-2811001, Email: dir.rtdc@hpmail.in, in writing within five (5) days from the date of publication of evaluation results of Technical Bids. The complaints received after expiry of five (5) days shall not be entertained.
- 4.1.7 The complaints received within stipulated period of three (5) days shall be duly replied by Director /RTDC and Financial Bids shall be opened after that.
- 4.1.8 Financial Bids of only those bidders whose submissions are found responsive and technically compliant will be opened in the presence of qualified Bidders or their authorised representatives who choose to attend. The time of opening of Financial Bid shall be informed through e-procurement portal only.
- 4.1.9 The bidders are advised to visit e-procurement portal <https://hptenders.gov.in> regularly for any updates.

4.2 Evaluation of Bids

- 4.2.1 Firstly, it will be determined whether each bid is accompanied with the valid “Bid Cost” and EMD. Bids not accompanied with the valid Bid Cost and EMD shall be rejected and will not be evaluated further.

4.2.2 Bidders have to meet the Eligibility and Qualification Criteria specified in **Clause 3.2, 3.3, and 3.2.2 of Section 3** and the evaluation would be as per this Section. Bids of firms/JV/Consortium who do not meet these criteria shall be rejected. The Bidder's competence and capability is proposed to be established by the following parameters.

- a. Technical Capacity; and
- b. Financial Capacity

4.2.3 If any information furnished by the Bidder is found to be incomplete or contained in formats other than those specified herein, the Authority shall, in its sole discretion, exclude the relevant information for consideration of eligibility and qualification of the Bidder.

4.2.4 Determination of Responsiveness – Prior to the detailed evaluation of bids, the Authority will determine whether each bid is responsive to the requirements as stipulated in the bid documents. For the purpose of this Clause, a responsive bid is one, which conforms to all the terms, conditions and specifications of the bid documents without material deviation or reservation which include exceptions, exclusions & qualifications. If a bid is not substantially responsive to the requirements as stipulated in bid documents, it will be rejected by the Authority and will not subsequently be permitted to be made responsive by the Bidder by correction or withdrawal of the non-conformity or infirmity. The financial proposal of such Bidder shall not be opened.

4.2.5 Tests of responsiveness

As a first step towards evaluation of Technical BIDs, the Authority shall determine whether technical bid is responsive to the requirements of this RFP. A Technical bid shall be considered responsive only if:

- (i) Technical BID is received online as per the format at **Appendix-IA** including **Annexure I, IV, V**.
- (ii) Documents listed are received on E-Procurement portal as mentioned.
- (iii) Technical Bid is accompanied by the Bid Cost and EMD as specified.
- (iv) The Power of Attorney is uploaded on e-procurement portal as specified.
- (v) Technical Bid is accompanied by Power of Attorney for Lead Member of Joint Venture and the Joint Bidding Agreement as specified, if so required.
- (vi) Technical Bid contains all the information (complete in all respects).
- (vii) Technical Bid does not contain any condition or qualification.

- 4.2.6 To facilitate evaluation of Technical Bids, the Authority shall, at its sole discretion, seek clarifications in writing from any Bidder regarding its Technical Bid. Such clarification(s) shall be provided within the time specified by the Authority for this purpose. Any request for clarification(s) and all clarification(s) in response thereto shall be in writing. The bids will be examined and evaluated in accordance with the provisions set out in this Section. The Authority will subsequently flag issues if any with the data updated by the Bidders.
- 4.2.7 If a Bidder does not provide clarifications sought above within the prescribed time, its Bid shall be liable to be rejected. In case the Bid is not rejected, the Authority shall proceed to evaluate the Bid by construing the particulars requiring clarification to the best of its understanding, and the Bidder shall be barred from subsequently questioning such interpretation of the Authority.
- 4.2.8 In the event that a Bidder claims credit for an Eligible Project, and such claim is determined by the Authority as incorrect or erroneous, the Authority shall reject such claim for the purpose of qualification requirements.
- 4.2.9 The Authority will get the Bid Security verified from the issuing authority and after due verification, the Authority will evaluate the Technical Bids for their compliance to the eligibility and qualification requirements of this RFP.
- 4.2.10 Evaluation of Material deviation or reservation; Each bid shall be evaluated for any material deviation or reservation. Material deviation or reservation is one:
- a) which contains any deviation in EMD;
 - b) which affects in any substantial way, the scope, quality or performance of the Works;
 - c) which limits in any substantial way, is inconsistent with the Bid Documents the Authority's right or the Bidder's obligations under the Contract; or
 - d) whose rectification would affect unfairly the competitive position of other bidders presenting responsive bids.
- Bid having any material deviation or reservation shall be disqualified and rejected.
- 4.2.11 The Authority shall evaluate those Technical Proposals only who meet minimum requirement as prescribed in the EQC.
- 4.2.12 If any bid is rejected, the Financial Bid of such bidder shall not be opened.

4.2.13 Evaluation of Financial Proposals: All technically responsive bids will be eligible for opening of their financial proposals. The Authority shall notify all technically qualified Bidders regarding opening of the financial proposal, such bidders shall witness the financial opening.

4.2.13.1 Consideration of Abnormally Low Bids: An abnormally low Bid is one in which the Bid price, (Capital cost and Operation & Maintenance cost to be evaluated separately under this clause) in combination with other elements of the Bid, appears so low that it raises substantive concerns as to the capability of the Bidder to perform the Contract at the offered prices. A bid shall be considered as abnormally low if the bidder offers a price that is 20% lower than the average price of all other offers. The Authority shall in such case seek written clarifications from the Bidder, including detailed price analysis of its Bid price in relation to scope, schedule, allocation of risks and responsibilities, and any other requirements of the bid document.

If, after evaluating the price analysis and clarification provided by the bidder,

- a) the Authority determines that the Bidder has substantively failed to demonstrate its capability to deliver the Contract at the offered price, the Authority shall reject the Bid.
- b) If Authority is satisfied with clarification provided by the bidder, his bid may be considered for award. However, Bank Guarantee of 3% of bid price as an additional Performance Security shall be obtained from the bidder duly pledged in favour of Deputy General Manager, Ropeways and Rapid Transport System Development Corporation H.P. Limited, Shimla” Himachal Pradesh.
- c) The decision by the Authority is final and binding in this regard.

4.2.14 The financial proposal(s) will then be opened online through e-procurement portal. the lowest cost discovered at e-procurement portal is not the deciding factor for award, there will be manual calculation on Guaranteed Power Consumption as per illustration provided at Annexure – A: Guaranteed Power Consumption and accordingly the quoted prices shall be adjusted.

4.2.15 The evaluation of Financial Proposals by the Authority will take into account, in addition to the bid amounts, the following factors:

- a) Quoted prices shall be adjusted to arrive at lowest bid (L1) as per the procedure described in the **Annexure – A: Guaranteed Power Consumption**.
- b) If the Bid that is evaluated as the lowest evaluated cost is, in the Authority’s opinion, seriously abnormally low, the Authority shall require the Bidder to provide written clarifications. Clarifications shall include detailed price analyses to demonstrate the consistency of the Bid prices with the scope of works, proposed methodology,

schedule and any other requirements of the Bid document. After evaluation of the price analyses, in the event that the Authority determines that the Bidder has failed to demonstrate its capability to perform the Contract for the offered Bid Price, the Authority shall reject the Bid.

- c) Price adjustment provisions applicable during the period of execution of the Contract shall not be taken into account in bid evaluation.
- d) Evaluation of financial offer will be based on values as per Pricing Document and rates quoted. Price quoted for the conforming bid shall only be considered for financial evaluation. Any alteration in the above will not be given any cognizance.
- e) Comparison of Bids: Bids will be compared in Indian Rupees (INR) only.

4.2.16 Selection of Bidder

The Bidder whose Bid is adjudged as responsive in terms of **Clause 4.2.5** will be evaluated for Technical Score as given below:

Technical Score

- a) Bidders scoring 70 marks and above out of 100 marks under technical evaluation criteria shall be shortlisted for FINANCIAL BID opening.
- b) Evaluation of Technical Bid shall be based on parameters mentioned below:

S. No.	Criteria	Max. Marks	Scale of marking
1.	The Bidders who have successfully completed or substantially completed similar works as defined in Clause No. 3.2.2 i of which falling during last 7 (Seven) years ending last day of the month before the month of Bid submission as given below. a) At least one “similar work” of value of INR 10930 million or more (excluding GST, if applicable). OR b) At least two “similar works” each of value of INR 6830 million or more (excluding GST, if applicable) OR c) At least three “similar works” each of value of INR 5470 million or more	20	Completed Works as per EQC whether a) or b) or c) – 10 Marks 1. For one additional completed similar work of value INR 10930 million or more (excluding GST, if applicable) - 10 marks each subject to ceiling of 10 Marks 2. For one additional completed similar work of value INR 6830 million or more (excluding GST, if applicable)- 05 marks each subject to ceiling of 10 Marks 3. For one additional completed similar work of value INR 5470 million or more (excluding GST, if applicable) - 2 marks each subject to ceiling of 10 Marks

S. No.	Criteria	Max. Marks	Scale of marking
	(excluding GST, if applicable).		Limit of additional marks shall be 15 marks maximum.
2.	Approach and Methodology including Staffing schedule and Work Plan for Construction and Operation & Maintenance of Ropeway.	15	a) Technical Approach and Methodology – 5 Marks b) Work Plan – 5 Marks c) Organization and Staffing – 5 Marks
3.	Proposed Key Personnels	20	CVs of Key Personnels
4.	Proposed Equipment's and Machines	5	List of minimum Equipment's and Machines to be deployed.
5.	Average Annual Turnover as per Clause 3.3.1 (b).	15	Marking system to be as follows. a) Meets EQC: 10 Marks b) 30% and above of EQC: 5 Marks
6.	Net Worth as per Clause 3.3.1(a).	10	Marking system to be as follows. a) Meets EQC: 05 Marks b) 30% and above of EQC: 5 Marks
7.	Bid Capacity as per Clause 3.3.2.	15	Marking system to be as follows. a) Meets EQC: 10 Marks b) 30% and above of EQC: 5 Marks
	Total	100	

4.2.17 After selection, a Letter of Acceptance (the “**LOA**”) shall be issued in the format set forth in **Appendix-VI**, in duplicate, by the Authority to the Selected Bidder and the Selected Bidder shall, within **7(seven)** days of the receipt of the LOA, sign and return the duplicate copy of the LOA in acknowledgement thereof. In the event the duplicate copy of the LOA duly signed by the Selected Bidder is not received by the stipulated date, the Authority shall, unless it consents to extension of time for submission thereof, appropriate the BID Security of such Bidder as Damages on account of failure of the Selected Bidder to acknowledge the LOA.

- 4.2.18 After acknowledgement of the LOA as aforesaid by the Selected Bidder, it shall cause the Bidder to submit Performance Security and Additional Performance Security (if any) within the period prescribed/extended by Authority and then execute the Agreement within the stipulated period as per RFP. The Selected Bidder shall not be entitled to seek any deviation, modification, or amendment in the Agreement.
- 4.2.19 After having received the performance security and verified it, the Authority shall invite the selected bidder for signing of Contract Agreement on a date and time convenient to both parties with-in **10 days** of receipt of valid Performance Security.
- 4.2.20 Authority shall return Bid Security of all bidders except for L-1. The same shall be dealt as per this RFP.
- 4.2.21 The successful firm with whom the contract is signed is expected to commence the assignment on the date and at the location specified in the data sheet.

5.0 FRAUD AND CORRUPT PRACTICES

- 5.1** The Bidders and their respective officers, employees, agents and advisers shall observe the highest standard of ethics during the Bidding Process and subsequent to the issue of the LOA and during the subsistence of the Agreement. Notwithstanding anything to the contrary contained herein, or in the LOA or the Agreement, the Authority shall reject a BID, withdraw the LOA, or terminate the Agreement, as the case may be, without being liable in any manner whatsoever to the Bidder, if it determines that the Bidder, directly or indirectly or through an agent, engaged in corrupt practice, fraudulent practice, coercive practice, undesirable practice or restrictive practice in the Bidding Process. In such an event, the Authority shall be entitled to forfeit and appropriate the BID Security or Performance Security, as the case may be, as Damages, without prejudice to any other right or remedy that shall be available to the Authority under the Bidding Documents and/ or the Agreement, or otherwise.
- 5.2** Without prejudice to the rights of the Authority under Clause 5.1 hereinabove and the rights and remedies which the Authority shall have under the LOA or the Agreement, or otherwise if a Bidder or Contractor, as the case may be, is found by the Authority to have directly or indirectly or through an agent, engaged or indulged in any corrupt practice, fraudulent practice, coercive practice, undesirable practice or restrictive practice during the Bidding Process, or after the issue of the LOA or the execution of the Agreement, such Bidder shall not be eligible to participate in any bid or RFP issued by the Authority during a period of 2 (two) years from the date such Bidder, or Contractor, as the case may be, is found by the Authority to have directly or indirectly or through an agent, engaged or indulged in any corrupt practice, fraudulent practice, coercive practice, undesirable practice or restrictive practices, as the case may be.
- 5.3** For the purposes of this Section 5, the following terms shall have the meaning hereinafter respectively assigned to them:
- a. “Corrupt practice”:** making offers or bribe, rewards or gifts or any material benefit, in exchange for an unfair advantage in the procurement process or to otherwise influence the procurement process or contract execution.
 - b. “Fraudulent practice”:** any omission or misrepresentation that shall mislead or attempt to mislead so that financial or other benefits shall be obtained, or an obligation avoided. This includes making false declarations or providing false information to participate in a bid process or to secure a contract or the execution of the contract.
 - c. “Coercive practice”:** harming or threatening to harm, persons or their property to influence their participation in the procurement process or affect the execution of a contract.
 - d. Anti-competitive practice”:** any collusion, bid rigging or anti-competitive arrangement, or any other practice coming under the purview of The Competition Act, 2002, between two or more bidders, with or without the knowledge of the procuring entity, that shall impair the transparency, fairness and the progress of the procurement process or to establish bid prices at artificial, non-competitive levels.

- e. “Obstructive practice”:** materially impede the procuring entity’s investigation into allegations of one or more of the above mentioned prohibited practices either by deliberately destroying, falsifying, altering; or by concealing of evidence material to the investigation; or by making false statements to investigators and/or by threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or by impeding the procuring entity’s rights of audit or access to information.
- f. “Undesirable practice” means**
- (i) establishing contact with any person connected with or employed or engaged by the Authority with the objective of canvassing, lobbying or in any manner influencing or attempting to influence the Bidding Process; or
 - (ii) having a Conflict of Interest.

6.0 PRE-BID CONFERENCE

- 6.1** Pre-BID conference of the Bidders shall be convened at the designated date, time and place. Pre-Bid conference will be conducted through Video Conference. In case Bidder wants to physically attend Pre-Bid Conference, maximum of two representatives of Bidders shall be allowed to participate on production of authority letter from the Bidder.
- 6.2** During the course of Pre-Bid conference(s), the Bidders will be free to seek clarifications and make suggestions for consideration of the Authority. The Authority shall endeavour to provide clarifications and such further information as it shall, in its sole discretion, consider appropriate for facilitating a fair, transparent, and competitive Bidding Process.
- 6.3** The bidders are requested to share the pre-bid queries 3 to 5 days before the pre-bid meeting so as the Authority has time to deliberate internally.
- 6.4** The bidders are also requested to send their queries in the following format along with editable format.

Name of the bidder:		Date:	
S. No.	Clause No. & Page No.	Description	Query

7.0 MISCELLANEOUS

- 7.1** The Bidding Process shall be governed by, and construed in accordance with, the laws of India and the Courts at Shimla shall have exclusive jurisdiction over all disputes arising under, pursuant to and/ or in connection with the Bidding Process.
- 7.2** The Authority, in its sole discretion and without incurring any obligation or liability, reserves the right, at any time, too.
- a. Suspend and/ or cancel the Bidding Process and/ or amend and/ or supplement the Bidding Process or modify the dates or other terms and conditions relating thereto.
 - b. Consult with any Bidder in order to receive clarification or further information.
 - c. Retain any information and/ or evidence submitted to the Authority by, on behalf of, and/ or in relation to any Bidder; and/ or
 - d. independently verify, disqualify, reject and/ or accept any and all submissions or other information and/ or evidence submitted by or on behalf of any Bidder.
- 7.3** It shall be deemed that by submitting the Bid, the Bidder agrees and releases the Authority, its employees, agents and advisers, irrevocably, unconditionally, fully and finally from any and all liability for claims, losses, damages, costs, expenses or liabilities in any way related to or arising from the exercise of any rights and/ or performance of any obligations hereunder, pursuant hereto and/ or in connection with the Bidding Process and waives, to the fullest extent permitted by applicable laws, any and all rights and/ or claims it shall have in this respect, whether actual or contingent, whether present or in future.

8.0 APPENDICES

APPENDIX – I A: LETTER COMPRISING THE TECHNICAL BID

Dated:

To,
Deputy General Manager,
Ropeways and Rapid
Transport System
Development Corporation
H.P. Ltd (RTDC)
U.S. Club, Shimla-1

Sub: Bid for “Design, Supply, Construction, Installation, Testing, Commissioning and Operation & Maintenance for 5 (five) years of Seamless Innovative Urban Transportation (Ropeways, Lifts & Escalators Etc.) Network in Shimla City (Himachal Pradesh) on Engineering Procurement and Construction (EPC) Mode.”

Dear Sir,

1. With reference to your **RFP** dated I/we, having examined the **RFP** and understood their contents, hereby submit my/our Bid for the aforesaid Project. The Bid is unconditional and unqualified.
2. I/ We acknowledge that the Authority will be relying on the information provided in the Bid and the documents accompanying the Bid for selection of the EPC Contractor for aforesaid Project, and we certify that all information provided in the Bid is true and correct; nothing has been omitted which renders such information misleading; and all documents accompanying the Bid are true copies of their respective originals.
3. This statement is made for the express purpose of our selection as EPC Contractor for the development, Design, and construction of the aforesaid Project.
4. I/We shall make available to the Authority any additional information it may find necessary or requires supplementing or authenticating the Bid.
5. I/We acknowledge the right of the Authority to reject our Bid without assigning any reason or otherwise and hereby waive our right to challenge the same on any account whatsoever.
6. We certify that in the last three years, we/any of the JV/Consortium Members or our/ their associate have neither failed to perform on any contract, as evidenced by imposition of a penalty or a judicial pronouncement or arbitration award, nor been expelled from any Project or contract nor have had any contract terminated for breach on our part.
7. I/We declare that:
 - (a) I/We have examined and have no reservations to the RFP, including any Addendum issued by the Authority; and
 - (b) I/We do not have any conflict of interest as per the conditions of the RFP.

- (c) I/We have not directly or indirectly or through an agent engaged or indulged in any corrupt practice, fraudulent practice, coercive practice, undesirable practice, or restrictive practice as defined in the RFP, in respect of any bid or request for proposal issued by or any agreement entered into with the Authority or any other public sector enterprise or any government, Central or State; and
 - (d) I/We hereby certify that we have taken steps to ensure that in conformity with the provisions of the RFP, no person acting for us or on our behalf has engaged or will engage in any corrupt practice, fraudulent practice, coercive practice, undesirable practice, or restrictive practice; and
 - (e) the undertaking given by us along with the Bid in response to the “Bidding Document” for the Project were true and correct as on the date of making the Bid and are also true and correct as on the Bid due date and I /We shall continue to abide by them.
8. I/We understand that Authority may cancel the Bidding Process at any time and that Authority are neither bound to accept any Bid that you may receive nor to invite the Bidders to Bid for the Project, without incurring any liability to the Bidders, in accordance with the RFP.
 9. I/We believe that we/ our JV/Consortium/ proposed JV/Consortium satisfy(s) the Net Worth criteria and meet(s) the requirements as specified in the RFP.
 10. I/We certify that in regard to matters other than security and integrity of the country, we/any Member of the JV/Consortium or any of our/ their Associates have not been convicted by a Court of Law or indicted or adverse orders passed by a regulatory authority which could cast a doubt on our ability to undertake the Project or which relates to a grave offence that outrages the moral sense of the community.
 11. I/We further certify that in regard to matters relating to security and integrity of the country, we/any Member of the JV/Consortium or any of our/their Associates have not been charge-sheeted by any agency of the Government or convicted by a Court of Law.
 12. I/We further certify that no investigation by a regulatory authority is pending either against us or against our Associates or against our CEO or any of our directors /managers /employees.
 13. I/We undertake that in case due to any change in facts or circumstances during the Bidding Process, we are attracted by the provisions of disqualification in terms of the guidelines referred to above, we shall intimate the Authority of the same immediately.
 14. I/We acknowledge and undertake that our JV/Consortium was qualified and short- listed on the basis of Technical Capacity and Financial Capacity of those of its Members or ASSOCIATE PARTNER.
 15. I/We acknowledge and agree that in the event of a change in control of an Associate whose Technical Capacity and/ or Financial Capacity was taken into consideration for the purposes of short- listing and qualification under and in accordance with the RFP, I/We shall inform the Authority forthwith along with all relevant particulars and the Authority may, in its sole discretion, disqualify our JV/Consortium or withdraw the Letter of Award, as the

- Request for Proposal

Agreement.

In witness thereof, I/We submit this Bid under and in accordance with the terms of the RFP.

Yours faithfully,

Date: (Signature, Name, and designation of the Authorized signatory)Place:

Name and seal of Bidder/Lead Member

Note: - The bidder may strike out the provisions applicable to JV/consortium if the bidder is not a JV/Consortium.

Date: (Signature, name, and designation of the Authorized Signatory)

Place: Name and seal of the Bidder/ Lead Member

APPENDIX – I B: LETTER COMPRISING THE FINANCIAL BID

Dated:

To,

Deputy General Manager,

Ropeways and Rapid

Transport System

Development Corporation

H.P. Ltd (RTDC)

U.S. Club, Shimla-1

Sub: Bid for “Design, Supply, Construction, Installation, Testing, Commissioning and Operation & Maintenance for 5 (five) years of Seamless Innovative Urban Transportation (Ropeways, Lifts & Escalators Etc.) Network in Shimla City (Himachal Pradesh) on Engineering Procurement and Construction (EPC) Mode.”

Dear Sir,

With reference to your RFP document dated *** **, I/we, having examined the Bidding Documents and understood their contents, hereby submit my/our BID for the aforesaid Project.

- The BID is unconditional.
- I/ We acknowledge that the Authority will be relying on the information provided in the BID and the documents accompanying the BID for selection of the Contractor for the aforesaid Project, and we certify that all information provided in the Bid are true and correct; nothing has been omitted which renders such information misleading; and all documents accompanying the BID are true copies of their respective originals.
- The BID Price has been quoted by me/us after taking into consideration all the terms and conditions stated in the RFP, draft Agreement, our own estimates of costs and after a careful assessment of the site and all the conditions that may affect the Project cost and implementation of the Project.
- I/ We acknowledge the right of the Authority to reject our BID without assigning any reason or otherwise and hereby waive, to the fullest extent permitted by applicable law, our right to challenge the same on any account whatsoever.
- In the event of my/ our being declared as the Selected Bidder, I/we agree to enter into an Agreement in accordance with the draft that has been provided to me/us prior to the BID Due Date. We agree not to seek any changes in the aforesaid draft and agree to abide by the same.
- I/ We shall keep this offer valid for 180 (one hundred and eighty) days from the BID Due Date Specified in the RFP.
- I/ We hereby submit our BID E-procurement Portal. <https://hptenders.gov.in> for undertaking the aforesaid Project in accordance with the Bidding Documents and the Agreement

Yours faithfully,

Date:

(Signature, name and designation of the

Place:

Authorized Signatory)

Name & seal of Bidder:

APPENDIX – II: BANK GUARANTEE FOR ERNEST MONEY DEPOSIT (EMD)

B.G. No.

Dated:

1. In consideration of you, *****, having its office at **** (hereinafter referred to as the “Authority”, which expression shall unless it be repugnant to the subject or context thereof include its, successors, and assigns) having agreed to receive the Bid of (a company registered under the Companies Act, 2013) and having its registered office at (and acting on behalf of its JV/Consortium) (hereinafter referred to as the “Bidder” which expression shall unless it be repugnant to the subject or context thereof include its/their executors, administrators, successors and assigns), for the “..... Project on EPC basis (hereinafter referred to as “the Project”) pursuant to the RFP dated issued in respect of the Project and other related documents including without limitation the draft EPC agreement (hereinafter collectively referred to as “Bidding Documents”), we (Name of the Bank) having our registered office at and one of its branches at (hereinafter referred to as the “Bank”), at the request of the Bidder, do hereby in terms of the RFP, irrevocably, unconditionally and without reservation guarantee the due and faithful fulfilment and compliance of the terms and conditions of the Bidding Document (including the RFP) by the said Bidder and unconditionally and irrevocably undertake to pay forthwith to the Authority an amount of INR ***** (Rupees ***** only) (hereinafter referred to as the “Guarantee”) as our primary obligation without any demur, reservation, recourse, contest or protest and without reference to the Bidder if the Bidder shall fail to fulfil or comply with all or any of the terms and conditions contained in the said Bidding Documents.
2. Any such written demand made by the Authority stating that the Bidder is in default of the due and faithful fulfillment and compliance with the terms and conditions contained in the Bidding Document shall be final, conclusive, and binding on the Bank.
3. We, the Bank, do hereby unconditionally undertake to pay the amounts due and payable under this Guarantee without any demur, reservation, recourse, contest or protest and without any reference to the Bidder or any other person and irrespective of whether the claim of the Authority is disputed by the Bidder or not, merely on the first demand from the Authority stating that the amount claimed is due to the Authority by reason of failure of the Bidder to fulfill and comply with the terms and conditions contained in the Bidding.
4. Documents including failure of the said Bidder to keep its Bid open during the Bid validity period as set forth in the said Bidding Document for any reason whatsoever. Any such demand made on the Bank shall be conclusive as regards amount due and payable by the Bank under this Guarantee. However, our liability under this Guarantee shall be restricted to an amount not exceeding INR ***** (Rupees ***** only).
- 4 This Guarantee shall be irrevocable and remain in full force for a period of 180 (one hundred and eighty) days from the Bid Due Date inclusive of a claim period of 60 (sixty) days or for such extended period as may be mutually agreed between the Authority and the

- Bidder, and agreed to by the Bank, and shall continue to be forceable till all amounts under this Guarantee have been paid.
- 5 We, the Bank, further agree that the Authority shall be the sole judge to decide as to whether the Bidder is in default of due and faithful fulfillment and compliance with the terms and conditions contained in the Bidding Document including ,inter alia, the failure of the Bidder to keep its Bid open during the Bid validity period set forth in the said Bidding Document, and the decision of the Authority that the Bidder is in default as aforesaid shall be final and binding on us, notwithstanding any differences between the Authority and the Bidder or any dispute pending before any Court, Tribunal, Arbitrator or any other Authority.
 - 6 The Guarantee shall not be affected by any change in the constitution or winding up of the Bidder or the Bank or any absorption, merger or amalgamation of the Bidder or the Bank with any other person.
 - 7 In order to give full effect to this Guarantee, the Authority shall be entitled to treat the Bank as the principal debtor. The Authority shall have the fullest liberty without affecting in any way the liability of the Bank under this Guarantee from time to time to vary any of the terms and conditions contained in the said Bidding Document or to extend time for submission of the Bids or the Bid validity period or the period for conveying acceptance of Letter of Award by the Bidder or the period for fulfilment and compliance with all or any of the terms and conditions contained in the said Bidding Document by the said Bidder or to postpone for any time and from time to time any of the powers exercisable by it against the said Bidder and either to enforce or forbear from enforcing any of the terms and conditions contained in the said Bidding Document or the securities available to the Authority, and the Bank shall not be released from its liability under these presents by any exercise by the Authority of the liberty with reference to the matters aforesaid or by reason of time being given to the said Bidder or any other forbearance, act or omission on the part of the Authority or any indulgence by the Authority to the said Bidder or by any change in the constitution of the Authority or its absorption, merger or amalgamation with any other person or any other matter or thing whatsoever which under the law relating to sureties would but for this provision have the effect of releasing the Bank from its such liability.
 - 8 Any notice by way of request, demand or otherwise hereunder shall be sufficiently given or made if addressed to the Bank and sent by courier or by registered mail to the Bank at the address set forth herein.
 - 9 We undertake to make the payment on receipt of your notice of claim on us addressed to [name of Bank along with branch address] and delivered at our above branch which shall be deemed to have been duly authorized to receive the said notice of claim.
 - 10 It shall not be necessary for the Authority to proceed against the said Bidder before proceeding against the Bank and the guarantee herein contained shall be forceable against the Bank, notwithstanding any other security which the Authority may have obtained from the said Bidder or any other person and which shall, at the time when proceedings are taken against the Bank hereunder, be outstanding or unrealized.
 - 11 We, the Bank, further undertake not to revoke this Guarantee during its currency except with the previous express consent of the Authority in writing.
 - 12 The Bank declares that it has power to issue this Guarantee and discharge the obligations contemplated herein, the undersigned is duly authorized and has full power to execute

this Guarantee for and on behalf of the Bank.

- 13 For the avoidance of doubt, the Bank's liability under this Guarantee shall be restricted to INR *** million (Rupees ***** million only). The Bank shall be liable to pay the said amount or any part thereof only if the Authority serves a written claim on the Bank in accordance with paragraph 9 hereof, on or before [*** (Indicate date falling 180 days after the Bid Due Date)].

Signed and Delivered by Bank

By the hand of Mr./Ms....., its..... and authorized official.

(Signature of the
Authorized Signatory)
(Official Seal)

APPENDIX – III: FORMAT FOR POWER OF ATTORNEY FOR SIGNING OF BID

Know all men by these presents, We (name of the firm and address of the registered office) do hereby irrevocably constitute, nominate, appoint and authorize Mr./Ms. (name) son/daughter/wife of..... and presently residing at , who is presently employed with us/ the Lead Member of our JV/Consortium and holding the position of , as our true and lawful attorney (hereinafter referred to as the “Attorney”) to do in our name and on our behalf, all such acts, deeds and things as are necessary or required in connection with or incidental to submission of our Bid for qualification and submission of our bid for the “the Passenger Ropeway Project proposed or being developed by the Ropeways and Rapid Transport System Development Authority Corporation HP Ltd. (RTDC) (the “Authority”) including but not limited to signing and submission of all Bid s, bids and other documents and writings, participate in Pre- Bid and other conferences and providing information/ responses to the Authority, representing us in all matters before the Authority, signing and execution of all contracts including the EPC Agreement and undertakings consequent to acceptance of our bid, and generally dealing with the Authority in all matters in connection with or relating to or arising out of our bid for the said Project and/ or upon award thereof to us and/or till the entering into of the EPC Agreement with the Authority.

AND we hereby agree to ratify and confirm and do hereby ratify and confirm all acts, deeds and things done or caused to be done by our said Attorney pursuant to and in exercise of the powers conferred by this Power of Attorney and that all acts, deeds and things done by our said Attorney in exercise of the powers hereby conferred shall and shall always be deemed to have been done by us.

IN WITNESS WHEREOF WE, ..., THE ABOVE-NAMED PRINCIPAL HAVE EXECUTED THIS POWER OF ATTORNEY ON THIS DAY OF 2.....

For

(Signature, name, designation, and address)

(Notarized)

Witnesses:

1.

2.

(Signature, name, designation, and address)

Accepted

..... (Signature)

(Name, Title, and Address of the Attorney)

Notes:

- The mode of execution of the Power of Attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and when it is so required, the same should be under common seal affixed in accordance with the required procedure.
- Wherever required, the Bidder should submit for verification the extract of the charter documents and documents such as a board or shareholders' resolution/ power of attorney in favor of the person executing this Power of Attorney for the delegation of power hereunder on behalf of the Bidder.
- For a Power of Attorney executed and issued overseas, the document will also have to be legalized by the Indian Embassy and notarized in the jurisdiction where the Power of Attorney is being issued. However, the Power of Attorney provided by Bidders from countries that have signed the Hague Legislation Convention 1961 are not required to be legalized by the Indian Embassy if it carries a conforming Apostilled certificate.

(To be executed on plain paper and submitted along with Technical Bid/Bid documents. To be signed by the Bidder and same signatory competent/ authorized to sign the relevant contract on behalf of the Authority)

BETWEEN

AND

Preamble

And Whereas the Principal values full compliance with all relevant laws of the land, rules of land, regulations, economic use of resources and of fairness/ transparency in its relations with its Bidder(s) and/ or Contractor(s). And whereas to meet the purpose aforesaid, both the parties have agreed to enter into this Integrity Pact (hereafter referred to as “Integrity Pact” or “Pact”) the terms and conditions of which shall also be read as integral part and parcel of the Bid documents and contract between the parties.

Now, therefore, in consideration of mutual covenants contained in this pact, the parties hereby agree as follows and this pact witnesses as under:

Article-1: Commitments of the Principal

1. The principal commits itself to take all measures necessary to prevent corruption and to observe the following principles: -
 - a. No employee of the principal, personally or through family Members, will in connection with the Bid for, or the execution of a Contract, demand, take a promise for or accept, for self, or third person, any material or immaterial benefit which the person is not legally entitled to.
 - b. The principal will, during the Bid process treat all Bidder(s) with equity and reason. The principal will in particular, before and during the Bid process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/ additional information through which the

Bidder(s) could obtain an advantage in relation to the bid process or the contract execution.

- c. The principal will exclude all known prejudiced persons from the process, whose conduct in the past has been of biased nature.
2. If the Principal obtains information on the conduct of any of its employees which is a criminal offence under the IPC/PC Act or any other Statutory Acts or if there be a substantive suspicion in this regard, the Principal will inform the Chief Vigilance Officer and in addition can initiate disciplinary actions as per its internal laid down Rules/Regulations.

Article - 2: Commitments of the Bidder(s)/ Contractor(s).

- a. The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the bid process and during the contract execution.
- b. The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to any of the Principal's employees involved in the bid process or the execution of the contract or to any third person any material or other benefit which he/she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the bid process or during the execution of the contract.
- c. The Bidder(s)/ Contractor(s) will not enter with other Bidders into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contract, submission or non-submission or bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process. The Bidder(s)/ Contractor(s) will not commit any offence under the relevant IPC/PC Act and other Statutory Acts; further the Bidder(s)/Contractor(s) will not use improperly, for purposes of completion or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.
- d. The Bidder(s)/ Contractor(s) of foreign origin shall disclose the name and address of the Agents/ Representatives in India, if any. Similarly, the Bidder(s)/ Contractor(s) of Indian Nationality shall furnish the name and address of the foreign principle, if any.
- e. The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract. He shall also disclose the details of services agreed upon for such payments.
- f. The Bidder(s)/ Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.
- g. The Bidder(s)/ Contractor(s) will not bring any outside influence through any Govt, bodies/quarters directly or indirectly on the bidding process in furtherance of his bid.

Article - 3 Disqualification from bid process and exclusion from future contracts

1. If the Bidder(s)/ Contractor(s), before award or during execution has committed a transgression through a violation of any provision of Article-2, above or in any other form

- ### Article- 4: Compensation for Damages

1. If the Principal has disqualified the Bidder(s) from the bid process prior to the award according to Article-3, the principal shall be entitled to forfeit the Earnest Money Deposit/ Bid Security or demand and recover the damages equivalent to Earnest Money Deposit/ Bid Security apart from any other legal right that may have accrued to the principal.
2. In addition to 1 above, the principal shall be entitled to take recourse to the relevant provisions of the contract related to Termination of Contract due to Contractor Default. In such case, the principal shall be entitled to forfeit the Performance Bank Guarantee of the Contractor and/ or demand and recover liquidated and all damages as per the provisions of the contract/EPC agreement against

Termination

Article- 5: Previous Transgressions

1. The Bidder declares that no previous transgressions occurred in the last 3 years immediately before signing of this Integrity Pact with any other Company in any country conforming to the anti-corruption/ Transparency International (TI) approach or with any other Public Sector Enterprise/ Undertaking in India or any Government Department in India that could justify his exclusion from the bid process.
2. If the Bidder makes incorrect statement on this subject, he can be disqualified from the bid process or action for his exclusion can be taken as mentioned under Article-3 above for transgressions of Article-2 and shall be liable for compensation for damages as per Article-4 above

Article - 6: Equal treatment of all Bidders/ Contractors.

1. The Bidder(s)/ Contractor(s) undertakes (s) to demand from all sub-contractors a commitment in conformity with this Integrity Pact and to submit it to the principal before contract signing.
2. The principal will enter into agreements with identical conditions as this one with all Bidders/ Contractors.
3. The principal will disqualify from the bid process all Bidders who do not sign this Pact or violate its provisions.

Article - 7: Criminal charges against violating Bidder(s)/ Contractor(s). If the Principal obtains knowledge of conduct of a Bidder/ Contractor, or of an employee or a representative or an associate of a Bidder/ Contractor, which constitutes corruption, or if the principal has substantive suspicion in this regard, the principal will inform the same to the Chief Vigilance Officer.

Article- 8: Pact Duration This Pact begins when both parties have legally signed it (in case of EPC). It expires for the Contractor 12 months after his Defect Notification Period is over or 12 months after his last payment under the contract whichever is later and for all other unsuccessful Bidders 6 months after this Contract has been awarded. If any claim is made/ lodged during his time, the same shall be binding and continue to be valid despite the lapse of this pact as specified above, unless it is discharged/ determined by Director General (Road Development) & Special Secretary.

Article- 9: Other Provisions.

1. This pact is subject to Indian Law. Place of performance and jurisdiction is the Registered Office of the Principal, i.e. Shimla.
2. Changes and supplements as well as termination notices need to be made in writing.
3. If the Bidder/Contractor is in a partnership or a consortium Joint Venture partner, this pact must be signed by all partners or consortium Members
4. Should one or several provisions of this agreement turn out to be invalid, the

remainder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

5. Any disputes/ differences arising between the parties with regard to term of this pact, any action taken by the principal in accordance with this Pact or interpretation thereof shall not be subject to any Arbitration.
6. The actions stipulated in this Integrity Pact are without prejudice to any other legal action that may follow in accordance with the provision of the extent law in force relating to any civil or criminal proceedings.

In witness whereof the parties have signed and executed this Pact at the place and date first done mentioned in the presence of following witness: -

(For & On behalf of the principal) (For & On behalf of the Bidder/Contractor)

(Office Seal)

Place

Date

Witness 1: (Name & Address):

Witness 2: (Name & Address):

APPENDIX – V: FORM OF BANK GUARANTEE [Performance Security]

To

_____ [name of Authority]

_____ [address of Authority]

WHEREAS _____ [name and address of Contractor] (hereafter called the “Contractor”) has undertaken, in pursuance of Letter of Acceptance (LOA) No. Dated. for construction of. [name of the Project] (hereinafter called the “Contract”).

AND WHEREAS the Contract requires the Contractor to furnish an {Performance Security/ Additional Performance Security} for due and faithful performance of its obligations, under and in accordance with the Contract, during the {Construction Period/Operation and Maintenance Period/Defects Notification Period} in a sum of million) (the “**Guarantee Amount**”²). through our branch at “Bank”) have agreed to furnish this Bank Guarantee (hereinafter called the “Guarantee”) by way of Performance Security. cr. (Indian Rupees INR..... million) (the Guarantee Amount”²).

AND WHEREAS we,..... through our branch at (the “Bank”) have agreed to furnish this Bank Guarantee (hereinafter called the “Guarantee”) by way of Performance Security.

NOW, THEREFORE, the Bank hereby, unconditionally, and irrevocably, guarantees and affirms as follows:

1. The Bank hereby unconditionally and irrevocably guarantees the due and faithful performance of the Contractor’s obligations during the {Construction Period / Defects Notification Period} under and in accordance with the Contract , and agrees and undertakes to pay to the Authority, upon its mere first written demand , and without any demur, reservation, recourse, contest or protest, and without any reference to the Contractor, such sum or sums up to an aggregate sum of the Guarantee Amount as the Authority shall claim, without the Authority being required to prove or to show grounds or reasons for its demand and/or for the sum specified therein.
2. Guarantee Amount for Performance Security and Additional Performance Security shall be calculated as per Contract.
3. A letter from the Authority, under the hand of an officer not below the rank of Deputy General Manager] Ropeways and Rapid Transport System Development Corporation US Club - Shimla -1 that the Contractor has committed default in the due and faithful performance of all or any of its obligations under and in accordance with the Contract shall be conclusive, final and binding on the Bank. The Bank further agrees that the Authority shall be the sole judge as to whether the Contractor is in default in due and faithful

- performance of its obligations during and under the Contract and its decision that the Contractor is in default shall be final and binding on the Bank, notwithstanding any differences between the Authority and the Contractor, or any dispute between them pending before any court, tribunal, arbitrators or any other authority or body, or by the discharge of the Contractor for any reason whatsoever.
4. In order to give effect to this Guarantee, the Authority shall be entitled to act as if the Bank were the principal debtor and any change in the constitution of the Contractor and/or the Bank, whether by their absorption with any other body or corporation, shall not in any way or manner affect the liability or obligation of the Bank under this Guarantee.
 5. It shall not be necessary, and the Bank hereby waives any necessity, for the Authority to proceed against the Contractor before presenting to the Bank its demand under this Guarantee.
 6. The Authority shall have the liberty, without affecting in any manner the liability of the Bank under this Guarantee, to vary at any time, the terms and conditions of the Contract or to extend the time or period for the compliance with, fulfilment and/ or performance of all or any of the obligations of the Contractor contained in the Contract or to postpone for any time, and from time to time, any of the rights and powers exercisable by the Authority against the Contractor, and either to enforce or forbear from enforcing any of the terms and conditions contained in the Contract and/or the securities available to the Authority, and the Bank shall not be released from its liability and obligation under these presents by any exercise by the Authority of the liberty with reference to the matters aforesaid or by reason of time being given to the Contractor or any other forbearance, indulgence, act or omission on the part of the Authority or of any other matter or thing whatsoever which under any law relating to sureties and guarantors would but for this provision have the effect of releasing the Bank from its liability and obligation under this Guarantee and the Bank hereby waives all of its rights under any such law.
 7. This Guarantee is in addition to and not in substitution of any other guarantee or security now or which may hereafter be held by the Authority in respect of or relating to the Contract or for the fulfilment, compliance and/or performance of all or any of the obligations of the Contractor under the Contract.
 8. Notwithstanding anything contained hereinbefore, the liability of the Bank under this Guarantee is restricted to the Guarantee Amount and this Guarantee will remain in force for the period specified in paragraph 8 below and unless a demand or claim in writing is made by the Authority on the Bank under this Guarantee all rights of the Authority under this Guarantee shall be forfeited and the Bank shall be relieved from its liabilities hereunder
 9. The Guarantee shall cease to be in force and effect on ****\$. Unless a demand or claim under this Guarantee is made in writing before expiry of the Guarantee, the Bank shall be discharged from its liabilities hereunder.
 10. The Bank undertakes not to revoke this Guarantee during its currency, except with the previous express consent of the Authority in writing and declares and warrants that it has the power to issue this Guarantee, and the undersigned has full powers to do so on behalf of the Bank.

11. Any notice by way of request, demand or otherwise hereunder may be sent by post addressed to the Bank at its above referred branch, which shall be deemed to have been duly authorized to receive such notice and to effect payment thereof forthwith, and if sent by post it shall be deemed to have been given at the time when it ought to have been delivered in due course of post and in proving such notice, when given by post, it shall be sufficient to prove that the envelope containing the notice was posted and a certificate signed by an officer of the Authority that the envelope was so posted shall be conclusive.
12. This Guarantee shall come into force with immediate effect and shall remain in force and effect for up to the date specified in paragraph 8 above or until it is released earlier by the Authority pursuant to the provisions of the Contract.

\$Insert date from the date of issuance of this Guarantee as per conditions of the bid. The Contractors can submit the BG for periods of two years at one time and keep on renewing the same up to required period if they have problems in getting the BG in one go for the entire. period

Signed and sealed this day of 20----- at

SIGNED, SEALED AND DELIVERED

For and on behalf of the Bank by:

(Signature)

(Name)

(Designation)

(Code Number)

(Address)

APPENDIX – VI: FORMAT OF LOA

No. _____

ROPEWAYS AND RAPID TRANSPORT SYSTEM DEVELOPMENT CORPORATION
US Club- Shimla 1

To,
{Name of selected Bidder}

Subject: {“Design, Supply, Construction, Installation, Testing, Commissioning and Operation & Maintenance for 5 (five) years of Seamless Innovative Urban Transportation (Ropeways, Lifts & Escalators Etc.) Network in Shimla City (Himachal Pradesh) on Engineering Procurement and Construction (EPC) Mode.”} - Letter of Acceptance (LOA)-Reg.

Reference: Your bid for the subject work dated.....

Sir,

This is to notify you that your Bid Dated,... for execution of the {Project description}, at your quoted bid price amounting to Rs...../- {amount in word} has been determined to be the lowest evaluated bid and is substantially responsive and has been accepted.

1. You are requested to return a duplicate of the LOA as an acknowledgement and sign the Contract Agreement within the period prescribed in the RFP.
2. You are also requested to furnish Performance Security for an amount of {and Additional Performance Security for an amount of} as per the RFP within 14 (fourteen) days of receipt of this Letter of Acceptance (LOA). In case of delay in submission of Performance Security and Additional Performance Security, if any, you may seek extension of time for a period not exceeding 60 (Sixty) days in accordance with RFP.
3. In case of failure of submission of Performance Security, Additional Performance Security (if any) and Security against Damages (if any) within the additional 60 (Sixty) days' time Period, the award shall be deemed to be cancelled and Bid security shall be encashed by the Authority as per the RFP.

Yours faithfully,

{authorized signatory}

APPENDIX – VII: FORMAT FOR POWER OF ATTORNEY FOR LEAD MEMBER OF JV/CONSORTIUM

Whereas the Development Authority (RTDC), (“the **Authority**”) has invited Bids from interested parties for **“Design, Supply, Construction, Installation, Testing, Commissioning and Operation & Maintenance for 5 (five) years of Seamless Innovative Urban Transportation (Ropeways, Lifts & Escalators Etc.) Network in Shimla City (Himachal Pradesh) on Engineering Procurement and Construction (EPC) Mode.”**

Whereas, ... and (collectively the “JV/Consortium”) being Members of the JV/Consortium are interested in bidding for the Project in accordance with the terms and conditions of the RFP and other connected documents in respect of the Project, and

Whereas it is necessary for the Members of the JV/Consortium to designate one of them as the Lead Member with all necessary power and authority to do for and on behalf of the JV/Consortium, all acts, deeds, and things as may be necessary in connection with the JV/Consortium’s bid for the Project and its execution.

NOW THEREFORE KNOW ALL MEN BY THESE PRESENTS

We, ... having our registered office at....., M/s having our registered office at, and having our registered office at, (hereinafter collectively referred to as the “Principals”) do hereby irrevocably designate, nominate, constitute, appoint, and authorize M/S..... having its registered office at, being one of the Members of the JV/Consortium, as the Lead Member and true and lawful attorney of the JV/Consortium (hereinafter referred to as the “Attorney”). We hereby irrevocably authorize the Attorney (with power to sub- delegate) to conduct all business for and on behalf of the JV/Consortium and any one of us during the bidding process and, in the event the JV/Consortium is awarded the contract, during the execution of the Project and in this regard, to do on our behalf and on behalf of the JV/Consortium, all or any of such acts, deeds or things as are necessary or required or incidental to the qualification of the JV/Consortium and submission of its bid for the Project, including but not limited to signing and submission of all Bids, bids and other documents and writings, participate in bidders and other conferences, respond to queries, submit information/ documents, sign and execute contracts and undertakings consequent to acceptance of the bid of the JV/Consortium and generally to represent the JV/Consortium in all its dealings with the Authority, and/ or any other Government Agency or any person, in all matters in connection with or relating to or arising out of the JV/Consortium’s bid for the Project and/ or upon award thereof till the EPC Agreement is entered into with the Authority.

AND hereby agree to ratify and confirm and do hereby ratify and confirm all acts, deeds and things done or caused to be done by our said Attorney pursuant to and in exercise of the powers conferred by this Power of Attorney and that all acts, deeds and things done by our said Attorney in exercise of the powers hereby conferred shall and shall always be deemed to have been done

by us JV/Consortium.

IN WITNESS WHEREOF WE THE PRINCIPALS ABOVE NAMED HAVE EXECUTED THIS POWEROF ATTORNEY ON THIS DAY OF..... 20.....

For.....

(Signature)

.....

(Name & Title)

For.....

(Signature)

.....

(Name & Title)

Witnesses:

1.

2.

..... (Executants)

(To be executed by all the Members of the JV/Consortium)

Notes:

- The mode of execution of the Power of Attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and when it is so required, the same should be under common seal affixed in accordance with the required procedure.
- Also, wherever required, the Bidder should submit for verification the extract of the charter documents and documents such as a board or shareholders' resolution/ power of attorney in favor of the person executing this Power of Attorney for the delegation of power hereunder on behalf of the Bidder.
- For a Power of Attorney executed and issued overseas, the document will also have to be legalized by the Indian Embassy and notarized in the jurisdiction where the Power of Attorney is being issued. However, the Power of Attorney provided by Bidder s from countries that have signed the Hague Legislation Convention 1961 are not required to be legalized by the Indian Embassy if it carries a conforming Apostilled certificate.

APPENDIX – VIII: FORMAT FOR JOINT BIDDING AGREEMENT FOR JOINT VENTURE

(To be executed on Stamp paper of appropriate value)

THIS JOINT BIDDING AGREEMENT is entered into on this the day of 20...

AMONGST

1. Limited, a company incorporated under the Companies Act, 2013 and having its registered office at (hereinafter referred to as the “First Part” which expression shall, unless repugnant to the context include its successors and permitted assigns)

AND

2. Limited, a company incorporated under the Companies Act, 2013 and having its registered office at (hereinafter referred to as the “Second Part” which expression shall, unless repugnant to the context include its successors and permitted assigns)

WHEREAS,

- (A) THE Ropeways and Rapid Transport System Development Authority Corporation HP Ltd. (RTDC) (hereinafter referred to as the “Authority” which expression shall, unless repugnant to the context meaning thereof, include its administrators, successors and assigns) has invited Bids (the Bid”) by its Request for Proposal No..... dated(RFP) for qualification and short- listing of bidders for “Construction & Implementation of Innovative Urban Transportation (Ropeways, Lifts & Escalators Etc.) In Shimla City (Himachal Pradesh) On Engineering, Procurement and Construction (EPC) Mode(the “Project”).
- (B) The Parties are interested in jointly bidding for the Project as Members of a Consortium and in accordance with the terms and conditions of the RFP and other bid documents in respect of the Project, and
- (C) It is a necessary condition under the RFP that the Members of the Consortium enter into a Joint Bidding Agreement and furnish a copy thereof with the Bid.

NOW IT IS HEREBY AGREED as follows:

1. Definitions and Interpretations

In this Agreement, the capitalized terms shall, unless the context otherwise requires, have the meaning ascribed thereto under the RFP.

2. Consortium

- 2.1 The Parties do hereby irrevocably constitute a consortium (the “Consortium”) for the purposes of jointly participating in the Bidding Process for the Project.

The Parties hereby undertake to participate in the Bidding Process only through this Consortium and not individually and/ or through any other consortium constituted for this Project, either directly or indirectly or through any of their Associates.

3. Covenants

The Parties hereby undertake that in the event the Consortium is declared the selected Bidder and awarded the Project, The Consortium shall enter into an Agreement with the Authority for performing all its obligations as the EPC Contractor in terms of the EPC Agreement for the Project.

4. Role of the Parties

The Parties hereby undertake to perform the roles and responsibilities as described below:

- a. Party of the First Part shall be the Lead Member of the Consortium and shall have the power of attorney from all Parties for conducting all business for and on behalf of the Consortium during the Bidding Process and until the Appointed Date under the EPC Agreement when all the obligations of the Consortium shall become effective.
- b. Party of the Second Part shall be the Financial Member of the Consortium; and

5. Joint and Several Liability

The Parties do hereby undertake to be jointly and severally responsible for all obligations and liabilities relating to the Project and in accordance with the terms of the RFP and the EPC Agreement, till such time as the Financial Close for the Project is achieved under and in accordance with the EPC Agreement.

6. Shareholding in the Consortium

- 6.1 The Parties agree that the proportion of shareholding among the Parties in the Consortium shall be as follows:

First Party:

Second Party:

- 6.2 The Parties undertake that a minimum of 26% (twenty-six per cent) of the subscribed and paid-up equity share capital of the Consortium shall, at all times till the second anniversary of the date of commercial operation of the Project, be held by the Parties of the First and Second Part whose experience and net worth have been reckoned for the purposes of qualification and short-listing of Bidders for the

Project in terms of the RFP.

- 6.3 The Parties undertake that each of the Parties specified in Clause 6.2 above shall, at all times between the commercial operation date of the Project and the second anniversary thereof, hold subscribed, and paid-up equity share capital of Consortium equivalent to at least 5% (five per cent) of the Total Project Cost.
- 6.4 The Parties undertake that they shall collectively hold at least 51% (fifty-one per cent) of the subscribed and paid-up equity share capital of the Consortium at all times until the second anniversary of the commercial operation date of the Project.
- 6.5 The Parties undertake that they shall comply with all equity lock-in requirements set forth in the EPC Agreement.

7. Representation of the Parties

Each Party represents to the other Parties as of the date of this Agreement that:

- a. Such Party is duly organized, validly existing and in good standing under the laws of its incorporation and has all requisite power and authority to enter into this Agreement.
- b. The execution, delivery and performance by such Party of this Agreement has been authorized by all necessary and appropriate corporate or governmental action and a copy of the extract of the charter documents and board resolution/ power of attorney in favour of the person executing this Agreement for the delegation of power and authority to execute this Agreement on behalf of the Consortium Member is annexed to this Agreement, and will not, to the best of its knowledge:
 - (i) require any consent or approval not already obtained.
 - (ii) violate any Applicable Law presently in effect and having applicability to it.
 - (iii) violate the memorandum and articles of association, by-laws, or other applicable organizational documents thereof.
 - (iv) violate any clearance, permit, concession, grant, license or other governmental authorization, approval, judgement, order or decree or any mortgage agreement, indenture, or any other instrument to which such Party is a party or by which such Party or any of its properties or assets are bound or that is otherwise applicable to such Party; or
 - (v) create or impose any liens, mortgages, pledges, claims, security interests, charges or Encumbrances or obligations to create a lien, charge, pledge, security interest, encumbrances or mortgage in or on the property of such Party, except for encumbrances that would not, individually or in the aggregate, have a material adverse effect on the financial condition or prospects or business of such Party so as to prevent such Party from fulfilling its obligations under this Agreement;
- c. this Agreement is the legal and binding obligation of such Party, enforceable in accordance with its terms against it; and

- d. there is no litigation pending or, to the best of such Party's knowledge, threatened to which it or any of its Affiliates is a party that presently affects, or which would have a material adverse effect on the financial condition or prospects or business of such Party in the fulfilment of its obligations under this Agreement.

8. Termination

This Agreement shall be effective from the date hereof and shall continue in full force and effect until the Financial Close of the Project is achieved under and in accordance with the EPC Agreement in case the Project is awarded to the Consortium. However, in case the Consortium is either not pre-qualified for the Project or does not get selected for award of the Project, the Agreement will stand terminated in case the Bidder is not pre-qualified or upon return of the Bid Security by the Authority to the Bidder, as the case may be.

9. Miscellaneous

9.1 This Joint Bidding Agreement shall be governed by laws of India.

9.2 The Parties acknowledge and accept that this Agreement shall not be amended by the Parties without the prior written consent of the Authority.

IN WITNESS WHEREOF THE PARTIES ABOVE NAMED HAVE EXECUTED AND DELIVERED THIS AGREEMENT AS OF THE DATE FIRST ABOVE WRITTEN.

SIGNED, SEALED AND DELIVERED
DELIVERED

For and on behalf of

LEAD MEMBER by:

(Signature)

(Name)

(Designation)

(Address)

In the presence of:

1.

SIGNED, SEALED AND

For and on behalf of

SECOND PART by:

(Signature)

(Name)

(Designation)

(Address)

2.

Notes:

- The mode of the execution of the Joint Bidding Agreement should be in accordance with the procedure, if any, laid down by the Applicable Law and the charter documents of the executant(s) and when it is so required, the same should be under common seal affixed in accordance with the required procedure.

2. Each Joint Bidding Agreement should attach a copy of the extract of the charter documents and documents such as resolution/power of attorney in favour of the person executing this Agreement for the delegation of power and authority to execute this Agreement on behalf of the Consortium Member.
3. For a Joint Bidding Agreement executed and issued overseas, the document shall be legalized by the Indian Embassy and notarized in the jurisdiction where the Power of Attorney has been executed.

APPENDIX – IX: BANK GUARANTEE FORMAT FOR MOBILIZATION ADVANCE

B.G. No. Dated:

1. In consideration of you, *****, having its office at **** (hereinafter referred to as the “Authority”, which expression shall unless it be repugnant to the subject or context thereof include its, successors, and assigns) having agreed to receive the Bid of (a company registered under the Companies Act, 2013) and having its registered office at (and acting on behalf of its JV/Consortium) (hereinafter referred to as the “Bidder” which expression shall unless it be repugnant to the subject or context thereof include its/their executors, administrators, successors and assigns), for the “..... Project on EPC basis (hereinafter referred to as “the Project”) pursuant to the RFP dated issued in respect of the Project and other related documents including without limitation the draft EPC agreement (hereinafter collectively referred to as “Bidding Documents”), we (Name of the Bank) having our registered office at and one of its branches at (hereinafter referred to as the “Bank”), at the request of the Bidder, do hereby in terms of the RFP, irrevocably, unconditionally and without reservation guarantee the due and faithful fulfilment and compliance of the terms and conditions of the Bidding Document (including the RFP) by the said Bidder and unconditionally and irrevocably undertake to pay forthwith to the Authority an amount of ₹ ***** (Rupees ***** only) (hereinafter referred to as the “Guarantee”) as our primary obligation without any demur, reservation, recourse, contest or protest and without reference to the Bidder if the Bidder shall fail to fulfil or comply with all or any of the terms and conditions contained in the said Bidding Documents.
2. Any such written demand made by the Authority stating that the Bidder is in default of the due and faithful fulfilment and compliance with the terms and conditions contained in the Bidding Document shall be final, conclusive, and binding on the Bank.
3. We, the Bank, do hereby unconditionally undertake to pay the amounts due and payable under this Guarantee without any demur, reservation, recourse, contest or protest and without any reference to the Bidder or any other person and irrespective of whether the claim of the Authority is disputed by the Bidder or not, merely on the first demand from the Authority stating that the amount claimed is due to the Authority by reason of failure of the Bidder to fulfill and comply with the terms and conditions contained in the Bidding.
4. Documents including failure of the said Bidder to keep its Bid open during the Bid validity period as set forth in the said Bidding Document for any reason whatsoever. Any such demand made on the Bank shall be conclusive as regards amount due and payable by the Bank under this Guarantee. However, our liability under this Guarantee shall be restricted to an amount not exceeding ₹ ***** (Rupees ***** only).

- 4 This Guarantee shall be irrevocable and remain in full force for a period till the full amount recovery of mobilization advance and as may be mutually agreed between the Authority and the Bidder, and agreed to by the Bank, and shall continue to be forceable till all amounts under this Guarantee have been paid.
- 5 We, the Bank, further agree that the Authority shall be the sole judge to decide as to whether the Bidder is in default of due and faithful fulfilment and compliance with the terms and conditions contained in the Bidding Document including ,inter alia, the failure of the Bidder to keep its Bid open during the Bid validity period set forth in the said Bidding Document, and the decision of the Authority that the Bidder is in default as aforesaid shall be final and binding on us, notwithstanding any differences between the Authority and the Bidder or any dispute pending before any Court, Tribunal, Arbitrator or any other Authority.
- 6 The Guarantee shall not be affected by any change in the constitution or winding up of the Bidder or the Bank or any absorption, merger or amalgamation of the Bidder or the Bank with any other person.
- 7 In order to give full effect to this Guarantee, the Authority shall be entitled to treat the Bank as the principal debtor. The Authority shall have the fullest liberty without affecting in any way the liability of the Bank under this Guarantee from time to time to vary any of the terms and conditions contained in the said Bidding Document or to extend time for submission of the Bids or the Bid validity period or the period for conveying acceptance of Letter of Award by the Bidder or the period for fulfilment and compliance with all or any of the terms and conditions contained in the said Bidding Document by the said Bidder or to postpone for any time and from time to time any of the powers exercisable by it against the said Bidder and either to enforce or forbear from enforcing any of the terms and conditions contained in the said Bidding Document or the securities available to the Authority, and the Bank shall not be released from its liability under these presents by any exercise by the Authority of the liberty with reference to the matters aforesaid or by reason of time being given to the said Bidder or any other forbearance, act or omission on the part of the Authority or any indulgence by the Authority to the said Bidder or by any change in the constitution of the Authority or its absorption, merger or amalgamation with any other person or any other matter or thing whatsoever which under the law relating to sureties would but for this provision have the effect of releasing the Bank from its such liability.
- 8 Any notice by way of request, demand or otherwise hereunder shall be sufficiently given or made if addressed to the Bank and sent by courier or by registered mail to the Bank at the address set forth herein.
- 9 We undertake to make the payment on receipt of your notice of claim on us addressed to [name of Bank along with branch address] and delivered at our above branch which shall be deemed to have been duly authorized to receive the said notice of claim.
- 10 It shall not be necessary for the Authority to proceed against the said Bidder before proceeding against the Bank and the guarantee herein contained shall be forceable against the Bank, notwithstanding any other security which the Authority may have

obtained from the said Bidder or any other person and which shall, at the time when proceedings are taken against the Bank hereunder, be outstanding or unrealized.

- 11 We, the Bank, further undertake not to revoke this Guarantee during its currency except with the previous express consent of the Authority in writing.
- 12 The Bank declares that it has power to issue this Guarantee and discharge the obligations contemplated herein, the undersigned is duly authorized and has full power to execute this Guarantee for and on behalf of the Bank.
- 13 For the avoidance of doubt, the Bank's liability under this Guarantee shall be restricted to ₹ *** crore (Rupees ***** crore only). The Bank shall be liable to pay the said amount or any part thereof only if the Authority serves a written claim on the Bank in accordance with paragraph 9 hereof.

Signed and Delivered by Bank

By the hand of Mr./Ms., its and authorized official.

(Signature of the Authorized Signatory) (Official Seal)

ANNEX - I to Appendix IA: Details of Bidder including JV Member and/or Associate Partner Member

1. Details of Bidder
 - a) Name:
 - b) Country of incorporation:
 - c) Address of the corporate headquarters and its branch office(s), if any, in India:
 - d) Date of incorporation and/ or commencement of business:
2. Brief description of the Company including details of its main lines of business and proposed role and responsibilities in this Projects:
3. Details of individual(s) who will serve as the point of contact/ communication for the Authority:

Name:

Designation:

Company:

Address:

Telephone Number:

E-Mail Address:

Fax Number:
4. Particulars of the Authorized Signatory of the Bidder:

Name:

Designation:

Address:

Phone Number:

Fax Number:
5. In case of a JV/Consortium:
 - The information above (1-4) should be provided for all the Members of the JV/Consortium.
 - A copy of the Joint Bidding Agreement, as envisaged, should be attached to the Bid.
 - Information regarding role of each Member should be provided as per table below:

Sl. No.	Name of Member	Role*	Percentage of equity in the JV/Consortium
1.			
2.			

* The role of each Member, as may be determined by the Bidder, should be indicated.

ANNEX - II to Appendix IA: Technical Capacity of the Bidder

Bidder type #	Member Code*	Project Code**	Project Cost (US\$ Mn) ***	Project Cost (INR Million) ****
(1)	(2)	(3)	(4)	(5)
Single entity Bidder		A		
		B		
		C		
		D		
JV/Consortium Member 1		1a		
		1b		
		1c		
		1d		
JV/Consortium Member 2		2a		
		2b		
		2c		
		2d		

@ Provide details of only those Projects that have been undertaken by the Bidder under its own name and/ or by an Associate.

A Bidder consisting of a single entity should fill in details as per the row titled Single entity Bidder and ignore the rows titled JV/Consortium Member. In case of a JV/Consortium, the row titled Single Entity Bidder may be ignored. In case credit is claimed for an Associate, necessary evidence to establish the relationship of the Bidder with such Associate shall be provided.

* Member Code shall indicate NA for Not Applicable in case of a single entity Bidder. For other Members, the following abbreviations are suggested viz. LM means Lead Member, TM means Technical Member, FM means Financial Member, OM means Other Member.

ANNEX – III to Appendix IA: Financial Capacity of the Bidder

Bidder type *	Member Code **	Net Worth (in INR million) ***Preceding Year
Single entity Bidder		
JV/Consortium Member 1		
JV/Consortium Member 2		
Total		

Name and address of Bidder's Bankers:

* A Bidder consisting of a single entity should fill in details as per the row titled Single entity Bidder and ignore the rows titled JV/Consortium Members. In case of a JV/Consortium, row titled Single entity Bidder may be ignored.

** For Member Code, see instruction 4 at Annex-IV of this Appendix-I.

*** The Bidder should provide details of its own Financial Capacity and / or of an Associate.

Instructions:

The Bidder/its constituent JV/consortium Members shall attach copy of the balance sheet, financial statements, and Annual Report for preceding 5 (five) Financial Years (excluding two fiscal years 2020- 21 and 2021-22 due to covid) The financial statement shall:

- reflect the financial situation of the Bidder and its Associates where the Bidder is relying on its Associate's financials.
 - be audited by a statutory auditor.
 - be complete, including all notes to the financial statements; and
 - Correspond to accounting periods already completed and audited (no statements for partial periods shall be requested or accepted).
- Net Worth shall mean the aggregate value of the paid-up share capital and all reserves created out of the profits after deducting the aggregate value of accumulated losses, deferred expenditure and miscellaneous expenditure not written off, as per the audited balance sheet, but doesn't include reserves created out of revaluation of assets, write-back of depreciation and amalgamation.
 - In the case of a Consortium, a copy of the Joint Bidding Agreement shall be submitted in accordance with the **RFP**.
 - The Bidder shall also provide the name and address of the Bankers to the Authority.
 - The Bidder shall provide an Auditor's Certificate specifying the net worth of the Bidder and also specifying the methodology adopted for calculating such net worth in accordance with the **RFP**.

ANNEX - IV to Appendix IA: Details of Eligible Projects

Project Code:		Member Code:	
Item (1)	Refer Instruction (2)	Of the Project (3)	
Title & nature of the Project			
Entity for which the Project was constructed/developed	5		
Location			
Capital cost of Project / Project cost (excluding land cost)	6		
Date of commencement of Project/ contract			
Date of completion/Commissioning	7		
Equity shareholding (with period during which equity was held)	8		
Whether credit is being taken for the Eligible Experience of an ASSOCIATE PARTNER (Yes/ No)	11		

Instructions:

1. Bidders are expected to provide information in respect of each Eligible Projects in this Annex. The Projects cited must comply with the eligibility criteria specified in the **RFP**, as the case may be. Information provided in this section is intended to serve as a backup for information provided in the Bid. Bidder s should also refer to the Instructions below.
2. For a single entity Bidder, the Project Codes would be a, b, c, d etc. In case the Bidder is a JV/Consortium then for Member 1, the Project Codes would be 1a, 1b, 1c, 1d etc., for Member 2 the Project Codes shall be 2a, 2b, 2c, 2d etc., and soon.
3. A separate sheet should be filled out for each Eligible Project.
4. Member Code shall indicate NA for Not Applicable in case of a single entity Bidder. For other Members, the following abbreviations are suggested viz. LM means Lead Member, TM means Technical Member, FM means Financial Member, and OM means Other Member. In case the Eligible Project relates to an Associate of the Bidder or its Member, write "Associate" along with Member Code.
5. Particulars such as name, address and contact details of owner/ Authority/ Agency may be provided.
6. Provide the estimated capital cost of the Eligible Project.
7. The date of commissioning of the Project, upon completion, should be indicated. In the case of Projects under construction, the likely date of completion or commissioning, as the case may be, shall be indicated.
8. The equity shareholding of the Bidder, in the company owning the Eligible Project, held continuously during the period for which Eligible Experience is claimed, needs to be given.

9. Experience for any activity relating to an Eligible Project shall not be claimed by two or more Members of the JV/Consortium. In other words, no double counting by a JV/Consortium in respect of the same experience shall be permitted in any manner whatsoever. Certificate from the Bidder's statutory auditors or Chartered Accountant or its respective clients must be furnished as per formats below for each Eligible Project. In jurisdictions that do not have statutory auditors, the auditors who audit the annual accounts of the Bidder/Member/Associate may provide the requisite certification.

Certificate from the qualified Chartered Accountant/Statutory Auditors regarding Eligible Projects*

Based on its books of accounts and other published information authenticated by it+*, this is to certify that (name of the Bidder/Member/Associate) is/ was an equity shareholder in (title of the Project company) and holds/ held INR. cr. (Rupees million) of equity (which constitutes %*** of the total paid up and subscribed equity capital) of the Project company from(date) to (date). The Project was/is likely to be commissioned on
(Date of commissioning of the Project).

We further certify that the total estimated capital cost / Project Cost of the Project is Rs cr. (Rupees million), of which INR. cr. (Rupees million) of capital expenditure was incurred during the past five financial years as per year- wise details noted below:

.....
.....

Name of the Chartered Accountant / Audit Firm:

Seal of the Chartered Accountant / Audit firm: (Signature, designation, name of and the authorized signatory) Date:

** In case duly certified audited annual financial statements containing the requisite details are provided, a separate certification by statutory auditors would not be necessary.

*** Refer instruction no. 8 in this Annex-4.

10. In the event that credit is being taken for the Eligible Experience of an Associate, the Bidder should also provide a certificate in the format below:

Certificate from Statutory Auditor/Chartered Accountant / Company Secretary regarding Associate *

"Based on the authenticated record of the Company, this is to certify that (a) more than 50% (fifty percent) of the subscribed and paid-up voting equity of (name of the Associate) is held, directly or indirectly**, by (name of Bidder / JV/Consortium Member).

By virtue of the aforesaid shareholding, the latter exercises control over the former, who is an Associate.

Or

(a) more than 50% (fifty per cent) of the subscribed and paid-up voting equity of (name of Bidder / JV / Consortium Member) is held, directly or indirectly by (Associate) or is controlled by (Associate) or (name of Bidder/JV/Consortium Member is under common control with (Associate). By virtue of the aforesaid shareholding, the latter exercises control over the former, who is an Associate.

Please delete (a) or (b) whichever is not applicable.

A brief description of the said equity held, directly or indirectly, is given below: {Describe the shareholding of the Associate in the Bidder / JV/Consortium Member}

Name of the audit firm/ Company Secretary / Chartered Accountant: Seal of the firm: (Signature, name and designation of Date: the authorized signatory).

11. It may be noted that in the absence of any detail in the above certificates, the information would be considered inadequate and could lead to exclusion of the relevant Project in computation of Experience Score.

* In the event that the Bidder /JV/ Consortium Member exercises control over an Associate by operation of law, this certificate may be suitably modified, and copies of the relevant law may be enclosed and referred to.

** In the case of indirect shareholding, the intervening companies in the chain of ownership should also be Associates i.e., the shareholding in each such company should be more than 50% in order to establish that the chain of “control” is not broken.

ANNEX - V to Appendix IA: Statement of Legal Capacity

(To be forwarded on the letterhead of the Bidder/Lead Member of JV/ Consortium)

Ref. Date:

To,

Deputy General Manager,

Ropeways and Rapid Transport System

Development Corporation H.P. Ltd (RTDC)

U.S. Club,

Shimla-1

Sub: Bid for “Design, Supply, Construction, Installation, Testing, Commissioning and Operation & Maintenance for 5 (five) years of Seamless Innovative Urban Transportation (Ropeways, Lifts & Escalators Etc.) Network in Shimla City (Himachal Pradesh) on Engineering Procurement and Construction (EPC) Mode.”

Dear Sir,

We hereby confirm that we/ our MMembers in the JV/Consortium (constitution of which has been described in the Bid) satisfy the terms and conditions laid out in the RFP.

We have agreed that (insert Member’s name) will act as the Lead Member of our JV/Consortium.

We have agreed that (insert individual’s name) will act as our representative/ will act as the representative of the JV/Consortium on its behalf and has been duly authorized to submit the **RFP**. Further, the authorized signatory is vested with requisite powers to furnish such letter and authenticate the same.

Thanking you,

Yours faithfully, (Signature, name, and designation of the authorized signatory)

For and on behalf of.....

***Please strike out whichever is not applicable.**

ANNEX - VI TO APPENDIX IA: FINANCIAL DATA

(SIMILAR WORK DONE DURING THE LATEST LAST SEVEN FINANCIAL YEARS)

NAME OF THE BIDDER (CONSTITUENT MEMBER IN CASE OF JV/CONSORTIUM):

(All amounts in Rupees in INR (Million))

S. No.	DESCRIPTION	Financial Data for Last 7 Audited Financial Years						
		Year 2017- 18	Year 2018- 19	Year 2019- 20	Year 2020- 21	Year 2021- 22	Year 2022- 23	Year 2023- 24
1	2	3	4	5	6	7	8	9
	Total value of Similar work done as per audited financial statements							
NOTE: 1. Separate Performa shall be used for each member in the case of JV/Consortium. 2. Attach attested copies of the Audited Financial Statements of the last seven financial years as Annexure. 3. All such documents reflect the financial data of the Bidder or member in the case of JV/Consortium, and not that of sister or parent company. 4. Historic financial statements must be complete, including all notes to the financial statements 5. Foreign applicants, in whose country calendar year is also the financial year, may submit all relevant data for the last 7 years i.e., 2016, 2017, 2018, 2019 and 2021. 6. The financial data in the above prescribed format shall be certified by Chartered Accountant / Company Auditor under his signature & stamp including CA's Membership Number and UDIN AND FIRM REGISTRATION NUMBER. 7. The above financial data will be updated to last day of the month previous to the month of Bids submission price level assuming 5% inflation for Indian Rupees every year and 2% for foreign currency portions per year. The exchange rate of foreign currency shall be applicable 28 days before the submission date of the Bid. 8. The Years mentioned in the table are indicative only. Financial Data (updated as per Note 7 above) for latest last 5 (Five) audited financial years shall be considered for evaluation. In case audited balance sheet of the last financial year is not made available by the bidder, he has to submit an affidavit certified by Chartered Accountant that 'the balance sheet has actually not been audited so far'. In such a case the financial data of previous '4' audited financial years will be taken into consideration for evaluation. If an audited balance sheet of any year other than the last year is not submitted, the Bid will be considered as non-responsive. However, the Bidder including all substantial members of JV / Consortium should								

	have been incorporated more than three years earlier from the last day of the previous month of Bid submission. In this case, for such a Bidder, the average annual turnover shall be arrived considering 'nil' turnover for the financial year(s) for which Bidder was not able to submit audited balance sheet on account of non-incorporation of Bidder. Such data shall be divided by 5 to work out the average annual turnover. In case balance sheet of the last year has not been audited so far, then data shall be divided by 4 to work out the average annual turnover. 9. The value of work done shall be updated to the last day of the month previous to the month of Bid submission price level considering 5% inflation per year. The exchange rate of foreign currency shall be applicable 28 days before the submission date of the Bid. 10. If the audited financial statements do not directly reflect the required values, a certificate from the chartered accountant is required. The data certified by the chartered accountant would be considered sufficient for this purpose.

ANNEX - VII TO APPENDIX IA: Net Worth of the Bidder / JV/Consortium Member

(to be submitted by bidder (single entity) or by each member separately in case of JV/Consortium)

Applicant's legal name:.....

Date:

JV/Consortium Member's legal name:

Page of Pages

Net Worth of the Bidder / JV/Consortium Member INR* Million during last audited financial year

S.No.	Contract Identification	Year of award	Total completed cost (current value in case of ongoing work) (INR*)	Total amount in dispute (including claims & counter-claim) (INR*)	Applicant's percentage participation (in case of work executed by the applicant in JV/Consortium)	Applicant's share of disputed amount (INR*)
(1)	(2)	(3)	(4)	(5)	(6)	(7)=(5) x (6)
	Contract Identification: Name of Employer: Address of Employer: Matter in dispute: [indicate main issues in dispute] Status of dispute: [indicate if it is under Arbitration or being dealt with by the Judiciary]					
1						
2						
Add required number of rows						
	Total of amounts of all contracts in dispute (INR*)					
	Percentage of net worth					

* or respective currency

STAMP & SIGNATURE OF AUTHORISED SIGNATORY

Note:

1. In case of JV/Consortium, this information shall be submitted by each member of the JV/Consortium.
2. This information shall be signed by authorized signatory of the Bidder. In case of JV/Consortium by the authorized signatory of the constituent members counter signed by the authorized signatory of Bidder.

ANNEX – VIII TO APPENDIX IA: ANNUAL TURNOVER OF THE BIDDER / JV/CONSORTIUM MEMBER

(to be submitted by bidder (single entity) or by each member separately in case of JV/Consortium)

Applicant's legal name:.....

Date:

JV/Consortium Member's legal name:

Page of Pages

Annual Turnover of the Bidder / JV/Consortium Member INR* Million during last audited financial year

S. No	Year	Turnover (INR Million)
1.	2019-20	
2.	2020-21	
3.	2021-22	
4.	2022-23	
5.	2023-24	

Date:

Seal and Signature of

Chartered
Accountant

(Name and Address)

Note:

1. The Bidder must submit financial data for the last three financial years (excluding fiscal years 2020-21 and 2021-22 due to COVID-19, if opted by the Bidder), accompanied by audited financial statements. These documents should specifically pertain to the Bidder or, in the case of a JV/Consortium, to the respective Member and not to any sister, subsidiary, or parent company. Additionally, the Bidder is required to provide details of Works in Hand to demonstrate existing commitments. The financial data must be presented in the prescribed format, duly endorsed, signed, and stamped by a Chartered Accountant, including the CA's Membership number and UDIN.
2. If the Bidder is unable to provide the audited balance sheet for the last financial year, they must submit an affidavit confirming that "the balance sheet has not been audited as of now." In such circumstances, the financial data from the previous three audited financial years (excluding fiscal years 2020-21 and 2021-22 due to COVID-19, if opted by the Bidder) will be used for evaluation. It's crucial to note that if the audited balance sheet of any year other than the last year is not submitted, the Bidder will be deemed non-responsive.

ANNEX - IX TO APPENDIX IA: WORKS IN HAND

As on first day of the month of bid submission

Applicant's legal name Date.....

Group Member's legal name..... Page of pages

Name and brief particulars of contract (Clearly indicate the part of the work assigned to the applicant(s))	Name of client with telephone number, Email ID and fax number	Contract Value in INR Equivalent (Give only the value of work assigned to the applicant(s) (Assume inflation as given in Annexure-B)	Value of balance work yet to be done in INR equivalent as on 31.10.2024	Date of Completion as per Contract Agreement	Expected Completion Date	Delay if any, with reason	Value of work to be done in 2024-25 (1st Nov. 2024 to 31st March 2025)	Value of work to be done in 2025-26. (1st April 2025 to 31st March 2026)	Value of work to be done in 2026-27. (1st April 2026 to 31st March 2027)	Value of work to be done in 2027-28 (1st April 2027 to 31st March 2028)	Value of work to be done in 2028-29 (1st April 2028 to 31.10.2029)
Total											

ANNEX - X TO APPENDIX IA: WORK EXPERIENCE

Applicant's legal name

Date.....

Group Member's legal name.....

Page of Pages For similar

works as per Clause No 3.2.2 (i) and (ii)

Specific Construction Experience		
Similar Contract Number _____ of _____ required	Information	
Contract Identification		
Award date		
Completion date		
Employer's Name		
Employer's Address: Telephone / Fax number: E Mail		
Role in Contract (Individual/JV-Consortium member)	Individual	JV Member
Completion Cost	Currency (as stated in Clients Certificate)	In equivalent INR at 31.10.2024 price level
If JV member specify percentage participation in contract & amount (Please refer Note-1)	% participation	In equivalent INR at 31.10.2024 price level
Length of Ropeway and carrying Capacity (in PPHPD)		In case of JV/Consortium, actual length executed by the Applicant (duly substantiated with Client Certificate)
Value of works done other than Ropeway works.		In case of JV/Consortium, actual length executed by the Applicant (duly substantiated with Client Certificate)

- NOTE:** 1. Only the value of contract as executed by the applicant/member in his own name should be indicated. Where a work is undertaken by a group, only that portion of the contract which is undertaken by the concerned applicant/member should be indicated and the remaining done by the other members of the group be excluded. This is to be substantiated with documentary evidence which clearly mentioned the staff quarters/other civil works containing quantity of the concrete executed.
2. Separate sheet for each work along with Clients Certificate to be submitted.

ANNEX – XI TO APPENDIX IA: SUMMARY OF INFORMATION PROVIDED IN ANNEX - X

Applicant's legal name Date.....

Group Member's legal name..... Page of pages

Name of Applicant (each member in case of group)	Total Number of works as per Clause No. 3.2.1.1 (a) at the price level as on the last day of the previous month of tender submission	Total Number of works as per Clause No.3.2.1.1 (b) at the price level of as on the last day of the previous month of tender submission	Total Number of works as per Clause No.3.2.1.1 (c) at the price level of as on the last day of the previous month of tender submission	No.of contracts delayed, i.e., completed beyond the original date of completion

NOTE: -

1. In case the work was done as JV/Consortium, only the value of work done by the applicant as per his Percentage participation must be given.
2. Reasons of delay whether on contractors account or on account of Employer in each applicable case need to be enclosed separately.

ANNEX – XII TO APPENDIX IA: UNDERTAKING REGARDING TERMINATION OF WORK

(to be submitted by Bidder (single entity) or by each member separately in case of JV/Consortium)

We do hereby undertake that any department Government of India and State Governments, Central and State Public Sector Undertakings has not banned business with us as on the date of bid submission. Also, any work of the value more than 10% of RFP cost of work, executed either individually or in a JV/Consortium, has not been rescinded/ terminated by any department Government of India and State Governments, Central and State Public Sector Undertakings after award of contract to us during last 3years (from the last day of the previous month of tender submission) due to our non-performance.

STAMP & SIGNATURE OF AUTHORISED SIGNATORY

Note:

1. In case of JV/Consortium, the undertaking shall be submitted by each member of the JV/Consortium.
2. The undertaking shall be signed by authorized signatory of the Bidder or constituent member in case of JV/Consortium by the authorized signatory of the constituent member counter signed by the authorized signatory of the Bidder.

**ANNEX – XIII TO APPENDIX IA: UNDERTAKING FOR NOT BEING PENALISED IN A
CONTRACT**

(to be submitted by Bidder (single entity) or by each member separately in case of JV/Consortium)

We do hereby undertake that we have been neither penalized with liquidated damages of 10% (or more) of the contract value in a contract due to delay nor imposed with penalty of 10% (or more) of the contract value due to any other reason in any works awarded by any department Government of India and State Governments, Central and State Public Sector Undertakings of value more than 10% of NIT cost of work executed either individually or in a JV/Consortium during last three years (from the last day of previous month of the tender submission).

STAMP & SIGNATURE OF AUTHORISED SIGNATORY

Note:

1. In case of JV/Consortium, the undertaking shall be submitted by each member of the JV/Consortium.
2. The undertaking shall be signed by authorized signatory of the Bidder. In case of JV/Consortium by the authorized signatory of the constituent members counter signed by the authorized signatory of Bidder.

ANNEX – XIV TO APPENDIX IA: UNDERTAKING FOR FINANCIAL STABILITY

(to be submitted by Bidder (single entity) or by each member separately in case of JV/Consortium)

We do hereby undertake that we have not suffered bankruptcy/insolvency during the last 5 years (from the last day of the previous month of the tender submission).

STAMP & SIGNATURE OF AUTHORISED
SIGNATORY

Note:

1. In case of JV/Consortium, the undertaking shall be submitted by each member of the JV/Consortium.
2. The undertaking shall be signed by authorized signatory of the Bidder. In case of JV/Consortium by the authorized signatory of the constituent members counter signed by the authorized signatory of Bidder.

ANNEX – XV TO APPENDIX IA: UNDERTAKING FOR DOWNLOADED TENDER DOCUMENT

We hereby confirm that we have downloaded / read the complete set of tender documents addendum/corrigendum/clarifications along with the set of enclosures hosted on e-tendering portal <https://hptenders.gov.in>. We confirm that we have gone through the bid documents, addendums and clarifications for this work placed up to the date of opening of bids on the e-tendering portal [<https://hptenders.gov.in>]. We confirm our unconditional acceptance of the same and have considered for these in the submission of our financial bid.

STAMP & SIGNATURE OF AUTHORISED SIGNATORY

**ANNEX – XVI TO APPENDIX IA: DETAILS OF BANK ACCOUNT FOR REFUND OF TENDER
SECURITY/EMD**

(Applicable if EMD/Tender Security deposited through RTGS/ NEFT)

1. Name of the firm/ Bidder:
 2. Complete Address:
 3. Name of the Bank:
 4. Branch:
 5. Address of the Bank Branch:
 6. Name of the account holder in bank:
 7. Account Type:
 8. Account Number:
 9. IFS Code of the bank Branch:
 10. Whether a copy of cancelled Cheque of the Bidder/Firm submitted:
Yes or No (Pleasetick)
- (A copy of cancelled cheque to be enclosed).

Signature of the Authorized person of the Bidder with seal & Date

Notes: -

- a) EMD/Tender Security will be refunded through NEFT/ RTGS/ IMPS/ DD/ Bankers Cheque/ any other mode of payment, in the name of firm and bank account mentioned in this appendix, which shall be of same firm and account through which EMD/Tender Security has been paid to Authority.

ANNEX – XVII (A) TO APPENDIX IA: LIST OF MINIMUM KEY PERSONNEL

Applicant's legal name Date.....

Group Member's legal name..... Page of pages

S. No	Position	No. of Personnel	Min. Experience (Years)	Min. Qualification	Experience	Marks	Remarks
Key Personnel							
1	Project Head	1	25	Graduation in Mechanical Engg.	Project Management of large infrastructure projects such as Ropeways, Railways, Metro Rails, Regional Railways and highways including, bridges, viaducts, buildings etc.	7	Meets EQC: 5 Marks 1-mark extra for each 5 years' experience . Maximum extra Marks: 2
2	Deputy Project Head	1	20	Graduation in Civil or Mech. Engg.	Projects Management of large infrastructure projects such as Ropeways, Railways, Metro Rails, Regional Railways and highways including, bridges, viaducts, buildings etc.	5	Meets EQC: 3 Marks 1-Mark extra for each 5 years' experience . Maximum extra Marks: 2
3	Ropeway Engineer	1	20	Graduation in Mech. Engg.	Installation and Commissioning of CEN Standard Ropeways.	4	Meets EQC: 2 Marks 1-Mark extra for each 5 years' experience . Maximum extra Marks: 2
4	Design Engineer (Civil)	1	20	M. Tech (Structural Design).	Design of large infrastructure projects such as Ropeways, Railways, Metro Rails, Regional Railways and	2	Meets EQC: 1 Marks 1-mark extra for each 5 years'

Shimla Ropeway Project

S. No	Position	No. of Personnel	Min. Experience (Years)	Min. Qualification	Experience	Marks	Remarks
					highways including, bridges, viaducts, buildings etc.		experience . Maximum extra Marks: 1
5	Environmental and Social Impact Assessment Expert	1	10	Post Graduation in Environment Science	Environmental management work of large infrastructure projects such as Ropeways, Railways, Metro Rails, Regional Railways and highways including, bridges, viaducts, buildings etc.	2	Meets EQC: 1 Marks 1-Mark extra for each 5 years' experience . Maximum extra Marks: 1
	Total	5			Total	20	

Note:

- CVs of Key personnels shall be considered for the Technical Evaluation.
- All the project Personnels shall be deployed for the entire duration of the Project.
- There shall be no replacement of project personnel in the normal circumstances. The project personnel may be replaced only in exceptional circumstances with an equivalent or better person with prior approval of the Authority/Engineer.

ANNEX – XVII (B) TO APPENDIX IA: LIST OF MINIMUM NON-KEY PERSONNEL

Applicant's legal name

Date.....

Group Member's legal name..... Page of pages

S. No	Position	No. of Personnels	Min. Experience (Years)	Min. Qualification	Experience
6	Safety Engineer	1	10	Graduation in Mechanical or Civil Engg.	Safety of large infrastructure projects such as Ropeways, Railways, Metro Rails, Regional Railways and highways including, bridges, viaducts, buildings etc
7	Quality Expert	1	15	Graduation in Mech/Civil Engg.	Quality Management of large infrastructure projects such as Ropeways, Railways, Metro Rails, Regional Railways and highways including, bridges, viaducts, buildings etc.
8	Geotechnical Impact Assessment Expert	1	15	Graduation in Civil Engg.	Geotechnical work of large infrastructure projects such as Ropeways, Railways, Metro Rails, Regional Railways and highways including, bridges, viaducts, buildings etc.
9	Programme cum Planning Engineer	1	10	Graduation in Mechanical or Civil Engg.	Preparation of programme for large infrastructure projects such as Ropeways, Railways, Metro Rails, Regional Railways and highways including, bridges, viaducts, buildings etc. Knowledge of Primavera Software is must.
10	Architect	1	10	Graduate in Architecture	Architectural detailed design of station buildings of Ropeways, Railways, Metro Rails, Regional Railways public buildings etc.
11	Mechanical Engineer	2	15	Graduation in Mechanical Engg.	Installation and Commissioning of large infrastructure projects such as Ropeways, Railways, Metro Rails, Regional Railways and highways including, bridges, viaducts, buildings etc.
12	Electrical Engineer	1	15	Graduation in Electrical Engg.	Installation and Commissioning of large infrastructure projects
13	Site Engineers	14	10	Degree/Diploma Mechanical or Civil Engg	Installation and Commissioning of large infrastructure projects such as Ropeways, Railways, Metro Rails, Regional Railways and highways including, bridges, viaducts, buildings etc.

S. No	Position	No. of Personnels	Min. Experience (Years)	Min. Qualification	Experience
Total		22			

Note:

- All the project Personnels shall be deployed for the entire duration of the Project.
- The bidder shall provide a list of the non-key personnel along with their names, qualifications and experience etc.
- There shall be no replacement of project personnel in the normal circumstances. The project personnel may be replaced only in exceptional circumstances with an equivalent or better person with prior approval of the Authority/Engineer.

ANNEX – XVIII TO APPENDIX IA: CURRICULUM VITAE (CV) FORMAT FOR PROPOSED KEY EXPERTS

1. General

Position Title and No.	
Name of Key Expert:	[Insert full name]
Name of the Firm proposing the Key Expert:	
Date of Birth:	[DAY/MONTH/YEAR]
Nationality:	
Country of Citizenship / Residence:	

2. Education:

[List college/university or other specialized education, giving names of educational institutions, dates attended, degree(s) /diploma(s) obtained]

College / University	Degree(s) / Diploma(s) obtained	Year of obtainment

3. Employment record relevant to the assignment:

[Starting with present position, list in reverse order. Please provide dates, name of employing organization, titles of positions held, types of activities performed and location of the assignment, and contact information of previous clients and employing organization(s) who can be contacted for references. Past employment that is not relevant to the assignment does not need to be included.]

Period	Employing organization	Title/position in employing organization & location. Contact information for references*	Details of project handled with position (Same/Equivalent or Higher)	Details of total working experience

*Contact information for references is required only for assignments during the last 3 years.

4. Language Skills (indicate only languages in which you can Read and Write):

Language skills	Speaking	Reading	Writing

5. Adequacy for the Assignment:

Detailed Tasks Assigned on Consultant's Team of Experts (List major deliverables/tasks as in ANNEX – XVIII in which the Expert will be involved):

Reference to Prior Work / Assignments that Best Illustrates Capability to Handle the Assigned Tasks:

Project No.1	
Year:	

Location:	
Client:	
Main Project Features:	
Positions held:	
Activities performed:	
Project No.2	
Year:	
Location:	
Client:	
Main Project Features:	
Positions held:	
Activities performed:	
Project No.3	
Year:	
Location:	
Client:	
Main Project Features:	
Positions held:	
Activities performed:	
Project No.4	
Year:	
Location:	
Client:	
Main Project Features:	
Positions held:	
Activities performed:	

Project No.5	
Year:	
Location:	
Client:	
Main Project Features:	
Positions held:	
Activities performed:	

6. Certification:

I, the undersigned, certify to the best of my knowledge and belief that:

(i) This CV correctly describes my qualifications and my experience.

(ii) In the absence of medical incapacity, I will undertake this assignment for the duration and in terms of the inputs specified for me in the Expert Schedule in ANNEX – XVII (A) TO APPENDIX IA provided team mobilization takes place within the validity of this proposal or any agreed extension thereof.

(iii) I am committed to undertake the assignment within the validity of Proposal.

(iv) I am not part of the team who wrote the terms of reference for this consulting services assignment.

I understand that any misstatement described herein may lead to my disqualification or dismissal, if engaged.

_____ Date: _____
[Signature of Key Expert] Day/Month/Year

_____ Date: _____
[Counter signed by authorized representative of Consultant/Bidder]

Full name of authorized representative: _____

**ANNEX – XIX TO APPENDIX IA: List of Minimum Construction Equipment's to be deployed
(owned/ hired) by the bidder**

Applicant's legal name Date.....

Group Member's legal name..... Page of pages

List of Minimum Construction Equipment's to be deployed (owned/ hired) by the bidder

S.N.	Equipment Type	Total	Required Capacity
1.	Hydraulic Rotary Piling Rig	2	-
2.	Excavators	2	21T/20T/13T
3.	Dumpers	10	16T/14 M3
4.	Flat Body Trailer	1	31 ton
5.	Vibratory Roller	2	11T
6.	Backhoe loader	6	1M3/.23M3
7.	Hydraulic mobile crane	2	40 ton & 50 M boom
8.	Transit Mixer	6	6 cum
9.	Air compressor HAH-210	2	450 cfm
10.	Water Tanker 12KL	4	12 KL
11.	Concrete pump	2	180 cum/hr
12.	Concrete Boom Placer	2	
13.	Concrete Batching Plant M1	1	60 cum/hr
14.	Concrete Mobile Batching & Mixing Drum Plant	1	20 cum/hr
15.	Concrete batching plant	1	30 cum/hr
16.	Hydraulic Rock Breaker	4	8 ton
17.	Tower Crane	4	10 ton
18.	DG Set	4	250 KVA
19.	Bar cutting and bar bending machine	2	
20.	Tower lights	14	
21.	Ambulance	2	-

ANNEX – XX TO APPENDIX IA: NON-PERFORMANCE, LITIGATION STATEMENT

(on Company Letter-head)

Tender Document No. Tend No./ xxxx; Tender Title: (name of the project)

Bidder's Name _____

[Address and Contact Details]

Bidder's Reference No. _____ Date.....

Note to Bidders: Fill this Form for Bidder and each member of a joint venture or other association that is a party to Bidder to highlight conformance to Criteria. Nonperforming Contracts and Litigation. The list below is indicative only. You may attach more documents as required. Add additional details not covered elsewhere in your bid in this regard.

Non-Performing Contracts			
☐ Contract non-performance did not occur during the five years before the deadline for the bid submission as per the above criteria			
Or			
☐ Contract(s) not performed during the five years before the deadline for the bid submission as per the above criteria are listed below			
Year	Non performed a portion of the contract	Contract Identification	Total Contract Amount
[insert year]	[insert amount and percentage]	Contract identification: [indicate complete contract title, number, and any other identification] Name of institution: [insert full name] Address of institution: [insert street/city/country] Reason(s) for non-performance: [indicate main reason(s)]	[insert amount]

<u>Current and Past Proceedings, Litigation, Arbitration, Actions, Claims, Investigations and Disputes,</u> the process or outcome of which the Authority could reasonably interpret may impact or have the potential to impact the financial or operational condition of Bidder in a manner that may adversely affect the Bidder's ability to satisfy any of its obligations under the contract as per Qualification Criteria Note: Bidder and each member of a Joint Venture/Consortium making up a Bidder must complete this table

☐ No **Or** ☐ Yes

If Yes, Describe:

Year	Matter in Dispute	Contract Identification	Value of Award (Actual or Potential) Against Bidder
[insert year]	[insert amount and percentage]	Contract identification: [indicate complete contract title, number, and any other identification] Name of institution: [insert full name] Address of institution: [insert street/city/country] Reason(s) for non-performance: [indicate main reason(s)]	[insert amount]

ANNEXURE – A: GUARANTEED POWER CONSUMPTION

Bidder to note that the cost of higher power consumption based on the guaranteed power consumption of Technically Accepted Bidders mentioned in the bid in comparison with guaranteed power consumption mentioned by other Technically Accepted Bidders will be added to financial quote of each Bidder during evaluation process.

The method of calculation for cost of higher power loading is mentioned below.

1. Bidders shall submit the **Guaranteed Power consumption per hour** at rated capacity as per Specifications for the offered CEN Standard Ropeway system complete in all respect along with the Bid in the format mentioned in this Annexure
2. The lowest power consumption (declared under Guaranteed Power Consumption) by Technically accepted Bidder shall be considered as the **“Base”** for the comparison and calculation of cost to be added against higher power consumption of the “Integrated Ropeway System” proposed by other Bidders
3. The procedure for calculating the cost against excessive power consumption to be added is demonstrated from the example below.

Example: Suppose there are Three (3) Technically Approved Bidders offering the CEN Standard Ropeway system as specified and have offered guaranteed power consumption as.

Bidder-1: (p) kW,

Bidder-II: (p+20) kW and

Bidder-III: (p+40) kW, respectively.

In this case, Guaranteed Power consumption of Bidder-1 i.e. (p) kW shall be considered as the **“Base”** value. The financial quote of Bidder-II shall be added for 20kW of higher power and financial quote of Bidder-III shall be added for 40kW of higher power based on the following formula.

$$\text{COST OF HIGHER POWER CONSUMPTION} = D \times N \times L \times R \times (1+3\%)^{40}$$

D= Difference in Power per hr = Higher Power - Base Value

N= Offered System =1

L= Life = 40 Years (16x330x40 =211,200 hrs.)

R= Tariff rate= Current rate of HPSEB Tariff as of on the day of evaluation = Rs.7/- unit (Assumed for this example)

E= Escalation = 3% per year (Escalation figure is indicative- Final figure Shall be decided by Authority during financial evaluation)

Calculation of cost of higher power consumption.

Parameter	Unit	Bidder-1	Bidder-II	Bidder-III
D	kW	0	20	40
N	No.	1	1	1
L	Hrs	211,200	211,200	211,200
R	Rs.	7	7	7
E	%	3	3	3
Cost of higher power		0 (A)	9,64,51,933 (B)	19,29,03,866 (C)

Parameter	Unit	Bidder-1	Bidder-II	Bidder-III
consumption (INR)				

Calculation of final bid price.

Cost of power consumption	Price quoted in Financial Bid (INR)	Final Bid Price
Bidder - I (A)	X	X+A
Bidder – II (B)	Y	Y+B
Bidder – III (C)	Z	Z+C

The bidder with minimum final bid price calculated based on the above method shall be considered as a “Selected Bidder”.

Guaranteed Power Consumption Per Hour (Format)- To Be Submitted by Bidder

Sr.no	Guaranteed Commitments	Description
1	Power consumption per hour at rated capacity as per Specifications for the offered CEN Standard Ropeway system complete in all respect	
Total		



“Design, Supply, Construction, Installation, Testing, Commissioning and Operation & Maintenance for 5 (five) years of Seamless Innovative Urban Transportation (Ropeways, Lifts & Escalators Etc.) Network in Shimla City (Himachal Pradesh) on Engineering Procurement and Construction (EPC) Mode.”

Conditions of Contract (GC and PC)

Volume II

October 2024

Externally Aided Project

(Under Consideration for funding by New Development Bank)

Conditions of Contract (GC and PC)

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GENERAL CONDITIONS (GC)

1 General Provisions

1.1 Definitions

- 1.1.1 **"Accepted Contract Amount"** means the amount accepted in the Letter of Acceptance for the execution of the Works in accordance with the Contract.
- 1.1.2 **"Advance Payment Certificate"** means a Payment Certificate issued by the Engineer for advance payment under Sub-Clause 14.2.2 [Advance Payment Certificate].
- 1.1.3 **"Advance Payment Guarantee"** means the guarantee under Sub-Clause 14.2.1 [Advance Payment Guarantee].
- 1.1.4 **"Base Date"** means the date 28 days before the latest date for submission of the Tender.
- 1.1.5 **"Claim"** means a request or assertion by one Party to the other Party for an entitlement or relief under any Clause of these Conditions or otherwise in connection with, or arising out of, the Contract or the execution of the Works.
- 1.1.6 **"Commencement Date"** means the date as stated in the Engineer's Notice issued under Sub-Clause 8.1 [Commencement of Works].
- 1.1.7 **"Compliance Verification System"** means the compliance verification system to be prepared and implemented by the Contractor for the Works in accordance with Sub-Clause 4.9.2 [Compliance Verification System].
- 1.1.8 **"Conditions of Contract"** or "these Conditions" means these General Conditions as amended by the Particular Conditions.
- 1.1.9 **"Contract"** means the Contract Agreement, the Letter of Acceptance, the Letter of Tender, any addenda referred to in the Contract Agreement, these Conditions, the Employer's Requirements, the Schedules, the Contractor's Proposal, the JV Undertaking (if applicable) and the further documents (if any) which are listed in the Contract Agreement or in the Letter of Acceptance.
- 1.1.10 **"Contract Agreement"** means the agreement entered into by both Parties in accordance with Sub-Clause 1.6 [Contract Agreement].
- 1.1.11 **"Contract Data"** means the pages, entitled contract data which constitute Part A of the Particular Conditions.
- 1.1.12 **"Contract Price"** means the price defined in Sub-Clause 14.1 [The Contract Price].
- 1.1.13 **"Contractor"** means the person(s) named as contractor in the Letter of Tender accepted by the Employer and the legal successors in title of such person(s).
- 1.1.14 **"Contractor's Documents"** means the documents prepared by the Contractor as

described in Sub-Clause 5.2 [Contractor's Documents], including calculations, digital files, computer programs and other software, drawings, manuals, models, specifications and other documents of a technical nature.

- 1.1.15 **"Contractor's Equipment"** means all apparatus, equipment, machinery, construction plant, vehicles and other items required by the Contractor for the execution of the Works. Contractor's Equipment excludes Temporary Works, Plant, Materials and any other things intended to form or forming part of the Permanent Works.
- 1.1.16 **"Contractor's Personnel"** means the Contractor's Representative and all personnel whom the Contractor utilises on Site or other places where the Works are being carried out, including the staff, labour and other employees of the Contractor and of each Subcontractor; and any other personnel assisting the Contractor in the execution of the Works.
- 1.1.17 **"Contractor's Proposal"** means the part of the Tender stated or implied as being the Contractor's proposal for execution of the Works, as included in the Contract. Such documents may include the Contractor's preliminary design.
- 1.1.18 **"Contractor's Representative"** means the natural person named by the Contractor in the Contract or appointed by the Contractor under Sub-Clause 4.3 [Contractor's Representative], who acts on behalf of the Contractor.
- 1.1.19 **"Cost"** means all expenditure reasonably incurred (or to be incurred) by the Contractor in performing the Contract, whether on or off the Site, including taxes, overheads and similar charges, but does not include profit. Where the Contractor is entitled under a Sub-Clause of these Conditions to payment of Cost, it shall be added to the Contract Price.
- 1.1.20 **"Cost Plus Profit"** means Cost plus the applicable percentage for profit stated in the Contract Data (if not stated, five percent (5%)). Such a percentage shall only be added to Cost-, and Cost-Plus Profit shall only be added to the Contract Price, where the Contractor is entitled under a Sub-Clause of these Conditions to payment of Cost Plus Profit.
- 1.1.21 **"Country"** means the country in which the Site (or most of it) is located, where the permanent Works are to be executed.
- 1.1.22 **"DAAB"** or "Dispute Avoidance/Adjudication Board" means the sole member or three members (as the case may be) so named in the Contract appointed under Sub-Clause 21.1 [Constitution of the DAAB] or Sub-Clause 21.2 [Failure to Appoint DAAB Member(s)].
- 1.1.23 **"DAAB Agreement"** means the agreement signed or deemed to have been signed by both Parties and the sole member or each of the three members (as the case may be) of the DAAB in accordance with Sub-Clause 21.1 [Constitution of the DAAB] or Sub-

- Clause 21.2 [Failure to Appoint DAAB Member(s)], incorporating by reference the General Conditions of Dispute avoidance/Adjudication Agreement contained in the Appendix to these General Conditions with such amendments as are agreed.
- 1.1.24 **"Date of Completion"** means the date stated in the Taking-Over Certificate issued by the Engineer; or, if the last paragraph of Sub-Clause 10.1 [Taking Over the Works and Sections] applies, the date on which the Works or Section are deemed to have been completed in accordance with the Contract; or, if Sub-Clause 10.2 [Taking Over Parts] or Sub-Clause 10.3. [Interference with Tests on Completion] applies, the date on which the Works or Section or Part are deemed to have been taken over by the Employer.
- 1.1.25 **"day"** means a calendar day.
- 1.1.26 **"Daywork Schedule"** means the document entitled daywork schedule (if any) included in the Contract, showing the amounts and manner of payments to be made to the Contractor for labour, materials and equipment used for daywork under Sub-Clause 13.5 [Daywork].
- 1.1.27 **"Defects Notification Period" or "DNP"** means the period for notifying defects and/or damage in the Works or a Section or a Part (as the case may be) under Sub-Clause 11.1 [Completion of Outstanding Work and Remedying Defects], as stated in the Contract Data (if not stated, one year), and as may be extended under Sub-Clause 11.3 [Extension of Defects Notification Period]. This period is calculated from the Date of Completion of the Works or Section or Part.
- 1.1.28 **"Delay Damages"** means the damages for which the Contractor shall be liable under Sub-Clause 8.8 [Delay Damages] for failure to comply with Sub-Clause 8.2 [Time for Completion].
- 1.1.29 **"Dispute"** means any situation where:
- one Party makes a claim against the other Party (which may be a Claim, as defined in these Conditions, or a matter to be determined by the Engineer under these Conditions, or otherwise);
 - the other Party (or the Engineer under Sub-Clause 3.7.2 [Engineer's Determination]) rejects the claim in whole or in part; and
 - the first Party does not acquiesce (by giving a NOD under Sub-Clause 3.7.5 [Dissatisfaction with Engineer's determination] or otherwise),
- provided however that a failure by the other Party (or the Engineer) to oppose or respond to the claim, in whole or in part, may constitute a rejection if, in the circumstances, the DAAB or the arbitrator(s), as the case may be, deem it reasonable for it to do so.
- 1.1.30 **"Employer"** means the person named as the Employer in the Contract Data and the legal successors in title to this person.

- 1.1.31 **"Employer's Equipment"** means the apparatus, equipment, machinery, construction plant and/or vehicles (if any) to be made available by the Employer for the use of the Contractor under Sub-Clause 2.6 [Employer-Supplied Materials and Employer's Equipment]; but does not include Plant which has not been taken over under Clause 10 [Employer's Taking Over].
- 1.1.32 **"Employer's Personnel"** means the Engineer, the Engineer's Representative (if appointed), the assistants described in Sub-Clause 3.4 [Delegation by the Engineer] and all other staff, labour and other employees of the Engineer and of the Employer engaged in fulfilling the Employer's obligations under the Contract; and any other personnel identified as Employer's Personnel, by a Notice from the Employer or the Engineer to the Contractor.
- 1.1.33 **"Employer's Requirements"** means the document entitled Employer's requirements, as included in the Contract, and any additions and modifications to such document in accordance with the Contract. Such document describes the purpose(s) for which the Works are intended, and specifies Key Personnel (if any), the scope, and/or design and/or other performance, technical and evaluation criteria, for the Works.
- 1.1.34 **"Employer-Supplied Materials"** means the materials (if any) to be supplied by the Employer to the Contractor under Sub-Clause 2.6 [Employer Supplied Materials and Employer's Equipment].
- 1.1.35 **"Engineer"** means the person named in the Contract Data appointed by the Employer to act as the Engineer for the purposes of the Contract, or any replacement appointed under Sub-Clause 3.6 [Replacement of the Engineer].
- 1.1.36 **"Engineer's Representative"** means the natural person who may be appointed by the Engineer under Sub-Clause 3.3 [Engineer's Representative].
- 1.1.37 **"Exceptional Event"** means an event or circumstance as defined in Sub-Clause 18.1 [Exceptional Events].
- 1.1.38 **"Extension of Time"** or "EOT" means an extension of the Time for Completion under Sub-Clause 8.5 [Extension of Time for Completion].
- 1.1.39 **"FIDIC"** means the Federation internationale des Ingenieurs-Conseils, the International Federation of Consulting Engineers.
- 1.1.40 **"Final Payment Certificate"** or "FPC" means the payment certificate issued by the Engineer under Sub-Clause 14.13 [Issue of FPC].
- 1.1.41 **"Final Statement"** means the Statement defined in Sub-Clause 14.11.2 [Agreed Final Statement].
- 1.1.42 **"Foreign Currency"** means a currency in which part (or all) of the Contract Price is payable, but not the Local Currency.

- 1.1.43 **"General Conditions"** means this document entitled "Conditions of Contract for Plant and Design-Build for Electrical & Mechanical Plant, and for Building and Engineering Works, designed by the Contractor", as published by FIDIC.
- 1.1.44 **"Goods"** means Contractor's Equipment, Materials, Plant and Temporary Works, or any of them as appropriate.
- 1.1.45 **"Interim Payment Certificate"** or "IPC" means a Payment Certificate issued by the Engineer for an interim payment under Sub-Clause 14.6 [Issue of IPC].
- 1.1.46 **"Joint Venture"** or "JV" means a joint venture, association, consortium or other unincorporated grouping of two or more persons, whether in the form of a partnership or otherwise.
- 1.1.47 **"JV Undertaking"** means the letter provided to the Employer as part of the Tender setting out the legal undertaking between the two or more persons constituting the Contractor as a JV. This letter shall be signed by all the persons who are members of the JV, shall be addressed to the Employer and shall include:
- a. each such member's undertaking to be jointly and severally liable to the Employer for the performance of the Contractor's obligations under the Contract;
 - b. identification and authorisation of the leader of the JV; and
 - c. identification of the separate scope or part of the Works (if any) to be carried out by each member of the JV.
- 1.1.48 **"Key Personnel"** means the positions (if any) of the Contractor's Personnel, other than the Contractor's Representative, that are stated in the Employer's Requirements.
- 1.1.49 **"Laws"** means all national (or state or provincial) legislation, statutes, acts, decrees, rules, ordinances, orders, treaties, international law and other laws, and regulations and by-laws of any legally constituted public authority.
- 1.1.50 **"Letter of Acceptance"** means the letter of formal acceptance, signed by the Employer, of the Letter of Tender, including any annexed memoranda comprising agreements between and signed by both Parties. If there is no such letter of acceptance, the expression "Letter of Acceptance" means the Contract Agreement and the date of issuing or receiving the Letter of Acceptance means the date of signing the Contract Agreement.
- 1.1.51 **"Letter of Tender"** means the letter of tender, signed by the Contractor, stating the Contractor's offer to the Employer for the execution of the Works.
- 1.1.52 **"Local Currency"** means the currency of the Country.
- 1.1.53 **"Materials"** means things of all kinds (other than Plant), whether on the Site or otherwise allocated to the Contract and intended to form or forming part of the

Permanent Works, including the supply-only materials (if any) to be supplied by the Contractor under the Contract.

- 1.1.54 **"month"** is a calendar month (according to the Gregorian calendar).
- 1.1.55 **"No-objection"** means that the Engineer has no objection to the Contractor's Documents, or other documents submitted by the Contractor under these Conditions, and such Contractor's Documents or other documents may be used for the Works.
- 1.1.56 **"Notice"** means a written communication identified as a Notice and issued in accordance with Sub-Clause 1.3 [Notices and Other Communications].
- 1.1.57 **"Notice of Dissatisfaction"** or **"NOD"** means the Notice one Party may give to the other Party if it is dissatisfied, either with an Engineer's determination under Sub-Clause 3.7 [Agreement or Determination] or with a DAAB's decision under Sub-Clause 21.4 [Obtaining DAAB's Decision].
- 1.1.58 **"Part"** means a part of the Works or part of a Section (as the case may be) which is used by the Employer and deemed to have been taken over under Sub-Clause 10.2 [Taking Over Parts].
- 1.1.59 **"Particular Conditions"** means the document entitled particular conditions of contract included in the Contract, which consists of Part A - Contract Data and PartB-Special Provisions.
- 1.1.60 **"Party"** means the Employer or the Contractor, as the context requires. "Parties" means both the Employer and the Contractor.
- 1.1.61 **"Payment Certificate"** means a payment certificate issued by the Engineer under Clause 14 [Contract Price and Payment].
- 1.1.62 **"Performance Certificate"** means the certificate issued by the Engineer (or deemed to be issued) under Sub-Clause 11.9 [Performance Certificate].
- 1.1.63 **"Performance Damages"** means the damages to be paid by the Contractor to the Employer, for the failure to achieve the guaranteed performance of the Plant and/or the Works or any part of the Works (as the case may be), as set out in the Schedule of Performance Guarantees.
- 1.1.64 **"Performance Security"** means the security under Sub-Clause 4.2 [Performance Security].
- 1.1.65 **"Permanent Works"** means the works of a permanent nature which are to be executed by the Contractor under the Contract.
- 1.1.66 **"Plant"** means the apparatus, equipment, machinery and vehicles (including any components) whether on the Site or otherwise allocated to the Contract and intended to form or forming part of the Permanent Works.

- 1.1.67 **"Programme"** means a detailed time programme prepared and submitted by the Contractor to which the Engineer has given (or is deemed to have given) a Notice of No-objection under Sub-Clause 8.3 [Programme].
- 1.1.68 **"Provisional Sum"** means a sum (if any) which is specified in the Contract by the Employer as a provisional sum, for the execution of any part of the Works or for the supply of Plant, Materials or services under Sub-Clause 13.4 [Provisional Sums].
- 1.1.69 **"QM System"** means the Contractor's quality management system (as may be updated and/or revised from time to time) in accordance with Sub-Clause 4.9.1 [Quality Management System].
- 1.1.70 **"Retention Money"** means the accumulated retention moneys which the Employer retains under Sub-Clause 14.3 [Application for Interim Payment] and pays under Sub-Clause 14.9 [Release of Retention Money].
- 1.1.71 **"Review"** means examination and consideration by the Engineer of a Contractor's submission in order to assess whether (and to what extent) it complies with the Contract and/or with the Contractor's obligations under or in connection with the Contract.
- 1.1.72 **"Schedules"** means the document(s) entitled schedules prepared by the Employer and completed by the Contractor, as attached to the Letter of Tender and included in the Contract. Such document(s) may include data, lists and schedules of payments and/or rates and prices, and guarantees.
- 1.1.73 **"Schedule of Payments"** means the document(s) entitled schedule of payments (if any) in the Schedules showing the amounts and manner of payments to be made to the Contractor.
- 1.1.74 **"Schedule of Performance Guarantees"** means the document(s) entitled schedule of performance guarantees (if any) in the Schedules showing the guarantees required by the Employer for performance of the Works and/ or the Plant or any part of the Works (as the case may be) and stating the applicable Performance Damages payable in the event of failure to attain any of the guaranteed performance(s).
- 1.1.75 **"Schedule of Rates and Prices"** means the document(s) entitled schedule of rates and prices (if any) in the Schedules.
- 1.1.76 **"Section"** means a part of the Works specified in the Contract Data as a Section (if any).
- 1.1.77 **"Site"** means the places where the Permanent Works are to be executed and to which Plant and Materials are to be delivered, and any other places specified in the Contract as forming part of the Site.
- 1.1.78 **"Special Provisions"** means the document (if any), entitled special provisions which constitutes Part B of the Particular Conditions.

- 1.1.79 **"Statement"** means a statement submitted by the Contractor as part of an application for a Payment Certificate under Sub-Clause 14.2.1 [Advance Payment Guarantee] (if applicable), Sub-Clause 14.3 [Application for Interim Payment], Sub-Clause 14.10 [Statement at Completion] or Sub-Clause 14.11 [Final Statement].
- 1.1.80 **"Subcontractor"** means any person named in the Contract as a subcontractor, or any person appointed by the Contractor as a subcontractor or designer, for a part of the Works; and the legal successors in title to each of these persons.
- 1.1.81 **"Taking-Over Certificate"** means a certificate issued (or deemed to be issued) by the Engineer in accordance with Clause 10 [Employer's Taking Over].
- 1.1.82 **"Temporary Works"** means all temporary works of every kind (other than Contractor's Equipment) required on Site for the execution of the Works.
- 1.1.83 **"Tender"** means the Letter of Tender, the Contractor's Proposal, the JV Undertaking (if applicable), and all other documents which the Contractor submitted with the Letter of Tender, as included in the Contract.
- 1.1.84 **"Tests after Completion"** means the tests (if any) which are stated in the Employer's Requirements and which are carried out in accordance with the Special Provisions after the Works or a Section (as the case may be) are taken over under Clause 10 [Employer's Taking Over].
- 1.1.85 **"Tests on Completion"** means the tests which are specified in the Contract or agreed by both Parties or instructed as a Variation, and which are carried out under Clause 9 [Tests on Completion] before the Works or a Section (as the case may be) are taken over under Clause 10 [Employer's Taking Over].
- 1.1.86 **"Time for Completion"** means the time for completing the Works or a Section (as the case may be) under Sub-Clause 8.2 [Time for Completion], as stated in the Contract Data as may be extended under Sub-Clause 8.5 [Extension of Time for Completion], calculated from the Commencement Date.
- 1.1.87 **"Unforeseeable"** means not reasonably foreseeable by an experienced contractor by the Base Date.
- 1.1.88 **"Variation"** means any change to the Employer's Requirements or the Works, which is instructed as a variation under Clause 13 [Variations and Adjustments].
- 1.1.89 **"Works"** mean the Permanent Works and the Temporary Works, or either of them as appropriate.
- 1.1.90 **"year"** means 365 days.

1.2 Interpretation

In the Contract, except where the context requires otherwise:

- a. words indicating one gender include all genders; and "he", "his" and "himself"

shall be read as "he/she", "his/her" and "himself/herself" respectively;

- b. words indicating the singular also include the plural and words indicating the plural also include the singular;
- c. provisions including the word "agree", "agreed" or "agreement" require the agreement to be recorded in writing;
- d. "written" or "in writing" means hand-written, type-written, printed or electronically made, and resulting in a permanent record;
- e. "may" means that the Party or person referred to has the choice of whether to act or not in the matter referred to;
- f. "shall" means that the Party or person referred to has an obligation under the Contract to perform the duty referred to;
- g. "consent" means that the Employer, the Contractor or the Engineer (as the case may be) agrees to, or gives permission for, the requested matter;
- h. "including", "include" and "includes" shall be interpreted as not being limited to, or qualified by, the stated items that follow;
- i. words indicating persons or parties shall be interpreted as referring to natural and legal persons (including corporations and other legal entities); and
- j. "Execute the Works" or "execution of the Works" means the design, construction and completion of the Works and the remedying of any defects.

In any list in these Conditions, where the second-last item of the list is followed by "and" or "or" or "and/or" then all of the list items going before this item shall also be read as if they are followed by "and" or "or" or "and/or" (as the case may be).

The marginal words and other headings shall not be taken into consideration in the interpretation of these Conditions.

1.3 Notices and Other Communications

Wherever these Conditions provide for the giving of a Notice (including a Notice of Dissatisfaction) or the issuing, providing, sending, submitting or transmitting of another type of communication (including acceptance, acknowledgement, advising, agreement, approval, certificate, Claim, consent, decision, determination, discharge, instruction, No-objection, record(s) of meeting, permission, proposal, record, reply, report, request, Review, Statement, statement, submission or any other similar type of communication), the Notice or other communication shall be in writing and:

- a. shall be:
 - i. a paper-original signed by the Contractor's Representative, the Engineer, or the authorised representative of the Employer (as the case may be); or

- ii. an electronic original generated from any of the systems of electronic transmission stated in the Contract Data (if not stated, system(s) acceptable to the Engineer), where the electronic original is transmitted by the electronic address uniquely assigned to each of such authorised representatives, or both, as stated in these Conditions; and
- b. if it is a Notice, it shall be identified as a Notice. If it is another form of communication, it shall be identified as such and include reference to the provision(s) of the Contract under which it is issued where appropriate;
- c. delivered by hand (against receipt), or sent by mail or courier (against receipt), or transmitted using any of the systems of electronic transmission under sub-paragraph (a) (ii) above; and
- d. delivered, sent or transmitted to the address for the recipient's communications as stated in the Contract Data. However, if the recipient gives a Notice of another address, all Notices and other communications shall be delivered accordingly after the sender receives such Notice.

Where these Conditions state that a Notice or NOD or other communication is to be delivered, given, issued, provided, sent, submitted or transmitted, it shall have effect when it is received (or deemed to have been received) at the recipient's current address under sub-paragraph (d) above. An electronically transmitted Notice or other communication is deemed to have been received on the day after transmission, provided no non-delivery notification was received by the sender.

All Notices, and all other types of communication as referred to above, shall not be unreasonably withheld or delayed.

When a Notice or NOD or certificate is issued by a Party or the Engineer, the paper and/or electronic original shall be sent to the intended recipient and a copy shall be sent to the Engineer or the other Party, as the case may be. All other communications shall be copied to the Parties and/or the Engineer as stated under these Conditions or elsewhere in the Contract.

1.4 Law and Language

The Contract shall be governed by the law of the country (or other jurisdiction) stated in the Contract Data (if not stated, the law of the Country), excluding any conflict of law rules.

The ruling language of the Contract shall be that stated in the Contract Data (if not stated, the language of these Conditions). If there are versions of any part of the Contract which are written in more than one language, the version which is in the ruling language shall prevail.

The language for communications shall be that stated in the Contract Data. If no language is stated there, the language for communications shall be the ruling language of the Contract.

1.5 Priority of Documents

The documents forming the Contract are to be taken as mutually explanatory of one another. If there is any conflict, ambiguity or discrepancy, the priority of the documents shall be in accordance with the following sequence:

- a. the Contract Agreement;
- b. the Letter of Acceptance;
- c. the Letter of Tender,
- d. the Particular Conditions Part A- Contract Data;
- e. the Particular Conditions Part B - Special Provisions;
- f. these General Conditions;
- g. the Employer's Requirements;
- h. the Schedules;
- i. the Contractor's Proposal;
- j. the JV Undertaking (if the Contractor is a JV); and
- k. any other documents forming part of the Contract.

If a Party finds an ambiguity or discrepancy in the documents, that Party shall promptly give a Notice to the Engineer, describing the ambiguity or discrepancy. After receiving such Notice, or if the Engineer finds an ambiguity or discrepancy in the documents, the Engineer shall issue the necessary clarification or instruction.

1.6 Contract Agreement

The Parties shall sign a Contract Agreement within 35 days after the Contractor receives the Letter of Acceptance, unless they agree otherwise. The Contract Agreement shall be based on the form annexed to the Particular Conditions. The costs of stamp duties and similar charges (if any) imposed by law in connection with entry into the Contract Agreement shall be borne by the Employer.

If the Contractor comprises a JV, the authorised representative of each member of the JV shall sign the Contract Agreement.

1.7 Assignment

Neither Party shall assign the whole or any part of the Contract or any benefit or interest in or under the Contract. However, either Party:

- a. may assign the whole or any part of the Contract with the prior agreement of the other Party, at the sole discretion of such other Party; and
- b. may, as security in favour of a bank or financial institution, assign the Party's right to any moneys due, or to become due, under the Contract without the prior agreement of the other Party.

1.8 Care and Supply of Documents

Each of the Contractor's Documents shall be in the custody and care of the Contractor, unless and until submitted to the Engineer. The Contractor shall supply to the Engineer one paper-original, one electronic copy (in the form as specified in the Employer's Requirements or, if not stated, a form acceptable to the Engineer) and additional paper copies (if any) as stated in the Contract Data of each of the Contractor's Documents.

The Contractor shall keep at all times, on the Site, a copy of:

- a. the Contract;
- b. the records under Sub-Clause 6.10 [Contractor's Records] and Sub-Clause 20.2.3 [Contemporary records];
- c. the publications (if any) named in the Employer's Requirements;
- d. the Contractor's Documents; and
- e. Variations, Notices and other communications given under the Contract.

The Employer's Personnel shall have right of access to all these documents during all normal working hours, or as otherwise agreed with the Contractor.

If a Party (or the Engineer) becomes aware of an error or defect (whether of a technical nature or otherwise) in a document which was prepared by (or on behalf of the Contractor for use in the execution of the Works, the Party (or the Engineer) shall promptly give a Notice of such error or defect to the other Party (or to the Parties). The Contractor shall then promptly rectify the error or defect at the Contractor's risk and cost.

1.9 Errors in the Employer's Requirements

If the Contractor finds an error, fault or defect in the Employer's Requirements as a result of scrutinising them under Sub-Clause 5.1 [General Design Obligations], the Contractor shall give a Notice to the Engineer within the period stated in the Contract Data (if not stated, 42 days) calculated from the Commencement Date.

If, after expiry of this period, the Contractor finds an error, fault or defect in the Employer's Requirements, the Contractor shall also give a Notice to the Engineer describing the error, fault or defect.

The Engineer shall then proceed as specified under Sub-Clause 3.7 [Agreement or Determination] to agree or determine:

- a. whether or not there is an error, fault or defect in the Employer's Requirements;
- b. whether or not (taking account of cost and time) an experienced contractor exercising due care would have discovered the error, fault or other defect:
 - when examining the Site and the Employer's Requirements before submitting the Tender; or
 - if the Contractor's Notice is given after the expiry of the period stated in

the first paragraph of this Sub-Clause, when scrutinising the Employer's Requirements under Sub-Clause 5.1 [General Design Obligations]; and

- c. what measures (if any) the Contractor is required to take to rectify the error, fault or defect

(and, for the purpose of Sub-Clause 3.7.3 [Time limits], the date the Engineer receives the Contractor's Notice under this Sub-Clause shall be the date of commencement of the time limit for agreement under Sub-Clause 3.7.3).

If, under sub-paragraph (b) above, an experienced contractor would not have discovered the error, fault or other defect:

- i. Sub-Clause 13.3.1 [Variation by Instruction] shall apply to the measures that the Contractor is required to take (if any); and
- ii. if the Contractor suffers delay and/or incurs Cost as a result of the error, fault or defect, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims for Payment and/or EOT] to EOT and/or payment of such Cost Plus Profit.

1.10 Employer's Use of Contractor's Documents

As between the Parties, the Contractor shall retain the copyright and other intellectual property rights in the Contractor's Documents and other design documents made by (or on behalf of) the Contractor.

The Contractor shall be deemed (by signing the Contract Agreement) to give to the Employer a non-terminable transferable non-exclusive royalty-free license to copy, use and communicate the Contractor's Documents and such other design documents, including making and using modifications of them. This license shall:

- a. apply throughout the actual or intended operational life (whichever is longer) of the relevant parts of the Works;
- b. entitle any person in proper possession of the relevant part of the Works to copy, use and communicate the Contractor's Documents and such other design documents for the purposes of completing, operating, maintaining, altering, adjusting, repairing and demolishing the Works;
- c. in the case of Contractor's Documents and such other design documents which are in the form of electronic or digital files, computer programs and other software, permit their use on any computer on the Site and/or at the locations of the Employer and the Engineer and/or at other places as envisaged by the Contract; and
- d. in the event of termination of the Contract:
 - i. under Sub-Clause 15.2 [Termination for Contractor's Default], entitle the Employer to copy, use and communicate the Contractor's

Documents and the other design documents made by or for the Contractor; or

- ii. under Sub-Clause 15.5 [Termination for Employer's Convenience], Sub-Clause 16.2 [Termination by Contractor] or Sub-Clause 18.5 [Optional Termination], entitle the Employer to copy, use and communicate the Contractor's Documents for which the Contractor has received payment for the purpose of completing the Works and/or arranging for any other entities to do so.

The Contractor's Documents and other design documents made by (or on behalf of) the Contractor shall not, without the Contractor's prior consent, be used, copied or communicated to a third party by (or on behalf of) the Employer for purposes other than those permitted under this Sub-Clause.

1.11 Contractor's Use of Employer's Documents

As between the Parties, the Employer shall retain the copyright and other intellectual property rights in the Employer's Requirements and other documents made by (or on behalf of) the Employer. The Contractor may, at the Contractor's cost, copy, use and communicate these documents for the purposes of the Contract.

These documents (in whole or in part) shall not, without the Employer's prior consent, be copied, used or communicated to a third party by the Contractor, except as necessary for the purposes of the Contract.

1.12 Confidentiality

The Contractor shall disclose all such confidential and other information as the Engineer may reasonably require in order to verify the Contractor's compliance with the Contract.

The Contractor shall treat all documents forming the Contract as confidential, except to the extent necessary to carry out the Contractor's obligations under the Contract. The Contractor shall not publish, permit to be published, or disclose any particulars of the Contract in any trade or technical paper or elsewhere without the Employer's prior consent.

The Employer and the Engineer shall treat all information provided by the Contractor and marked "confidential", as confidential. The Employer shall not disclose or permit to be disclosed any such information to third parties, except as may be necessary when exercising the Employer's rights under Sub-Clause 15.2 [Termination for Contractor's Default].

A Party's obligation of confidentiality under this Sub-Clause shall not apply where the information:

- a. was already in that Party's possession without an obligation of confidentiality before receipt from the other Party;
- b. becomes generally available to the public through no breach of these Conditions; or
- c. is lawfully obtained by the Party from a third party which is not bound by an

obligation of confidentiality.

1.13 Compliance with Laws

The Contractor and the Employer shall, in performing the Contract, comply with all applicable Laws. Unless otherwise stated in the Employer's Requirements:

- a. the Employer shall have obtained (or shall obtain) the planning, zoning or building permit or similar permits, permissions, licenses and/or approvals for the Permanent Works, and any other permits, permissions, licenses and/or

approvals described in the Employer's Requirements as having been (or being) obtained by the Employer. The Employer shall indemnify and hold the Contractor harmless against and from the consequences of any delay or failure to do so, unless the failure is caused by the Contractor's failure to comply with sub-paragraph (c) below;

- b. the Contractor shall give all notices, pay all taxes, duties and fees, and obtain all other permits, permissions, licenses and/or approvals, as required by the Laws in relation to the execution of the Works. The Contractor shall indemnify and hold the Employer harmless against and from the consequences of any failure to do so unless the failure is caused by the Employer's failure to comply with Sub-Clause 2.2 [Assistance];
- c. within the time(s) stated in the Employer's Requirement's the Contractor shall provide such assistance and all documentation, as described in the Employer's Requirements or otherwise reasonably required by the Employer, so as to allow the Employer to obtain any permit, permission, license or approval under sub-paragraph (a) above; and
- d. the Contractor shall comply with all permits, permissions, licenses and/or approvals obtained by the Employer under sub-paragraph (a) above.

If, having complied with sub-paragraph (c) above, the Contractor suffers delay and/or incurs Cost as a result of the Employer's delay or failure to obtain any permit, permission, license or approval under sub-paragraph (a) above, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to EOT and/or payment of such Cost Plus Profit.

If the Employer incurs additional costs as a result of the Contractor's failure to comply with:

- i. sub-paragraph (c) above; or
- ii. sub-paragraph (b) or (d) above, provided that the Employer shall have complied with Sub-Clause 2.2 [Assistance],

the Employer shall be entitled subject to Sub-Clause 20.2 [Claims for Payment and/or EOT] to payment of these costs by the Contractor.

1.14 Joint and Several Liability

If the Contractor is a Joint Venture:

- a. the members of the JV shall be jointly and severally liable to the Employer for the performance of the Contractor's obligations under the Contract;
- b. the JV leader shall have authority to bind the Contractor and each member of the JV; and
- c. neither the members nor (if known) the scope and parts of the Works to be carried out by each member nor the legal status of the JV shall be altered without the prior consent of the Employer (but such consent shall not relieve the altered JV from any liability under Sub paragraph (a) above);

1.15 Limitation of Liability

Neither Party shall be liable to the other Party for loss of use of any Works, loss of profit, loss of any contract or for any indirect or consequential loss or damage which may be suffered by the other Party in connection with the Contract, other than under:

- a. Sub-Clause 8.8 [Delay Damages];
- b. sub-paragraph (c) of Sub-Clause 13.3.1 [Variation by Instruction];
- c. Sub-Clause 15.7 [Payment after Termination for Employer's Convenience].
- d. Sub-Clause 16.4 [Payment after Termination by Contractor];
- e. Sub-Clause 17.3 [Intellectual and Industrial Property Rights];
- f. the first paragraph of Sub-Clause 17.4 [Indemnities by Contractor]; and
- g. Sub-Clause 17.5 [Indemnities by Employer].

The total liability of the Contractor to the Employer under or in connection with the Contract, other than:

- i. under Sub-Clause 2.6 [Employer-Supplied Materials and Employer's Equipment];
- ii. under Sub-Clause 4.19 [Temporary Utilities];
- iii. under Sub-Clause 17.3 [Intellectual and Industrial Property Rights]; and
- iv. under the first paragraph of Sub-Clause 17.4 [Indemnities by Contractor],

shall not exceed the sum stated in the Contract Data or (if a sum is not so stated) the Accepted Contract Amount.

This Sub-Clause shall not limit liability in any case of fraud, gross negligence, deliberate default or reckless misconduct by the defaulting Party.

1.16 Contract Termination

Subject to any mandatory requirements under the governing law of the Contract, termination of the Contract under any Sub-Clause of these Conditions shall require no

action of whatsoever kind by either Party other than as stated in the Sub-Clause.

2 The Employer

2.1 Right of Access to the Site

The Employer shall give the Contractor right of access to, and possession of, all parts of the Site within the time (or times) stated in the Contract Data. The right and possession may not be exclusive to the Contractor. If, under the Contract, the Employer is required to give (to the Contractor) possession of any foundation, structure, plant or means of access, the Employer shall do so in the time and manner stated in the Employer's Requirements. However, the Employer may withhold any such right or possession until the Performance Security has been received.

If no such time is stated in the Contract Data, the Employer shall give the Contractor right of access to, and possession of, those parts of the Site within such times as may be required to enable the Contractor to proceed in accordance with the

Programme or, if there is no Programme at that time, the initial programme submitted under Sub-Clause 8.3 [Programme].

If the Contractor suffers delay and/or incurs Cost as a result of a failure by the Employer to give any such right or possession within such time, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims for Payment and/or EOT] to EOT and/or payment of such Cost Plus Profit.

However, if and to the extent that the Employer's failure was caused by any error or delay by the Contractor, including an error in, or delay in the submission of, any of the applicable Contractor's Documents, the Contractor shall not be entitled to such EOT and/or Cost Plus Profit.

If, under the Contract, the Employer is required to give to the Contractor possession of any foundation, structure, plant or means of access in accordance with Contractor's Documents, the Contractor shall submit such Contractor's Documents to the Engineer in the time and manner stated in the Employer's Requirements.

2.2 Assistance

If requested by the Contractor, the Employer shall promptly provide reasonable assistance to the Contractor so as to allow the Contractor to obtain:

- a. copies of the Laws of the Country which are relevant to the Contract but are not readily available; and
- b. any permits, permissions, licenses or approvals required by the Laws of the Country (including information required to be submitted by the Contractor in order to obtain such permits, permissions, licenses or approvals):
 - i. which the Contractor is required to obtain under Sub-Clause 1.13 [Compliance with Laws];
 - ii. for the delivery of Goods, including clearance through customs; and

- iii. for the export of Contractor's Equipment when it is removed from the Site.

2.3 Employer's Personnel and Other Contractors

The Employer shall be responsible for ensuring that the Employer's Personnel and the Employer's other contractors (if any) on or near the Site:

- a. co-operate with the Contractor's efforts under Sub-Clause 4.6 [Co-operation]; and
- b. comply with the same obligations which the Contractor is required to comply with under sub-paragraphs (a) to (e) of Sub-Clause 4.8 [Health and Safety Obligations] and under Sub-Clause 4.18 [Protection of the Environment].

The Contractor may require the Employer to remove (or cause to be removed) any person of the Employer's Personnel or of the Employer's other contractors (if any) who is found, based on reasonable evidence, to have engaged in corrupt, fraudulent, collusive or coercive practice.

2.4 Employer's Financial Arrangements

The Employer's arrangements for financing the Employer's obligations under the Contract shall be detailed in the Contract Data.

If the Employer intends to make any material change (affecting the Employer's ability to pay the part of the Contract Price remaining to be paid at that time as estimated by the Engineer) to these financial arrangements or has to do so because of changes in the Employer's financial situation, the Employer shall immediately give a Notice to the Contractor with detailed supporting particulars.

If the Contractor:

- a. receives an instruction to execute a Variation with a price greater than ten percent (10%) of the Accepted Contract Amount, or the accumulated total of Variations exceeds thirty percent (30%) of the Accepted Contract Amount;
- b. does not receive payment in accordance with Sub-Clause 14.7 [Payment]; or
- c. becomes aware of a material change in the Employer's financial arrangements of which the Contractor has not received a Notice under this Sub-Clause,

the Contractor may request and the Employer shall, within 28 days after receiving this request, provide reasonable evidence that financial arrangements have been made and are being maintained which will enable the Employer to pay the part of the Contract Price remaining to be paid at that time (as estimated by the Engineer).

2.5 Site Data and Items of Reference

The Employer shall have made available to the Contractor for information, before the Base Date, all relevant data in the Employer's possession on the topography of the Site and on sub-surface, hydrological, climatic and environmental conditions at the Site. The Employer shall promptly make available to the Contractor all such data which comes into the Employer's possession after the Base Date.

The original survey control points, lines and levels of reference (the "items of reference" in these Conditions) shall be specified in the Employer's Requirements or issued to the Contractor by a Notice from the Engineer.

2.6 Employer-Supplied Materials and Employer's Equipment

If Employer-Supplied Materials and/or Employer's Equipment are listed in the Employer's Requirements for the Contractor's use in the execution of the Works, the Employer shall make such materials and/or equipment available to the Contractor in accordance with the details, times, arrangements, rates and prices stated in the Employer's Requirements.

The Contractor shall be responsible for each item of Employer's Equipment whilst any of the Contractor's Personnel is operating it, driving it, directing it, using it, or incontrol of it.

3 The Engineer

3.1 The Engineer

The Employer shall appoint the Engineer, who shall carry out the duties assigned to the Engineer in the Contract.

The Engineer shall be vested with all the Employer necessary to act as the Engineer under the Contract.

If the Engineer is a legal entity, a natural person employed by the Engineer shall be appointed and authorised to act on behalf of the Engineer under the Contract.

The Engineer (or, if a legal entity, the natural person appointed to act on its behalf) shall be:

- a. a professional engineer having suitable qualifications, experience and competence to act as the Engineer under the Contract; and
- b. shall be fluent in the ruling language defined in Sub-Clause 1.4 [Law and Language].

Where the Engineer is a legal entity, the Engineer shall give a Notice to the Parties of the natural person (or any replacement) appointed and authorised to act on its behalf. The authority shall not take effect until this Notice has been received by both Parties. The Engineer shall similarly give a Notice of any revocation of such authority.

3.2 Engineer's Duties and Authority

Except as otherwise stated in these Conditions, whenever carrying out duties or exercising authority, specified in or implied by the Contract, the Engineer shall act as a skilled professional and shall be deemed to act for the Employer.

The Engineer shall have no authority to amend the Contract or, except as otherwise stated in these Conditions, to relieve either Party of any duty, obligation or responsibility under or in connection with the Contract.

The Engineer may exercise the authority attributable to the Engineer as specified in or necessarily to be implied from the Contract. If the Engineer is required to obtain the consent of the Employer before exercising a specified authority, the requirements shall

be as stated in the Particular Conditions. There shall be no requirement for the Engineer to obtain the Employer's consent before the Engineer exercises his/her authority under Sub-Clause 3.7 [Agreement or Determination]. The Employer shall not impose further constraints on the Engineer's authority.

However, whenever the Engineer exercises a specified authority for which the Employer's consent is required, then (for the purposes of the Contract) such consent shall be deemed to have been given.

Any acceptance, agreement, approval, check, certificate, comment, consent, disapproval, examination, inspection, instruction, Notice, No-objection, record(s) of meeting, permission, proposal, record, reply, report, request, Review, test, valuation, or similar act (including the absence of any such act) by the Engineer, the Engineer's Representative or any assistant shall not relieve the Contractor from any duty, obligation or responsibility the Contractor has under or in connection with the Contract.

3.3 The Engineer's Representative

The Engineer may appoint an Engineer's Representative and delegate to him/her in accordance with Sub-Clause 3.4 [Delegation by the Engineer] the authority necessary to act on the Engineer's behalf at the Site, except to replace the Engineer's Representative.

The Engineer's Representative (if appointed) shall comply with sub-paragraphs (a) and (b) of Sub-Clause 3.1 [The Engineer] and shall be based at the Site for the whole time that the Works are being executed at the Site. If the Engineer's Representative is to be temporarily absent from the Site during the execution of the Works, an equivalently qualified, experienced and competent replacement shall be appointed by the Engineer, and the Contractor shall be given a Notice of such replacement.

3.4 Delegation by the Engineer

The Engineer may from time to time assign duties and delegate authority to assistants, and may also revoke such assignment or delegation, by giving a Notice to the Parties, describing the assigned duties and the delegated authority of each assistant. The assignment, delegation or revocation shall not take effect until this Notice has been received by both Parties. However, the Engineer shall not delegate the authority to:

- a. act under Sub-Clause 3.7 [Agreement or Determination]; and/or
- b. issue a Notice to Correct under Sub-Clause 15.1 [Notice to Correct].

Assistants shall be suitably qualified natural persons, who are experienced and competent to carry out these duties and exercise this authority, and who are fluent in the language for communications defined in Sub-Clause 1.4 [Law and Language].

Each assistant, to whom duties have been assigned or authority has been delegated, shall only be authorised to issue instructions to the Contractor to the extent defined by the Engineer's Notice of delegation under this Sub-Clause. Any act by an assistant, in accordance with the Engineer's Notice of delegation, shall have the same effect as though the act had been an act of the Engineer. However, if the Contractor questions any instruction or Notice given by an assistant, the Contractor may by giving a Notice refer the matter to the Engineer. The Engineer shall be deemed to have confirmed the assistant's instruction or Notice if the Engineer does not respond, within 7 days after

receiving the Contractor's Notice, reversing or varying the assistant's instruction or Notice (as the case may be).

3.5 Engineer's Instructions

The Engineer may issue to the Contractor (at any time) instructions which may be necessary for the execution of the Works, all in accordance with the Contract. The Contractor shall only take instructions from the Engineer, or from the Engineer's Representative (if appointed) or an assistant to whom the appropriate authority to give instruction has been delegated under Sub-Clause 3.4 [Delegation by the Engineer].

Subject to the following provisions of this Sub-Clause, the Contractor shall comply with the instructions given by the Engineer or the Engineer's Representative (if appointed) or delegated assistant, on any matter related to the Contract.

If an instruction states that it constitutes a Variation, Sub-Clause 13.3.1 [Variation by Instruction] shall apply.

If not so stated, and the Contractor considers that the instruction:

- a. constitutes a Variation (or involves work that is already part of an existing Variation); or
- b. does not comply with applicable Laws or will reduce the safety of the Works or is technically impossible

the Contractor shall immediately, and before commencing any work related to the instruction, give a Notice to the Engineer with reasons. If the Engineer does not respond within 7 days after receiving this Notice, by giving a Notice confirming, reversing or varying the instruction, the Engineer shall be deemed to have revoked the instruction. Otherwise, the Contractor shall comply with and be bound by the terms of the Engineer's response.

3.6 Replacement of the Engineer

If the Employer intends to replace the Engineer, the Employer shall, not less than 42 days before the intended date of replacement, give a Notice to the Contractor of the name, address and relevant experience of the intended replacement Engineer.

If the Contractor does not respond within 14 days after receiving this Notice, by giving a Notice stating an objection to such replacement with reasons, the Contractor shall be deemed to have accepted the replacement.

The Employer shall not replace the Engineer with a person (whether a legal entity or a natural person) against whom the Contractor has raised reasonable objection by a Notice under this Sub-Clause.

If the Engineer is unable to act as a result of death, illness, disability or resignation (or, in the case of an entity, the Engineer becomes unable or unwilling to carry out any of its duties, other than for a cause attributable to the Employer) the Employer shall be entitled to immediately appoint a replacement by giving a Notice to the Contractor with reasons and the name, address and relevant experience of the replacement. This appointment shall be treated as a temporary appointment until this replacement is accepted by the

Contractor, or another replacement is appointed, under this Sub-Clause.

3.7 Agreement or Determination

When carrying out his/her duties under this Sub-Clause, the Engineer shall act neutrally between the Parties and shall not be deemed to act for the Employer.

Whenever these Conditions provide that the Engineer shall proceed under this Sub-Clause to agree or determine any matter or Claim, the following procedure shall apply:

3.7.1 Consultation to reach agreement

The Engineer shall consult with both Parties jointly and/or separately and shall encourage discussion between the Parties in an endeavour to reach agreement. The Engineer shall commence such consultation promptly to allow adequate time to comply with the time limit for agreement under Sub-Clause 3.7.3 [Time limits].

Unless otherwise proposed by the Engineer and agreed by both Parties, the Engineer shall provide both Parties with a record of the consultation.

If agreement is achieved within the time limit for agreement under Sub-Clause 3.7.3 [Time limits] the Engineer shall give a Notice to both Parties of the agreement, which agreement shall be signed by both Parties. This Notice shall state that it is a "Notice of the Parties' Agreement" and shall include a copy of the agreement.

If:

a. no agreement is achieved within the time limit for agreement under Sub-

Clause 3.7.3 [Time limits]; or

b. both Parties advise the Engineer that no agreement can be achieved within this time limit

whichever is the earlier, the Engineer shall give a Notice to the Parties accordingly and shall immediately proceed under Sub-Clause 3.7.2 [Engineer's Determination].

3.7.2 Engineer's Determination

The Engineer shall make a fair determination of the matter or Claim, in accordance with the Contract, taking due regard of all relevant circumstances.

Within the time limit for determination under Sub-Clause 3.7.3 [Time limits], the Engineer shall give a Notice to both Parties of his/her determination. This Notice shall state that it is a "Notice of the Engineer's Determination" and shall describe the determination in detail with reasons and detailed supporting particulars.

3.7.3 Time limits

The Engineer shall give the Notice of agreement, if agreement is achieved, within 42 days or within such other time limit as may be proposed by the Engineer and agreed by both Parties {the "time limit for agreement" in these Conditions}. after:

a. in the case of a matter to be agreed or determined (not a Claim), the date of commencement of the time limit for agreement as stated in the applicable Sub-Clause of these Conditions;

- b. in the case of a Claim under sub-paragraph (c) of Sub-Clause 20.1 [Claims], the date the Engineer receives a Notice under Sub-Clause 20.1 from the claiming Party; or
- c. in the case of a Claim under sub-paragraph (a) or (b) of Sub-Clause 20.1 [Claims], the date the Engineer receives:
 - i. a fully detailed Claim under Sub-Clause 20.2.4 [Fully Detailed Claim]; or
 - ii. in the case of a Claim under Sub-Clause 20.2.6 [Claims of continuing effect], an interim or final fully detailed Claim (as the case may be).

The Engineer shall give the Notice of his/her determination within 42 days or within such other time limit as may be proposed by the Engineer and agreed by both Parties (the "time limit for determination" in these Conditions), after the date corresponding to his/her obligation to proceed under the last paragraph of Sub-

Clause 3.7.1 [Consultation to reach agreement].

If the Engineer does not give the Notice of agreement or determination within the relevant time limit:

- i. in the case of a Claim, the Engineer shall be deemed to have given a determination rejecting the Claim; or
- ii. in the case of a matter to be agreed or determined, the matter shall be deemed to be a Dispute which may be referred by either Party to the DAAB for its decision under Sub-Clause 21.4 [Obtaining DAAB's Decision] without the need for a NOD (and Sub-Clause 3.7.5 [Dissatisfaction with Engineers determination] and sub-paragraph (a) of Sub-Clause 21.4.1 [Reference of a Dispute to the DAAB] shall not apply).

3.7.4 Effect of the agreement or determination

Each agreement or determination shall be binding on both Parties (and shall be complied with by the Engineer) unless and until corrected under this Sub-Clause or, in the case of a determination, it is revised under Clause 21 [Disputes and Arbitration].

If an agreement or determination concerns the payment of an amount from one Party to the other Party, the Contractor shall include such an amount in the next Statement and the Engineer shall include such amount in the Payment Certificate that follows that Statement.

If, within 14 days after giving or receiving the Engineer's Notice of agreement or determination, any error of a typographical or clerical or arithmetical nature is found:

- a. by the Engineer: then he/she shall immediately advise the Parties accordingly; or
- b. by a Party: then that Party shall give a Notice to the Engineer, stating that it is given under this Sub-Clause 3.7.4 and clearly identifying the error. If the Engineer does not agree there was an error, he/she shall immediately advise the

Parties accordingly.

The Engineer shall within 7 days of finding the error, or receiving a Notice under sub-paragraph (b) above (as the case may be), give a Notice to both Parties of the corrected agreement or determination. Thereafter, the corrected agreement or determination shall be treated as the agreement or determination for the purpose of these Conditions.

3.7.5 Dissatisfaction with Engineer's determination

If either Party is dissatisfied with a determination of the Engineer:

- a. the dissatisfied Party may give a NOD to the other Party, with a copy to the Engineer;
- b. this NOD shall state that it is a "Notice of Dissatisfaction with the Engineer's Determination" and shall set out the reason(s) for dissatisfaction;
- c. this NOD shall be given within 28 days after receiving the Engineer's Notice of the determination under Sub-Clause 3.7.2 [Engineer's Determination] or, if applicable, his/her Notice of the corrected determination under Sub-Clause 3.7.4 [Effect of the agreement or determination] (or, in the case of a deemed determination rejecting the Claim, within 28 days after the time limit for determination under Sub-Clause 3.7.3 [Time limits] has expired); and
- d. thereafter, either Party may proceed under Sub-Clause 21.4 [Obtaining DAAB's Decision].

If no NOD is given by either Party within the period of 28 days stated in sub-paragraph (c) above, the determination of the Engineer shall be deemed to have been accepted by both Parties and shall be final and binding on them.

If the dissatisfied Party is dissatisfied with only part(s) of the Engineer's determination:

- i. this part(s) shall be clearly identified in the NOD;
- ii. this part(s), and any other parts of the determination that are affected by such part(s) or rely on such part(s) for completeness, shall be deemed to be severable from the remainder of the determination; and
- iii. the remainder of the determination shall become final and binding on both Parties as if the NOD had not been given.

In the event that a Party fails to comply with an agreement of the Parties under this Sub-Clause 3.7 or a final and binding determination of the Engineer, the other Party may, without prejudice to any other rights it may have, refer the failure itself directly to arbitration under Sub-Clause 21.6 [Arbitration] in which case the first and the third paragraphs of Sub-Clause 21.7 [Failure to Comply with DAAB's Decision] shall apply to such reference in the same manner as these paragraphs apply to a final and binding decision of the DAAB.

3.8 Meetings

The Engineer or the Contractor's Representative may require the other to attend a management meeting to discuss arrangements for future work and/ or other matters in connection with execution of the Works.

The Employer's other contractors, the personnel of legally constituted public authorities and/or private utility companies, and/or Subcontractors may attend any such meeting, if requested by the Engineer or the Contractor's Representative.

The Engineer shall keep a record of each management meeting and supply copies of the record to those attending and to the Employer. At any such meeting, and in the record, responsibilities for any actions to be taken shall be in accordance with the Contract.

4 The Contractor

4.1 Contractor's General Obligations

The Contractor shall execute the Works in accordance with the Contract. When completed, the Works (or Section or Part or major item of Plant, if any) shall be fit for the purpose(s) for which they are intended, as defined and described in the Employer's Requirements (or, where no purpose(s) are so defined and described, fit for their ordinary purpose(s)).

The Contractor shall provide the Plant (and spare parts, if any) and Contractor's Documents specified in the Employer's Requirements, and all Contractor's Personnel, Goods, consumables and other things and services, whether of a temporary or permanent nature, required to fulfil the Contractor's obligations under the Contract.

The Works shall include any work which is necessary to satisfy the Employer's Requirements, Contractor's Proposal and Schedules, or is implied by the Contract, and all works which (although not mentioned in the Contract) are necessary for stability or for the completion, or safe and proper operation, of the Works.

The Contractor shall be responsible for the adequacy, stability and safety of all the Contractor's operations and activities, of all methods of construction and of all the Works.

The Contractor shall, whenever required by the Engineer, submit details of the arrangements and methods which the Contractor proposes to adopt for the execution of the Works. No significant alteration to these arrangements and methods shall be made without this alteration having been submitted to the Engineer.

4.2 Performance Security

The Contractor shall obtain (at the Contractor's cost) a Performance Security to secure the Contractor's proper performance of the Contract, in the amount and currencies stated in the Contract Data. If no amount is stated in the Contract Data, this Sub-Clause shall not apply.

4.2.1 Contractor's obligations

The Contractor shall deliver the Performance Security to the Employer, with a copy to the Engineer, within 28 days after receiving the Letter of Acceptance. The Performance Security shall be issued by an entity and from within a country (or other jurisdiction) to which the Employer gives consent and shall be in the form annexed to the Particular

Conditions, or in another form agreed by the Employer (but such consent and/or agreement shall not relieve the Contractor from any obligation under this Sub-Clause).

The Contractor shall ensure that the Performance Security remains valid and enforceable until the issue of the Performance Certificate and the Contractor has complied with Sub-Clause 11.11 [Clearance of Site]. If the terms of the Performance Security specify an expiry date, and the Contractor has not become entitled to receive the Performance Certificate by the date 28 days before the expiry date, the Contractor shall extend the validity of the Performance Security until the issue of the Performance Certificate and the Contractor has complied with Sub-Clause 11.11 [Clearance of Site].

Whenever Variations and/or adjustments under Clause 13 [Variations and Adjustments] result in an accumulative increase or decrease of the Contract Price by more than twenty percent (20%) of the Accepted Contract Amount:

- a. in the case of such an increase, at the Employer's request the Contractor shall promptly increase the amount of the Performance Security in that currency by a percentage equal to the accumulative increase. If the Contractor incurs Costs as a result of this Employer's request, Sub-Clause 13.3.1 [Variation by Instruction] shall apply as if the increase had been instructed by the Engineer; or
- b. in the case of such a decrease, subject to the Employer's prior consent the Contractor may decrease the amount of the Performance Security in that currency by a percentage equal to the accumulative decrease.

4.2.2 Claims under the Performance Security

The Employer shall not make a claim under the Performance Security, except for amounts to which the Employer is entitled under the Contract in the event of:

- a. failure by the Contractor to extend the validity of the Performance Security, as described in this Sub-Clause, in which event the Employer may claim the full amount (or, in the case of previous reduction(s), the full remaining amount) of the Performance Security;
- b. failure by the Contractor to pay the Employer an amount due, as agreed or determined under Sub-Clause 3.7 [Agreement or Determination] or agreed or decided under Clause 21 [Disputes and Arbitration], within 42 days after the date of the agreement or determination or decision or arbitral award (as the case may be);
- c. failure by the Contractor to remedy a default stated in a Notice given under Sub-Clause 15.1 [Notice to Correct] within 42 days or other time (if any) stated in the Notice;
- d. circumstances which entitle the Employer to terminate the Contract under Sub-Clause 15.2 [Termination for Contractor's Default], irrespective of whether a Notice of termination has been given; or

- e. if under Sub-Clause 11.5 [Remedying of Defective Work off Site] the Contractor removes any defective or damaged Plant from the Site, failure by the Contractor to repair such Plant, return it to the Site, reinstall it and retest it by the date of expiry of the relevant duration stated in the Contractor's Notice (or other date agreed by the Employer).

The Employer shall indemnify and hold the Contractor harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from a claim under the Performance Security to the extent that the Employer was not entitled to make the claim.

Any amount which is received by the Employer under the Performance Security shall be taken into account:

- i. in the Final Payment Certificate under Sub-Clause 14.13 [Issue of FPC]; or
- ii. if the Contract is terminated, in payment due to the Contractor under Sub-Clause 15.4 [Payment after Termination for Contractor's Default], Sub-Clause 15.7 [Payment after Termination for Employer's Convenience], Sub-

Clause 16.4 [Payment after Termination by Contractor], Sub-Clause 18.5 [Optional Termination], or Sub-Clause 18.6 [Release from Performance under the Law] (as the case may be).

4.2.3 Return of the Performance Security

The Employer shall return the Performance Security to the Contractor:

- a. within 21 days after the issue of the Performance Certificate and the Contractor has complied with Sub-Clause 11.11 [Clearance of Site]; or
- b. promptly after the date of termination if the Contract is terminated in accordance with Sub-Clause 15.5 [Termination for Employer's Convenience], Sub-Clause 16.2 [Termination by Contractor], Sub-Clause 18.5 [Optional Termination] or Sub-Clause 18.6 [Release from Performance under the Law].

4.3 **Contractor's Representative**

The Contractor shall appoint the Contractor's Representative and shall give him/her all authority necessary to act on the Contractor's behalf under the Contract, except to replace the Contractor's Representative.

The Contractor's Representative shall be qualified, experienced and competent in the main engineering discipline applicable to the Works and fluent in the language for communications defined in Sub-Clause 1.4 [Law and Language].

Unless the Contractor's Representative is named in the Contract, the Contractor shall, before the Commencement Date, submit to the Engineer for consent the name and particulars of the person the Contractor proposes to appoint as Contractor's Representative. If consent is withheld or subsequently revoked, or if the appointed person fails to act as Contractor's Representative, the Contractor shall similarly submit the name and particulars of another suitable replacement for such appointment. If the

Engineer does not respond within 28 days after receiving this submission, by giving a Notice to the Contractor objecting to the proposed person or replacement, the Engineer shall be deemed to have given his/her consent.

The Contractor shall not, without the Engineer's prior consent, revoke the appointment of the Contractor's Representative or appoint a replacement (unless the Contractor's Representative is unable to act as a result of death, illness, disability or resignation, in which case his/her appointment shall be deemed to have been revoked with immediate effect and the appointment of a replacement shall be treated as a temporary appointment until the Engineer gives his/her consent to this replacement, or another replacement is appointed, under this Sub-Clause).

The whole time of the Contractor's Representative shall be given to directing the Contractor's performance of the Contract. The Contractor's Representative shall act for and on behalf of the Contractor at all times during the performance of the Contract, including issuing and receiving all Notices and other communications under Sub-Clause 1.3 [Notices and Other Communications] and for receiving instructions under Sub-Clause 3.5 [Engineer's Instructions].

The Contractor's Representative shall be based at the Site for the whole time that

the Works are being executed at the Site. If the Contractor's Representative is to be temporarily absent from the Site during the execution of the Works, a suitable replacement shall be temporarily appointed, subject to the Engineer's prior consent.

The Contractor's Representative may delegate any powers, functions and authority except:

- a) the authority to issue and receive Notices and other communications under Sub-Clause 1.3 [Notices and Other Communications]; and
- b) the authority to receive instructions under Sub-Clause 3.5 [Engineer's Instructions]),

to any suitably competent and experienced person and may at any time revoke the delegation. Any delegation or revocation shall not take effect until the Engineer has received a Notice from the Contractor's Representative, naming the person, specifying the powers, functions and authority being delegated or revoked, and stating the timing of the delegation or revocation.

All these persons shall be fluent in the language for communications defined in Sub-Clause 1.4 [Law and Language].

4.4 Subcontractors

The Contractor shall not subcontract:

- a) works with a total accumulated value greater than the percentage of the Accepted Contract Amount stated in the Contract Data (if not stated, the whole of the Works); or
- b) any part of the Works for which subcontracting is not permitted as stated in the Contract Data.

The Contractor shall be responsible for the work of all Subcontractors, for managing and coordinating all the Subcontractors' works, and for the acts or defaults of any Subcontractor, any Subcontractor's agents or employees, as if they were the acts or

defaults of the Contractor.

The Contractor shall obtain the Engineer's prior consent to all proposed Subcontractors, except:

- i. suppliers of Materials; or
- ii. a subcontract for which the Subcontractor is named in the Contract.

Where the Contractor is required to obtain the Engineer's consent to a proposed Subcontractor, the Contractor shall submit the name, address, detailed particulars and relevant experience of such Subcontractor and the work intended to be subcontracted to the Engineer and further information which the Engineer may reasonably require. If the Engineer does not respond within 14 days after receiving this submission (or further information if requested), by giving a Notice objecting to the proposed Subcontractor, the Engineer shall be deemed to have given his/her consent.

The Contractor shall give a Notice to the Engineer not less than 28 days before the intended date of the commencement of each Subcontractor's work, and of the commencement of such work on the Site.

4.5 Nominated Subcontractors

In this Sub-Clause, "nominated Subcontractor" means a Subcontractor named as such in the Employer's Requirements or whom the Engineer, under Sub-Clause 13.4 [Provisional Sums], instructs the Contractor to employ as a Subcontractor.

4.5.1 Objection to Nomination

The Contractor shall not be under any obligation to employ a nominated Subcontractor whom the Engineer instructs and against whom the Contractor raises reasonable objection by giving a Notice to the Engineer, with detailed supporting particulars, no later than 14 days after receiving the Engineer's instruction. An objection shall be deemed reasonable if it arises from (among other things) any of the following matters, unless the Employer agrees to indemnify the Contractor against and from the consequences of the matter:

- a. there are reasons to believe that the nominated Subcontractor does not have sufficient competence, resources or financial strength;
- b. the subcontract does not specify that the nominated Subcontractor shall indemnify the Contractor against and from any negligence or misuse of Goods by the nominated Subcontractor, the nominated Subcontractor's agents and employees; or
- c. the subcontract does not specify that, for the subcontracted work (including design, if any), the nominated Subcontractor shall:
 - i. undertake to the Contractor such obligations and liabilities as will enable the Contractor to discharge the Contractor's corresponding obligations and liabilities under the Contract; and
 - ii. indemnify the Contractor against and from all obligations and liabilities

arising under or in connection with the Contract and from the consequences of any failure by the Subcontractor to perform these obligations or to fulfil these liabilities.

4.5.2 Payments to nominated Subcontractors

The Contractor shall pay to the nominated Subcontractor the amounts due in accordance with the subcontract. These amounts plus other charges shall be included in the Contract Price in accordance with sub-paragraph (b) of Sub-Clause 13.4 [Provisional Sums], except as stated in Sub-Clause 4.5.3 [Evidence of Payments].

4.5.3 Evidence of Payments

Before issuing a Payment Certificate which includes an amount payable to a nominated Subcontractor, the Engineer may request the Contractor to supply reasonable evidence that the nominated Subcontractor has received all amounts due in accordance with previous Payment Certificates, less applicable deductions for retention or otherwise. Unless the Contractor:

- a. submits this reasonable evidence to the Engineer, or
- b. (i) satisfies the Engineer in writing that the Contractor is reasonably entitled to withhold or refuse to pay these amounts, and
(ii) submits to the Engineer reasonable evidence that the nominated Subcontractor has been notified of the Contractor's entitlement,

then the Employer may (at the Employer's sole discretion) pay, directly to the nominated Subcontractor, part or all of such amounts previously certified (less applicable deductions) as are due to the nominated Subcontractor and for which the Contractor has failed to submit the evidence described in sub-paragraphs (a) or (b) above.

Thereafter, the Engineer shall give a Notice to the Contractor stating the amount paid directly to the nominated Subcontractor by the Employer and, in the next IPC after this Notice, shall include this amount as a deduction under sub-paragraph (b) of Sub-Clause 14.6.1 [The IPC].

4.6 **Co-operation**

The Contractor shall, as specified in the Employer's Requirements or as instructed by the Engineer, co-operate with and allow appropriate opportunities for carrying out work by:

- a. the Employer's Personnel;
- b. any other contractors employed by the Employer; and
- c. the personnel of any legally constituted public authorities and private utility companies,

who may be employed in the carrying out, on or near the Site, of any work not included in the Contract. Such appropriate opportunities may include the use of Contractor's Equipment, Temporary Works, access arrangements which are the responsibility of the Contractor, and/or other of the Contractor's facilities or services on the Site.

The Contractor shall be responsible for the Contractor's construction activities on the Site and shall use all reasonable endeavours to co-ordinate these activities with those of other contractors to the extent (if any) specified in the Employer's Requirements or as instructed by the Engineer.

If the Contractor suffers delay and/or incurs Cost as a result of an instruction under this Sub-Clause, to the extent (if any) that co-operation, allowance of opportunities and coordination was Unforeseeable having regard to that specified in the Employer's Requirements, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims for Payment and/or EOT] to EOT and/ or payment of such Cost-Plus Profit.

4.7 Setting Out

The Contractor shall set out the Works in relation to the items of reference under Sub-Clause 2.5 [Site Data and Items of Reference].

4.7.1 Accuracy

- a. verify the accuracy of all these items of reference before they are used for the Works;
- b. promptly deliver the results of each verification to the Engineer;
- c. rectify any error in the positions, levels, dimensions or alignment of the Works; and
- d. be responsible for the correct positioning of all parts of the Works.

4.7.2 Errors

If the Contractor finds an error in any items of reference, the Contractor shall give a Notice to the Engineer describing it:

- a. within the period stated in the Contract Data (if not stated, 28 days) calculated from the Commencement Date, if the items of reference are specified in the Employer's Requirements; or
- b. as soon as practicable after receiving the items of reference, if they are issued by the Engineer under Sub-Clause 2.5 [Site Data and Items of Reference].

4.7.3 Agreement or Determination of rectification measures, delay and/or Cost

After receiving a Notice from the Contractor under Sub-Clause 4.7.2 [Errors], the Engineer shall proceed under Sub-Clause 3.7 [Agreement or Determination] to agree or determine:

- a. whether or not there is an error in the items of reference;
- b. whether or not (taking account of cost and time) an experienced contractor exercising due care would have discovered such error
 - when examining the Site and the Employer's Requirements before submitting the Tender; or
 - when scrutinising the Employer's Requirements under Sub-Clause 5.1

[General Design Obligations], if the items of reference are specified in the Employer's Requirements and the Contractor's Notice is given after the expiry of the period stated in sub-paragraph (a) of Sub-Clause 4.7.2; and

- c. what measures (if any) the Contractor is required to take to rectify the error (and, for the purpose of Sub-Clause 3.7.3 [Time limits], the date the Engineer receives the Contractor's Notice under Sub-Clause 4.7.2 [Errors] shall be the date of commencement of the time limit for agreement under Sub-Clause 3.7.3).
 - i. If, under sub-paragraph (b) above, an experienced contractor would not have discovered the error:
 - ii. Sub-Clause 13.3. 1 [Variation by Instruction] shall apply to the measures that the Contractor is required to take (if any); and
 - iii. if the Contractor suffers delay and/or incurs Cost as a result of the error, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to EOT and/or payment of such Cost Plus Profit.

4.8 Health and Safety Obligations

The Contractor shall:

- a. comply with all applicable health and safety regulations and Laws;
- b. comply with all applicable health and safety obligations specified in the Contract;
- c. comply with all directives issued by the Contractor's health and safety officer (appointed under Sub-Clause 6.7 [Health and Safety of Personnel];
- d. take care of the health and safety of all persons entitled to be on the Site and other places (if any) where the Works are being executed;
- e. keep the Site, Works (and the other places (if any) where the Works are being executed) clear of unnecessary obstruction so as to avoid danger to these persons;
- f. provide fencing, lighting, safe access, guarding and watching of:
 - i. the Works, until the Works are taken over under Clause 10 [Employer's Taking Over]; and
 - ii. any part of the Works where the Contractor is executing outstanding works or remedying any effects during the DNP; and
- g. provide any Temporary Works (including roadways, footways, guards and fences) which may be necessary, because of the execution of the Works, for the

use and protection of the public and of owners and occupiers of adjacent land and property.

Within 21 days of the Commencement Date and before commencing any construction on the Site, the Contractor shall submit to the Engineer for information a health and safety manual which has been specifically prepared for the Works, the Site and other places (if any) where the Contractor intends to execute the Works. This manual shall be in addition to any other similar document required under applicable health and safety regulations and Laws.

The health and safety manual shall set out all the health and safety requirements:

- i. specified in the Employer's Requirements;
- ii. that comply with all the Contractor's health and safety obligations under the Contract; and
- iii. that are necessary to effect and maintain a healthy and safe working environment for all persons entitled to be on the Site and other places (if any) where the Works are being executed.

This manual shall be revised as necessary by the Contractor or the Contractor's health and safety officer, or at the reasonable request of the Engineer. Each revision of the manual shall be submitted promptly to the Engineer.

In addition to the reporting requirement of sub-paragraph (g) of Sub-Clause 4.20 [Progress Reports], the Contractor shall submit to the Engineer details of any accident as soon as practicable after its occurrence and, in the case of an accident causing serious injury or death, shall inform the Engineer immediately.

The Contractor shall, as specified in the Employer's Requirements and as the Engineer may reasonably require, maintain records and make reports (in compliance with the applicable health and safety regulations and Laws) concerning the health and safety of persons and any damage to property.

4.9 Quality Management and Compliance Verification System

4.9.1 Quality Management System

The Contractor shall prepare and implement a QM System to demonstrate compliance with the requirements of the Contract. The QM System shall be specifically prepared for the Works and submitted to the Engineer within 28 days of the Commencement Date. Thereafter, whenever the QM System is updated or revised, a copy shall promptly be submitted to the Engineer.

The QM System shall be in accordance with the details stated in the Employer's Requirements (if any) and shall include the Contractor's procedures:

- a. to ensure that all Notices and other communications under Sub-Clause 1.3 [Notices and Other Communications], Contractor's Documents, as-built records, O&M Manuals, and contemporary records can be traced, with full certainty, to the Works, Goods, work, workmanship or test to which they relate;

- b. to ensure proper coordination and management of interfaces between the stages of execution of the Works, and between Subcontractors; and
- c. for the submission of Contractor's Documents to the Engineer for Review.

The Engineer may Review the QM System and may give a Notice to the Contractor stating the extent to which it does not comply with the Contract. Within 14 days after receiving this Notice, the Contractor shall revise the QM System to rectify such non-compliance. If the Engineer does not give such a Notice within 21 days of the date of submission of the QM System, the Engineer shall be deemed to have given a Notice of No-objection.

The Engineer may, at any time, give a Notice to the Contractor stating the extent to which the Contractor is failing to correctly implement the QM System to the Contractor's activities under the Contract. After receiving this Notice, the Contractor shall immediately remedy such failure.

The Contractor shall carry out internal audits of the QM System regularly, and at least once every 6 months. The Contractor shall submit to the Engineer a report listing the results of each internal audit within 7 days of completion. Each report shall include, where appropriate, the proposed measures to improve and/or rectify the OM System and/or its implementation.

If the Contractor is required by the Contractor's quality assurance certification to be subject to external audit, the Contractor shall immediately give a Notice to the Engineer describing any failing(s) identified in any external audit. If the Contractor is a JV, this obligation shall apply to each member of the JV.

4.9.2 Compliance Verification System

The Contractor shall prepare and implement a Compliance Verification System to demonstrate that the design, Materials, Employer-Supplied Materials (if any), Plant, work and workmanship comply in all respects with the Contract.

The Compliance Verification System shall be in accordance with the details stated in the Employer's Requirements (if any) and shall include a method for reporting the results of all inspections and tests carried out by the Contractor. In the event that any inspection or test identifies a non-compliance with the Contract, Sub-Clause 7.5 [Defects and Rejection] shall apply.

The Contractor shall prepare and submit to the Engineer a complete set of compliance verification documentation for the Works or Section (as the case may be), fully compiled and collated in the manner described in the Employer's Requirements or, if not so described, in a manner acceptable to the Engineer.

4.9.3 General provision

Compliance with the QM System and/or Compliance Verification System shall not relieve the Contractor from any duty, obligation or responsibility under or in connection with the Contract.

4.10 **Use of Site Data**

The Contractor shall be responsible for interpreting all data referred to under Sub-Clause 2.5 [Site Data and Items of Reference].

To the extent which was practicable (taking account of cost and time), the Contractor shall be deemed to have obtained all necessary information as to risks, contingencies and other circumstances which may influence or affect the Tender or Works. To the same extent, the Contractor shall be deemed to have inspected and examined the Site, access to the Site, its surroundings, the above data and other available information, and to have been satisfied before submitting the Tender as to all matters relevant to the execution of the Works, including:

- a. the form and nature of the Site, including sub-surface conditions;
- b. the hydrological and climatic conditions, and the effects of climatic conditions at the Site;
- c. the extent and nature of the work and Goods necessary for the execution of the Works;
- d. the Laws, procedures and labour practices of the Country; and
- e. the Contractor's requirements for access, accommodation, facilities, personnel, power, transport, water and any other utilities or services.

4.11 Sufficiency of the Accepted Contract Amount

The Contractor shall be deemed to:

- a. have satisfied himself/herself as to the correctness and sufficiency of the Accepted Contract Amount; and
- b. have based the Accepted Contract Amount on the data, interpretations, necessary information, inspections, examinations and satisfaction as to all relevant matters described in Sub-Clause 4.10 [Use of Site Data] and any further data relevant to the Contractor's design.

Unless otherwise stated in the Contract, the Accepted Contract Amount shall be deemed to cover all the Contractor's obligations under the Contract and all things necessary for the proper execution of the Works in accordance with the Contract.

4.12 Unforeseeable Physical Conditions

In this Sub-Clause, "physical conditions" means natural physical conditions and physical obstructions (natural or man-made) and pollutants, which the Contractor encounters at the Site during execution of the Works, including sub-surface and hydrological conditions but excluding climatic conditions at the Site and the effects of those climatic conditions.

If the Contractor encounters physical conditions which the Contractor considers to have been Unforeseeable and that will have an adverse effect on the progress and/or increase the Cost of the execution of the Works, the following procedure shall apply:

4.12.1 Contractor's Notice

After discovery of such physical conditions, the Contractor shall give a Notice to the Engineer, which shall:

- a. be given as soon as practicable and in good time to give the Engineer opportunity to inspect and investigate the physical conditions promptly and before they are disturbed;
- b. describe the physical conditions, so that they can be inspected and/ or investigated promptly by the Engineer;
- c. set out the reasons why the Contractor considers the physical conditions to be Unforeseeable; and
- d. describe the manner in which the physical conditions will have an adverse effect on the progress and/or increase the Cost of the execution of the Works.

4.12.2 Engineer's Inspection and investigation

The Engineer shall inspect and investigate the physical conditions within 7 days, or longer period agreed with the Contractor, after receiving the Contractor's Notice.

The Contractor shall continue execution of the Works, using such proper and reasonable measures as are appropriate for the physical conditions and to enable the Engineer to inspect and investigate them.

4.12.3 Engineer's Instructions

The Contractor shall comply with any instructions which the Engineer may give for dealing with the physical conditions and, if such an instruction constitutes a Variation, Sub-Clause 13.3.1 [Variation by Instruction] shall apply.

4.12.4 Delay and/or Cost

If and to the extent that the Contractor suffers delay and/or incurs Cost due to these physical conditions, having complied with Sub-Clauses 4.12.1 to 4.12.3 above, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to EOT and/or payment of such Cost.

4.12.5 Agreement or Determination of Delay and/or Cost

The agreement or determination, under Sub-Clause 20.2.5 [Agreement or determination of the Claim], of any Claim under Sub-Clause 4.12.4 [Delay and/or Cost] shall include consideration of whether and (if so) to what extent the physical conditions were Unforeseeable.

The Engineer may also review whether other physical conditions in similar parts of the Works (if any) were more favourable than could reasonably have been foreseen by the Base Date. If and to the extent that these more favourable conditions were encountered, the Engineer may take account of the reductions in Cost which were due to these conditions in calculating the additional Cost to be agreed or determined under this Sub-Clause 4.12.5. However, the net effect of all additions and reductions under this Sub-Clause 4.12.5 shall not result in a net reduction in the Contract Price.

The Engineer may take account of any evidence of the physical conditions foreseen by the Contractor by the Base Date, which the Contractor may include in the supporting particulars for the Claim under Sub-Clause 20.2.4 [Fully detailed Claim] but shall not be

bound by any such evidence.

4.13 Rights of Way and Facilities

The Contractor shall bear all costs and charges for special and/or temporary rights-of-way which may be required for the purposes of the Works, including those for access to the Site.

The Contractor shall also obtain, at the Contractor's risk and cost, any additional facilities outside the Site which may be required for the purposes of the Works.

4.14 Avoidance of Interference

The Contractor shall not interfere unnecessarily or improperly with:

- a. the convenience of the public; or
- b. the access to and use and occupation of all roads and footpaths, irrespective of whether they are public or in the possession of the Employer or of others.

The Contractor shall indemnify and hold the Employer harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from any such unnecessary or improper interference.

4.15 Access Route

The Contractor shall be deemed to have been satisfied, at the Base Date, as to the suitability and availability of the access routes to the Site. The Contractor shall take all necessary measures to prevent any road or bridge from being damaged by the Contractor's traffic or by the Contractor's Personnel. These measures shall include the proper use of appropriate vehicles (conforming to legal load and width limits (if any) and any other restrictions) and routes.

Except as otherwise stated in these Conditions:

- a. the Contractor shall (as between the Parties) be responsible for repair of any damage caused to, and any maintenance which may be required for the Contractor's use of, access routes;
- b. the Contractor shall provide all necessary signs or directions along access routes, and shall obtain any permissions or permits which may be required from the relevant authorities, for the Contractor's use of routes, signs and directions;
- c. the Employer shall not be responsible for any third-party claims which may arise from the Contractor's use or otherwise of any access route;
- d. the Employer does not guarantee the suitability or availability of particular access routes; and
- e. all Costs due to non-suitability or non-availability, for the use required by the Contractor, of access routes shall be borne by the Contractor.

To the extent that non-suitability or non-availability of an access route arises as a result of changes to that access route by the Employer or a third party after the Base Date, and

as a result the Contractor suffers delay and/or incurs Cost, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to EOT and/or payment of such Cost.

4.16 Transport of Goods

The Contractor shall:

- a. give a Notice to the Engineer not less than 21 days before the date on which any Plant, or a major item of other Goods (as specified in the Employer's Requirements), will be delivered to the Site;
- b. be responsible for packing, loading, transporting, receiving, unloading, storing and protecting all Goods and other things required for the Works;
- c. be responsible for customs clearance, permits, fees and charges related to the import, transport and handling of all Goods, including all obligations necessary for their delivery to the Site; and
- d. indemnify and hold the Employer harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from the import, transport and handling of all Goods, and shall negotiate and pay all third-party claims arising from their import, transport and handling.

4.17 Contractor's Equipment

The Contractor shall be responsible for all Contractor's Equipment. When brought on to the Site, Contractor's Equipment shall be deemed to be exclusively intended for the execution of the Works. The Contractor shall not remove from the Site any major items of Contractor's Equipment without the Engineer's consent. However, consent shall not be required for vehicles transporting Goods or Contractor's Personnel off Site.

In addition to any Notice given under Sub-Clause 4.16 [Transport of Goods], the Contractor shall give a Notice to the Engineer of the date on which any major item of Contractor's Equipment has been delivered to the Site. This Notice shall be given within 7 days of the delivery date, shall identify whether the item of Contractor's Equipment is owned by the Contractor or a Subcontractor or another person and, if rented or leased, shall identify the rental or leasing entity.

4.18 Protection of the Environment

The Contractor shall take all necessary measures to;

- a. protect the environment (both on and off the Site);
- b. comply with the environmental impact statement for the Works (if any); and
- c. limit damage and nuisance to people and property resulting from pollution, noise and other results of the Contractor's operations and/ or activities.

The Contractor shall ensure that emissions, surface discharges, effluent and any other pollutants from the Contractor's activities shall exceed neither the values indicated in the Employer's Requirements nor those prescribed by applicable Laws.

4.19 Temporary Utilities

The Contractor shall, except as stated below, be responsible for the provision of all temporary utilities, including electricity, gas, telecommunications, water and any other services the Contractor may require for the execution of the Works.

The following provisions of this Sub-Clause shall only apply if, as stated in the Employer's Requirements, the Employer is to provide utilities for the Contractor's use. The Contractor shall be entitled to use, for the purposes of the Works, the utilities on the Site for which details and prices are given in the Employer's Requirements. The Contractor shall, at the Contractor's risk and cost, provide any apparatus necessary for the Contractor's use of these services and for measuring the quantities consumed. The apparatus provided for measuring quantities consumed shall be subject to the Engineer's consent. The quantities consumed (if any) during each period of payment stated in the Contract Data (if not stated, each month) shall be measured by the Contractor, and the amount to be paid by the Contractor for such quantities (at the prices stated in the Employer's Requirements) shall be included in the relevant Statement.

4.20 Progress Reports

Monthly progress reports, in the format stated in the Employer's Requirements (if not stated, in a format acceptable to the Engineer), shall be prepared by the Contractor and submitted to the Engineer. Each progress report shall be submitted in one paper-original, one electronic copy and additional paper copies (if any) as stated in the Contract Data. The first report shall cover the period up to the end of the first month following the Commencement Date. Reports shall be submitted monthly thereafter, each within 7 days after the last day of the month to which it relates.

Reporting shall continue until the Date of Completion of the Works or, if outstanding work is listed in the Taking-Over Certificate, the date on which such outstanding work is completed. Unless otherwise stated in the Employer's Requirements, each progress report shall include:

- a. charts, diagrams and detailed descriptions of progress, including each stage of design, Contractor's Documents, procurement, manufacture, delivery to Site, construction, erection, testing, commissioning and trial operation;
- b. photographs and/or video recordings showing the status of manufacture and of progress on and off the Site;
- c. for the manufacture of each main item of Plant and Materials, the name of the manufacturer, manufacture location, percentage progress, and the actual or expected dates of:
 - i. commencement of manufacture,
 - ii. Contractor's inspections,
 - iii. tests, and
 - iv. shipment and arrival at the Site;
- d. the details described in Sub-Clause 6.10 [Contractor's Records];

- e. copies of quality management documents, inspection reports, test results, and compliance verification documentation (including certificates of Materials);
- f. a list of Variations, and any Notices given (by either Party) under Sub-Clause 20.2.1 [Notice of Claim];
- g. health and safety statistics, including details of any hazardous incidents and activities relating to environmental aspects and public relations; and
- h. comparisons of actual and planned progress, with details of any events or circumstances which may adversely affect the completion of the Works in accordance with the Programme and the Time for Completion, and the measures being (or to be) adopted to overcome delays.

However, nothing stated in any progress report shall constitute a Notice under a Sub-Clause of these Conditions.

4.21 Security of the Site

The Contractor shall be responsible for the security of the Site, and:

- a. for keeping unauthorised persons off the Site; and
- b. authorised persons shall be limited to the Contractor's Personnel, the Employer's Personnel, and to any other personnel identified as authorised personnel (including the Employer's other contractors on the Site), by a Notice from the Employer or the Engineer to the Contractor.

4.22 Contractor's Operations on Site

The Contractor shall confine the Contractor's operations to the Site, and to any additional areas which may be obtained by the Contractor and acknowledged by the Engineer as working areas. The Contractor shall take all necessary precautions to keep Contractor's Equipment and Contractor's Personnel within the Site and these additional areas, and to keep them off adjacent land.

At all times, the Contractor shall keep the Site free from all unnecessary obstruction and shall properly store or remove from the Site any Contractor's Equipment (subject to Sub-Clause 4.17 [Contractor's Equipment]) and/or surplus materials. The Contractor shall promptly clear away and remove from the Site any wreckage, rubbish, hazardous waste and Temporary Works which are no longer required.

Promptly after the issue of a Taking-Over Certificate, the Contractor shall clear away and remove, from that part of the Site and Works to which the Taking-Over Certificate refers, all Contractor's Equipment, surplus material, wreckage, rubbish, hazardous waste and Temporary Works. The Contractor shall leave that part of the Site and the Works in a clean and safe condition. However, the Contractor may retain at locations on the Site agreed with the Engineer, during the DNP, such Goods as are required for the Contractor to fulfil obligations under the Contract.

4.23 Archaeological and Geological Findings

All fossils, coins, articles of value or antiquity, and structures and other remains or items

of geological or archaeological interest found on the Site shall be placed under the care and authority of the Employer. The Contractor shall take all reasonable precautions to prevent Contractor's Personnel or other persons from removing or damaging any of these findings.

The Contractor shall, as soon as practicable after discovery of any such finding, give a Notice to the Engineer in good time to give the Engineer opportunity to promptly inspect and/or investigate the finding before it is disturbed. This Notice shall describe the finding and the Engineer shall issue instructions for dealing with it.

If the Contractor suffers delay and/or incurs Cost from complying with the Engineer's instructions, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to EOT and/or payment of such Cost.

5 Design

5.1 General Design Obligations

The Contractor shall carry out, and be responsible for, the design of the Works. Design shall be prepared by designers who:

- a. are engineers or other professionals, qualified, experienced and competent in the disciplines of the design for which they are responsible;
- b. comply with the criteria (if any) stated in the Employer's Requirements; and
- c. are qualified and entitled under applicable Laws to design the Works.

Unless otherwise stated in the Employer's Requirements, the Contractor shall submit to the Engineer for consent the name, address, detailed particulars and relevant experience of each proposed designer/design Subcontractor.

The Contractor warrants that the Contractor, the Contractor's designers and design Subcontractors have the experience, capability and competence necessary for the design. The Contractor undertakes that the designers and design Subcontractors shall be available to attend discussions with the Engineer and/or the Employer at all reasonable times (on or off the Site), until the issue of the Performance Certificate.

Promptly after receiving a Notice under Sub-Clause 8.1 [Commencement of Works], the Contractor shall scrutinise the Employer's Requirements (including design criteria and calculations, if any). If the Contractor discovers any error, fault or other defect in the Employer's Requirements, Sub-Clause 1.9 [Errors in the Employer's Requirements] shall apply (unless it is an error in the items of reference specified in the Employer's Requirements, in which case Sub-Clause 4.7 [Setting Out] shall apply).

5.2 Contractor's Documents

The Contractor's Documents shall comprise the documents:

- a. specified in the Employer's Requirements;
- b. required to satisfy all permits, permissions, licenses and other regulatory approvals which are the Contractor's responsibility under Sub-Clause 1.13 [Compliance with Laws]; and

- c. described in Sub-Clause 5.6 [As-Built Records] and Sub-Clause 5.7 [Operation and Maintenance Manuals].

5.2.1 Preparation by Contractor

Unless otherwise stated in the Employer's Requirements, the Contractor's Documents shall be written in the language for communications defined in Sub-Clause 1.4 [Law and Language].

The Contractor shall prepare all Contractor's Documents, and any other documents necessary to complete and implement the design during execution of the Works and to instruct the Contractor's Personnel. The Employer's Personnel shall have the right to inspect the preparation of all these documents (including any investigation, modelling and testing), wherever they are being prepared.

5.2.2 Review by Engineer

In this Sub-Clause 5.2.2:

- "Review Period" means the period not exceeding 21 days, or as otherwise stated in the Employer's Requirements, calculated from the date on which the Engineer receives a Contractor's Document and a Contractor's Notice;
- "Contractor's Document" excludes any of the Contractor's Documents which are not specified in the Employer's Requirements or these Conditions as being required to be submitted for Review, but includes all documents on which a specified Contractor's Document relies for completeness; and
- "Contractor's Notice" means the Notice which shall state that the relevant Contractor's Document is considered by the Contractor to be ready for Review under this Sub-Clause 5.2.2 and for use, and that it complies with the Employer's Requirements and these Conditions, or the extent to which it does not do so.

If the Employer's Requirements or these Conditions specify that a Contractor's Document is to be submitted to the Engineer for Review, it shall be submitted accordingly, together with a Contractor's Notice.

The Engineer shall, within the Review Period, give a Notice to the Contractor:

- a. of No-objection (which may include comments concerning minor matters which will not substantially affect the Works); or
- b. that the Contractor's Document fails (to the extent stated) to comply with the Employer's Requirements and/or the Contract, with reasons.

If the Engineer gives no Notice within the Review Period, the Engineer shall be deemed to have given a Notice of No-objection to the Contractor's Document (provided that all other Contractor's Documents on which that Contractor's Document relies (if any) have been given, or are deemed to have been given, a Notice of No-objection).

If the Engineer instructs that further Contractor's Documents are reasonably required to demonstrate that the Contractor's design complies with the Contract, the Contractor

shall prepare and submit them promptly to the Engineer at the Contractor's cost.

If the Engineer gives a Notice under sub-paragraph (b) above, the Contractor shall:

- i. revise the Contractor's Document;
- ii. resubmit it to the Engineer for Review in accordance with this Sub-Clause 5.2.2, and the Review Period shall be calculated from the date that the Engineer receives it; and
- iii. not be entitled to EOT for any delay caused by any such revision and resubmission and/or by subsequent Review by the Engineer.

If the Employer incurs additional costs as a result of such resubmission and subsequent Review, the Employer shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment by the Contractor of the costs reasonably incurred.

5.2.3 Construction

Except for Contractor's Documents under Sub-Clause 5.6 [As-Built Records] and Sub-Clause 5.7 [Operation and Maintenance Manuals], for each part of the Works requiring Contractor's Documents to be submitted for Review:

- a. construction of such a part shall not commence until a Notice of No-objection is given (or is deemed to have been given) by the Engineer for all the Contractor's Documents which are relevant to its design and execution;
- b. construction of such a part shall be in accordance with these Contractor's Documents; and
- c. the Contractor may modify any design or Contractor's Documents which have previously been submitted for Review, by giving a Notice to the Engineer with reasons. If the Contractor has commenced construction of the part of the Works to which such design or Contractor's Documents are relevant:
 - i. work on this part shall be suspended;
 - ii. the provisions of Sub-Clause 5.2.2 [Review by Engineer] shall apply as if the Engineer had given a Notice in respect of the Contractor's Documents under sub-paragraph (b) of Sub-Clause 5.2.2; and
 - iii. work on this part shall not resume until a Notice of No-objection is given (or is deemed to have been given) by the Engineer for the revised documents.

5.3 **Contractor's Undertaking**

The Contractor undertakes that the design, the Contractor's Documents, the execution of the Works and the completed Works will be in accordance with:

- a. the Laws of the Country; and
- b. the documents forming the Contract, as altered or modified by Variations.

5.4 Technical Standards and Regulations

The Contractor's Documents, the execution of the Works and the completed Works (including defects remedied by the Contractor) shall comply with the Country's technical standards, building, construction and environmental Laws, Laws applicable to the product being produced from the Works, and other standards specified in the Employer's Requirements, applicable to the Works, or defined by applicable Laws.

All these technical or other standards and Laws shall, in respect of the Works, and each Section and Part, be those in force when the Works or Section or Part are taken over under Clause 10 [Employer's Taking Over].

References in the Contract to published standards shall be understood to be references to the edition applicable on the Base Date, unless stated otherwise. If changed or new applicable standards come into force in the Country after the Base Date, the Contractor shall promptly give a Notice to the Engineer and (if appropriate or requested by the Engineer) submit proposals for compliance. To the extent that:

- a. the Engineer considers that compliance is required and such compliance requires change(s) to the execution of the Works; and
- b. the Contractor's proposals for compliance constitute a Variation;

then the Engineer shall initiate a Variation in accordance with Clause 13 [Variations and Adjustments].

5.5 Training

The Contractor shall carry out training of employees of the Employer (and/or other personnel identified in the Employer's Requirements) in the operation and maintenance of the Works, and any other aspect of the Works, to the extent specified in the Employer's Requirements.

If the Employer's Requirements specify training which is to be carried out before taking over, the Works shall not be considered to be completed for the purposes of taking over under Sub-Clause 10.1 [Taking Over the Works and Sections] until this training has been completed in accordance with the Employer's Requirements.

The timing of the training shall be as stated in the Employer's Requirements (if not stated, as acceptable to the Employer). The Contractor shall provide qualified and experienced training staff, training facilities and all training materials as necessary and/or as stated in the Employer's Requirements.

5.6 As-Built Records

The Contractor shall prepare, and keep up-to-date, a complete set of "as-built" records of the execution of the Works, showing the exact as-built locations, sizes and details of the work as executed by the Contractor. The format, referencing system, system of electronic storage and other relevant details of the as-built records shall be as stated in the Employer's Requirements (if not stated, as acceptable to the Engineer). These records shall be kept on the Site and shall be used exclusively for the purposes of this Sub-Clause.

The Contractor shall submit to the Engineer under Sub-Clause 5.2.2 [Review by

Engineer]:

- a. the as-built records for the Works or Section (as the case may be) before the commencement of the Tests on Completion; and
- b. updated as-built records to the extent that any work is executed by the Contractor:
 - i. during and/or after the Tests on Completion, before the issue of any Taking-Over Certificate under Sub-Clause 10.1 [Taking Over the Works and Sections]; and
 - ii. after taking over under Sub-Clause 10.1 [Taking Over the Works and Sections], before the issue of the Performance Certificate.

The number of copies of as-built records to be submitted by the Contractor under this Sub-Clause shall be as required under Sub-Clause 1.8 [Care and Supply of Documents].

5.7 Operation and Maintenance Manuals

The Contractor shall prepare, and keep up-to-date, a complete set of operation and maintenance manuals for the Works (the "O&M Manuals" in these Conditions).

The format and other relevant details of the O&M Manuals shall be as stated in the Employer's Requirements and, in any case, these manuals shall:

- a. be in sufficient detail for the Employer to:
 - i. operate, maintain and adjust the Works to ensure that the performance of the Works, Section and/or Plant (as the case may be) continues to comply with the performance criteria specified in the Employer's Requirements and the Schedule of Performance Guarantees; and
 - ii. operate, maintain, dismantle, reassemble, adjust and repair the Plant; and
- b. include an inventory of spare parts required for the Employer's future operation and maintenance of the Plant.

Before commencement of the Tests on Completion, the Contractor shall submit provisional O&M Manuals for the Works or Section (as the case may be) to the Engineer under Sub-Clause 5.2.2 [Review by Engineer].

If during the Tests on Completion any error or defect is found in the provisional O&M Manuals, the Contractor shall promptly rectify the error or defect at the Contractor's risk and cost.

Before the issue of any Taking-Over Certificate under Sub-Clause 10.1 [Taking Over the Works and Sections], the final O&M Manuals shall be submitted to the Engineer under Sub-Clause 5.2.2 [Review by Engineer].

5.8 Design Error

If errors, omissions, ambiguities, inconsistencies, inadequacies or other defects are found in the Contractor's design and/or the Contractor's Documents, they and the Works shall be corrected in accordance with Sub-Clause 7.5 [Defects and Rejection]. If such Contractor's Documents were previously the subject of a Notice of No-objection given (or deemed to be given) by the Engineer under Sub-Clause 5.2.2 [Review by Engineer], the provisions of Sub-Clause 5.2.2 shall apply as if the Engineer had given a Notice in respect of the Contractor's Documents under sub-paragraph (b) of Sub-Clause 5.2.2.

All corrections and resubmissions under this Sub-Clause shall be at the Contractor's risk and cost.

6 Staff and Labour

6.1 Engagement of Staff and Labour

Except as otherwise stated in the Employer's Requirements, the Contractor shall make arrangements for the engagement of all Contractor's Personnel, and for their payment, accommodation, feeding, transport and welfare.

6.2 Rates of Wages and Conditions of Labour

The Contractor shall pay rates of wages, and observe conditions of labour, which comply with all applicable Laws and are not lower than those established for the trade or industry where the work is carried out.

If no established rates or conditions are applicable, the Contractor shall pay rates of wages and observe conditions which are not lower than the general level of wages and conditions observed locally by Employer's whose trade or industry is similar to that of the Contractor.

6.3 Recruitment of Persons

The Contractor shall not recruit, or attempt to recruit, staff and labour from amongst the Employer's Personnel.

Neither the Employer nor the Engineer shall recruit, or attempt to recruit, staff and labour from amongst the Contractor's Personnel.

6.4 Labour Laws

The Contractor shall comply with all the relevant labour Laws applicable to the Contractor's Personnel, including Laws relating to their employment (including wages and working hours), health, safety, welfare, immigration and emigration, and shall allow them all their legal rights.

The Contractor shall require the Contractor's Personnel to obey all applicable Laws, including those concerning health and safety at work.

6.5 Working Hours

No work shall be carried out on the Site on locally recognised days of rest, or outside the normal working hours stated in the Contract Data, unless:

- a. otherwise stated in the Contract;
- b. the Engineer gives consent; or

- c. the work is unavoidable or necessary for the protection of life or property or for the safety of the Works, in which case the Contractor shall immediately give a Notice to the Engineer with reasons and describing the work required.

6.6 Facilities for Staff and Labour

Except as otherwise stated in the Employer's Requirements, the Contractor shall provide and maintain all necessary accommodation and welfare facilities for the Contractor's Personnel.

If such accommodation and facilities are to be located on the Site, except where the Employer has given the Contractor prior permission, they shall be located within the areas identified in the Employer's Requirements. If any such accommodation or facilities are found elsewhere within the Site, the Contractor shall immediately remove them at the Contractor's risk and cost. The Contractor shall also provide facilities for the Employer's Personnel as stated in the Employer's Requirements.

6.7 Health and Safety of Personnel

In addition to the requirements of Sub-Clause 4.8 [Health and Safety Obligations], the Contractor shall at all times take all necessary precautions to maintain the health and safety of the Contractor's Personnel. In collaboration with local health authorities, the Contractor shall ensure that:

- a. medical staff, first aid facilities, sick bay, ambulance services and any other medical services stated in the Employer's Requirements are available at all times at the Site and at any accommodation for Contractor's and Employer's Personnel; and
- b. suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics.

The Contractor shall appoint a health and safety officer at the Site, responsible for maintaining health, safety and protection against accidents. This officer shall:

- i. be qualified, experienced and competent for this responsibility; and
- ii. have the authority to issue directives for the purpose of maintaining the health and safety of all personnel authorised to enter and/or work on the Site and to take protective measures to prevent accidents.

Throughout the execution of the Works, the Contractor shall provide whatever is required by this person to exercise this responsibility and authority.

6.8 Contractor's Superintendence

From the Commencement Date until the issue of the Performance Certificate, the Contractor shall provide all necessary superintendence to plan, arrange, direct, manage, inspect, test and monitor the execution of the Works.

Superintendence shall be given by a sufficient number of persons:

- a. who are fluent in or have adequate knowledge of the language for

communications (defined in Sub-Clause 1.4 [Law and Language]); and

- b. who have adequate knowledge of the operations to be carried out (including the methods and techniques required, the hazards likely to be encountered and methods of preventing accidents), for the satisfactory and safe execution of the Works.

6.9 Contractor's Personnel

The Contractor's Personnel (including Key Personnel, if any) shall be appropriately qualified, skilled, experienced and competent in their respective trades or occupations.

The Engineer may require the Contractor to remove (or cause to be removed) any person employed on the Site or Works, including the Contractor's Representative and Key Personnel (if any), who:

- a. persists in any misconduct or lack of care;
- b. carries out duties incompetently or negligently;
- c. fails to comply with any provision of the Contract;
- d. persists in any conduct which is prejudicial to safety, health, or the protection of the environment;
- e. is found, based on reasonable evidence, to have engaged in corrupt, fraudulent, collusive or coercive practice; or
- f. has been recruited from the Employer's Personnel in breach of Sub-Clause 6.3 [Recruitment of Persons].

If appropriate, the Contractor shall then promptly appoint (or cause to be appointed) a suitable replacement. In the case of the replacement of the Contractor's Representative, Sub-Clause 4.3 [Contractor's Representative] shall apply. In the case of the replacement of Key Personnel (if any), Sub-Clause 6.12 [Key Personnel] shall apply.

6.10 Contractor's Records

Unless otherwise proposed by the Contractor and agreed by the Engineer, in each progress report under Sub-Clause 4.20 [Progress Reports], the Contractor shall include records of:

- a. occupations and actual working hours of each class of Contractor's Personnel;
- b. the type and actual working hours of each of the Contractor's Equipment;
- c. the types of Temporary Works used;
- d. the types of Plant installed in the Permanent Works; and
- e. the quantities and types of Materials used for each work activity shown in the Programme, at each work location and for each day of work.

6.11 Disorderly Conduct

The Contractor shall at all times take all necessary precautions to prevent any unlawful, riotous or disorderly conduct by or amongst the Contractor's Personnel, and to preserve peace and protection of persons and property on and near the Site.

6.12 Key Personnel

If no Key Personnel are specified in the Employer's Requirements this Sub-Clause shall not apply.

The Contractor shall appoint the natural persons named in the Tender to the positions of Key Personnel. If not so named, or if an appointed person fails to act in the relevant position of Key Personnel, the Contractor shall submit to the Engineer for consent the name and particulars of another person the Contractor proposes to appoint to such position. If consent is withheld or subsequently revoked, the Contractor shall similarly submit the name and particulars of a suitable replacement for such position.

If the Engineer does not respond within 14 days after receiving any such submission, by giving a Notice stating his/her objection to the appointment of such person (or replacement) with reasons, the Engineer shall be deemed to have given his/her consent.

The Contractor shall not, without the Engineer's prior consent, revoke the appointment of any of the Key Personnel or appoint a replacement (unless the person is unable to act as a result of death, illness, disability or resignation, in which case the appointment shall be deemed to have been revoked with immediate effect and the appointment of a replacement shall be treated as a temporary appointment until the Engineer gives his/her consent to this replacement, or another replacement is appointed, under this Sub-Clause).

All Key Personnel shall be based at the Site (or, where Works are being executed off the Site, at the location of the Works) for the whole time that the Works are being executed. If any of the Key Personnel is to be temporarily absent during execution of the Works, a suitable replacement shall be temporarily appointed, subject to the Engineer's prior consent.

All Key Personnel shall be fluent in the language for communications defined in Sub-Clause 1.4 [Law and Language].

7 Plant, Materials and Workmanship

7.1 Manner of Execution

The Contractor shall carry out the manufacture, supply, installation, testing and commissioning and/or repair of Plant, the production, manufacture, supply and testing of Materials, and all other operations and activities during the execution of the Works:

- a. in the manner (if any) specified in the Contract;
- b. in a proper workmanlike and careful manner, in accordance with recognised good practice; and

- c. with properly equipped facilities and non-hazardous Materials, except as otherwise specified in the Contract.

7.2 Samples

The Contractor shall submit the following samples of Materials, and relevant information, to the Engineer for consent prior to using the Materials in or for the Works:

- a. manufacturer's standard samples of Materials and samples specified in the Contract, all at the Contractor's cost; and
- b. additional samples instructed by the Engineer as a Variation.

Each sample shall be labelled as to origin and intended use in the Works.

7.3 Inspection

The Employer's Personnel shall, during all the normal working hours stated in the Contract Data and at all other reasonable times:

- a. have full access to all parts of the Site and to all places from which natural Materials are being obtained;
- b. during production, manufacture and construction (at the Site and elsewhere), be entitled to:
 - i. examine, inspect, measure and test (to the extent stated in the Employer's Requirements) the Materials, Plant and workmanship,
 - ii. check the progress of manufacture of Plant and production and manufacture of Materials, and
 - iii. make records (including photographs and/or video recordings); and
- c. carry out other duties and inspections, as specified in these Conditions and the Employer's Requirements.

The Contractor shall give the Employer's Personnel full opportunity to carry out these activities, including providing safe access, facilities, permissions and safety equipment.

The Contractor shall give a Notice to the Engineer whenever any Materials, Plant or work is ready for inspection, and before it is to be covered up, put out of sight, or packaged for storage or transport. The Employer's Personnel shall then either carry out the examination, inspection, measurement or testing without unreasonable delay, or the Engineer shall promptly give a Notice to the Contractor that the Employer's Personnel do not require to do so. If the Engineer gives no such Notice and/or the Employer's Personnel do not attend at the time stated in the Contractor's Notice (or such time as may be agreed with the Contractor), the Contractor may proceed with covering up, putting out of sight or packaging for storage or transport.

If the Contractor fails to give a Notice in accordance with this Sub-Clause, the Contractor shall, if and when required by the Engineer, uncover the work and thereafter reinstate and make good, all at the Contractor's risk and cost.

7.4 Testing by the Contractor

This Sub-Clause shall apply to all tests specified in the Contract, other than the Tests after Completion (if any).

The Contractor shall provide all apparatus, assistance, documents and other information, temporary supplies of electricity and water, equipment, fuel, consumables, instruments, labour, materials, and suitably qualified, experienced and competent staff, as are necessary to carry out the specified tests efficiently and properly. All apparatus, equipment and instruments shall be calibrated in accordance with the standards specified in the Employer's Requirements or defined by applicable Laws and, if requested by the Engineer, the Contractor shall submit calibration certificates before carrying out testing.

The Contractor shall give a Notice to the Engineer, stating the time and place for the specified testing of any Plant, Materials and other parts of the Works. This Notice shall be given in reasonable time, having regard to the location of the testing, for the Employer's Personnel to attend.

The Engineer may, under Clause 13 [Variations and Adjustments], vary the location or timing or details of specified tests, or instruct the Contractor to carry out additional tests. If these varied or additional tests show that the tested Plant, Materials or workmanship is not in accordance with the Contract, the Cost and any delay incurred in carrying out this Variation shall be borne by the Contractor.

The Engineer shall give a Notice to the Contractor of not less than 72 hours of his/her intention to attend the tests. If the Engineer does not attend at the time and place stated in the Contractor's Notice under this Sub-Clause, the Contractor may proceed with the tests, unless otherwise instructed by the Engineer, which tests shall then be deemed to have been made in the Engineer's presence. If the Contractor suffers delay and/or incurs Cost from complying with any such instruction or as a result of a delay for which the Employer is responsible, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to EOT and/or payment of Cost Plus Profit.

If the Contractor causes any delay to specified tests (including varied or additional tests) and such delay causes the Employer to incur costs, the Employer shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment of these costs by the Contractor.

The Contractor shall promptly forward to the Engineer duly certified reports of the tests. When the specified tests have been passed, the Engineer shall endorse the Contractor's test certificate, or issue a test certificate to the Contractor, to that effect. If the Engineer has not attended the tests, he/she shall be deemed to have accepted the readings as accurate.

Sub-Clause 7.5 [Defects and Rejection] shall apply in the event that any Plant, Materials and other parts of the Works fails to pass a specified test.

7.5 Defects and Rejection

If, as a result of an examination, inspection, measurement or testing, any Plant, Materials, design or workmanship is found to be defective or otherwise not in accordance with the Contract, the Engineer shall give a Notice to the Contractor describing the item of Plant, Materials, design or workmanship that has been found to be

defective. The Contractor shall then promptly prepare and submit a proposal for necessary remedial work.

The Engineer may Review this proposal and may give a Notice to the Contractor stating the extent to which the proposed work, if carried out, would not result in the Plant, Materials, design or workmanship complying with the Contract. After receiving such a Notice the Contractor shall promptly submit a revised proposal to the Engineer. If the Engineer gives no such Notice within 14 days after receiving the Contractor's proposal (or revised proposal), the Engineer shall be deemed to have given a Notice of No-objection.

If the Contractor fails to promptly submit a proposal (or revised proposal) for remedial work, or fails to carry out the proposed remedial work to which the Engineer has given (or is deemed to have given) a Notice of No-objection, the Engineer may:

- a. instruct the Contractor under sub-paragraph (a) and/or (b) of Sub-Clause 7.6 [Remedial Work]; or
- b. reject the design, Plant, Materials or workmanship by giving a Notice to the Contractor, with reasons, in which case sub-paragraph (a) of Sub-Clause 11.4 [Failure to Remedy Defects] shall apply.

After remedying defects in any Plant, Materials, design or workmanship, if the Engineer requires any such items to be retested, the tests shall be repeated in accordance with Sub-Clause 7.4 [Testing by the Contractor] at the Contractor's risk and cost. If the rejection and retesting cause the Employer to incur additional costs, the Employer shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment of these costs by the Contractor.

7.6 Remedial Work

In addition to any previous examination, inspection, measurement or testing, or test certificate or Notice of No-objection by the Engineer, at any time before the issue of the Taking-Over Certificate for the Works the Engineer may instruct the Contractor to:

- a. repair or remedy (if necessary, off the Site), or remove from the Site and replace any Plant or Materials which are not in accordance with the Contract;
- b. repair or remedy, or remove and re-execute, any other work which is not in accordance with the Contract; and
- c. carry out any remedial work which is urgently required for the safety of the Works, whether because of an accident, unforeseeable event or otherwise.

The Contractor shall comply with the instruction as soon as practicable and not later than the time (if any) specified in the instruction, or immediately if urgency is specified under sub-paragraph (c) above.

The Contractor shall bear the cost of all remedial work required under this Sub-Clause, except to the extent that any work under sub-paragraph (c) above is attributable to:

- i. any act by the Employer or the Employer's Personnel. If the Contractor suffers delay and/or incurs Cost in carrying out such work, the Contractor shall be

entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to EOT and/or payment of such Cost Plus Profit; or

- ii. an Exceptional Event, in which case Sub-Clause 18.4 [Consequences of an Exceptional Event] shall apply.

If the Contractor fails to comply with the Engineer's instruction, the Employer may (at the Employer's sole discretion) employ and pay other persons to carry out the work. Except to the extent that the Contractor would have been entitled to payment for work under this Sub-Clause, the Employer shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment by the Contractor of all costs arising from this failure. This entitlement shall be without prejudice to any other rights the Employer may have, under the Contract or otherwise.

7.7 Ownership of Plant and Materials

Each item of Plant and Materials shall, to the extent consistent with the mandatory requirements of the Laws of the Country, become the property of the Employer at whichever is the earlier of the following times, free from liens and other encumbrances:

- a. when it is delivered to the Site;
- b. when the Contractor is paid the value of the Plant and Materials under Sub-Clause 8.11 [Payment for Plant and Materials after Employer's Suspension]; or
- c. when the Contractor is paid the amount determined for the Plant and Materials under Sub-Clause 14.5 [Plant and Materials intended for the Works].

7.8 Royalties

Unless otherwise stated in the Employer's Requirements, the Contractor shall pay all royalties, rents and other payments for:

- a. natural Materials obtained from outside the Site; and
- b. the disposal of material from demolitions and excavations and of other surplus material (whether natural or man-made), except to the extent that disposal areas within the Site are specified in the Employer's Requirements.

8 Commencement, Delays and Suspension

8.1 Commencement of Works

The Engineer shall give a Notice to the Contractor stating the Commencement Date, not less than 14 days before the Commencement Date. Unless otherwise stated in the Particular Conditions, the Commencement Date shall be within 42 days after the Contractor receives the Letter of Acceptance.

The Contractor shall commence the execution of the Works on, or as soon as is reasonably practicable after, the Commencement Date and shall then proceed with the Works with due expedition and without delay.

8.2 Time for Completion

The Contractor shall complete the whole of the Works, and each Section (if any), within the Time for Completion for the Works or Section (as the case may be), including completion of all work which is stated in the Contract as being required for the Works or Section to be considered to be completed for the purposes of taking over under Sub-Clause 10.1 [Taking Over the Works and Sections].

8.3 Programme

The Contractor shall submit an initial programme for the execution of the Works to the Engineer within 28 days after receiving the Notice under Sub-Clause 8.1 [Commencement of Works]. This programme shall be prepared using programming software stated in the Employer's Requirements (if not stated, the programming software acceptable to the Engineer). The Contractor shall also submit a revised programme which accurately reflects the actual progress of the Works, whenever any programme ceases to reflect actual progress or is otherwise inconsistent with the Contractor's obligations.

The initial programme and each revised programme shall be submitted to the Engineer in one paper copy, one electronic copy and additional paper copies (if any) as stated in the Contract Data, and shall include:

- a. the Commencement Date and the Time for Completion, of the Works and of each Section (if any);
- b. the date right of access to and possession of (each part of) the Site is to be given to the Contractor in accordance with the time (or times) stated in the Contract Data. If not so stated, the dates the Contractor requires the Employer to give right of access to and possession of (each part of) the Site;
- c. the order in which the Contractor intends to carry out the Works, including the anticipated timing of each stage of design, preparation and submission of Contractor's Documents, procurement, manufacture, inspection, delivery to Site, construction, erection, installation, work to be undertaken by any nominated Subcontractor (as defined in Clause 4.5 [Nominated Subcontractors]), testing, commissioning and trial operation;
- d. the Review periods under Sub-Clause 5.2.2 [Review by Engineer], and periods for Review for any other submissions specified in the Employer's Requirements or required under these Conditions;
- e. the sequence and timing of inspections and tests specified in, or required by, the Contract;
- f. for a revised programme: the sequence and timing of the remedial work (if any) to which the Engineer has given a Notice of No-objection under Sub-Clause 7.5 [Defects and Rejection] and/or the remedial work (if any) instructed under Sub-Clause 7.6 [Remedial Work];
- g. all activities (to the level of detail specified in the Employer's Requirements), logically linked and showing the earliest and latest start and finish dates for

- each activity, the float (if any), and the critical path(s);
- h. the dates of all locally recognised days of rest and holiday periods (if any);
 - i. all key delivery dates of Plant and Materials;
 - j. for a revised programme and for each activity: the actual progress to date, any delay to such progress and the effects of such delay on other activities (if any); and
 - k. a supporting report which includes:
 - i. a description of all the major stages of the execution of the Works;
 - ii. a general description of the methods which the Contractor intends to adopt in the execution of the Works;
 - iii. details showing the Contractor's reasonable estimate of the number of each class of Contractor's Personnel, and of each type of Contractor's Equipment, required on the Site, for each major stage of the execution of the Works;
 - iv. if a revised programme, identification of any significant change(s) to the previous programme submitted by the Contractor; and
 - v. the Contractor's proposals to overcome the effects of any delay(s) on progress of the Works.

The Engineer shall Review the initial programme and each revised programme submitted by the Contractor and may give a Notice to the Contractor stating the extent to which it does not comply with the Contract or ceases to reflect actual progress or is otherwise inconsistent with the Contractor's obligations. If the Engineer gives no such Notice:

- within 21 days after receiving the initial programme; or
- within 14 days after receiving a revised programme,

The Engineer shall be deemed to have given a Notice of No-objection and the initial programme or revised programme (as the case may be) shall be the Programme.

The Contractor shall proceed in accordance with the Programme, subject to the Contractor's other obligations under the Contract. The Employer's Personnel shall be entitled to rely on the Programme when planning their activities.

Nothing in any programme, the Programme or any supporting report shall be taken as, or relieve the Contractor from any obligation to give, a Notice under the Contract.

If, at any time, the Engineer gives a Notice to the Contractor that the Programme fails (to the extent stated) to comply with the Contract or ceases to reflect actual progress or is otherwise inconsistent with the Contractor's obligations, the Contractor shall within 14 days after receiving this Notice submit a revised programme to the Engineer in accordance with this Sub-Clause.

8.4 Advance Warning

Each Party shall advise the other and the Engineer, and the Engineer shall advise the Parties, in advance of any known or probable future events or circumstances which may:

- a. adversely affect the work of the Contractor's Personnel;
- b. adversely affect the performance of the Works when completed;
- c. increase the Contract Price; and/or
- d. delay the execution of the Works or a Section (if any).

The Engineer may request the Contractor to submit a proposal under Sub-Clause 13.3.2 [Variation by Request for Proposal] to avoid or minimise the effects of such event(s) or circumstance(s).

8.5 Extension of Time for Completion

The Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to Extension of Time if and to the extent that completion for the purposes of Sub-Clause 10.1 [Taking Over the Works and Sections] is or will be delayed by any of the following causes:

- a. a Variation (except that there shall be no requirement to comply with Sub-Clause 20.2 [Claims For Payment and/or EOT]);
- b. a cause of delay giving an entitlement to EOT under a Sub-Clause of these Conditions;
- c. exceptionally adverse climatic conditions, which for the purpose of these Conditions shall mean adverse climatic conditions at the Site which are Unforeseeable having regard to climatic data made available by the Employer under Sub-Clause 2.5 [Site Data and Items of Reference] and/or climatic data published in the Country for the geographical location of the Site;
- d. Unforeseeable shortages in the availability of personnel or Goods (or Employer-Supplied Materials, if any) caused by epidemic or governmental actions; or
- e. any delay, impediment or prevention caused by or attributable to the Employer, the Employer's Personnel, or the Employer's other contractors on the Site.

When determining each EOT under Sub-Clause 20.2 [Claims For Payment and/or EOT], the Engineer shall review previous determinations under Sub-Clause 3.7 [Agreement or Determination] and may increase, but shall not decrease, the total EOT.

If a delay caused by a matter which is the Employer's responsibility is concurrent with a delay caused by a matter which is the Contractor's responsibility, the Contractor's entitlement to EOT shall be assessed in accordance with the rules and procedures stated in the Special Provisions (if not stated, as appropriate taking due regard of all relevant circumstances).

8.6 Delays Caused by Authorities

If:

- a. the Contractor has diligently followed the procedures laid down by the relevant legally constituted public authorities or private utility entities in the Country;
- b. these authorities or entities delay or disrupt the Contractor's work; and
- c. the delay or disruption was Unforeseeable,

then this delay or disruption will be considered as a cause of delay under sub-paragraph (b) of Sub-Clause 8.5 [Extension of Time for Completion].

8.7 Rate of Progress

If, at any time:

- a. actual progress is too slow to complete the Works or a Section (if any) within the relevant Time for Completion; and/or
- b. progress has fallen (or will fall) behind the Programme (or the initial programme if it has not yet become the Programme) under Sub-Clause 8.3 [Programme],

other than as a result of a cause listed in Sub-Clause 8.5 [Extension of Time for Completion], then the Engineer may instruct the Contractor to submit, under Sub-Clause 8.3 [Programme], a revised programme describing the revised methods which the Contractor proposes to adopt in order to expedite progress and complete the Works or a Section (if any) within the relevant Time for Completion.

Unless the Engineer gives a Notice to the Contractor stating otherwise, the Contractor shall adopt these revised methods, which may require increases in the working hours and/or in the numbers of Contractor's Personnel and/or the Goods, at the Contractor's risk and cost. If these revised methods cause the Employer to incur additional costs, the Employer shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment of these costs by the Contractor, in addition to Delay Damages (if any).

Sub-Clause 13.3.1 [Variation by Instruction] shall apply to revised methods, including acceleration measures, instructed by the Engineer to reduce delays resulting from causes listed under Sub-Clause 8.5 [Extension of Time for Completion].

8.8 Delay Damages

If the Contractor fails to comply with Sub-Clause 8.2 [Time for Completion], the Employer shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment of Delay Damages by the Contractor for this default. Delay Damages shall be the amount stated in the Contract Data, which shall be paid for every day which shall elapse between the relevant Time for Completion and the relevant Date of Completion of the Works or Section. The total amount due under this Sub-Clause shall not exceed the maximum amount of Delay Damages (if any) stated in the Contract Data.

These Delay Damages shall be the only damages due from the Contractor for the Contractor's failure to comply with Sub-Clause 8.2 [Time for Completion], other than in the event of termination under Sub-Clause 15.2 [Termination for Contractor's Default] before completion of the Works. These Delay Damages shall not relieve the Contractor from the obligation to complete the Works, or from any other duties, obligations or

responsibilities which the Contractor may have under or in connection with the Contract.

This Sub-Clause shall not limit the Contractor's liability for Delay Damages in any case of fraud, gross negligence, deliberate default or reckless misconduct by the Contractor.

8.9 Employer's Suspension

The Engineer may at any time instruct the Contractor to suspend progress of part or all of the Works, which instruction shall state the date and cause of the suspension.

During such suspension, the Contractor shall protect, store and secure such part or all of the Works (as the case may be) against any deterioration, loss or damage.

To the extent that the cause of such suspension is the responsibility of the Contractor, Sub-Clauses 8.10 [Consequences of Employer's Suspension], 8.11 [Payment for Plant and Materials after Employer's Suspension] and 8.12 [Prolonged Suspension] shall not apply.

8.10 Consequences of Employer's Suspension

If the Contractor suffers delay and/or incurs Cost from complying with an Engineer's instruction under Sub-Clause 8.9 [Employer's Suspension] and/ or from resuming the work under Sub-Clause 8.13 [Resumption of Work], the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to EOT and/or payment of such Cost Plus Profit.

The Contractor shall not be entitled to EOT, or to payment of the Cost incurred, in making good:

- a. the consequences of the Contractor's faulty or defective design, workmanship, Plant or Materials; and/or
- b. any deterioration, loss or damage caused by the Contractor's failure to protect, store or secure in accordance with Sub-Clause 8.9 [Employer's Suspension].

8.11 Payment for Plant and Materials after Employer's Suspension

The Contractor shall be entitled to payment of the value (as at the date of suspension instructed under Sub-Clause 8.9 [Employer's Suspension]) of Plant and/or Materials which have not been delivered to Site, if:

- a. the work on Plant, or delivery of Plant and/or Materials, has been suspended for more than 28 days and
 - i. the Plant and/or Materials were scheduled, in accordance with the Programme, to have been completed and ready for delivery to the Site during the suspension period; and
 - ii. the Contractor provides the Engineer with reasonable evidence that the Plant and/or Materials comply with the Contract; and
- b. the Contractor has marked the Plant and/or Materials as the Employer's property in accordance with the Engineer's instructions.

8.12 Prolonged Suspension

If the suspension under Sub-Clause 8.9 [Employer's Suspension] has continued for more than 84 days, the Contractor may give a Notice to the Engineer requesting permission to proceed.

If the Engineer does not give a Notice under Sub-Clause 8.13 [Resumption of Work] within 28 days after receiving the Contractor's Notice under this Sub-Clause, the Contractor may either:

- a. agree to a further suspension, in which case the Parties may agree the EOT and/or Cost-Plus Profit (if the Contractor incurs Cost), and/or payment for suspended Plant and/or Materials, arising from the total period of suspension; or (and if the Parties fail to reach agreement under this sub-paragraph (a))
- b. after giving a (second) Notice to the Engineer, treat the suspension as an omission of the affected part of the Works (as if it had been instructed under Sub-Clause 13.3. 1 [Variation by Instruction]) with immediate effect including release from any further obligation to protect, store and secure under Sub-Clause 8.9 [Employer's Suspension]. If the suspension affects the whole of the Works, the Contractor may give a Notice of termination under Sub-Clause 16.2 [Termination by Contractor].

8.13 Resumption of Work

The Contractor shall resume work as soon as practicable after receiving a Notice from the Engineer to proceed with the suspended work.

At the time stated in this Notice (if not stated, immediately after the Contractor receives this Notice), the Contractor and the Engineer shall jointly examine the Works and the Plant and Materials affected by the suspension. The Engineer shall record any deterioration, loss, damage or defect in the Works or Plant or Materials which has occurred during the suspension and shall provide this record to the Contractor. The Contractor shall promptly make good all such deterioration, loss, damage or defect so that the Works, when completed, shall comply with the Contract.

9 Tests on Completion

9.1 Contractor's Obligations

The Contractor shall carry out the Tests on Completion in accordance with this Clause and Sub-Clause 7.4 [Testing by the Contractor], after submitting the documents under Sub-Clause 5.6 [As-Built Records] and Sub-Clause 5.7 [Operation and Maintenance Manuals].

The Contractor shall submit to the Engineer, not less than 42 days before the date the Contractor intends to commence the Tests on Completion, a detailed test programme showing the intended timing and resources required for these tests.

The Engineer may Review the proposed test programme and may give a Notice to the Contractor stating the extent to which it does not comply with the Contract. Within 14 days after receiving this Notice, the Contractor shall revise the test programme to rectify such non-compliance. If the Engineer gives no such Notice within 14 days after receiving

the test programme (or revised test programme), the Engineer shall be deemed to have given a Notice of No-objection. The Contractor shall not commence the Tests on Completion until a Notice of No-objection is given (or is deemed to have been given) by the Engineer.

In addition to any date(s) shown in the test programme, the Contractor shall give a Notice to the Engineer, of not less than 21 days, of the date after which the Contractor will be ready to carry out each of the Tests on Completion. The Contractor shall commence the Tests on Completion within 14 days after this date, or on such day or days as the Engineer shall instruct and shall proceed in accordance with the Contractor's test programme to which the Engineer has given (or is deemed to have given) a Notice of No-objection.

Unless otherwise stated in the Employer's Requirements, the Tests on Completion shall be carried out in stages in the following sequence:

- a. pre-commissioning tests (on or off the Site, as appropriate), which shall include the appropriate inspections and ("dry" or "cold") functional tests to demonstrate that each item of the Works or Section can safely undertake the next stage under sub-paragraph (b) below;
- b. commissioning tests, which shall include the operational tests specified in the Employer's Requirements to demonstrate that the Works or Section can be operated safely and as specified in the Employer's Requirements, under all available operating conditions; and
- c. trial operation (to the extent possible under available operating conditions), which shall demonstrate that the Works or Section perform reliably and in accordance with the Contract.

The tests of each stage described in sub-paragraphs (b) and (c) above shall not be commenced until the Works or Section have passed the previous stage.

During trial operation, when the Works or Section (as the case may be) are operating under stable conditions, the Contractor shall give a Notice to the Engineer

that they are ready for any other Tests on Completion, including performance tests. Performance tests shall be carried out to demonstrate whether the Works or Section comply with the performance criteria specified in the Employer's Requirements and with the Schedule of Performance Guarantees.

Trial operation, including performance testing, shall not constitute a taking over under Clause 10 [Employer's Taking Over].

Any product produced by, and any revenue or other benefit resulting from, trial operation under this Sub-Clause shall be the property of the Employer.

As soon as the Works or Section have, in the Contractor's opinion, passed each stage of the Tests on Completion described in sub-paragraphs (a) to (c) above, the Contractor shall submit a certified report of the results of these tests to the Engineer. The Engineer shall Review each such report and may give a Notice to the Contractor stating the extent to which the results of the tests do not comply with the Contract. If the Engineer does not give such a Notice within 14 days after receiving the results of the tests, the Engineer shall

be deemed to have given a Notice of No-objection.

In considering the results of the Tests on Completion, the Engineer shall make allowances for the effect of any use of (any part of) the Works by the Employer on the performance or other characteristics of the Works.

9.2 Delayed Tests

If the Contractor has given a Notice under Sub-Clause 9.1 [Contractor's Obligations] that the Works or Section (as the case may be) are ready for Tests on Completion, and these tests are unduly delayed by the Employer's Personnel or by a cause for which the Employer is responsible, Sub-Clause 10.3 [Interference with Tests on Completion] shall apply.

If the Tests on Completion are unduly delayed by the Contractor, the Engineer may by giving a Notice to the Contractor require the Contractor to carry out the tests within 21 days after receiving the Notice. The Contractor shall carry out the tests on such day or days within this period of 21 days as the Contractor may fix, for which the Contractor shall give a prior Notice to the Engineer of not less than 7 days.

If the Contractor fails to carry out the Tests on Completion within this period of 21 days:

- a. after a second Notice is given by the Engineer to the Contractor, the Employer's Personnel may proceed with the tests;
- b. the Contractor may attend and witness these tests;
- c. within 28 days of these tests being completed, the Engineer shall send a copy of the test results to the Contractor; and
- d. if the Employer incurs additional costs as a result of such testing, the Employer shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment by the Contractor of the costs reasonably incurred.

Whether or not the Contractor attends, these Tests on Completion shall be deemed to have been carried out in the presence of the Contractor and the results of these tests shall be accepted as accurate.

9.3 Retesting

If the Works, or a Section, fail to pass the Tests on Completion, Sub-Clause 7.5 [Defects and Rejection] shall apply. The Engineer or the Contractor may require these failed tests, and the Tests on Completion on any related work, to be repeated under the same terms and conditions. Such repeated tests shall be treated as Tests on Completion for the purposes of this Clause.

9.4 Failure to Pass Tests on Completion

If the Works, or a Section, fail to pass the Tests on Completion repeated under Sub-Clause 9.3 [Retesting], the Engineer shall be entitled to:

- a. order further repetition of Tests on Completion under Sub-Clause 9.3 [Retesting];

- b. reject the Works if the effect of the failure is to deprive the Employer of substantially the whole benefit of the Works, in which event the Employer shall have the same remedies as are provided in sub-paragraph (d) of Sub-Clause 11.4 [Failure to Remedy Defects];
- c. reject the Section if the effect of the failure is that the Section cannot be used for its intended purpose(s) under the Contract, in which event the Employer shall have the same remedy as is provided in sub-paragraph (c) of Sub-Clause 11.4 [Failure to Remedy Defects]; or
- d. issue a Taking-Over Certificate, if the Employer so requests.

In the event of sub-paragraph (d) above, the Contractor shall then proceed in accordance with all other obligations under the Contract, and the Employer shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment by the Contractor or a reduction in the Contract Price as described under sub-paragraphs (b)(i) or (b)(ii) of Sub-Clause 11.4 [Failure to Remedy Defects], respectively. This entitlement shall be without prejudice to any other rights the Employer may have, under the Contract or otherwise.

10 Employer's Taking Over

10.1 Taking Over the Works and Sections

Except as stated in Sub-Clause 9.4 [Failure to Pass Tests on Completion], Sub-Clause 10.2 [Taking Over Parts] and Sub-Clause 10.3 [Interference with Tests on Completion], the Works shall be taken over by the Employer when:

- a. the Works have been completed in accordance with the Contract, including the passing of the Tests on Completion and except as allowed in sub-paragraph (i) below;
- b. the Engineer has given (or is deemed to have given) a Notice of No-objection to the as-built records submitted under sub-paragraph (a) of Sub-Clause 5.6 [As-Built Records];
- c. the Engineer has given (or is deemed to have given) a Notice of No-objection to the provisional O&M Manuals for the Works submitted under Sub-Clause 5.7 [Operation and Maintenance Manuals];
- d. the Contractor has carried out the training (if any) as described under Sub-Clause 5.5 [Training]; and
- e. a Taking-Over Certificate for the Works has been issued, or is deemed to have been issued in accordance with this Sub-Clause.

The Contractor may apply for a Taking-Over Certificate by giving a Notice to the Engineer not more than 14 days before the Works will, in the Contractor's opinion, be complete and ready for taking over. If the Works are divided into Sections, the Contractor may similarly apply for a Taking-Over Certificate for each Section.

If any Part of the Works is taken over under Sub-Clause 10.2 [Taking Over Parts], the remaining Works or Section shall not be taken over until the conditions described in subparagraphs (a) to (e) above have been fulfilled.

The Engineer shall, within 28 days after receiving the Contractor's Notice, either:

- i. issue the Taking-Over Certificate to the Contractor, stating the date on which the Works or Section were completed in accordance with the Contract, except for any minor outstanding work and defects (as listed in the Taking-Over Certificate) which will not substantially affect the safe use of the Works or Section for their intended purpose (either until or whilst this work is completed and these defects are remedied); or
- ii. reject the application by giving a Notice to the Contractor, with reasons. This Notice shall specify the work required to be done, the defects required to be remedied and/or the documents required to be submitted by the Contractor to enable the Taking-Over Certificate to be issued. The Contractor shall then complete this work, remedy such defects and/or submit such documents before giving a further Notice under this Sub-Clause.

If the Engineer does not issue the Taking-Over Certificate or reject the Contractor's application within this period of 28 days, and if the conditions described in subparagraphs (a) to (d) above have been fulfilled, the Works or Section shall be deemed to have been completed in accordance with the Contract on the fourteenth day after the Engineer receives the Contractor's Notice of application and the Taking-Over Certificate shall be deemed to have been issued.

10.2 Taking Over Parts

The Engineer may, at the sole discretion of the Employer, issue a Taking-Over Certificate for any part of the Permanent Works.

The Employer shall not use any part of the Works (other than as a temporary measure, which is either specified in the Employer's Requirements or with the prior agreement of the Contractor) unless and until the Engineer has issued a Taking-Over Certificate for this part. However, if the Employer does use any part of the Works before the Taking-Over Certificate is issued the Contractor shall give a Notice to the Engineer identifying such part and describing such use, and:

- a. that Part shall be deemed to have been taken over by the Employer as from the date on which it is used;
- b. the Contractor shall cease to be liable for the care of such Part as from this date, when responsibility shall pass to the Employer; and
- c. the Engineer shall immediately issue a Taking-Over Certificate for this Part, and any outstanding work to be completed (including Tests on Completion) and/or defects to be remedied shall be listed in this certificate.

After the Engineer has issued a Taking-Over Certificate for a Part, the Contractor shall be given the earliest opportunity to take such steps as may be necessary to carry out the

outstanding work (including Tests on Completion) and/or remedial work for any defects listed in the certificate. The Contractor shall carry out these works as soon as practicable and, in any case, before the expiry date of the relevant DNP.

If the Contractor incurs Cost as a result of the Employer taking over and/ or using a Part, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment of such Cost Plus Profit.

If the Engineer issues a Taking-Over Certificate for any part of the Works, or if the Employer is deemed to have taken over a Part under sub-paragraph (a) above, for any period of delay after the date under sub-paragraph (a) above, the Delay Damages for completion of the remainder of the Works shall be reduced. Similarly, the Delay Damages for the remainder of the Section (if any) in which this Part is included shall also be reduced. This reduction shall be calculated as the proportion which the value of the Part (except the value of any outstanding works and/or defects to be remedied) bears to the value of the Works or Section (as the case may be) as a whole. The Engineer shall proceed under Sub-Clause 3.7 [Agreement or Determination] to agree or determine this reduction (and, for the purpose of Sub-Clause 3.7.3 [Time limits], the date the Engineer receives the Contractor's Notice under this Sub-Clause shall be the date of commencement of the time limit for agreement under Sub-Clause 3.7.3). The provisions of this paragraph shall only apply to the daily rate of Delay Damages and shall not affect the maximum amount of these damages.

10.3 Interference with Tests on Completion

If the Contractor is prevented, for more than 14 days (either a continuous period, or multiple periods which total more than 14 days), from carrying out the Tests on Completion by the Employer's Personnel or by a cause for which the Employer is responsible (including any performance test that is not possible due to available operating conditions during trial operation):

- a. the Contractor shall give a Notice to the Engineer describing such prevention;
- b. the Employer shall be deemed to have taken over the Works or Section (as the case may be) on the date when the Tests on Completion would otherwise have been completed; and
- c. the Engineer shall immediately issue a Taking-Over Certificate for the Works or Section (as the case may be).

After the Engineer has issued this Taking-Over Certificate, the Contractor shall carry out the Tests on Completion as soon as practicable and, in any case, before

the expiry date of the DNP. The Engineer shall give a Notice to the Contractor, of not less than 14 days, of the date after which the Contractor may carry out each of the Tests on Completion. Thereafter, Sub-Clause 9.1 [Contractor's Obligations] shall apply.

If the Contractor suffers delay and/or incurs Cost as a result of being prevented from carrying out the Tests on Completion, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to EOT and/or payment of such Cost Plus Profit.

10.4 Surfaces Requiring Reinstatement

Except as otherwise stated in the Taking-Over Certificate, a certificate for a Section or Part of the Works shall not be deemed to certify completion of any ground or other surfaces requiring reinstatement.

11 Defects after Taking Over

11.1 Completion of Outstanding Work and Remedying Defects

In order that the Works and Contractor's Documents, and each Section and/ or Part, shall be in the condition required by the Contract (fair wear and tear excepted) by the expiry date of the relevant Defects Notification Period or as soon as practicable thereafter, the Contractor shall:

- a. complete any work which is outstanding on the relevant Date of Completion, within the time(s) stated in the Taking-Over Certificate or such other reasonable time as is instructed by the Engineer; and
- b. execute all work required to remedy defects or damage, of which a Notice is given to the Contractor by (or on behalf of) the Employer on or before the expiry date of the DNP for the Works or Section or Part (as the case may be).

If a defect appears or damage occurs during the relevant DNP, a Notice shall be given to the Contractor accordingly, by (or on behalf of) the Employer. Promptly thereafter:

- i. the Contractor and the Employer's Personnel shall jointly inspect the defector damage;
- ii. the Contractor shall then prepare and submit a proposal for necessary remedial work; and
- iii. the second, third and fourth paragraphs of Sub-Clause 7.5 [Defects and Rejection] shall apply.

11.2 Cost of Remedying Defects

All work under sub-paragraph (b) of Sub-Clause 11.1 [Completion of Outstanding Work and Remedying Defects] shall be executed at the risk and cost of the Contractor, if and to the extent that the work is attributable to:

- a. the design of the Works, other than a part of the design for which the Employer is responsible (if any);
- b. Plant, Materials or workmanship not being in accordance with the Contract;
- c. improper operation or maintenance which was attributable to matters for which the Contractor is responsible (under Sub-Clause 5.5 [Training], Sub-Clause 5.6 [As-Built Records] and/or Sub-Clause 5.7 [Operation and Maintenance Manuals] or otherwise); or
- d. failure by the Contractor to comply with any other obligation under the Contract.

If the Contractor considers that the work is attributable to any other cause, the Contractor shall promptly give a Notice to the Engineer and the Engineer shall proceed under Sub-Clause 3.7 [Agreement or Determination] to agree or determine the cause (and, for the purpose of Sub-Clause 3.7.3 [Time limits], the date of this Notice shall be the date of commencement of the time limit for agreement under Sub-Clause 3.7.3). If it is agreed or determined that the work is attributable to a cause other than those listed above, Sub-Clause 13.3.1 [Variation by Instruction] shall apply as if such work had been instructed by the Engineer.

11.3 Extension of Defects Notification Period

The Employer shall be entitled to an extension of the DNP for the Works, or a Section or a Part:

- a. if and to the extent that the Works, Section, Part or a major item of Plant (as the case may be, and after taking over) cannot be used for the intended purpose(s) by reason of a defect or damage which is attributable to any of the matters under sub-paragraphs (a) to (d) of Sub-Clause 11.2 [Cost of Remedying Defects]; and
- b. subject to Sub-Clause 20.2 [Claims For Payment and/or EOT].

However, a DNP shall not be extended by more than a period of two years after the expiry of the DNP stated in the Contract Data.

If delivery and/or erection of Plant and/or Materials was suspended under Sub-Clause 8.9 [Employer's Suspension] (other than where the cause of such suspension is the responsibility of the Contractor) or Sub-Clause 16.1 [Suspension by Contractor], the Contractor's obligations under this Clause shall not apply to any defects or damage occurring more than two years after the DNP for the Works, of which the Plant and/or Materials form part, would otherwise have expired.

11.4 Failure to Remedy Defects

If the remedying of any defect or damage under Sub-Clause 11.1 [Completion of Outstanding Works and Remedying Defects] is unduly delayed by the Contractor, a date may be fixed by (or on behalf of) the Employer, on or by which the defect or damage is to be remedied. A Notice of this fixed date shall be given to the Contractor by (or on behalf of) the Employer, which Notice shall allow the Contractor reasonable time (taking due regard of all relevant circumstances) to remedy the defect or damage.

If the Contractor fails to remedy the defect or damage by the date stated in this Notice and this remedial work was to be executed at the cost of the Contractor under Sub-Clause 11.2 [Cost of Remedying Defects], the Employer may (at the

Employer's sole discretion):

- a. carry out the work or have the work carried out by others (including any retesting), in the manner required under the Contract and at the Contractor's cost, but the Contractor shall have no responsibility for this work. The Employer shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment by the Contractor of the costs reasonably incurred by the Employer in remedying the defect or damage;

- b. accept the damaged or defective work, in which case the Employer shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to:
 - i. payment of Performance Damages by the Contractor in full satisfaction of this failure; or
 - ii. if there is no Schedule of Performance Guarantees under the Contract, or no applicable Performance Damages, a reduction in the Contract Price. The reduction shall be in full satisfaction of this failure only and shall be in the amount as shall be appropriate to cover the reduced value to the Employer as a result of this failure;
- c. require the Engineer to treat any part of the Works which cannot be used for its intended purpose(s) under the Contract by reason of this failure as an omission, as if such omission had been instructed under Sub-Clause 13.3.1 [Variation by Instruction]; or
- d. terminate the Contract as a whole with immediate effect (and Sub-Clause

15.2 [Termination for Contractor's Default] shall not apply) if the defect or damage deprives the Employer of substantially the whole benefit of the Works. The Employer shall then be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to recover from the Contractor all sums paid for the Works, plus financing charges and any costs incurred in dismantling the same, clearing the Site and returning Plant and Materials to the Contractor.

The exercise of discretion by the Employer under sub-paragraph (c) or (d) above shall be without prejudice to any other rights the Employer may have, under the Contract or otherwise.

11.5 Remedying of Defective Work off Site

If, during the DNP, the Contractor considers that any defect or damage in any Plant cannot be remedied expeditiously on the Site the Contractor shall give a Notice, with reasons, to the Employer requesting consent to remove the defective or damaged Plant off the Site for the purposes of repair. This Notice shall clearly identify each item of defective or damaged Plant, and shall give details of:

- a. the defect or damage to be repaired;
- b. the place to which defective or damaged Plant is to be taken for repair;
- c. the transportation to be used (and insurance cover for such transportation);
- d. the proposed inspections and testing off the Site;
- e. the planned duration required before the repaired Plant shall be returned to the Site; and
- f. the planned duration for reinstallation and retesting of the repaired Plant (under Sub-Clause 7.4 [Testing by the Contractor] and/or Clause 9 [Tests on

Completion] if applicable).

The Contractor shall also provide any further details that the Employer may reasonably require.

When the Employer gives consent (which consent shall not relieve the Contractor from any obligation or responsibility under this Clause), the Contractor may remove from the Site such items of Plant as are defective or damaged. As a condition of this consent, the Employer may require the Contractor to increase the amount of the Performance Security by the full replacement cost of the defective or damaged Plant.

11.6 Further Tests after Remedying Defects

Within 7 days of completion of the work of remedying of any defect or damage, the Contractor shall give a Notice to the Engineer describing the remedied Works, Section, Part and/or Plant and the proposed repeated tests (under Clause 9 [Tests on Completion] or Clause 12 [Tests after Completion], as applicable).

Within 7 days after receiving this Contractor's Notice, the Engineer shall give a Notice to the Contractor either:

- a. agreeing with such proposed testing; or
- b. instructing the repeated tests that are necessary to demonstrate that the remedied Works, Section, Part and/or Plant comply with the Contract.

If the Contractor fails to give such a Notice within the 7 days, the Engineer may give a Notice to the Contractor, within 14 days after the defect or damage is remedied, instructing the repeated tests that are necessary to demonstrate that the remedied Works, Section, Part and/or Plant comply with the Contract.

All repeated tests under this Sub-Clause shall be carried out in accordance with the terms applicable to the previous tests, except that they shall be carried out at the risk and cost of the Party liable, under Sub-Clause 11.2 [Cost of Remedying Defects], for the cost of the remedial work.

11.7 Right of Access after Taking Over

Until the date 28 days after issue of the Performance Certificate, the Contractor shall have the right of access to all parts of the Works and to records of the operation, maintenance and performance of the Works, except as may be inconsistent with the Employer's reasonable security restrictions.

Whenever the Contractor intends to access any part of the Works or such records during the relevant DNP:

- a. the Contractor shall request access by giving a Notice to the Employer, describing the parts of the Works and/or records to be accessed, the reasons for such access, and the Contractor's preferred date for access. This Notice shall be given in reasonable time in advance of the preferred date for access, taking due regard of all relevant circumstances including the Employer's security restrictions; and
- b. within 7 days after receiving the Contractor's Notice, the Employer shall give a

Notice to the Contractor either:

- i. stating the Employer's consent to the Contractor's request; or
- ii. proposing reasonable alternative date(s), with reasons. If the Employer fails to give this Notice within the 7 days, the Employer shall be deemed to have given consent to the Contractor's access on the preferred date stated in the Contractor's Notice.

If the Contractor incurs additional Cost as a result of any unreasonable delay by the Employer in permitting access to the Works or such records by the Contractor, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment of any such Cost Plus Profit.

11.8 Contractor to Search

The Contractor shall, if instructed by the Engineer, search for the cause of any defect, under the direction of the Engineer. The Contractor shall carry out the search on the date(s) stated in the Engineer's instruction or other date(s) agreed with the Engineer.

Unless the defect is to be remedied at the cost of the Contractor under Sub-Clause 11.2 [Cost of Remedying Defects], the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment of the Cost Plus Profit of the search.

If the Contractor fails to carry out the search in accordance with this Sub-Clause, the search may be carried out by the Employer's Personnel. The Contractor shall be given a Notice of the date when such a search will be carried out and the Contractor may attend at the Contractor's own cost. If the defect is to be remedied at the cost of the Contractor under Sub-Clause 11.2 [Cost of Remedying Defects], the Employer shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment by the Contractor of the costs of the search reasonably incurred by the Employer.

11.9 Performance Certificate

Performance of the Contractor's obligations under the Contract shall not be considered to have been completed until the Engineer has issued the Performance Certificate to the Contractor, stating the date on which the Contractor fulfilled the Contractor's obligations under the Contract.

The Engineer shall issue the Performance Certificate to the Contractor (with a copy to the Employer and to the DAAB) within 28 days after the latest of the expiry dates of the Defects Notification Periods, or as soon thereafter as the Contractor has:

- a. supplied all the Contractor's Documents, and the Engineer has given (or is deemed to have given) a Notice of No-objection to the as-built records under sub-paragraph (b) of Sub-Clause 5.6 [As-Built Records]; and
- b. completed and tested all the Works (including remedying any defects) in accordance with the Contract.

If the Engineer fails to issue the Performance Certificate within this period of 28 days, the Performance Certificate shall be deemed to have been issued on the date 28 days after the date on which it should have been issued, as required by this Sub-Clause. Only the

Performance Certificate shall be deemed to constitute acceptance of the Works.

11.10 Unfulfilled Obligations

After the issue of the Performance Certificate, each Party shall remain liable for the fulfilment of any obligation which remains unperformed at that time. For the purposes of determining the nature and extent of unperformed obligations, the Contract shall be deemed to remain in force.

However, in relation to Plant, the Contractor shall not be liable for any defects or damage occurring more than two years after expiry of the DNP for the Plant except if prohibited by law or in any case of fraud, gross negligence, deliberate default or reckless misconduct.

11.11 Clearance of Site

Promptly after the issue of the Performance Certificate, the Contractor shall:

- a. remove any remaining Contractor's Equipment, surplus material, wreckage, rubbish and Temporary Works from the Site;
- b. reinstate all parts of the Site which were affected by the Contractor's activities during the execution of the Works and are not occupied by the Permanent Works; and
- c. leave the Site and the Works in the condition stated in the Employer's Requirements (if not stated, in a clean and safe condition).

If the Contractor fails to comply with sub-paragraphs (a), (b) and/or (c) above within 28 days after the issue of the Performance Certificate, the Employer may sell (to the extent permitted by applicable Laws) or otherwise dispose of any remaining items and/or may reinstate and clean the Site (as may be necessary) at the Contractor's cost.

The Employer shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment by the Contractor of the costs reasonably incurred in connection with, or attributable to, such sale or disposal and reinstating and/or cleaning the Site, less an amount equal to the moneys from the sale (if any).

12 Tests after Completion

12.1 Procedure for Tests after Completion

If Tests after Completion are specified in the Employer's Requirements, this Clause shall apply.

The Employer shall:

- a. provide all electricity, water, sewage (if applicable), equipment, fuel, consumables, instruments, labour, materials, and suitably qualified, experienced and competent staff, as are necessary to carry out the Tests after Completion efficiently and properly; and
- b. carry out the Tests after Completion in accordance with:

- i. the Employer's Requirements,
- ii. the O&M Manuals to which the Engineer has given (or is deemed to have given) a Notice of No-objection, under Sub-Clause 5.7 [Operation and Maintenance Manuals], and
- iii. such guidance as the Contractor may be required to give during the course of these tests; and

in the presence of such Contractor's Personnel as either Party may reasonably request.

The timing of the Tests after Completion shall be as stated in the Employer's Requirements (if not stated, as soon as is reasonably practicable) after the Works or Section (as the case may be) have been taken over under Clause 10 [Employer's Taking Over]. The Engineer shall give a Notice to the Contractor, of not less than 21 days, of the date on which and place at which the Tests after Completion will be carried out. This Notice shall also include a test programme showing the estimated timing for each of such tests. Unless otherwise agreed with the Contractor, these tests shall be carried out on this date.

If the Contractor does not attend at the time and place stated in the Engineer's Notice (or otherwise agreed with the Contractor), the Employer may proceed with the Tests after Completion, which shall be deemed to have been made in the Contractor's presence, and the Contractor shall be deemed to have accepted the readings as accurate.

The results of the Tests after Completion shall be compiled and evaluated by both Parties. Appropriate account shall be taken of the effect of the Employer's prior use of the Works.

12.2 Delayed Tests

If the Contractor incurs Cost as a result of any unreasonable delay by the Employer in carrying out the Tests after Completion, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment of such Cost Plus Profit.

If, for reasons not attributable to the Contractor, a Test after Completion on the Works or any Section cannot be completed during the DNP (or any other period agreed by both Parties), then the Works or Section shall be deemed to have passed this Test after Completion.

12.3 Retesting

Subject to Sub-Clause 12.4 [Failure to Pass Tests after Completion], if the Works, or a Section, fail to pass the Tests after Completion:

- a. sub-paragraph (b) of Sub-Clause 11.1 [Completion of Outstanding Work and Remedying Defects] shall apply; and
- b. after remedying any defect or damage, Sub-Clause 11.6 [Further Tests after Remedying Defects] shall apply.

If and to the extent that this failure and retesting are attributable to any of the matters listed in sub-paragraphs (a) to (d) of Sub-Clause 11.2 [Cost of Remedying Defects] and cause the Employer to incur additional costs, the Employer shall be entitled subject to Sub-

Clause 20.2 [Claims For Payment and/or EOT] to payment of these costs by the Contractor.

12.4 Failure to Pass Tests after Completion

If:

- a. the Works, or a Section, fail to pass any or all of the Tests after Completion; and
- b. applicable Performance Damages are set out in the Schedule of Performance Guarantees

the Employer shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment of these Performance Damages by the Contractor in full satisfaction of this failure. If the Contractor pays these Performance Damages to the Employer during the DNP, then the Works or Section shall be deemed to have passed these Tests after Completion.

If the Works, or a Section, fail to pass a Test after Completion and, by giving a Notice to the Employer, the Contractor proposes to make adjustments or modifications to the Works or such Section (including an item of Plant):

- i. the Contractor may be instructed by a Notice given by the Employer that right of access to the Works or Section cannot be given until a time that is convenient to the Employer, which time shall be reasonable;
- ii. the Contractor shall remain liable to carry out the adjustments or modifications and to satisfy this Test, within a reasonable period of receiving the Notice under sub-paragraph (i) above; and
- iii. if the Contractor does not receive a Notice under sub-paragraph (i) above during the relevant DNP, the Contractor shall be relieved of the obligation to make such adjustments or modifications and the Works or Section (as the case may be) shall be deemed to have passed this Test after Completion.

If the Contractor incurs additional Cost as a result of any unreasonable delay by the Employer in permitting access to the Works or Section by the Contractor, either to investigate the causes of a failure to pass a Test after Completion or to carry out any adjustments or modifications, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment of any such Cost Plus Profit.

13 Variations and Adjustments

13.1 Right to Vary

Variations may be initiated by the Engineer under Sub-Clause 13.3 [Variation Procedure] at any time before the issue of the Taking-Over Certificate for the Works.

Other than as stated under Sub-Clause 11.4 [Failure to Remedy Defects], a Variation shall not comprise the omission of any work which is to be carried out by the Employer or by others unless otherwise agreed by the Parties.

The Contractor shall be bound by each Variation instructed under Sub-Clause

13.3.1 [Variation by Instruction], and shall execute the Variation with due expedition and without delay, unless the Contractor promptly gives a Notice to the Engineer stating (with detailed supporting particulars) that:

- a. the varied work was Unforeseeable having regard to the scope and nature of the Works described in the Employer's Requirements;
- b. the Contractor cannot readily obtain the Goods required for the Variation;
- c. it will adversely affect the Contractor's ability to comply with Sub-Clause 4.8 [Health and Safety Obligations] and/or Sub-Clause 4.18 [Protection of the Environment];
- d. it will have an adverse impact on the achievement of the Schedule of Performance Guarantees; or
- e. it may adversely affect the Contractor's obligation to complete the Works so that they shall be fit for the purpose(s) for which they are intended under Sub-Clause 4.1 [Contractor's General Obligations].

Promptly after receiving this Notice, the Engineer shall respond by giving a Notice to the Contractor cancelling, confirming or varying the instruction. Any instruction so confirmed or varied shall be taken as an instruction under Sub-Clause 13.3.1 [Variation by instruction].

13.2 Value Engineering

The Contractor may, at any time, submit to the Engineer a written proposal which (in the Contractor's opinion) will, if adopted:

- a. accelerate completion;
- b. reduce the cost to the Employer of executing, maintaining or operating the Works;
- c. improve the efficiency or value to the Employer of the completed Works; or
- d. otherwise be of benefit to the Employer.

The proposal shall be prepared at the cost of the Contractor and shall include the details as stated in sub-paragraphs (a) to (c) of Sub-Clause 13.3.1 [Variation by Instruction].

The Engineer shall, as soon as practicable after receiving such a proposal, respond by giving a Notice to the Contractor stating his/her consent or otherwise. The Engineer's consent or otherwise shall be at the sole discretion of the Employer. The Contractor shall not delay any work while awaiting a response.

If the Engineer gives his/her consent to the proposal, with or without comments, the Engineer shall then instruct a Variation. Thereafter:

- i. the Contractor shall submit any further particulars that the Engineer may reasonably require; and

- ii. then the third paragraph of Sub-Clause 13.3.1 [Variation by Instruction] shall apply, which shall include consideration by the Engineer of the sharing (if any) of the benefit, costs and/or delay between the Parties stated in the Particular Conditions.

13.3 Variation Procedure

Subject to Sub-Clause 13.1 [Right to Vary], Variations shall be initiated by the Engineer in accordance with either of the following procedures:

13.3.1 Variation by Instruction

The Engineer may instruct a Variation by giving a Notice (describing the required change and stating any requirements for the recording of Costs) to the Contractor in accordance with Sub-Clause 3.5 [Engineer's Instructions].

The Contractor shall proceed with execution of the Variation and shall, within 28 days (or other period proposed by the Contractor and agreed by the Engineer) of receiving the Engineer's instruction, submit to the Engineer detailed particulars including:

- a. a description of the varied work performed or to be performed, including details of the resources and methods adopted or to be adopted by the Contractor;
- b. a programme for its execution and the Contractor's proposal for any necessary modifications (if any) to the Programme according to Sub-Clause 8.3 [Programme] and to the Time for Completion; and
- c. the Contractor's proposal for adjustment to the Contract Price, with supporting particulars. Whenever the omission of any work forms part (or all) of a Variation, and if:
 - the Contractor has incurred or will incur cost which, if the work had not been omitted, would have been deemed to be covered by a sum forming part of the Accepted Contract Amount; and
 - the omission of the work has resulted or will result in this sum not forming part of the Contract Price

this cost may be included in the Contractor's proposal (and, if so, shall be clearly identified). If the Parties have agreed to the omission of any work which is to be carried out by others, the Contractor's proposal may also include the amount of any loss of profit and other losses and damages suffered (or to be suffered) by the Contractor as a result of the omission.

Thereafter, the Contractor shall submit any further particulars that the Engineer may reasonably require.

The Engineer shall then proceed under Sub-Clause 3.7 [Agreement or Determination] to agree or determine:

- i. EOT, if any; and/or

ii. the adjustments to the Contract Price and the Schedule of Payments, if any

(and, for the purpose of Sub-Clause 3.7.3 [Time limits], the date the Engineer receives the Contractor's submission under this Sub-Clause (including any requested further particulars) shall be the date of commencement of the time limit for agreement under Sub-Clause 3.7.3). The Contractor shall be entitled to such EOT and/or adjustments to the Contract Price, without any requirement to comply with Sub-Clause 20.2 [Claims For Payment and/or EOT].

If no Schedule of Rates and Prices is included in the Contract, the adjustments under sub-paragraph (ii) above shall be derived from the Cost Plus Profit of executing the work.

If a Schedule of Rates and Prices is included in the Contract, the following provisions of this Sub-Clause 13.3.1 shall apply to the adjustments under sub- paragraph (ii) above.

For each item of work forming part (or all) of a Variation, the appropriate rate or price for the item shall be the rate or price specified for such item in the Schedule of Rates and Prices or, if there is no such item, the rate or price specified for similar work. However, a new rate or price shall be appropriate for an item of work if no rate or price for this item is specified in the Schedule of Rates and Prices and no specified rate or price is appropriate because the item of work is not of similar character, or is not executed under similar conditions, as any item in the Contract.

Each new rate or price shall be derived from any relevant rates or prices in the Schedule of Rates and Prices, with reasonable adjustments taking account of all relevant circumstances. If no rates or prices are relevant for the derivation of a new rate or price, it shall be derived from the Cost Plus Profit of executing the work.

Until such time as the adjustments under sub-paragraph (ii) above are agreed or determined, the Engineer shall assess a provisional rate or price for the purposes of Interim Payment Certificates.

13.3.2 Variation by Request for Proposal

The Engineer may request a proposal, before instructing a Variation, by giving a Notice (describing the proposed change) to the Contractor.

The Contractor shall respond to this Notice as soon as practicable, by either:

- a. submitting a proposal, which shall include the matters as described in sub-paragraphs (a) to (c) of Sub-Clause 13.3.1 [Variation by Instruction]; or
- b. giving reasons why the Contractor cannot comply (if this is the case), by reference to the matters described in sub-paragraphs (a) to (e) of Sub-Clause 13.1 [Right to Vary]

If the Contractor submits a proposal, the Engineer shall, as soon as practicable after receiving it, respond by giving a Notice to the Contractor stating his/her consent or otherwise. The Contractor shall not delay any work whilst awaiting a response.

If the Engineer gives consent to the proposal, with or without comments, the Engineer shall then instruct the Variation. Thereafter, the Contractor shall submit any further particulars that the Engineer may reasonably require and the third paragraph of

Sub-Clause 13.3.1 [Variation by Instruction] shall apply.

If the Engineer does not give consent to the proposal, with or without comments, and if the Contractor has incurred Cost as a result of submitting it, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment of such Cost.

13.4 Provisional Sums

Each Provisional Sum shall only be used, in whole or in part, in accordance with the Engineer's instructions, and the Contract Price shall be adjusted accordingly. The total sum paid to the Contractor shall include only such amounts for the work, supplies or services to which the Provisional Sum relates, as the Engineer shall have instructed.

For each Provisional Sum, the Engineer may instruct:

- a. work to be executed (including Plant, Materials or services to be supplied) by the Contractor, and for which adjustments to the Contract Price and the Schedule of Payments (if any) shall be agreed or determined under Sub-Clause 13.3.1 [Variation by Instruction]; and/or
- b. Plant, Materials, works or services to be purchased by the Contractor, from a nominated Subcontractor (as defined in Sub-Clause 4.5 [Nominated Subcontractors]) or otherwise, and for which there shall be included in the Contract Price:
 - i. the actual amounts paid (or due to be paid) by the Contractor; and
 - ii. a sum for overhead charges and profit, calculated as a percentage of these actual amounts by applying the relevant percentage rate (if any) stated in the applicable Schedule. If there is no such rate, the percentage rate stated in the Contract Data shall be applied.

If the Engineer instructs the Contractor under sub-paragraph (a) and/or (b) above, this instruction may include a requirement for the Contractor to submit quotations from the Contractor's suppliers and/or subcontractors for all (or some) of the items of the work to be executed or Plant, Materials, works or services to be purchased. Thereafter, the Engineer may respond by giving a Notice either instructing the Contractor to accept one of these quotations (but such an instruction shall not be taken as an instruction under Sub-Clause 4.5 [Nominated Subcontractors]) or revoking the instruction. If the Engineer does not so respond within 7 days of receiving the quotations, the Contractor shall be entitled to accept any of these quotations at the Contractor's discretion.

Each Statement that includes a Provisional Sum shall also include all applicable invoices, vouchers and accounts or receipts in substantiation of the Provisional Sum.

13.5 Daywork

If a Daywork Schedule is not included in the Contract, this Sub-Clause shall not apply.

For work of a minor or incidental nature, the Engineer may instruct that a Variation shall be executed on a daywork basis. The work shall then be valued in accordance with the

Daywork Schedule, and the following procedure shall apply.

Before ordering Goods for such work (other than any Goods priced in the Daywork Schedule), the Contractor shall submit one or more quotations from the Contractor's suppliers and/or subcontractors to the Engineer. Thereafter, the Engineer may instruct the Contractor to accept one of these quotations (but such an instruction shall not be taken as an instruction under Sub-Clause 4.5 [Nominated Subcontractors]). If the Engineer does not so instruct the Contractor within 7 days of receiving the quotations, the Contractor shall be entitled to accept any of these quotations at the Contractor's discretion.

Except for any items for which the Daywork Schedule specifies that payment is not due, the Contractor shall deliver each day to the Engineer accurate statements in duplicate (and one electronic copy), which shall include records (as described under Sub-Clause 6.10 [Contractor's Records]) of the resources used in executing the previous day's work.

One copy of each statement shall, if correct and agreed, be signed by the Engineer and promptly returned to the Contractor. If not correct or agreed, the Engineer shall proceed under Sub-Clause 3.7 [Agreement or Determination] to agree or determine the resources (and, for the purpose of Sub-Clause 3.7.3 [Time limits], the date the works which are the subject of the Variation under this Sub-Clause are completed by the Contractor shall be the date of commencement of the time limit for agreement under Sub-Clause 3.7.3).

In the next Statement, the Contractor shall then submit priced statements of the agreed or determined resources to the Engineer, together with all applicable invoices, vouchers and accounts or receipts in substantiation of any Goods used in the daywork (other than Goods priced in the Daywork Schedule).

Unless otherwise stated in the Daywork Schedule, the rates and prices in the Daywork Schedule shall be deemed to include taxes, overheads and profit.

13.6 Adjustments for Changes in Laws

Subject to the following provisions of this Sub-Clause, the Contract Price shall be adjusted to take account of any increase or decrease in Cost resulting from a change in:

- a. the Laws of the Country (including the introduction of new Laws and the repeal or modification of existing Laws);
- b. the judicial or official governmental interpretation or implementation of the Laws referred to in sub-paragraph (a) above;
- c. any permit, permission, license or approval obtained by the Employer or the Contractor under sub-paragraph (a) or (b), respectively, of Sub-Clause 1.13 [Compliance with Laws]; or
- d. the requirements for any permit, permission, license and/or approval to be obtained by the Contractor under sub-paragraph (b) of Sub-Clause 1.13 [Compliance with Laws],

made and/or officially published after the Base Date, which affect the Contractor in the performance of obligations under the Contract. In this Sub-Clause "change in Laws" means any of the changes under sub-paragraphs (a), (b), (c) and/or (d) above.

If the Contractor suffers delay and/or incurs an increase in Cost as a result of any change in Laws, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to EOT and/or payment of such Cost.

If there is a decrease in Cost as a result of any change in Laws, the Employer shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to a reduction in the Contract Price.

If any adjustment to the execution of the Works becomes necessary as a result of any change in Laws:

- i. the Contractor shall promptly give a Notice to the Engineer, or
- ii. the Engineer shall promptly give a Notice to the Contractor (with detailed supporting particulars).

Thereafter, the Engineer shall either instruct a Variation under Sub-Clause 13.3.1 [Variation by Instruction] or request a proposal under Sub-Clause 13.3.2 [Variation by Request for Proposal].

13.7 Adjustments for Changes in Cost

If Schedule(s) of cost indexation are not included in the Contract, this Sub-Clause shall not apply.

The amounts payable to the Contractor shall be adjusted for rises or falls in the cost of labour, Goods and other inputs to the Works, by the addition or deduction of the amounts calculated in accordance with the Schedule(s) of cost indexation.

To the extent that full compensation for any rise or fall in Costs is not covered by this Sub-Clause or other Clauses of these Conditions, the Accepted Contract Amount shall be deemed to have included amounts to cover the contingency of other rises and falls in costs.

The adjustment to be applied to the amount otherwise payable to the Contractor, as certified in Payment Certificates, shall be calculated for each of the currencies in which the Contract Price is payable. No adjustment shall be applied to work valued on the basis of Cost or current prices.

Until such time as each current cost index is available, the Engineer shall use a provisional index for the issue of Interim Payment Certificates. When a current cost index is available, the adjustment shall be recalculated accordingly.

If the Contractor fails to complete the Works within the Time for Completion, adjustment of prices thereafter shall be made using either:

- a. each index or price applicable on the date 49 days before the expiry of the Time for Completion of the Works; or
- b. the current index or price

whichever is more favourable to the Employer.

14 Contract Price and Payment

14.1 The Contract Price

Unless otherwise stated in the Particular Conditions:

- a. the Contract Price shall be the lump sum Accepted Contract Amount and be subject to adjustments, additions (including Cost or Cost-Plus Profit to which the Contractor is entitled under these Conditions) and/ or deductions in accordance with the Contract;
- b. the Contractor shall pay all taxes, duties and fees required to be paid by the Contractor under the Contract, and the Contract Price shall not be adjusted for any of these costs, except as stated in Sub-Clause 13.6 [Adjustments for Changes in Laws];
- c. any quantities which may be set out in a Schedule are estimated quantities and are not to be taken as the actual and correct quantities of the Works which the Contractor is required to execute; and
- d. any quantities or price data which may be set out in a Schedule shall be used for the purposes stated in the Schedule and may be inapplicable for other purposes.

However, if any part of the Works is to be paid according to quantity supplied or work done, the provisions for measurement and valuation shall be as stated in the Particular Conditions. The Contract Price shall be valued accordingly, subject to adjustments in accordance with the Contract.

14.2 Advance Payment

If no amount of advance payment is stated in the Contract Data, this Sub-Clause shall not apply.

After receiving the Advance Payment Certificate, the Employer shall make an advance payment, as an interest-free loan for mobilisation and design. The amount of the advance payment and the currencies in which it is to be paid shall be as stated in the Contract Data.

14.2.1 Advance Payment Guarantee

The Contractor shall obtain (at the Contractor's cost) an Advance Payment Guarantee in amounts and currencies equal to the advance payment and shall submit it to the Employer with a copy to the Engineer. This guarantee shall be issued by an entity and from within a country (or other jurisdiction) to which the Employer gives consent and shall be based on the sample form included in the tender documents or on another form agreed by the Employer (but such consent and/or agreement shall not relieve the Contractor from any obligation under this Sub-Clause).

The Contractor shall ensure that the Advance Payment Guarantee is valid and enforceable until the advance payment has been repaid, but its amount may be progressively reduced by the amount repaid by the Contractor as stated in the Payment Certificates.

If the terms of the Advance Payment Guarantee specify its expiry date, and the advance payment has not been repaid by the date 28 days before the expiry date:

- a. the Contractor shall extend the validity of this guarantee until the advance payment has been repaid;
- b. the Contractor shall immediately submit evidence of this extension to the Employer, with a copy to the Engineer; and
- c. if the Employer does not receive this evidence 7 days before the expiry date of this guarantee, the Employer shall be entitled to claim under the guarantee the amount of advance payment which has not been repaid.

When submitting the Advance Payment Guarantee, the Contractor shall include an application (in the form of a Statement) for the advance payment.

14.2.2 Advance Payment Certificate

The Engineer shall issue an Advance Payment Certificate for the advance payment within 14 days after:

- a. the Employer has received both the Performance Security and the Advance Payment Guarantee, in the form and issued by an entity in accordance with Sub-Clause 4.2.1 [Contractor's Obligations] and Sub-Clause 14.2.1 [Advance Payment Guarantee] respectively; and
- b. the Engineer has received a copy of the Contractor's application for the advance payment under Sub-Clause 14.2.1 [Advance Payment Guarantee].

14.2.3 Repayment of Advance Payment

The advance payment shall be repaid through percentage deductions in Payment Certificates. Unless other percentages are stated in the Contract Data:

- a. deductions shall commence in the IPC in which the total of all certified interim payments in the same currency as the advance payment (excluding the advance payment and deductions and release of retention moneys) exceed ten percent (10%) of the portion of the Accepted Contract Amount payable in that currency less Provisional Sums; and
- b. deductions shall be made at the amortisation rate of one quarter (25%) of the amount of each IPC (excluding the advance payment and deductions and release of retention moneys) in the currencies and proportions of the advance payment, until such time as the advance payment has been repaid.

If the advance payment has not been repaid before the issue of the Taking-Over Certificate for the Works, or before termination under Clause 15 [Termination by Employer], Clause 16 [Suspension and Termination by Contractor] or Clause 18 [Exceptional Events] (as the case may be), the whole of the balance then outstanding shall immediately become due and payable by the Contractor to the Employer.

14.3 Application for Interim Payment

The Contractor shall submit a Statement to the Engineer after the end of the period of payment stated in the Contract Data (if not stated, after the end of each month). Each Statement shall:

- a. be in a form acceptable to the Engineer;
- b. be submitted in one paper-original, one electronic copy and additional paper copies (if any) as stated in the Contract Data; and
- c. show in detail the amounts to which the Contractor considers that the Contractor is entitled, with supporting documents which shall include sufficient detail for the Engineer to investigate these amounts together with the relevant report on progress in accordance with Sub-Clause 4.20 [Progress Reports].

The Statement shall include the following items, as applicable, which shall be expressed in the various currencies in which the Contract Price is payable, in the sequence listed:

- i. the estimated contract value of the Works executed, and the Contractor's Documents produced, up to the end of the period of payment (including Variations but excluding items described in sub-paragraphs (ii) to (x) below);
- ii. any amounts to be added and/or deducted for changes in Laws under Sub-Clause 13.6 [Adjustments for Changes in Laws], and for changes in Cost under Sub-Clause 13.7 [Adjustments for Changes in Cost];
- iii. any amount to be deducted for retention, calculated by applying the percentage of retention stated in the Contract Data to the total of the amounts under sub-paragraphs (i), (ii) and (vi) of this Sub-Clause, until the amount so retained by the Employer reaches the limit of Retention Money (if any) stated in the Contract Data;
- iv. any amounts to be added and/or deducted for the advance payment and repayments under Sub-Clause 14.2 [Advance Payment];
- v. any amounts to be added and/or deducted for Plant and Materials under Sub-Clause 14.5 [Plant and Materials intended for the Works];
- vi. any other additions and/or deductions which have become due under the Contract or otherwise, including those under Sub-Clause 3.7 [Agreement or Determination];
- vii. any amounts to be added for Provisional Sums under Sub-Clause 13.4 [Provisional Sums];
- viii. any amount to be added for release of Retention Money under Sub-Clause 14.9 [Release of Retention Money];

- ix. any amount to be deducted for the Contractor's use of utilities provided by the Employer under Sub-Clause 4.1 9 [Temporary Utilities]; and
- x. the deduction of amounts certified in all previous Payment Certificates.

14.4 Schedule of Payments

If the Contract includes a Schedule of Payments specifying the instalments in which the Contract Price will be paid then, unless otherwise stated in this Schedule:

- a. the instalments quoted in the Schedule of Payments shall be treated as the estimated contract values for the purposes of sub-paragraph (i) of Sub-Clause 14.3 [Application for Interim Payment];
- b. Sub-Clause 14.5 [Plant and Materials intended for the Works] shall not apply; and
- c. if:
 - i. these instalments are not defined by reference to the actual progress achieved in the execution of the Works; and
 - ii. actual progress is found by the Engineer to differ from that on which the Schedule of Payments was based,

then the Engineer may proceed under Sub-Clause 3.7 [Agreement or Determination] to agree or determine revised instalments (and, for the purpose of Sub-Clause 3.7.3 [Time limits], the date when the difference under sub-paragraph (ii) above was found by the Engineer shall be the date of commencement of the time limit for agreement under Sub-Clause 3.7.3). Such revised instalments shall take account of the extent to which progress differs from that on which the Schedule of Payments was based.

If the Contract does not include a Schedule of Payments, the Contractor shall submit non-binding estimates of the payments which the Contractor expects to become due during each period of 3 months. The first estimate shall be submitted within 42 days after the Commencement Date. Revised estimates shall be submitted at intervals of 3 months, until the issue of the Taking-Over Certificate for the Works.

14.5 Plant and Materials intended for the Works

If no Plant and/or Materials are listed in the Contract Data for payment when shipped and/or payment when delivered, this Sub-Clause shall not apply.

The Contractor shall include, under sub-paragraph (v) of Sub-Clause 14.3 [Application for Interim Payment]:

- an amount to be added for Plant and Materials which have been shipped or delivered (as the case may be) to the Site for incorporation in the Permanent Works; and
- an amount to be deducted when the contract value of such Plant and Materials is included as part of the Permanent Works under sub-paragraph (i) of Sub-Clause 14.3 [Application for Interim Payment].

The Engineer shall proceed under Sub-Clause 3.7 [Agreement or Determination] to agree or determine each amount to be added for Plant and Materials if the following conditions are fulfilled (and, for the purpose of Sub-Clause 3.7.3 [Time limits], the date these conditions are fulfilled shall be the date of commencement of the time limit for agreement under Sub-Clause 3.7.3):

a. the Contractor has:

- i. kept satisfactory records (including the orders, receipts, Costs and use of Plant and Materials) which are available for inspection by the Engineer;
- ii. submitted evidence demonstrating that the Plant and Materials comply with the Contract (which may include test certificates under Sub-Clause 7.4 [Testing by the Contractor] and/or compliance verification documentation under Sub-Clause 4.9.2 [Compliance Verification System]) to the Engineer; and
- iii. submitted a statement of the Cost of acquiring and shipping or delivering (as the case may be) the Plant and Materials to the Site, supported by satisfactory evidence;

and either:

b. the relevant Plant and Materials:

- i. are those listed in the Contract Data for payment when shipped;
- ii. have been shipped to the Country, enroute to the Site, in accordance with the Contract; and
- iii. are described in a clean shipped bill of lading or other evidence of shipment, which has been submitted to the Engineer together with:
 - evidence of payment of freight and insurance;
 - any other documents reasonably required by the Engineer; and
 - a written undertaking by the Contractor that the Contractor will deliver to the Employer (prior to submitting the next Statement) a bank guarantee in a form and issued by an entity to which the Employer gives consent (but such consent shall not relieve the Contractor from any obligation in the following provisions of this sub-paragraph), in amounts and currencies equal to the amount due under this Sub-Clause. This guarantee shall be in a similar form to the form described in Sub-Clause 14.2.1 [Advance Payment Guarantee] and shall be valid until the Plant and Materials are properly stored on Site and protected against loss, damage or deterioration;

or

c. the relevant Plant and Materials:

- i. are those listed in the Contract Data for payment when delivered to the Site, and
- ii. have been delivered to and are properly stored on the Site, are protected against loss, damage or deterioration, and appear to be in accordance with the Contract.

The amount so agreed or determined shall take account of the evidence and documents required under this Sub-Clause and of the contract value of the Plant and Materials. If sub-paragraph (b) above applies, the Engineer shall have no obligation to certify any payment under this Sub-Clause until the Employer has received the bank guarantee in accordance with sub-paragraph (b)(iii) above. The sum to be certified by the Engineer in an IPC shall be the equivalent of eighty percent (80%) of this agreed or determined amount. The currencies for this certified sum shall be the same as those in which payment will become due when the contract value is included under sub-paragraph (i) of Sub-Clause 14.3 [Application for Interim Payment]. At that time, the Payment Certificate shall include the applicable amount to be deducted which shall be equivalent to, and in the same currencies and proportions as, this additional amount for the relevant Plant and Materials.

14.6 Issue of IPC

No amount will be certified or paid to the Contractor until:

- a. the Employer has received the Performance Security in the form, and issued by an entity, in accordance with Sub-Clause 4.2.1 [Contractor's obligations]; and
- b. the Contractor has appointed the Contractor's Representative in accordance with Sub-Clause 4.3 [Contractor's Representative].

14.6.1 The IPC

The Engineer shall, within 28 days after receiving a Statement and supporting documents, issue an IPC to the Employer, with a copy to the Contractor:

- a. stating the amount which the Engineer fairly considers to be due; and
- b. including any additions and/or deductions which have become due under Sub-Clause 3.7 [Agreement or Determination] or under the Contract or otherwise,

with detailed supporting particulars (which shall identify any difference between a certified amount and the corresponding amount in the Statement and give the reasons for such difference).

14.6.2 Withholding (amounts in) an IPC

Before the issue of the Taking-Over Certificate for the Works, the Engineer may withhold an IPC in an amount which would (after retention and other deductions) be less than the minimum amount of IPC (if any) stated in the Contract Data. In this event, the Engineer

shall promptly give a Notice to the Contractor accordingly.

An IPC shall not be withheld for any other reason, although:

- a. if anything supplied or work done by the Contractor is not in accordance with the Contract, the estimated cost of rectification or replacement may be withheld until rectification or replacement has been completed;
- b. if the Contractor was or is failing to perform any work, service or obligation in accordance with the Contract, the value of this work or obligation may be withheld until the work or obligation has been performed. In this event, the Engineer shall promptly give a Notice to the Contractor describing the failure and with detailed supporting particulars of the value withheld; and/or
- c. if the Engineer finds any significant error or discrepancy in the Statement or supporting documents, the amount of the IPC may take account of the extent to which this error or discrepancy has prevented or prejudiced proper investigation of the amounts in the Statement until such error or discrepancy is corrected in a subsequent Statement.

For each amount so withheld, in the supporting particulars for the IPC the Engineer shall detail his/her calculation of the amount and state the reasons for it being withheld.

14.6.3 Correction or modification

The Engineer may in any Payment Certificate make any correction or modification that should properly be made to any previous Payment Certificate. A Payment Certificate shall not be deemed to indicate the Engineer's acceptance, approval, consent or Notice of No-objection to any Contractor's Document or to (any part of) the Works.

If the Contractor considers that an IPC does not include any amounts to which the Contractor is entitled, these amounts shall be identified in the next Statement (the "identified amounts" in this paragraph). The Engineer shall then make any correction or modification that should properly be made in the next Payment Certificate. Thereafter, to the extent that:

- a. the Contractor is not satisfied that this next Payment Certificate includes the identified amounts; and
- b. the identified amounts do not concern a matter for which the Engineer is already carrying out his/her duties under Sub-Clause 3.7 [Agreement or Determination]

the Contractor may, by giving a Notice, refer this matter to the Engineer and Sub-Clause 3.7 [Agreement or Determination] shall apply (and, for the purpose of Sub-Clause 3.7.3 [Time limits], the date the Engineer receives this Notice shall be the date of commencement of the time limit for agreement under Sub-Clause 3.7.3).

14.7 **Payment**

The Employer shall pay to the Contractor:

- a. the amount certified in each Advance Payment Certificate within the period stated in the Contract Data (if not stated, 21 days) after the Employer receives the Advance Payment Certificate;
- b. the amount certified in each IPC issued under:
 - i. Sub-Clause 14.6 [Issue of IPC], within the period stated in the Contract Data (if not stated, 56 days) after the Engineer receives the Statement and supporting documents; or
 - ii. Sub-Clause 14.13 [Issue of FPC], within the period stated in the Contract Data (if not stated, 28 days) after the Employer receives the IPC; and
- c. the amount certified in the FPC within the period stated in the Contract Data (if not stated, 56 days) after the Employer receives the FPC.

Payment of the amount due in each currency shall be made into the bank account, nominated by the Contractor, in the payment country (for this currency) specified in the Contract.

14.8 Delayed Payment

If the Contractor does not receive payment in accordance with Sub-Clause 14.7 [Payment], the Contractor shall be entitled to receive financing charges compounded monthly on the amount unpaid during the period of delay. This period shall be deemed to commence on the expiry of the time for payment specified in Sub-Clause 14.7 [Payment], irrespective (in the case of sub-paragraph (b) of Sub-Clause 14.7) of the date on which any IPC is issued.

Unless otherwise stated in the Contract Data, these financing charges shall be calculated at the annual rate of three percent (3%) above:

- a. the average bank short-term lending rate to prime borrowers prevailing for the currency of payment at the place for payment, or
- b. where no such rate exists at that place, the same rate in the country of the currency of payment, or
- c. in the absence of such a rate at either place, the appropriate rate fixed by the law of the country of the currency of payment.

The Contractor shall by request be entitled to payment of these financing charges by the Employer without:

- i. the need for the Contractor to submit a Statement or any formal Notice (including any requirement to comply with Sub-Clause 20.2 [Claims For Payment and/or EOT]) or certification; and
- ii. prejudice to any other right or remedy.

14.9 Release of Retention Money

After the issue of the Taking-Over Certificate for:

- a. the Works, the Contractor shall include the first half of the Retention Money in a Statement; or
- b. for a Section, the Contractor shall include the relevant percentage of the first half of the Retention Money in a Statement.

After the latest of the expiry dates of the Defects Notification Periods, the Contractor shall include the second half of the Retention Money in a Statement promptly after such latest date. If a Taking-Over Certificate was (or was deemed to have been) issued for a Section, the Contractor shall include the relevant percentage of the second half of the Retention Money in a Statement promptly after the expiry date of

the DNP for the Section.

In the next IPC after the Engineer receives any such Statement, the Engineer shall certify the release of the corresponding amount of Retention Money. However, when certifying any release of Retention Money under Sub-Clause 14.6 [Issue of IPC], if any work remains to be executed under Clause 11 [Defects after Taking Over] or Clause 12 [Tests after Completion], the Engineer shall be entitled to withhold certification of the estimated cost of this work until it has been executed.

The relevant percentage for each Section shall be the percentage value of the Section as stated in the Contract Data. If the percentage value of a Section is not stated in the Contract Data, no percentage of either half of the Retention Money shall be released under this Sub-Clause in respect of such Section.

14.10 Statement at Completion

Within 84 days after the Date of Completion of the Works, the Contractor shall submit to the Engineer a Statement at completion with supporting documents, in accordance with Sub-Clause 14.3 [Application for Interim Payment], showing:

- a. the value of all work done in accordance with the Contract up to the Date of Completion of the Works;
- b. any further sums which the Contractor considers to be due at the Date of Completion of the Works; and
- c. an estimate of any other amounts which the Contractor considers have or will become due after the Date of Completion of the Works, under the Contract or otherwise. These estimated amounts shall be shown separately (to those of sub-paragraphs (a) and (b) above) and shall include estimated amounts for:
 - i. Claims for which the Contractor has submitted a Notice under Sub-Clause 20.2 [Claims For Payment and/or EOT];
 - ii. any matter referred to the DAAB under Sub-Clause 21.4 [Obtaining DAAB's Decision]; and
 - iii. any matter for which a NOD has been given under Sub-Clause 21.4

[Obtaining DAAB's Decision].

The Engineer shall then issue an IPC in accordance with Sub-Clause 14.6 [Issue of IPC].

14.11 Final Statement

Submission by the Contractor of any Statement under the following provisions of this Sub-Clause shall not be delayed by reason of any referral under Sub-Clause

21.4 [Obtaining DAAB's Decision] or any arbitration under Sub-Clause 21.6 [Arbitration].

14.11.1 Draft Final Statement

Within 56 days after the issue of the Performance Certificate the Contractor shall submit to the Engineer a draft final Statement.

This Statement shall:

- a. be in the same form as Statements previously submitted under Sub-Clause 14.3 [Application for Interim Payment];
- b. be submitted in one paper-original, one electronic copy and additional paper copies (if any) as stated in the Contract Data; and
- c. show in detail, with supporting documents:
 - i. the value of all work done in accordance with the Contract;
 - ii. any further sums which the Contractor considers to be due at the date of the issue of the Performance Certificate, under the Contract or otherwise; and
 - iii. an estimate of any other amounts which the Contractor considers have or will become due after the issue of the Performance Certificate, under the Contract or otherwise, including estimated amounts by reference to the matters described in sub-paragraphs (c) (i) to (iii) of Sub-Clause 14.10 [Statement at Completion]. These estimated amounts shall be shown separately (to those of sub-paragraphs (i) and (ii) above).

Except for any amount under sub-paragraph (iii) above, if the Engineer disagrees with or cannot verify any part of the draft final Statement, the Engineer shall promptly give a Notice to the Contractor. The Contractor shall then submit such further information as the Engineer may reasonably require within the time stated in this Notice and shall make such changes in the draft as may be agreed between them.

14.11.2 Agreed Final Statement

If there are no amounts under sub-paragraph (iii) of Sub-Clause 14.11 .1 [Draft Final Statement], the Contractor shall then prepare and submit to the Engineer the final Statement as agreed (the "Final Statement" in these Conditions).

However, if:

- a. there are amounts under sub-paragraph (iii) of Sub-Clause 14.11 .1 [Draft Final

Statement]; and/or

- b. following discussions between the Engineer and the Contractor, it becomes evident that they cannot agree any amount(s) in the draft final Statement,

the Contractor shall then prepare and submit to the Engineer a Statement identifying separately: the agreed amounts, the estimated amounts and the disagreed amount(s) (the "Partially Agreed Final Statement" in these Conditions).

14.12 Discharge

When submitting the Final Statement or the Partially Agreed Final Statement (as the case may be), the Contractor shall submit a discharge which confirms that the total of such Statement represents full and final settlement of all moneys due to the Contractor under or in connection with the Contract. This discharge may state that the total of the Statement is subject to any payment that may become due in respect of any Dispute for which a DAAB proceeding or arbitration is in progress under

Clause 21 [Disputes and Arbitration] and/or that it becomes effective after the Contractor has received:

- a. full payment of the amount certified in the FPC; and
- b. the Performance Security.

If the Contractor fails to submit this discharge, the discharge shall be deemed to have been submitted and to have become effective when the conditions of sub- paragraphs (a) and (b) have been fulfilled.

A discharge under this Sub-Clause shall not affect either Party's liability or entitlement in respect of any Dispute for which a DAAB proceeding or arbitration is in progress under Clause 21 [Disputes and Arbitration].

14.13 Issue of FPC

Within 28 days after receiving the Final Statement or the Partially Agreed Final Statement (as the case may be), and the discharge under Sub-Clause 14.12 [Discharge], the Engineer shall issue to the Employer (with a copy to the Contractor), the Final Payment Certificate which shall state:

- a. the amount which the Engineer fairly considers is finally due, including any additions and/or deductions which have become due under Sub-Clause 3.7 [Agreement or Determination] or under the Contract or otherwise; and
- b. after giving credit to the Employer for all amounts previously paid by the Employer and for all sums to which the Employer is entitled, and after giving credit to the Contractor for all amounts (if any) previously paid by the Contractor and/or received by the Employer under the Performance Security, the balance (if any) due from the Employer to the Contractor or from the Contractor to the Employer, as the case may be.

If the Contractor has not submitted a draft final Statement within the time specified under Sub-Clause 14.11.1 [Draft Final Statement], the Engineer shall request the

Contractor to do so. Thereafter, if the Contractor fails to submit a draft final Statement within a period of 28 days, the Engineer shall issue the FPC for such an amount as the Engineer fairly considers to be due.

If:

i. the Contractor has submitted a Partially Agreed Final Statement under Sub-

Clause 14.11.2 [Agreed Final Statement]; or

ii. no Partially Agreed Final Statement has been submitted by the Contractor but, to the extent that a draft final Statement submitted by the Contractor is deemed by the Engineer to be a Partially Agreed Final Statement

the Engineer shall proceed in accordance with Sub-Clause 14.6 [Issue of IPC] to issue an IPC.

14.14 Cessation of Employer's Liability

The Employer shall not be liable to the Contractor for any matter or thing under or in connection with the Contract or execution of the Works, except to the extent that the Contractor shall have included an amount expressly for it in:

- a. the Final Statement or Partially Agreed Final Statement; and
- b. (except for matters or things arising after the issue of the Taking-Over Certificate for the Works) the Statement under Sub-Clause 14.10 [Statement at Completion].

Unless the Contractor makes or has made a Claim under Sub-Clause 20.2 [Claims For Payment and/or EOT] in respect of an amount or amounts under the FPC within 56 days of receiving a copy of the FPC, the Contractor shall be deemed to have accepted the amounts so certified. The Employer shall then have no further liability to the Contractor, other than to pay the amount due under the FPC and return the Performance Security to the Contractor.

However, this Sub-Clause shall not limit the Employer's liability under the Employer's indemnification obligations, or the Employer's liability in any case of fraud, gross negligence, deliberate default or reckless misconduct by the Employer.

14.15 Currencies of Payment

The Contract Price shall be paid in the currency or currencies named in the Contract Data. If more than one currency is so named, payments shall be made as follows:

- a. if the Accepted Contract Amount was expressed in Local Currency only or in Foreign Currency only:
 - i. the proportions or amounts of the Local and Foreign Currencies, and the fixed rates of exchange to be used for calculating the payments, shall be as stated in the Contract Data, except as otherwise agreed by both Parties;
 - ii. payments and deductions under Sub-Clause 13.4 [Provisional Sums]

and Sub-Clause 13.6 [Adjustments for Changes in Laws] shall be made in the applicable currencies and proportions; and

- iii. other payments and deductions under sub-paragraphs (i) to (iv) of Sub-Clause 14.3 [Application for Interim Payment] shall be made in the currencies and proportions specified in sub-paragraph (a) (i) above;
- b. whenever an adjustment is agreed or determined under Sub-Clause 13.2 [Value Engineering] or Sub-Clause 13.3 [Variation Procedure], the amount payable in each of the applicable currencies shall be specified. For this purpose, reference shall be made to the actual expected currency proportions of the Cost of the varied work, and to the proportions of various currencies specified in sub-paragraph (a)(i) above;
- c. payment of Delay Damages shall be made in the currencies and proportions specified in the Contract Data;
- d. payment of Performance Damages shall be made in the currencies and proportions specified in the Schedule of Performance Guarantees;
- e. other payments to the Employer by the Contractor shall be made in the currency in which the sum was expended by the Employer, or in such currency as may be agreed by both Parties;
- f. if any amount payable by the Contractor to the Employer in a particular currency exceeds the sum payable by the Employer to the Contractor in that currency, the Employer may recover the balance of this amount from the sums otherwise payable to the Contractor in other currencies; and
- g. if no rates of exchange are stated in the Contract Data, they shall be those prevailing on the Base Date and published by the central bank of the Country.

15 Termination by Employer

15.1 Notice to Correct

If the Contractor fails to carry out any obligation under the Contract the Engineer may, by giving a Notice to the Contractor, require the Contractor to make good the failure and to remedy it within a specified time ("Notice to Correct" in these Conditions).

The Notice to Correct shall:

- a. describe the Contractor's failure;
- b. state the Sub-Clause and/or provisions of the Contract under which the Contractor has the obligation; and
- c. specify the time within which the Contractor shall remedy the failure, which shall be reasonable, taking due regard of the nature of the failure and the work and/or other action required to remedy it.

After receiving a Notice to Correct the Contractor shall immediately respond by giving a Notice to the Engineer describing the measures the Contractor will take to remedy the failure and stating the date on which such measures will be commenced in order to comply with the time specified in the Notice to Correct.

The time specified in the Notice to Correct shall not imply any extension of the Time for Completion.

15.2 Termination for Contractor's Default

Termination of the Contract under this Clause shall not prejudice any other rights of the Employer under the Contract or otherwise.

15.2.1 Notice

The Employer shall be entitled to give a Notice (which shall state that it is given under this Sub-Clause 15.2.1) to the Contractor of the Employer's intention to terminate the Contract or, in the case of sub-paragraph (f), (g) or (h) below a Notice of termination, if the Contractor:

- a. fails to comply with:
 - i. a Notice to Correct;
 - ii. a binding agreement, or final and binding determination, under Sub-Clause 3.7 [Agreement or Determination]; or
 - iii. a decision of the DAAB under 21.4 [Obtaining DAAB's Decision] (whether binding or final and binding) and such failure constitutes a material breach of the Contractor's obligations under the Contract;
- b. abandons the Works or otherwise plainly demonstrates an intention not to continue performance of the Contractor's obligations under the Contract;
- c. without reasonable excuse fails to proceed with the Works in accordance with Clause 8 [Commencement, Delays and Suspension] or, if there is a maximum amount of Delay Damages stated in the Contract Data, the Contractor's failure to comply with Sub-Clause 8.2 [Time for Completion] is such that the Employer would be entitled to Delay Damages that exceed this maximum amount;
- d. without reasonable excuse fails to comply with a Notice of rejection given by the Engineer under Sub-Clause 7.5 [Defects and Rejection] or an Engineer's instruction under Sub-Clause 7.6 [Remedial Work], within 28 days after receiving it;
- e. fails to comply with Sub-Clause 4.2 [Performance Security];
- f. subcontracts the whole, or any part of, the Works in breach of Sub-Clause 4.4 [Subcontractors], or assigns the Contract without the required agreement under Sub-Clause 1.7 [Assignment];
- g. becomes bankrupt or insolvent; goes into liquidation, administration,

reorganisation, winding-up or dissolution; becomes subject to the appointment of a liquidator, receiver, administrator, manager or trustee; enters into a composition or arrangement with the Contractor's creditors; or any act is done or any event occurs which is analogous to or has a similar effect to any of these acts or events under applicable Laws; or if the Contractor is a JV:

- i. any of these matters apply to a member of the JV, and
- ii. the other member(s) do not promptly confirm to the Employer that, in accordance with Sub-Clause 1.14(a) [Joint and Several Liability], such member's obligations under the Contract shall be fulfilled in accordance with the Contract; or
- h. is found, based on reasonable evidence, to have engaged in corrupt, fraudulent, collusive or coercive practice at any time in relation to the Works or to the Contract.

15.2.2 Termination

Unless the Contractor remedies the matter described in a Notice given under Sub-Clause 15.2.1 [Notice] within 14 days of receiving the Notice, the Employer may by giving a second Notice to the Contractor immediately terminate the Contract. The date of termination shall be the date the Contractor receives this second Notice

However, in the case of sub-paragraph (f), (g) or (h) of Sub-Clause 15.2.1 [Notice], the Employer may by giving a Notice under Sub-Clause 15.2.1 immediately terminate the Contract and the date of termination shall be the date the Contractor receives this Notice.

15.2.3 After termination

After termination of the Contract under Sub-Clause 15.2.2 [Termination], the Contractor shall:

- a. comply immediately with any reasonable instructions included in a Notice given by the Employer under this Sub-Clause:
 - i. for the assignment of any subcontract; and
 - ii. for the protection of life or property or for the safety of the Works;
- b. deliver to the Engineer:
 - i. any Goods required by the Employer,
 - ii. all Contractor's Documents, and
 - iii. all other design documents made by or for the Contractor; and
- c. leave the Site and, if the Contractor does not do so, the Employer shall have the right to expel the Contractor from the Site.

15.2.4 Completion of the Works

After termination under this Sub-Clause, the Employer may complete the Works and/or arrange for any other entities to do so. The Employer and/or these entities may then use any Goods, Contractor's Documents and other design documents made by or on behalf of the Contractor to complete the Works.

After such completion of the Works, the Employer shall give another Notice to the Contractor that the Contractor's Equipment and Temporary Works will be released to the Contractor at or near the Site. The Contractor shall then promptly arrange their removal, at the risk and cost of the Contractor. However, if by this time the Contractor has failed to make a payment due to the Employer, these items may be sold (to the extent permitted by applicable Laws) by the Employer in order to recover this payment. Any balance of the proceeds shall then be paid to the Contractor.

15.3 Valuation after Termination for Contractor's Default

After termination of the Contract under Sub-Clause 15.2 [Termination for Contractor's Default], the Engineer shall proceed under Sub-Clause 3.7 [Agreement or Determination] to agree or determine the value of the Permanent Works, Goods and Contractor's Documents, and any other sums due to the Contractor for work executed in accordance with the Contract (and, for the purpose of Sub-Clause 3.7.3 [Time limits], the date of termination shall be the date of commencement of the time limit for agreement under Sub-Clause 3.7.3).

This valuation shall include any additions and/or deductions, and the balance due (if any), by reference to the matters described in sub-paragraphs (a) and (b) of Sub-Clause 14.13 [Issue of FPC].

This valuation shall not include the value of any Contractor's Documents, Materials, Plant and Permanent Works to the extent that they do not comply with the Contract.

15.4 Payment after Termination for Contractor's Default

The Employer may withhold payment to the Contractor of the amounts agreed or determined under Sub-Clause 15.3 [Valuation after Termination for Contractor's

Default] until all the costs, losses and damages (if any) described in the following provisions of this Sub-Clause have been established.

After termination of the Contract under Sub-Clause 15.2 [Termination for Contractor's Default], the Employer shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment by the Contractor of:

- a. the additional costs of execution of the Works, and all other costs reasonably incurred by the Employer (including costs incurred in clearing, cleaning and reinstating the Site as described under Sub-Clause 11.11 [Clearance of Site]), after allowing for any sum due to the Contractor under Sub-Clause 15.3 [Valuation after Termination for Contractor's Default];
- b. any losses and damages suffered by the Employer in completing the Works; and
- c. Delay Damages, if the Works or a Section have not been taken over under Sub-Clause 10.1 [Taking Over the Works and Sections] and if the date of termination

under Sub-Clause 15.2 [Termination for Contractor's Default] occurs after the date corresponding to the Time for Completion of the Works or Section (as the case may be). Such Delay Damages shall be paid for everyday that has elapsed between these two dates.

15.5 Termination for Employer's Convenience

The Employer shall be entitled to terminate the Contract at any time for the Employer's convenience, by giving a Notice of such termination to the Contractor (which Notice shall state that it is given under this Sub-Clause 15.5).

After giving a Notice to terminate under this Sub-Clause, the Employer shall immediately:

- a. have no right to further use any of the Contractor's Documents, which shall be returned to the Contractor, except those for which the Contractor has received payment or for which payment is due under a Payment Certificate;
- b. if Sub-Clause 4.6 [Co-operation] applies, have no right to allow the continued use (if any) of any Contractor's Equipment, Temporary Works, access arrangements and/or other of the Contractor's facilities or services; and
- c. make arrangements to return the Performance Security to the Contractor.

Termination under this Sub-Clause shall take effect 28 days after the later of the dates on which the Contractor receives this Notice or the Employer returns the Performance Security. Unless and until the Contractor has received payment of the amount due under Sub-Clause 15.6 [Valuation after Termination for Employer's Convenience], the Employer shall not execute (any part of) the Works or arrange for (any part of) the Works to be executed by any other entities.

After this termination, the Contractor shall proceed in accordance with Sub-Clause 16.3 [Contractor's Obligations After Termination].

15.6 Valuation after Termination for Employer's Convenience

After termination under Sub-Clause 15.5 [Termination for Employer's Convenience]

the Contractor shall, as soon as practicable, submit detailed supporting particulars (as reasonably required by the Engineer) of:

- a. the value of work done, which shall include:
 - i. the matters described in sub-paragraphs (a) to (e) of Sub-Clause 18.5 [Optional Termination], and
 - ii. any additions and/or deductions, and the balance due (if any), by reference to the matters described in sub-paragraphs (a) and (b) of Sub-Clause 14.13 [Issue of FPC]; and
- b. the amount of any loss of profit or other losses and damages suffered by the Contractor as a result of this termination.

The Engineer shall then proceed under Sub-Clause 3.7 [Agreement or Determination] to agree or determine the matters described in sub-paragraphs (a) and (b) above (and, for the purpose of Sub-Clause 3.7.3 [Time limits], the date the Engineer receives the Contractor's particulars under this Sub-Clause shall be the date of commencement of the time limit for agreement under Sub-Clause 3.7.3).

The Engineer shall issue a Payment Certificate for the amount so agreed or determined, without the need for the Contractor to submit a Statement.

15.7 Payment after Termination for Employer's Convenience

The Employer shall pay the Contractor the amount certified in the Payment Certificate under Sub-Clause 15.6 [Valuation after Termination for Employer's Convenience] within 112 days after the Engineer receives the Contractor's submission under that Sub-Clause.

16 Suspension and Termination by Contractor

16.1 Suspension by Contractor

If:

- a. the Engineer fails to certify in accordance with Sub-Clause 14.6 [Issue of IPC];
- b. the Employer fails to provide reasonable evidence in accordance with Sub-Clause 2.4 [Employer's Financial Arrangements];
- c. the Employer fails to comply with Sub-Clause 14.7 [Payment]; or
- d. the Employer fails to comply with:
 - i. a binding agreement, or final and binding determination under Sub-Clause 3.7 [Agreement or Determination]; or
 - ii. a decision of the DAAB under 21.4 [Obtaining DAAB's Decision] (whether binding or final and binding)

and such failure constitutes a material breach of the Employer's obligations under the Contract,

the Contractor may, not less than 21 days after giving a Notice to the Employer (which Notice shall state that it is given under this Sub-Clause 16.1), suspend work (or reduce the rate of work) unless and until the Employer has remedied such a default.

This action shall not prejudice the Contractor's entitlements to financing charges under Sub-Clause 14.8 [Delayed Payment] and to termination under Sub-Clause 1.2 [Termination by Contractor].

If the Employer subsequently remedies the default as described in the above Notice before the Contractor gives a Notice of termination under Sub-Clause 16.2 [Termination by Contractor], the Contractor shall resume normal working as soon as is reasonably practicable.

If the Contractor suffers delay and/or incurs Cost as a result of suspending work (or

reducing the rate of work) in accordance with this Sub-Clause, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to EOT and/or payment of such Cost Plus Profit.

16.2 Termination by Contractor

Termination of the Contract under this Clause shall not prejudice any other rights of the Contractor, under the Contract or otherwise.

16.2.1 Notice

The Contractor shall be entitled to give a Notice (which shall state that it is given under this Sub-Clause 16.2.1) to the Employer of the Contractor's intention to terminate the Contract or, in the case of sub-paragraph (g)(ii), (h), (i) or (j) below, a Notice of termination, if:

- a. the Contractor does not receive the reasonable evidence within 42 days after giving a Notice under Sub-Clause 16.1 [Suspension by Contractor] in respect of a failure to comply with Sub-Clause 2.4 [Employer's Financial Arrangements];
- b. the Engineer fails, within 56 days after receiving a Statement and supporting documents, to issue the relevant Payment Certificate;
- c. the Contractor does not receive the amount due under any Payment Certificate within 42 days after the expiry of the time stated in Sub-Clause 14.7 [Payment];
- d. the Employer fails to comply with:
 - i. a binding agreement, or final and binding determination under Sub-Clause 3.7 [Agreement or Determination]; or
 - ii. a decision of the DAAB under 21.4 [Obtaining DAAB's Decision] (whether binding or final and binding) and such failure constitutes a material breach of the Employer's obligations under the Contract;
- e. the Employer substantially fails to perform, and such failure constitutes a material breach of, the Employer's obligations under the Contract;
- f. the Contractor does not receive a Notice of the Commencement Date under Sub-Clause 8.1 [Commencement of Works] within 84 days after receiving the Letter of Acceptance;
- g. the Employer:
 - i. fails to comply with Sub-Clause 1.6 [Contract Agreement]. or
 - ii. assigns the Contract without the required agreement under Sub-Clause 1.7 [Assignment];
- h. prolonged suspension affects the whole of the Works as described in sub-paragraph (b) of Sub-Clause 8.12 [Prolonged Suspension];

- i. the Employer becomes bankrupt or insolvent; goes into liquidation, administration, reorganisation, winding-up or dissolution; becomes subject to the appointment of a liquidator, receiver, administrator, manager or trustee; enters into a composition or arrangement with the Employer's creditors; or any act is done or any event occurs which is analogous to or has a similar effect to any of these acts or events under applicable Laws; or
- j. the Employer is found, based on reasonable evidence, to have engaged in corrupt, fraudulent, collusive or coercive practice at any time in relation to the Works or to the Contract.

16.2.2 Termination

Unless the Employer remedies the matter described in a Notice given under Sub- Clause 16.2.1 [Notice] within 14 days of receiving the Notice, the Contractor may by giving a second Notice to the Employer immediately terminate the Contract. The date of termination shall then be the date the Employer receives this second Notice.

However, in the case of sub-paragraph (g)(ii), (h), (i) or (j) of Sub-Clause 16.2.1 [Notice]. by giving a Notice under Sub-Clause 16.2.1 the Contractor may terminate the Contract immediately and the date of termination shall be the date the Employer receives this Notice.

If the Contractor suffers delay and/or incurs Cost during the above period of 14 days, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to EOT and/or payment of such Cost Plus Profit.

16.3 **Contractor's Obligations After Termination**

After termination of the Contract under Sub-Clause 15.5 [Termination for Employer's Convenience], Sub-Clause 16.2 [Termination by Contractor] or Sub- Clause 18.5 [Optional Termination], the Contractor shall promptly:

- a. cease all further work, except for such work as may have been instructed by the Engineer for the protection of life or property or for the safety of the Works. If the Contractor incurs Cost as a result of carrying out such instructed work the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to be paid such Cost Plus Profit;
- b. deliver to the Engineer all Contractor's Documents, Plant, Materials and other work for which the Contractor has received payment; and
- c. remove all other Goods from the Site, except as necessary for safety, and leave the Site.

16.4 **Payment after Termination by Contractor**

After termination under Sub-Clause 16.2 [Termination by Contractor], the Employer shall promptly:

- a. pay the Contractor in accordance with Sub-Clause 18.5 [Optional Termination]; and

- b. subject to the Contractor's compliance with Sub-Clause 20.2 [Claims For Payment and/or EOT], pay the Contractor the amount of any loss of profit or other losses and damages suffered by the Contractor as a result of this termination.

17 Care of the Works and Indemnities

17.1 Responsibility for Care of the Works

Unless the Contract is terminated in accordance with these Conditions or otherwise, subject to Sub-Clause 17.2 [Liability for Care of the Works] the Contractor shall take full responsibility for the care of the Works, Goods and Contractor's Documents from the Commencement Date until the issue of the Taking-Over Certificate for the Works, when responsibility for the care of the Works shall pass to the Employer. If a Taking-Over Certificate is issued (or is deemed to be issued) for any Section or Part, responsibility for the care of the Section or Part shall then pass to the Employer.

If the Contract is terminated in accordance with these Conditions or otherwise, the Contractor shall cease to be responsible for the care of the Works from the date of termination.

After responsibility has accordingly passed to the Employer, the Contractor shall take responsibility for the care of any work which is outstanding on the Date of Completion, until this outstanding work has been completed.

If any loss or damage occurs to the Works, Goods or Contractor's Documents, during the period when the Contractor is responsible for their care, from any cause whatsoever except as stated in Sub-Clause 17.2 [Liability for Care of the Works], the Contractor shall rectify the loss or damage at the Contractor's risk and cost, so that the Works, Goods, or Contractor's Documents (as the case may be) comply with the Contract.

17.2 Liability for Care of the Works

The Contractor shall be liable for any loss or damage caused by the Contractor to the Works, Goods or Contractor's Documents after the issue of a Taking-Over Certificate. The Contractor shall also be liable for any loss or damage, which occurs after the issue of a Taking-Over Certificate and which arose from an event which occurred before the issue of this Taking-Over Certificate, for which the Contractor was liable.

The Contractor shall have no liability whatsoever, whether by way of indemnity or otherwise, for loss or damage to the Works, Goods or Contractor's Documents caused by any of the following events (except to the extent that such Works, Goods or Contractor's Documents have been rejected by the Engineer under Sub-Clause

7.5 [Defects and Rejection] before the occurrence of any of the following events):

- a. interference, whether temporary or permanent, with any right of way, light, air, water or other easement (other than that resulting from the Contractor's method of construction) which is the unavoidable result of the execution of the Works in accordance with the Contract;
- b. use or occupation by the Employer of any part of the Permanent Works, except

as may be specified in the Contract;

- c. fault, error, defect or omission in any element of the design of the Works by the Employer or which may be contained in the Employer's Requirements (and which an experienced contractor exercising due care would not have discovered when examining the Site and the Employer's Requirements before submitting the Tender), other than design carried out by the Contractor in accordance with the Contractor's obligations under the Contract;
- d. any operation of the forces of nature (other than those allocated to the Contractor in the Contract Data) which is Unforeseeable or against which an experienced contractor could not reasonably have been expected to have taken adequate preventative precautions;
- e. any of the events or circumstances listed under sub-paragraphs (a) to (f) of Sub-Clause 18.1 [Exceptional Events]; and/or
- f. any act or default of the Employer's Personnel or the Employer's other contractors.

Subject to Sub-Clause 18.4 [Consequences of an Exceptional Event], if any of the events described in sub-paragraphs (a) to (f) above occurs and results in damage to the Works, Goods or Contractor's Documents the Contractor shall promptly give a Notice to the Engineer. Thereafter, the Contractor shall rectify any such loss and/or damage that may arise to the extent instructed by the Engineer. Such instruction shall be deemed to have been given under Sub-Clause 13.3.1 [Variation by Instruction].

If the loss or damage to the Works or Goods or Contractor's Documents results from a combination of:

- i. any of the events described in sub-paragraphs (a) to (f) above, and
- ii. a cause for which the Contractor is liable,

and the Contractor suffers a delay and/or incurs Cost from rectifying the loss and/or damage, the Contractor shall subject to Sub-Clause 20.2 [Claims for Payment and/or EOT] be entitled to a proportion of EOT and/or Cost-Plus Profit to the extent that any of the above events have contributed to such delays and/or Cost.

17.3 Intellectual and Industrial Property Rights

In this Sub-Clause, "infringement" means an infringement (or alleged infringement) of any patent, registered design, copyright, trademark, trade name, trade secret or other intellectual or industrial property right relating to the Works; and "claim" means a third-party claim (or proceedings pursuing a third-party claim) alleging an infringement.

Whenever a Party receives a claim but fails to give a Notice to the other Party of

the claim within 28 days of receiving it, the first Party shall be deemed to have waived any right to indemnity under this Sub-Clause.

The Employer shall indemnify and hold the Contractor harmless against and from any

claim (including legal fees and expenses) alleging an infringement which is or was:

- a. an unavoidable result of the Contractor's compliance with the Employer's Requirements and/or any Variation; or
- b. a result of any Works being used by the Employer:
 - i. for a purpose other than that indicated by, or reasonably to be inferred from, the Contract, or
 - ii. in conjunction with anything not supplied by the Contractor, unless such use was disclosed to the Contractor before the Base Date or is stated in the Contract.

The Contractor shall indemnify and hold the Employer harmless against and from any other claim (including legal fees and expenses) alleging an infringement which arises out of or in relation to:

- i. the Contractor's execution of the Works; or
- ii. the use of Contractor's Equipment.

If a Party is entitled to be indemnified under this Sub-Clause, the indemnifying Party may (at the indemnifying Party's cost) assume overall responsibility for negotiating the settlement of the claim, and/or any litigation or arbitration which may arise from it. The other Party shall, at the request and cost of the indemnifying Party, assist in contesting the claim. This other Party (and the Contractor's Personnel or the Employer's Personnel, as the case may be) shall not make any admission which might be prejudicial to the indemnifying Party, unless the indemnifying Party failed to promptly assume overall responsibility for the conduct of any negotiations, litigation or arbitration after being requested to do so by the other Party.

17.4 Indemnities by Contractor

The Contractor shall indemnify and hold harmless the Employer, the Employer's Personnel, and their respective agents, against and from all third party claims, damages, losses and expenses (including legal fees and expenses) in respect of:

- a. bodily injury, sickness, disease or death of any person whatsoever arising out of or in the course of or by reason of the Contractor's execution of the Works, unless attributable to any negligence, willful act or breach of the Contract by the Employer, the Employer's Personnel, or any of their respective agents; and
- b. damage to or loss of any property, real or personal (other than the Works), to the extent that such damage or loss:
 - i. arises out of or in the course of or by reason of the Contractor's execution of the Works, and
 - ii. is attributable to any negligence, willful act or breach of the Contract by the

Contractor, the Contractor's Personnel, their respective agents, or anyone directly or

indirectly employed by any of them.

The Contractor shall also indemnify and hold harmless the Employer against all acts, errors or omissions by the Contractor in carrying out the Contractor's design obligations that result in the Works (or Section or Part or major item of Plant, if any), when completed, not being fit for the purpose(s) for which they are intended under Sub-Clause 4.1 [Contractor's General Obligations].

17.5 Indemnities by Employer

The Employer shall indemnify and hold harmless the Contractor, the Contractor's Personnel, and their respective agents, against and from all third party claims, damages, losses and expenses (including legal fees and expenses) in respect of:

- a. bodily injury, sickness, disease or death, or loss of or damage to any property other than the Works, which is attributable to any negligence, willful act or breach of the Contract by the Employer, the Employer's Personnel, or any of their respective agents; and
- b. damage to or loss of any property, real or personal (other than the Works), to the extent that such damage or loss arises out of any event described under sub-paragraphs (a) to (f) of Sub-Clause 17.2 [Liability for Care of the Works].

17.6 Shared Indemnities

The Contractor's liability to indemnify the Employer, under Sub-Clause 17.4 [Indemnities by Contractor] and/or under Sub-Clause 17.3 [Intellectual and Industrial Property Rights], shall be reduced proportionately to the extent that any event described under sub-paragraphs (a) to (f) of Sub-Clause 17.2 [Liability for Care of the Works] may have contributed to the said damage, loss or injury.

Similarly, the Employer's liability to indemnify the Contractor, under Sub-Clause 17.5 [Indemnities by Employer] and/or under Sub-Clause 17.3 [Intellectual and Industrial Property Rights], shall be reduced proportionately to the extent that any event for which the Contractor is responsible under Sub-Clause 17.1 [Responsibility for Care of the Works] may have contributed to the said damage, loss or injury.

18 Exceptional Events

18.1 Exceptional Events

"Exceptional Event" means an event or circumstance which:

- i. is beyond a Party's control;
- ii. the Party could not reasonably have provided against before entering into the Contract;
- iii. having arisen, such Party could not reasonably have avoided or overcome; and
- iv. is not substantially attributable to the other Party.

An Exceptional Event may comprise but is not limited to any of the following events

or circumstances provided that conditions (i) to (iv) above are satisfied:

- a. war, hostilities (whether war be declared or not), invasion, act of foreign enemies;
- b. rebellion, terrorism, revolution, insurrection, military or usurped power, or civil war;
- c. riot, commotion or disorder by persons other than the Contractor's Personnel and other employees of the Contractor and Subcontractors;
- d. strike or lockout not solely involving the Contractor's Personnel and other employees of the Contractor and Subcontractors;
- e. encountering munitions of war, explosive materials, ionising radiation or contamination by radio-activity, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity; or
- f. natural catastrophes such as earthquake, tsunami, volcanic activity, hurricane or typhoon.

18.2 Notice of an Exceptional Event

If a Party is or will be prevented from performing any obligations under the Contract due to an Exceptional Event (the "affected Party" in this Clause), then the affected Party shall give a Notice to the other Party of such an Exceptional Event, and shall specify the obligations, the performance of which is or will be prevented (the "prevented obligations" in this Clause).

This Notice shall be given within 14 days after the affected Party became aware, or should have become aware, of the Exceptional Event, and the affected Party shall then be excused performance of the prevented obligations from the date such performance is prevented by the Exceptional Event. If this Notice is received by the other Party after this period of 14 days, the affected Party shall be excused performance of the prevented obligations only from the date on which this Notice is received by the other Party.

Thereafter, the affected Party shall be excused performance of the prevented obligations for so long as such Exceptional Event prevents the affected Party from performing them. Other than performance of the prevented obligations, the affected Party shall not be excused performance of all other obligations under the Contract.

However, the obligations of either Party to make payments due to the other Party under the Contract shall not be excused by an Exceptional Event.

18.3 Duty to Minimise Delay

Each Party shall at all times use all reasonable endeavours to minimise any delay in the performance of the Contract as a result of an Exceptional Event.

If the Exceptional Event has a continuing effect, the affected Party shall give further Notices describing the effect every 28 days after giving the first Notice under Sub- Clause 18.2 [Notice of an Exceptional Event].

The affected Party shall immediately give a Notice to the other Party when the affected Party ceases to be affected by the Exceptional Event. If the affected Party

fails to do so, the other Party may give a Notice to the affected Party stating that the other Party considers that the affected Party's performance is no longer prevented by the Exceptional Event, with reasons.

18.4 Consequences of an Exceptional Event

If the Contractor is the affected Party and suffers delay and/or incurs Cost by reason of the Exceptional Event of which he/she gave a Notice under Sub-Clause 18.2 [Notice of an Exceptional Event], the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to:

- a. EOT; and/or
- b. if the Exceptional Event is of the kind described in sub-paragraphs (a) to (e) of Sub-Clause 18.1 [Exceptional Events] and, in the case of sub-paragraphs {b) to (e) of that Sub-Clause, occurs in the Country, payment of such Cost.

18.5 Optional Termination

If the execution of substantially all the Works in progress is prevented for a continuous period of 84 days by reason of an Exceptional Event of which Notice has been given under Sub-Clause 18.2 [Notice of an Exceptional Event]. or for multiple periods which total more than 140 days due to the same Exceptional Event, then either Party may give to the other Party a Notice of termination of the Contract.

In this event, the date of termination shall be the date 7 days after the Notice is received by the other Party, and the Contractor shall proceed in accordance with Sub-Clause 16.3 [Contractor's Obligations After Termination].

After the date of termination the Contractor shall, as soon as practicable, submit detailed supporting particulars (as reasonably required by the Engineer) of the value of the work done, which shall include:

- a. the amounts payable for any work carried out for which a price is stated in the Contract;
- b. the Cost of Plant and Materials ordered for the Works which have been delivered to the Contractor, or of which the Contractor is liable to accept delivery. This Plant and Materials shall become the property of (and be at the risk of) the Employer when paid for by the Employer, and the Contractor shall place the same at the Employer's disposal;
- c. any other Cost or liability which in the circumstances was reasonably incurred by the Contractor in the expectation of completing the Works;
- d. the Cost of removal of Temporary Works and Contractor's Equipment from the Site and the return of these items to the Contractor's place of business in the Contractor's country (or to any other destination(s) at no greater cost); and

- e. the Cost of repatriation of the Contractor's staff and labour employed wholly in connection with the Works at the date of termination.

The Engineer shall then proceed under Sub-Clause 3.7 [Agreement or Determination] to agree or determine the value of work done (and, for the purpose

of Sub-Clause 3.7.3 [Time limits], the date the Engineer receives the particulars under this Sub-Clause shall be the date of commencement of the time limit for agreement under Sub-Clause 3.7.3).

The Engineer shall issue a Payment Certificate, under Sub-Clause 14.6 [Issue of IPC], for the amount so agreed or determined, without the need for the Contractor to submit a Statement.

18.6 Release from Performance under the Law

In addition to any other provision of this Clause, if any event arises outside the control of the Parties (including, but not limited to, an Exceptional Event) which:

- a. makes it impossible or unlawful for either Party or both Parties to fulfil their contractual obligations; or
- b. under the law governing the Contract, entitles the Parties to be released from further performance of the Contract,

and if the Parties are unable to agree on an amendment to the Contract that would permit the continued performance of the Contract, then after either Party gives a Notice to the other Party of such event:

- i. the Parties shall be discharged from further performance, and without prejudice to the rights of either Party in respect of any previous breach of the Contract; and
- ii. the amount payable by the Employer to the Contractor shall be the same as would have been payable under Sub-Clause 18.5 [Optional Termination], and such amount shall be certified by the Engineer, as if the Contract had been terminated under that Sub-Clause.

19 Insurance

19.1 General Requirements

Without limiting either Party's obligations or responsibilities under the Contract, the Contractor shall affect and maintain all insurances for which the Contractor is responsible with insurers and in terms, both of which shall be subject to consent by the Employer. These terms shall be consistent with terms (if any) agreed by both Parties before the date of the Letter of Acceptance.

The insurances required to be provided under this Clause are the minimum required by the Employer, and the Contractor may, at the Contractor's own cost, add such other insurances that the Contractor may deem prudent.

Whenever required by the Employer, the Contractor shall produce the insurance policies

which the Contractor is required to effect under the Contract. As each premium is paid, the Contractor shall promptly submit either a copy of each receipt of payment to the Employer (with a copy to the Engineer), or confirmation from the insurers that the premium has been paid.

If the Contractor fails to effect and keep in force any of the insurances required under Sub-Clause 19.2 [Insurances to be provided by Contractor] then, and in any such case, the Employer may effect and keep in force such insurances and pay any

premium as may be necessary and recover the same from the Contractor from time to time by deducting the amount(s) so paid from any moneys due to the Contractor or otherwise recover the same as a debt from the Contractor. The provisions of Clause 20 [Employer's and Contractor's Claims] shall not apply to this Sub-Clause.

If either the Contractor or the Employer fails to comply with any condition of the insurances effected under the Contract, the Party so failing to comply shall indemnify the other Party against all direct losses and claims (including legal fees and expenses) arising from such failure.

The Contractor shall also be responsible for the following:

- a. notifying the insurers of any changes in the nature, extent or programme for the execution of the Works; and
- b. the adequacy and validity of the insurances in accordance with the Contract at all times during the performance of the Contract.

The permitted deductible limits allowed in any policy shall not exceed the amounts stated in the Contract Data (if not stated, the amounts agreed with the Employer).

Where there is a shared liability the loss shall be borne by each Party in proportion to each Party's liability, provided the non-recovery from insurers has not been caused by a breach of this Clause by the Contractor or the Employer. In the event that non-recovery from insurers has been caused by such a breach, the defaulting Party shall bear the loss suffered.

19.2 Insurance to be provided by the Contractor

The Contractor shall provide the following insurances:

19.2.1 The Works

The Contractor shall insure and keep insured in the joint names of the Contractor and the Employer from the Commencement Date until the date of the issue of the Taking-Over Certificate for the Works:

- a. the Works and Contractor's Documents, together with Materials and Plant for incorporation in the Works, for their full replacement value. The insurance cover shall extend to include loss and damage of any part of the Works as a consequence of failure of elements defectively designed or constructed with defective material or workmanship; and
- b. an additional amount of fifteen percent (15%) of such replacement value (or

such other amount as may be specified in the Contract Data) to cover any additional costs incidental to the rectification of loss or damage, including professional fees and the cost of demolition and removal of debris.

The insurance cover shall cover the Employer and the Contractor against all loss or damage from whatever cause arising until the issue of the Taking-Over Certificate for the Works. Thereafter, the insurance shall continue until the date of the issue of the Performance Certificate in respect of any incomplete work for loss or damage arising from any cause occurring before the date of the issue of the Taking-Over Certificate for the Works, and for any loss or damage occasioned by the Contractor in the course of any operation carried out by the Contractor for the purpose of complying with the Contractor's obligations under Clause 11 [Defects after Taking Over] and Clause 12 [Tests after Completion].

However, the insurance cover provided by the Contractor for the Works may exclude any of the following:

- i. the cost of making good any part of the Works which is defective (including defective material and workmanship) or otherwise does not comply with the Contract, provided that it does not exclude the cost of making good any loss or damage to any other part of the Works attributable to such defect or non-compliance;
- ii. indirect or consequential loss or damage including any reductions in the Contract Price for delay;
- iii. wear and tear, shortages and pilferages; and
- iv. unless otherwise stated in the Contract Data, the risks arising from Exceptional Events.

19.2.2 Goods

The Contractor shall insure, in the joint names of the Contractor and the Employer, the Goods and other things brought to Site by the Contractor to the extent specified and/or amount stated in the Contract Data (if not specified or stated, for their full replacement value including delivery to Site).

The Contractor shall maintain this insurance from the time the Goods are delivered to the Site until they are no longer required for the Works.

19.2.3 Liability for breach of professional duty

To the extent that the Contractor is responsible for the design of the Permanent Works, and consistent with the indemnities specified in Clause 17 [Care of the Works and Indemnities]:

- a. the Contractor shall effect and maintain professional indemnity insurance against liability arising out of any act, error or omission by the Contractor in carrying out the Contractor's design obligations in an amount not less than that stated in the Contract Data (if not stated, the amount agreed with the

Employer); and

- b. if stated in the Contract Data, such professional indemnity insurance shall also indemnify the Contractor against liability arising out of any act, error or omission by the Contractor in carrying out the Contractor's design obligations under the Contract that results in the Works (or Section or Part or major item of Plant, if any), when completed, not being fit for the purpose(s) for which they are intended under Sub-Clause 4.1 [Contractor's General Obligations].

The Contractor shall maintain this insurance for the period specified in the Contract Data.

19.2.4 Injury to persons and damage to property

The Contractor shall insure, in the joint names of the Contractor and the Employer, against liabilities for death or injury to any person, or loss of or damage to any property (other than the Works) arising out of the performance of the Contract and occurring before the issue of the Performance Certificate, other than loss or damage caused by an Exceptional Event.

The insurance policy shall include a cross liability clause such that the insurance shall apply to the Contractor and the Employer as separate insureds.

Such insurance shall be effected before the Contractor begins any work on the Site and shall remain in force until the issue of the Performance Certificate and shall be for not less than the amount stated in the Contract Data (if not stated, the amount agreed with the Employer).

19.2.5 Injury to employees

The Contractor shall effect and maintain insurance against liability for claims, damages, losses and expenses (including legal fees and expenses) arising out of the execution of the Works in respect of injury, sickness, disease or death of any person employed by the Contractor or any of the Contractor's other personnel.

The Employer and the Engineer shall also be indemnified under the policy of insurance, except that this insurance may exclude losses and claims to the extent that they arise from any act or neglect of the Employer or of the Employer's Personnel.

The insurance shall be maintained in full force and effect during the whole time that the Contractor's Personnel are assisting in the execution of the Works. For any person employed by a Subcontractor, the insurance may be effected by the Subcontractor, but the Contractor shall be responsible for the Subcontractor's compliance with this Sub-Clause.

19.2.6 Other insurances required by Laws and by local practice

The Contractor shall provide all other insurances required by the Laws of the countries where (any part on the Works are being carried out, at the Contractor's own cost.

Other insurances required by local practice (if any) shall be detailed in the Contract Data and the Contractor shall provide such insurances in compliance with the details given, at the Contractor's own cost.

20 Employer's and Contractor's Claims

20.1 Claims

A Claim may arise:

- a. if the Employer considers that the Employer is entitled to any additional payment from the Contractor (or reduction in the Contract Price) and/ or to an extension of the DNP;
- b. if the Contractor considers that the Contractor is entitled to any additional payment from the Employer and/or to EOT; or
- c. if either Party considers that he/she is entitled to another entitlement or relief against the other Party. Such other entitlement or relief may be of any kind whatsoever (including in connection with any certificate, determination,

instruction, Notice, opinion or valuation of the Engineer) except to the extent that it involves any entitlement referred to in sub-paragraphs (a) and/or (b) above.

In the case of a Claim under sub-paragraph (a) or (b) above, Sub-Clause 20.2[Claims For Payment and/or EOT] shall apply.

In the case of a Claim under sub-paragraph (c) above, where the other Party or the Engineer has disagreed with the requested entitlement or relief (or is deemed to have disagreed if he/she does not respond within a reasonable time), a Dispute shall not be deemed to have arisen but the claiming Party may by giving a Notice refer the Claim to the Engineer and Sub-Clause 3.7 [Agreement or Determination] shall apply. This Notice shall be given as soon as practicable after the claiming Party becomes aware of the disagreement (or deemed disagreement) and shall include details of the claiming Party's case and the other Party's or the Engineer's disagreement (or deemed disagreement).

20.2 Claims for Payment and/or EOT

If either Party considers that he/she is entitled to any additional payment by the other Party (or, in the case of the Employer, a reduction in the Contract Price) and/or to EOT (in the case of the Contractor) or an extension of the DNP (in the case of the Employer) under any Clause of these Conditions or otherwise in connection with the Contract, the following Claim procedure shall apply:

20.2.1 Notice of Claim

The claiming Party shall give a Notice to the Engineer, describing the event or circumstance giving rise to the cost, loss, delay or extension of DNP for which the Claim is made as soon as practicable, and no later than 28 days after the claiming Party became aware, or should have become aware, of the event or circumstance (the "Notice of Claim" in these Conditions).

If the claiming Party fails to give a Notice of Claim within this period of 28 days, the claiming Party shall not be entitled to any additional payment, the Contract Price shall not be reduced (in the case of the Employer as the claiming Party), the Time for Completion (in the case of the Contractor as the claiming Party) or the DNP (in the case of the Employer as the claiming Party) shall not be extended, and the other Party shall be

discharged from any liability in connection with the event or circumstance giving rise to the Claim.

20.2.2 Engineer's initial response

If the Engineer considers that the claiming Party has failed to give the Notice of Claim within the period of 28 days under Sub-Clause 20.2.1 [Notice of Claim] the Engineer shall, within 14 days after receiving the Notice of Claim, give a Notice to the claiming Party accordingly (with reasons).

If the Engineer does not give such a Notice within this period of 14 days, the Notice of Claim shall be deemed to be a valid Notice. If the other Party disagrees with such deemed valid Notice of Claim the other Party shall give a Notice to the Engineer which shall include details of the disagreement. Thereafter, the agreement or determination of the Claim under Sub-Clause 20.2.5 [Agreement or determination

of the Claim] shall include a review by the Engineer of such disagreement.

If the claiming Party receives a Notice from the Engineer under this Sub-Clause and disagrees with the Engineer or considers there are circumstances which justify late submission of the Notice of Claim, the claiming Party shall include in its fully detailed Claim under Sub-Clause 20.2.4 [Fully detailed claim] details of such disagreement or why such late submission is justified (as the case may be).

20.2.3 Contemporary records

In this Sub-Clause 20.2, "contemporary records" means records that are prepared or generated at the same time, or immediately after, the event or circumstance giving rise to the Claim.

The claiming Party shall keep such contemporary records as may be necessary to substantiate the Claim.

Without admitting the Employer's liability, the Engineer may monitor the Contractor's contemporary records and/or instruct the Contractor to keep additional contemporary records. The Contractor shall permit the Engineer to inspect all these records during normal working hours (or at other times agreed by the Contractor), and shall if instructed submit copies to the Engineer. Such monitoring, inspection or instruction (if any) by the Engineer shall not imply acceptance of the accuracy or completeness of the Contractor's contemporary records.

20.2.4 Fully detailed Claim

In this Sub-Clause 20.2, "fully detailed Claim" means a submission which includes:

- a. a detailed description of the event or circumstance giving rise to the Claim;
- b. a statement of the contractual and/or other legal basis of the Claim;
- c. all contemporary records on which the claiming Party relies; and
- d. detailed supporting particulars of the amount of additional payment claimed (or amount of reduction of the Contract Price in the case of the Employer as the claiming Party), and/or EOT claimed (in the case of the Contractor) or extension

of the DNP claimed (in the case of the Employer).

Within either:

- i. 84 days after the claiming Party became aware, or should have become aware, of the event or circumstance giving rise to the Claim,

or

- ii. such other period (if any) as may be proposed by the claiming Party and agreed by the Engineer

the claiming Party shall submit to the Engineer a fully detailed Claim.

If within this time limit the claiming Party fails to submit the statement under sub-paragraph (b) above, the Notice of Claim shall be deemed to have lapsed, it shall no longer be considered as a valid Notice, and the Engineer shall, within 14 days after this time limit has expired, give a Notice to the claiming Party accordingly.

If the Engineer does not give such a Notice within this period of 14 days, the Notice of Claim shall be deemed to be a valid Notice. If the other Party disagrees with such deemed valid Notice of Claim the other Party shall give a Notice to the Engineer which shall include details of the disagreement. Thereafter, the agreement or determination of the Claim under Sub-Clause 20.2.5 [Agreement or determination of the Claim] shall include a review by the Engineer of such disagreement.

If the claiming Party receives a Notice from the Engineer under this Sub-Clause 20.2.4 and if the claiming Party disagrees with such Notice or considers there are circumstances which justify late submission of the statement under sub-paragraph (b) above, the fully detailed claim shall include details of the claiming Party's disagreement or why such late submission is justified (as the case may be).

If the event or circumstance giving rise to the Claim has a continuing effect, Sub-Clause 20.2.6 [Claims of continuing effect] shall apply.

20.2.5 Agreement or determination of the Claim

After receiving a fully detailed Claim under Sub-Clause 20.2.4 [Fully detailed Claim], or an interim or final fully detailed Claim (as the case may be) under Sub-Clause 20.2.4 [Claims of continuing effect], the Engineer shall proceed under Sub-Clause 3.7 [Agreement or Determination] to agree or determine:

- a. the additional payment (if any) to which the claiming Party is entitled or the reduction of the Contract Price (in the case of the Employer as the claiming Party); and/or
- b. the extension (if any) of the Time for Completion (before or after its expiry) under Sub-Clause 8.5 [Extension of Time for Completion] (in the case of the Contractor as the claiming Party), or the extension (if any) of the DNP (before its expiry) under Sub-Clause 11.3 [Extension of Defects Notification Period] (in the case of the Employer as the claiming Party), to which the claiming Party is entitled under the Contract.

If the Engineer has given a Notice under Sub-Clause 20.2.2 [Engineer's initial response] and/or under Sub-Clause 20.2.4 [Fully detailed Claim], the Claim shall nevertheless be agreed or determined in accordance with this Sub-Clause 20.2.5. The agreement or determination of the Claim shall include whether or not the Notice of Claim shall be treated as a valid Notice taking account of the details (if any) included in the fully detailed claim of the claiming Party's disagreement with such Notice(s) or why late submission is justified (as the case may be). The circumstances which may be taken into account (but shall not be binding) may include:

- whether or to what extent the other Party would be prejudiced by acceptance of the late submission;
- in the case of the time limit under Sub-Clause 20.2.1 [Notice of Claim], any evidence of the other Party's prior knowledge of the event or circumstance giving rise to the Claim, which the claiming Party may include in its supporting particulars; and/or
- in the case of the time limit under Sub-Clause 20.2.4 [Fully detailed Claim],

any evidence of the other Party's prior knowledge of the contractual and/or other legal basis of the Claim, which the claiming Party may include in its supporting particulars.

If, having received the fully detailed Claim under Sub-Clause 20.2.4 [Fully detailed Claim], or in the case of a Claim under Sub-Clause 20.2.6 [Claims of continuing effect] an interim or final fully detailed Claim (as the case may be), the Engineer requires necessary additional particulars:

- i. he/she shall promptly give a Notice to the claiming Party, describing the additional particulars and the reasons for requiring them;
- ii. he/she shall nevertheless give his/her response on the contractual or other legal basis of the Claim, by giving a Notice to the claiming Party, within the time limit for agreement under Sub-Clause 3.7.3 [Time limits];
- iii. as soon as practicable after receiving the Notice under sub-paragraph (i) above, the claiming Party shall submit the additional particulars; and
- iv. the Engineer shall then proceed under Sub-Clause 3.7 [Agreement or Determination] to agree or determine the matters under sub-paragraphs (a) and/or (b) above (and, for the purpose of Sub-Clause 3.7.3 [Time limits], the date the Engineer receives the additional particulars from the claiming Party shall be the date of commencement of the time limit for agreement under Sub-Clause 3.7.3).

20.2.6 Claims of continuing effect

If the event or circumstance giving rise to a Claim under this Sub-Clause 20.2 has a continuing effect:

- a. the fully detailed Claim submitted under Sub-Clause 20.2.4 [Fully detailed

Claim] shall be considered as interim;

- b. in respect of this first interim fully detailed Claim, the Engineer shall give his/her response on the contractual or other legal basis of the Claim, by giving a Notice to the claiming Party, within the time limit for agreement under Sub-Clause 3.7.3 [Time limits];
- c. after submitting the first interim fully detailed Claim the claiming Party shall submit further interim fully detailed Claims at monthly intervals, giving the accumulated amount of additional payment claimed (or the reduction of the Contract Price, in the case of the Employer as the claiming Party), and/or extension of time claimed (in the case of the Contractor as the claiming Party) or extension of the DNP (in the case of the Employer as the claiming Party); and
- d. the claiming Party shall submit a final fully detailed Claim within 28 days after the end of the effects resulting from the event or circumstance, or within such other period as may be proposed by the claiming Party and agreed by the Engineer. This final fully detailed claim shall give the total amount of additional payment claimed (or the reduction of the Contract Price, in the case of the Employer as the claiming Party) and/or extension of time claimed (in the case of the Contractor as the claiming Party) or extension of the DNP (in the case of the Employer as the claiming Party).

20.2.7 General requirements

After receiving the Notice of Claim, and until the Claim is agreed or determined under Sub-Clause 20.2.5 [Agreement or determination of the Claim], in each Payment Certificate the Engineer shall include such amounts for any Claim as have been reasonably substantiated as due to the claiming Party under the relevant provision of the Contract.

The Employer shall only be entitled to claim any payment from the Contractor and/or to extend the DNP or set off against or make any deduction from any amount due to the Contractor, by complying with this Sub-Clause 20.2.

The requirements of this Sub-Clause 20.2 are in addition to those of any other Sub-Clause which may apply to the Claim. If the claiming Party fails to comply with this or any other Sub-Clause in relation to the Claim, any additional payment and/or any EOT (in the case of the Contractor as the claiming Party) or extension of the DNP (in the case of the Employer as the claiming Party), shall take account of the extent (if any) to which the failure has prevented or prejudiced proper investigation of the Claim by the Engineer.

21 Disputes and Arbitration

21.1 Constitution of the DAAB

Disputes shall be decided by a DAAB in accordance with Sub-Clause 21.4 [Obtaining DAAB's Decision]. The Parties shall jointly appoint the member(s) of the DAAB within the time stated in the Contract Data (if not stated, 28 days) after the date the Contractor receives the Letter of Acceptance.

The DAAB shall comprise, as stated in the Contract Data, either one suitably qualified member (the "sole member") or three suitably qualified members (the "members"). If the number is not so stated, and the Parties do not agree otherwise, the DAAB shall comprise three members.

The sole member or three members (as the case may be) shall be selected from those named in the list in the Contract Data, other than anyone who is unable or unwilling to accept appointment to the DAAB.

If the DAAB is to comprise three members, each Party shall select one member for the agreement of the other Party. The Parties shall consult both these members and shall agree the third member, who shall be appointed to act as chairperson.

The DAAB shall be deemed to be constituted on the date that the Parties and the sole member or the three members (as the case may be) of the DAAB have all signed a DAAB Agreement.

The terms of the remuneration of either the sole member or each of the three members, including the remuneration of any expert whom the DAAB consults, shall be mutually agreed by the Parties when agreeing the terms of the DAAB Agreement. Each Party shall be responsible for paying one-half of this remuneration.

If at any time the Parties so agree, they may appoint a suitably qualified person or persons to replace any one or more members of the DAAB.

Unless the Parties agree otherwise, a replacement DAAB member shall be appointed if a member declines to act or is unable to act as a result of death, illness, disability, resignation or termination of appointment. The replacement member shall be appointed in the same manner as the replaced member was required to have been selected or agreed, as described in this Sub-Clause.

The appointment of any member may be terminated by mutual agreement of both Parties, but not by the Employer or the Contractor acting alone.

Unless otherwise agreed by both Parties, the term of the DAAB (including the appointment of each member) shall expire either:

- a. on the date the discharge shall have become, or deemed to have become, effective under Sub-Clause 14.12 [Discharge]; or
- b. 28 days after the DAAB has given its decision on all Disputes, referred to it under Sub-Clause 21.4 [Obtaining DAAB's Decision] before such discharge has become effective,

whichever is later.

However, if the Contract is terminated under any Sub-Clause of these Conditions or otherwise, the term of the DAAB (including the appointment of each member) shall expire 28 days after:

- i. the DAAB has given its decision on all Disputes, which were referred to it (under Sub-Clause 21.4 [Obtaining DAAB's Decision]) within 224 days after the date of termination; or

- ii. the date that the Parties reach a final agreement on all matters (including payment) in connection with the termination

whichever is earlier.

21.2 Failure to Appoint DAAB Member(s)

If any of the following conditions apply, namely:

- a. if the DAAB is to comprise a sole member, the Parties fail to agree the appointment of this member by the date stated in the first paragraph of Sub-Clause 21 .1 [Constitution of the DAAB]; or
- b. if the DAAB is to comprise three persons, and if by the date stated in the first paragraph of Sub-Clause 21 .1 [Constitution of the DAAB]:
 - i. either Party fails to select a member (for agreement by the other Party);
 - ii. either Party fails to agree a member selected by the other Party; and/or
 - iii. the Parties fail to agree the appointment of the third member (to act as chairperson) of the DAAB;
- c. the Parties fail to agree the appointment of a replacement within 42 days after the date on which the sole member or one of the three members declines to act or is unable to act as a result of death, illness, disability, resignation, or termination of appointment; or
- d. if, after the Parties have agreed the appointment of the member(s) or replacement, such appointment cannot be effected because one Party refuses or fails to sign a DAAB Agreement with any such member or replacement (as the case may be) within 14 days of the other Party's request to do so,

then the appointing entity or official named in the Contract Data shall, at the request of either or both Parties and after due consultation with both Parties, appoint the member(s) of the DAAB who, in the case of sub-paragraph (d) above, shall be the agreed member(s) or replacement). This appointment shall be final and conclusive.

Thereafter, the Parties and the member(s) so appointed shall be deemed to have signed and be bound by a DAA Agreement under which:

- i. the monthly services fee and daily fee shall be as stated in the terms of the appointment; and
- ii. the law governing the DAAB Agreement shall be the governing law of the Contract defined in Sub-Clause 1.4 [Law and Language].

Each Party shall be responsible for paying one-half of the remuneration of the appointing entity or official. If the Contractor pays the remuneration in full, the Contractor shall

include one-half of the amount of such remuneration in a Statement and the Employer shall then pay the Contractor in accordance with the Contract. If the Employer pays the remuneration in full, the Engineer shall include one-half of the amount of such remuneration as a deduction under sub-paragraph (b) of Sub- Clause 14.6.1 [The IPC].

21.3 Avoidance of Disputes

If the Parties so agree, they may jointly request (in writing, with a copy to the Engineer) the DAAB to provide assistance and/or informally discuss and attempt to resolve any issue or disagreement that may have arisen between them during the performance of the Contract. If the DAAB becomes aware of an issue or disagreement, it may invite the Parties to make such a joint request.

Such joint request may be made at any time, except during the period that the Engineer is carrying out his/her duties under Sub-Clause 3.7 [Agreement or Determination] on the matter at issue or in disagreement unless the Parties agree otherwise.

Such informal assistance may take place during any meeting, Site visit or otherwise. However, unless the Parties agree otherwise, both Parties shall be present at such discussions. The Parties are not bound to act on any advice given during such informal meetings, and the DAAB shall not be bound in any future Dispute resolution process or decision by any views or advice given during the informal assistance process, whether provided orally or in writing.

21.4 Obtaining DAAB's Decision

If a Dispute arises between the Parties then either Party may refer the Dispute to the DAAB for its decision (whether or not any informal discussions have been held under Sub-Clause 21.3 [Avoidance of Disputes]) and the following provisions shall apply.

21.4.1 Reference of a Dispute to the DAAB

The reference of a Dispute to the DAAB (the "reference" in this Sub-Clause 21.4) shall:

- a. if Sub-Clause 3.7 [Agreement or Determination] applied to the subject matter of the Dispute, be made within 42 days of giving or receiving (as the case maybe) a NOD under Sub-Clause 3.7.5 [Dissatisfaction with Engineer's determination]. If the Dispute is not referred to the DAAB within this period of 42 days, such NOD shall be deemed to have lapsed and no longer be valid;
- b. state that it is given under this Sub-Clause;
- c. set out the referring Party's case relating to the Dispute;
- d. be in writing, with copies to the other Party and the Engineer; and
- e. for a DAAB of three persons, be deemed to have been received by the DAAB on the date it is received by the chairperson of the DAAB.

The reference of a Dispute to the DAAB under this Sub-Clause shall, unless prohibited by law, be deemed to interrupt the running of any applicable statute of limitation or prescription period.

21.4.2 The Parties' obligations after the reference

Both Parties shall promptly make available to the DAAB all information, access to the Site, and appropriate facilities, as the DAAB may require for the purposes of making a decision on the Dispute.

Unless the Contract has already been abandoned or terminated, the Parties shall continue to perform their obligations in accordance with the Contract.

21.4.3 The DAAB's decision

The DAAB shall complete and give its decision within:

- a. 84 days after receiving the reference; or
- b. such period as may be proposed by the DAAB and agreed by both Parties.

However, if at the end of this period, the due date(s) for payment of any DAAB member's invoice(s) has passed but such invoice(s) remains unpaid, the DAAB shall not be obliged to give its decision until such outstanding invoice(s) have been paid in full, in which case the DAAB shall give its decision as soon as practicable after payment has been received.

The decision shall be given in writing to both Parties with a copy to the Engineer, shall be reasoned, and shall state that it is given under this Sub-Clause.

The decision shall be binding on both Parties, who shall promptly comply with it whether or not a Party gives a NOD with respect to such decision under this Sub- Clause. The Employer shall be responsible for the Engineer's compliance with the DAAB decision.

If the decision of the DAAB requires a payment of an amount by one Party to the other Party

- i. subject to sub-paragraph (ii) below, this amount shall be immediately due and payable without any certification or Notice; and
- ii. the DAAB may (as part of the decision), at the request of a Party but only if there are reasonable grounds for the DAAB to believe that the payee will be unable to repay such amount in the event that the decision is reversed under Sub-Clause 21.6 [Arbitration], require the payee to provide an appropriate security (at the DAAB's sole discretion) in respect of such amount.

The DAAB proceeding shall not be deemed to be an arbitration and the DAAB shall not act as arbitrator(s).

21.4.4 Dissatisfaction with DAAB's decision

If either Party is dissatisfied with the DAAB's decision:

- a. such Party may give a NOD to the other Party, with a copy to the DAAB and to the Engineer;
- b. this NOD shall state that it is a "Notice of Dissatisfaction with the DAAB's Decision" and shall set out the matter in Dispute and the reason(s) for dissatisfaction; and

- c. this NOD shall be given within 28 days after receiving the DAAB's decision.

If the DAAB fails to give its decision within the period stated in Sub-Clause 21.4.3 [The DAAB's decision], then either Party may, within 28 days after this period has expired, give a NOD to the other Party in accordance with sub-paragraphs (a) and (b) above.

Except as stated in the last paragraph of Sub-Clause 3.7.5 [Dissatisfaction with Engineer's determination], in Sub-Clause 21.7 [Failure to Comply with DAAB's Decision] and in Sub-Clause 21.8 [No DAAB In Place], neither Party shall be entitled to commence arbitration of a Dispute unless a NOD in respect of that Dispute has been given in accordance with this Sub-Clause 21.4.4.

If the DAAB has given its decision as to a matter in Dispute to both Parties, and no NOD under this Sub-Clause 21.4.4 has been given by either Party within 28 days after receiving the DAAB's decision, then the decision shall become final and binding on both Parties.

If the dissatisfied Party is dissatisfied with only part(s) of the DAAB's decision:

- i. this part(s) shall be clearly identified in the NOD;
- ii. this part(s), and any other parts of the decision that are affected by such part(s) or rely on such part(s) for completeness, shall be deemed to be severable from the remainder of the decision; and
- iii. the remainder of the decision shall become final and binding on both Parties as if the NOD had not been given.

21.5 Amicable Settlement

Where a NOD has been given under Sub-Clause 21.4 [Obtaining DAAB's Decision] both Parties shall attempt to settle the Dispute amicably before the commencement of arbitration. However, unless both Parties agree otherwise, arbitration may be commenced on or after the twenty-eighth (28th) day after the day on which this NOD was given, even if no attempt at amicable settlement has been made.

21.6 Arbitration

Unless settled amicably, and subject to Sub-Clause 3.7.5 [Dissatisfaction with Engineer's determination], Sub-Clause 21.4.4 [Dissatisfaction with DAAB 's decision], Sub-Clause 21 .7 [Failure to Comply with DAAB 's Decision] and Sub- Clause 21 .8 [No DAAB In Place], any Dispute in respect of which the DAAB's decision (if any) has not become final and binding shall be finally settled by international arbitration. Unless otherwise agreed by both Parties:

- a. the Dispute shall be finally settled under the Rules of Arbitration of the International Chamber of Commerce;
- b. the Dispute shall be settled by one or three arbitrators appointed in accordance with these Rules; and
- c. the arbitration shall be conducted in the ruling language defined in Sub-Clause 1.4 [Law and Language].

The arbitrator(s) shall have full power to open up, review and revise any certificate, determination (other than a final and binding determination), instruction, opinion or valuation of the Engineer, and any decision of the DAAB (other than a final and binding decision) relevant to the Dispute. Nothing shall disqualify the Engineer from being called as a witness and giving evidence before the arbitrator(s) on any matter whatsoever relevant to the Dispute.

In any award dealing with costs of the arbitration, the arbitrator(s) may take account of the extent (if any) to which a Party failed to cooperate with the other Party in constituting a DAAB under Sub-Clause 21.1 [Constitution of the DAAB] and/or Sub-Clause 21.2 [Failure to Appoint DAAB Member(s)].

Neither Party shall be limited in the proceedings before the arbitrator(s) to the evidence or arguments previously put before the DAAB to obtain its decision, or to the reasons for dissatisfaction given in the Party's NOD under Sub-Clause 21.4 [Obtaining DAAB's Decision]. Any decision of the DAAB shall be admissible in evidence in the arbitration.

Arbitration may be commenced before or after completion of the Works. The obligations of the Parties, the Engineer and the DAAB shall not be altered by reason of any arbitration being conducted during the progress of the Works.

If an award requires a payment of an amount by one Party to the other Party, this amount shall be immediately due and payable without any further certification or Notice.

21.7 Failure to Comply with DAAB's Decision

In the event that a Party fails to comply with any decision of the DAAB, whether binding or final and binding, then the other Party may, without prejudice to any other rights it may have, refer the failure itself directly to arbitration under Sub-Clause 21.6 [Arbitration] in which case Sub-Clause 21.4 [Obtaining DAAB's Decision] and Sub-Clause 21.5 [Amicable Settlement] shall not apply to this reference. The arbitral tribunal (constituted under Sub-Clause 21.6 [Arbitration]) shall have the power, by way of summary or other expedited procedure, to order, whether by an interim or provisional measure or an award (as may be appropriate under applicable law or otherwise), the enforcement of that decision.

In the case of a binding but not final decision of the DAAB, such interim or provisional measure or award shall be subject to the express reservation that the rights of the Parties as to the merits of the Dispute are reserved until they are resolved by an award.

Any interim or provisional measure or award enforcing a decision of the DAAB which has not been complied with, whether such decision is binding or final and binding, may also include an order or award of damages or other relief.

21.8 No DAAB In Place

If a Dispute arises between the Parties in connection with, or arising out of, the Contract or the execution of the Works and there is no DAAB in place (or no DAAB is being constituted), whether by reason of the expiry of the DAAB's appointment or otherwise:

- a. Sub-Clause 21.4 [Obtaining DAAB's Decision] and Sub-Clause 21.5 [Amicable Settlement] shall not apply; and
- b. the Dispute may be referred by either Party directly to arbitration under Sub-

Clause 21 .6 [Arbitration] without prejudice to any other rights the Party may have.

APPENDIX - General Conditions of Dispute Avoidance/Adjudication Agreement

1 Definitions

- 1.1 **“General Conditions of Dispute Avoidance/Adjudication Agreement”** or **“GCs”** means this document entitled “General Conditions of Dispute Avoidance/Adjudication Agreement”, as published by FIDIC.
- 1.2 In the DAA Agreement (as defined below) and in the GCs, words and expressions which are not otherwise defined shall have the meanings assigned to them in the Contract (as defined in the DAA Agreement).
- 1.3 **“DAA Agreement”** is as defined under the Contract and is a tripartite agreement by and between:
 - a. the Employer;
 - b. the Contractor; and
 - c. the DAAB Member who is defined in the DAA Agreement as being either:
 - i. the sole member of the DAAB, or
 - ii. one of the three members (or the chairperson) of the DAAB.
- 1.4 **“DAAB’s Activities”** means the activities carried out by the DAAB in accordance with the Contract and the GCs, including all Informal Assistance, meetings (including meetings and/or discussions between the DAAB members in the case of a three-member DAAB), Site visits, hearings and decisions.
- 1.5 **“DAAB Rules”** means the document entitled “DAAB Procedural Rules” published by FIDIC which are annexed to, and form part of, the GCs.
- 1.6 **“Informal Assistance”** means the informal assistance given by the DAAB to the Parties when requested jointly by the Parties under Sub-Clause 21.3 [Avoidance of Disputes] of the Conditions of Contract.
- 1.7 **“Term of the DAAB”** means the period starting on the Effective Date (as defined in Sub-Clause 2.1 below) and finishing on the date that the term of the DAAB expires in accordance with Sub-Clause 21.1 [Constitution of the DAAB] of the Conditions of Contract.
- 1.8 **“Notification”** means a notice in writing given under the GCs, which shall be:
 - a.
 - i. a paper-original signed by the DAAB Member or the authorised representative of the Contractor or of the Employer (as the case may be); or

- ii. an electronic original generated from the system of electronic transmission agreed between the Parties and the DAAB, which electronic original is transmitted by the electronic address uniquely assigned to the DAAB Member or each such authorised representative (as the case may be);
- b. delivered by hand (against receipt), or sent by mail or courier (against receipt), or transmitted using the system of electronic transmission under sub-paragraph (a)(ii) above; and
- c. delivered, sent or transmitted to the address for the recipient's communications as stated in the DAAB Agreement. However, if the recipient gives a Notification of another address, all Notifications Shall be delivered accordingly after the sender receives such Notification.

2 General Provisions

2.1 The DAA Agreement shall take effect:

- a. in the case of a sole-member DAAB, on the date when the Employer, the Contractor and the DAAB Member have each signed (or, under the Contract, are deemed to have signed) the DAAB Agreement; or
- b. in the case of a three-member DAAB, on the date when the Employer, the Contractor, the DAAB Member and the Other Members have each signed (or under the Contract are deemed to have signed) a DAAB Agreement.

(the "Effective Date" in the GCs).

2.2 Immediately after the Effective Date, either or both Parties shall give a Notification to the DAAB Member that the DAA Agreement has come into effect. If the DAAB Member does not receive such a notice within 182 days after entering into the DAAB Agreement, it shall be void and ineffective.

2.3 The employment of the DAAB Member is a personal appointment. No assignment of, or subcontracting or delegation of the DAAB Member's rights and/or obligations under the DAA Agreement is permitted.

3 Warranties

3.1 The DAAB Member warrants and agrees that he/she is, and will remain at all times during the Term of the DAAB, impartial and independent of the Employer, the Contractor, the Employer's Personnel and the Contractor's Personnel (including in accordance with Sub-Clause 4.1 below).

3.2 If, after signing the DAA Agreement (or after he/she is deemed to have signed the DAA Agreement under the Contract), the DAAB Member becomes aware of any fact or circumstance which might:

- a. call into question his/her independence or impartiality; and/or
- b. be, or appear to be, inconsistent with his/her warranty and agreement under Sub-Clause 3.1 above

the DAAB Member warrants and agrees that he/she shall immediately disclose this in writing to the Parties and the Other Members (if any).

3.3 When appointing the DAAB Member, each Party relies on the DAAB Member's representations that he/she is:

- a. experienced and/or knowledgeable in the type of work which the Contractor is to carry out under the Contract;
- b. experienced in the interpretation of construction and/or engineering contract documentation; and
- c. fluent in the language for communications stated in the Contract Data (or the language as agreed between the Parties and the DAAB).

4 Independence and Impartiality

4.1 Further to Sub-Clauses 3.1 and 3.2 above, the DAAB Member shall:

- a. have no financial interest in the Contract, or in the project of which the Works are part, except for payment under the DAAB Agreement;
- b. have no interest whatsoever (financial or otherwise) in the Employer, the Contractor, the Employer's Personnel or the Contractor's Personnel;
- c. in the ten years before signing the DAAB Agreement, not have been employed as a consultant or otherwise by the Employer, the Contractor, the Employer's Personnel or the Contractor's Personnel;
- d. not previously have acted, and shall not act, in any judicial or arbitral capacity in relation to the Contract;
- e. have disclosed in writing to the Employer, the Contractor and the Other Members (if any) before signing the DAAB Agreement (or before he/she is deemed to have signed the DAAB Agreement under the Contract) and to his/her best knowledge and recollection, any:
 - i. existing and/or past professional or personal relationships with any director, officer or employee of the Employer, the Contractor, the Employer's Personnel or the Contractor's Personnel (including as a dispute resolution practitioner on another project),
 - ii. facts or circumstances which might call into question his/her independence or impartiality, and
 - iii. previous involvement in the project of which the Contract forms part;

- f. not, while a DAAB Member and for the Term of the DAAB:
 - i. be employed as a consultant or otherwise by, and/or
 - ii. enter into discussions or make any agreement regarding future employment with the Employer, the Contractor, the Employer's Personnel or the Contractor's Personnel, except as may be agreed by the Employer, the Contractor and the Other Members (if any); and/or
- g. not solicit, accept or receive (directly or indirectly) any gift, gratuity, commission or other thing of value from the Employer, the Contractor, the Employer's Personnel or the Contractor's Personnel, except for payment under the DAAB Agreement.

5 General Obligations of the DAAB Member

5.1 The DAAB Member shall:

- a. comply with the GCs, the DAAB Rules and the Conditions of Contract that are relevant to the DAAB's Activities;
- b. not give advice to the Employer, the Contractor, the Employer's Personnel or the Contractor's Personnel concerning the conduct of the Contract, except as required to carry out the DAAB's Activities;
- c. ensure his/her availability during the Term of the DAAB (except in exceptional circumstances, in which case the DAAB Member shall give a Notification without delay to the Parties and the Other Members (if any) detailing the exceptional circumstances) for all meetings, Site visits, hearings and as is necessary to comply with sub-paragraph (a) above
- d. become, and shall remain for the duration of the Term of the DAAB, knowledgeable about the Contract and informed about:
 - i. the Parties' performance of the Contract;
 - ii. the Site and its surroundings; and
 - iii. the progress of the Works (and of any other parts of the project of which the Contract forms part)

including by visiting the Site, meeting with the Parties and by studying all documents received from either Party under Rule 4.3 of the DAAB Rules (which shall be maintained in a current working file, in hard-copy or electronic format at the DAAB Member's discretion); and

- e. be available to give Informal Assistance when requested jointly by the Parties.

6 General Obligations of the Parties

6.1 Each Party shall comply with the GCs, the DAAB Rules and the Conditions of Contract

that are relevant to the DAAB's Activities. The Employer and the Contractor shall be responsible for compliance with this provision by the Employer's Personnel and the Contractor's Personnel, respectively.

6.2 Each Party shall cooperate with the other Party in constituting the DAAB, under Sub-Clause 21.1 [Constitution of the DAAB] and/or Sub-Clause 21.2 [Failure to Appoint DAAB Member(s)] of the Conditions of Contract, without delay.

6.3 In connection with the DAAB's Activities, each Party shall:

- a. cooperate in good faith with the DAAB; and
- b. fulfil its duties, and exercise any right or entitlement, under the Contract, the GCs and the DAAB Rules and/or otherwise

in the manner necessary to achieve the objectives under Rule 1 of the DAAB Rules.

6.4 The Parties, the Employer's Personnel and the Contractor's Personnel shall not request advice from or consultation with the DAAB Member regarding the Contract, except as required for the DAAB Member to carry out the DAAB's Activities.

6.5 At all times when interacting with the DAAB, each Party shall not compromise the DAAB's warranty of independence and impartiality under Sub-Clause 3.1 above.

6.6 In addition to providing documents under Rule 4.3 of the DAAB Rules, each Party shall ensure that the DAAB Member remains informed as is necessary to enable

him/her to comply with sub-paragraph (d) of Sub-Clause 5.1 above.

7 Confidentiality

7.1 Subject to Sub-Clause 7.4 below, the DAAB Member shall treat the details of the Contract, all the DAAB's Activities and the documents provided under Rule 4.3 of the DAAB Rules as private and confidential, and shall not publish or disclose them without the prior written consent of the Parties and the Other Members (if any).

7.2 Subject to Sub-Clause 7.4 below, the Employer, the Contractor, the Employer's Personnel and the Contractor's Personnel shall treat the details of all the DAAB's Activities as private and confidential

7.3 Each person's obligation of confidentiality under Sub-Clause 7.1 or Sub-Clause 7.2 above (as the case may be) shall not apply where the information:

- a. was already in that person's possession without an obligation of confidentiality before receipt under the DAAB Agreement;
- b. becomes generally available to the public through no breach of the GCs; or
- c. is lawfully obtained by the person from a third party which is not bound by an obligation of confidentiality.

7.4 If a DAAB Member is replaced under the Contract, the Parties and/or the Other Members (if any) shall disclose details of the Contract, the documents provided under Rule 4.3 of the DAAB Rules and previous DAAB's Activities (including decisions, if any) to the replacement DAAB Member as is necessary in order to:

- a. enable the replacement DAAB Member to comply with sub-paragraph (d) of Sub-Clause 5.1 above; and
- b. ensure consistency in the manner in which the DAAB's Activities are conducted following such replacement.

8 The Parties' undertaking and indemnity

8.1 The Employer and the Contractor undertake to each other and to the DAAB Member that the DAAB Member shall not:

- a. be appointed as an arbitrator in any arbitration under the Contract;
- b. be called as a witness to give evidence concerning any Dispute in any arbitration under the Contract; or
- c. be liable for any claims for anything done or omitted in the discharge or purported discharge of the DAAB Member's functions, except in any case of fraud, gross negligence, deliberate default or reckless misconduct by him/her.

8.2 The Employer and the Contractor hereby jointly and severally indemnify and hold the DAAB Member harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from any claim from which he/she is relieved from liability under: Sub-Clause 8.1 above.

9 Fees and Expenses

9.1 The DAAB Member shall be paid as follows, in the currency named in the DAAB Agreement:

- a. a monthly fee, which shall be a fixed fee as payment in full for:
 - i. being available on 28-days' notice for all meetings, Site visits and hearings under the DAAB Rules (and, in the event of a request under Rule 3.6 of the DAAB Rules, being available for an urgent meeting or Site visit);
 - ii. becoming and remaining knowledgeable about the Contract, informed about the progress of the Works and maintaining a current working file of documents, in accordance with sub-paragraph (d) of Clause 5.1 above;
 - iii. all office and overhead expenses including secretarial services photocopying and office supplies incurred in connection with his duties' and
 - iv. all services performed hereunder except those referred to in sub-

paragraphs (b) and (c) of this Clause.

This fee shall be paid monthly with effect from the last day of the month in which the Effective Date occurs until the end of the month in which the Term of the DAAB expires, or the DAAB Member declines to act or is unable to act as a result of death, illness, disability, resignation or termination of his/her DAAB Agreement.

If no monthly fee is stated in the DAAB Agreement, the matters described in sub—paragraphs (i) to (iv) above shall be deemed to be covered by the daily fee under sub-paragraph (b) below;

- b. a daily fee, which shall be considered as payment in full for each day:
 - i. or part of a day, up to a maximum of two days' travel time in each direction, for the journey between the DAAB Member's home and the Site, or another location of a meeting with the Parties and/or the Other Members (if any);
 - ii. spent on attending meetings and making Site visits in accordance with Rule 3 of the DAAB Rules, and writing reports in accordance with Rule

3.10 of the DAAB Rules;

- iii. spent on giving informal Assistance;
 - iv. spent on attending hearings (and, in case of a three-member DAAB, attending meeting(s) between the DAAB Members in accordance with sub-paragraph (a) of Rule 8.2 of the DAAB Rules, and communicating with the Other Members), and preparing decisions; and
 - v. spent in preparation for a hearing, and studying written documentation and arguments from the Parties submitted in accordance with sub-paragraph (c) of Rule 7.1 of the DAAB Rules;
- c. all reasonable expenses, including necessary travel expenses (air fare in business class or equivalent, hotel and subsistence and other direct travel expenses, including visa charges) incurred in connection with the DAAB Member's duties, as well as the cost of telephone calls (and video conference calls, if any, and internet access). courier charges and faxes. The DAAB

Member shall provide the Parties with a receipt for each item of expenses;

- d. any taxes properly levied in the Country on payments made to the DAAB Member (unless a national or permanent resident of the Country) under this Sub-Clause 9.1.

9.2 Subject to Sub-Clause 9.3 below, the amounts of the DAAB Member's monthly fee and daily fee, under Sub-Clause 9.1 above, shall be as specified in the DAA Agreement signed (or, under the Contract, deemed to have been signed) by the Parties and the DAAB Member.

- 9.3 If the Parties and the DAAB Member have agreed all other terms of the DAA Agreement but fail to jointly agree the amount of the monthly fee or the daily fee in the DAA Agreement (the “non-agreed fee” in this Sub-Clause):
- the DAA Agreement shall nevertheless be deemed to have been signed by the Parties and the DAAB Member, except that the fee proposed by the DAAB Member shall only temporarily apply;
 - either Party or the DAAB Member may apply to the appointing entity or official named in the Contract Data to set the amount of the non-agreed fee;
 - the appointing entity or official shall, as soon as practicable and in any case within 28 days after receiving any such application, set the amount of the non-agreed fee, which amount shall be reasonable taking due regard of the complexity of the Works, the experience and qualifications of the DAAB Member, and all other relevant circumstances;
 - once the appointing entity or official has set the amount of the non-agreed fee, this amount shall be final and conclusive, shall replace the fee under subparagraph (a) above, and shall be deemed to have applied from the Effective Date; and
 - thereafter, after giving credit to the Parties for all amounts previously paid in respect of the non-agreed fee, the balance (if any) due from the DAAB Member to the Parties or from the Parties to the DAAB Member, as the casemay be, shall be paid
- 9.4 The DAAB Member shall submit invoices for payment of the monthly fee and air fares quarterly in advance. Invoices for other expenses and for daily fees shall be submitted following the conclusion of a meeting, Site visit or hearing; and following the giving of a decision or an informal written note (under Rule 2.1 of the DAAB Rules). All invoices shall be accompanied by a brief description of the DAAB’s Activities performed during the relevant period and shall be addressed to the Contractor.
- 9.5 The Contractor shall pay each of the DAAB Member’s invoices in full within 28 days after receiving each invoice. Thereafter, the Contractor shall apply to the Employer (in the Statements under the Contract) for reimbursement of one-half of the amounts of these invoices. The Employer shall then pay the Contractor in accordance with the Contract.
- 9.6 If the Contractor fails to pay to the DAAB Member the amount to which he/ she is entitled under the DAA Agreement within the period of 28 days stated at Sub- Clause 9.5 above, the DAAB Member shall inform the Employer who shall promptly pay the amount due to the DAAB Member and any other amount which may be required to maintain the function of the DAAB. Thereafter the Employer shall, by written request, be entitled to payment from the Contractor of:

- a. all sums paid in excess of one-half of these amounts;
- b. the reasonable costs of recovering these amounts from the Contractor; and
- c. financing charges calculated at the rate specified in Sub-Clause 14.9[Delayed Payment] of the Conditions of Contract.

The Employer shall be entitled to such payment from the Contractor without any requirement to comply with Sub-Clause 20.2 [Claims For Payment and or EOT] of the Conditions of Contract, and without prejudice to any other right or remedy.

9.7 If the DAAB Member does not receive payment of the amount due within 56 days after submitting a valid invoice, the DAAB Member may:

- a. not less than 7 days after giving a Notification to the Parties and the Other Members (if any), suspend his/her services until the payment is received; and/or
- b. resign his/her appointment by giving a Notification under Sub-Clause 10.1 below.

10 Resignation and Termination

10.1 The DAAB Member may resign at any time for any reason, by giving a Notification of not less than 28 days (or other period as may be agreed by the Parties) to the Parties and to the Other Members (if any). During this period the Parties shall take the necessary steps to appoint, without delay, a replacement DAAB Member in accordance with Sub-Clause 21.1 [Constitution of the DAAB] of the Conditions of Contract (and, if applicable, Sub-Clause 21.2 [Failure to Appoint DAAB Member(s)] of the Conditions of Contract).

10.2 On expiry of the period stated in Sub-Clause 10.1 above, the resigning DAAB Member's DAA Agreement shall terminate with immediate effect. However (except if the DAAB Member is unable to act as a result of illness or disability) if, on the date of the DAAB Member's notice under Sub-Clause 10.1 above, the DAAB is dealing with any Dispute under Sub-Clause 21.4 [Obtaining DAAB's Decision] of the Conditions of Contract, the DAAB Member's resignation shall not take effect and his/her DAA Agreement shall not terminate until after the DAAB has given all the corresponding decisions in accordance with the Contract.

10.3 At any time, the Parties may jointly terminate the DAA Agreement by giving a Notification of not less than 42 days to the DAAB Member.

10.4 If the DAAB Member fails, without justifiable excuse, to comply with Sub-Clause 5.1 above, the Parties may, without prejudice to their other rights or remedies, jointly terminate his/her DAA Agreement by giving a Notification (by recorded delivery) to the DAAB Member. This notice shall take effect when it is received by the DAAB Member.

10.5 If either-Party fails, without justifiable excuse. to comply with Clause 6 above, the

- DAAB Member may, without prejudice to his/her other rights or remedies, terminate the DAA Agreement by giving a Notification to the Parties. This notice shall take effect when received by both Parties.
- 10.6 Any resignation or termination under this Clause shall be final and binding on the Parties and the DAAB Member. However, a notice given under Sub-Clause 10.3 or 10.4 above by either the Employer or the Contractor, but not by both, shall be of no effect.
- 10.7 Subject to sub-paragraph (b) of Sub-Clause 11.5 below, in the event of resignation or termination under this Clause the DAAB Member shall nevertheless be entitled to payment of any fees and/or expenses under his/ her DAA Agreement that remain outstanding as of the date of termination of his/her DAAB Agreement.
- 10.8 After resignation by the DAAB Member or termination of his/her DAA Agreement under this Clause, the DAAB Member shall:
- remain bound by his/her obligation of confidentiality under Sub-Clause 7.1 above; and
 - return the original of any document in his/her possession to the Party who submitted such document in connection with the DAAB's Activities, at that Party's written request and cost.
- 10.9 Subject to any mandatory requirements under the governing law of the DAAB Agreement, termination of the DAA Agreement under this Clause shall require no action of whatsoever kind by the Parties or the DAAB Member (as the case may be) other than as stated in this Clause.
- 11 Challenge**
- 11.1 The Parties shall not object against the DAAB Member, except that either Party shall be entitled to do so for an alleged lack of independence or impartiality or otherwise in which case Rule 10 Objection Procedure and Rule 11 Challenge Procedure of the DAAB Rules shall apply.
- 11.2 The decision issued under Rule 11 of the DAAB Rules (the "Decision on the Challenge" in the GCs) shall be final and conclusive.
- 11.3 At any time before the Decision on the Challenge is issued, the challenged DAAB Member may resign under Sub-Clause 10.1 above and, in such case, the challenging Party shall inform the International Chamber of Commerce (ICC). However, Sub-Clause 10.2 shall not apply to such resignation and the resigning DAAB Member's DAA Agreement shall terminate with immediate effect.
- 11.4 Unless the challenged DAAB Member has resigned, or his/her DAA Agreement has been terminated under Sub-Clause 10.3 above, the DAAB Member and the Other Members (if any) shall continue with the DAAB's Activities until the Decision on the

Challenge is issued.

11.5 If the Decision on the Challenge is that the challenge is successful:

- a. the challenged DAAB Member's appointment, and his/her DAAB Agreement, shall be deemed to have been terminated with immediate effect on the date

of the notification of the Decision on the Challenge by ICC;

- b. the challenged DAAB Member shall not be entitled to any fees or expenses under his/her DAA Agreement from the date of the notification of the Decision on the Challenge by ICC;
- c. any decision under Sub-Clause 21.4.3 [The DAAB's decision] of the Conditions of Contract, given by the DAAB:
 - i. after the challenge was referred under Rule 11 of the DAAB Rules; and
 - ii. before the resignation (if any) of the challenged DAAB Member under Sub-Clause 11.3 above, or his/her DAAB Agreement is terminated under subparagraph (a) above or under Sub-Clause 10.3 above

shall become void and ineffective. In the case of a sole-member DAAB, all other DAAB's Activities during this period shall also become void and ineffective. In the case of a three-member DAAB, all other DAAB's Activities during this period shall remain unaffected by the Decision on the Challenge except if there has been a challenge to all three members of the DAAB and such challenge is successful;

- d. the successfully challenged DAAB Member shall be removed from the DAAB; and
- e. the Parties shall, without delay, appoint a replacement DAAB Member in accordance with Sub-Clause 21.1 [Constitution of the DAAB] of the Conditions of Contract

12 Disputes under the DAAB Agreement

Any dispute arising out of or in connection with the DAAB Agreement, or the breach, termination or invalidity thereof, shall be finally settled by arbitration under the Rules of Arbitration of the International Chamber of Commerce 2017 by one arbitrator appointed in accordance with these Rules of Arbitration. and Article 30 and the Expedited Procedure Rules at Appendix VI of these Rules of Arbitration shall apply.

Annex: DAAB PROCEDURAL RULES

Rule 1 objectives

- 1.1 The objectives of these Rules are:
 - a. to facilitate the avoidance of Disputes that might otherwise arise between the Parties; and
 - b. to achieve the expeditious, efficient and cost effective resolution of any Dispute that arises between the Parties.
- 1.2 These Rules shall be interpreted, the DAAB's Activities shall be conducted and the DAAB shall use its powers under the Contract and these Rules, in the manner necessary to achieve the above objectives.

Rule 2 Avoidance of Disputes

- 2.1 Where Sub-Clause 21.3 [Avoidance of Disputes] of the Conditions of Contract applies, the DAAB (in the case of a three-member DAAB, all three DAAB Members acting together) may give Informal Assistance during discussions at any meeting with the Parties (whether face-to-face or by telephone or by video conference) or at any Site visit or by an informal written note to the Parties.

Rule 3 Meeting and Site Visits

- 3.1 The purpose of meetings with the Parties and Site visits by the DAAB is to enable the DAAB to:
 - a. become and remain informed about the matters described in sub-paragraphs (d)(i) to (d)(iii) of Sub-Clause 5.1 of the GCs;
 - b. become aware of, and remain informed about, any actual or potential issue or disagreement between the Parties; and
 - c. give Informal Assistance if and when jointly requested by the Parties.
- 3.2 As soon as practicable after the DAAB is appointed, the DAAB shall convene a face-to-face meeting with the Parties. At this meeting, the DAAB shall establish a schedule of planned meetings and Site visits in consultation with the Parties, which schedule shall reflect the requirements of Rule 3.3 below and shall be subject to adjustment by the DAAB in consultation with the Parties.
- 3.3 The DAAB shall hold face-to-face meetings with the Parties, and/or visit the Site, at regular intervals and/or at the written request of either Party. The frequency of such meetings and/or Site visits shall be:
 - a. sufficient to achieve the purpose under Rule 3.1 above;
 - b. at intervals of not more than 140 days unless otherwise agreed jointly by the Parties and the DAAB; and

- c. at intervals of not less than 70 days, subject to Rules 3.5 and 3.6 below and except as required to conduct a hearing as described under Rule 7 below, unless otherwise agreed jointly by the Parties and the DAAB.
- 3.4 In addition to the face-to-face meetings referred to in Rules 3.2 and 3.3 above, the DAAB may also hold meetings with the Parties by telephone or video conference as agreed with the Parties (in which case each Party bears the risk of interrupted or faulty telephone or video conference transmission and reception).
- 3.5 At times of critical construction events (which may include suspension of the Work or termination of the Contract), the DAAB shall visit the Site at the written request of either Party. This request shall describe the critical construction event. If the DAAB becomes aware of an upcoming critical construction event, it may invite the Parties to make such a request.
- 3.6 Either Party may request an urgent meeting or Site visit by the DAAB. This shall be a written request and shall give reasons for the urgency of the meeting or Site visit. If the DAAB agrees that such a meeting or Site visit is urgent, the DAAB Members shall use all reasonable endeavours to:
 - a. hold a meeting with the Parties by telephone or video conference (as agreed with the Parties under Rule 3.4 above) within 3 days after receiving the request; and
 - b. if requested and (having given the other Party opportunity at this meeting to respond to or oppose this request) the DAAB agrees that a Site visit is necessary, visit the Site within 14 days after the date of this meeting.
- 3.7 The time of, and agenda for, each meeting and Site visit shall be set by the DAAB in consultation with the Parties.
- 3.8 Each meeting and Site visit shall be attended by the Employer, the Contractor and the Engineer.
- 3.9 Each meeting and Site visit shall be co-ordinated by the Contractor in co-operation with the Employer and the Engineer. The Contractor shall ensure the provision of appropriate:
 - a. personal safety equipment, security controls (if necessary) and site transport for each Site visit;
 - b. meeting room/conference facilities and secretarial and copying services for each face-to-face meeting; and
 - c. telephone conference or video conference facilities for each meeting by telephone or video conference.
- 3.10 At the conclusion of each meeting and Site visit and, if possible before leaving the venue of the face-to-face meeting or the Site (as the case may be) but in any event

within 7 days, the DAAB shall prepare a report on its activities during the meeting or Site visit and shall send copies of this report to the Parties and the Engineer.

Rule 4 Communications and Documentation

4.1 The language to be used:

- a. in all communications to and from the DAAB and the Parties (and, in the case of a three-member DAAB, between the DAAB Members);
- b. in all reports and decisions issued by the DAAB; and
- c. during all Site visits, meetings and hearings relating to the DAAB's Activities

shall be the language for communications defined in Sub-Clause 1.4 [Law and Language] of the Conditions of Contract, unless otherwise agreed jointly by the Parties and the DAAB.

4.2 All communications and/or documents sent between the DAAB and a Party shall simultaneously be copied to the other Party. In the case of a three-member DAAB, the sending Party shall send all communications and/ or documents to the chairperson of the DAAB and simultaneously send copies of these communications and/or documents to the Other Members.

4.3 The Parties shall provide the DAAB with a copy of all documents which the DAAB may request, including:

- a. the documents forming the Contract;
- b. progress reports under Sub-Clause 4.20 [Progress Reports] of the Conditions of Contract;
- c. the initial programme and each revised programme under Sub-Clause 8.3 [Programme] of the Conditions of Contract;
- d. relevant instructions given by the Engineer, and Variations under Clause 13.3 [Variation Procedure] of the Conditions of Contract;
- e. Statements submitted by the Contractor, and all certificates issued by the Engineer under the Contract;
- f. relevant Notices;
- g. relevant communications between the Parties and between either Party and the Engineer

and any other document relevant to the performance of the Contract and/ or necessary to enable the DAAB to become and remain informed about the matters described in subparagraphs (d)(i) to (d)(iii) of Sub-Clause 5.1 of the GCs.

Rule 5 Powers of the DAAB

- 5.1 In addition to the powers granted to the DAAB under the Conditions of Contract, the General Conditions of the DAA Agreement and elsewhere in these Rules, the Parties empower the DAAB to:
- establish the procedure to be applied in making Site visits and/or giving Informal Assistance;
 - establish the procedure to be applied in giving decisions under the Conditions of Contract;
 - decide on the DAAB's own jurisdiction, and the scope of any Dispute referred to the DAAB;
 - appoint one or more experts (including legal and technical expert(s)), with the agreement of the Parties;
 - decide whether or not there shall be a hearing (or more than one hearing, if necessary) in respect of any Dispute referred to the DAAB;
 - conduct any meeting with the Parties and/or any hearing as the DAAB thinks fit, not being bound by any rules or procedures for the hearing other than those contained in the Contract and in these Rules;
 - take the initiative in ascertaining the facts and matters required for a DAAB decision;
 - make use of a DAAB Member's own specialist knowledge, if any;
 - decide on the payment of financing charges in accordance with the Contract;
 - decide on any provisional relief such as interim or conservatory measures;
 - open up, review and revise any certificate, decision, determination, instruction, opinion or valuation of (or acceptance, agreement approval, consent, disapproval, No-objection, permission, or similar act by) the Engineer that is relevant to the Dispute; and
 - proceed with the DAAB's Activities in the absence of a Party who after receiving a Notification from the DAAB, fails to comply with Sub-Clause 6.3 of the GCs.
- 5.2 The DAAB shall have discretion to decide whether and to what extent any powers granted to the DAAB, under the Conditions of Contract, the GCs and these Rules, may be exercised.

Rule 6 Disputes

- 6.1 If any Dispute is referred to the DAAB in accordance with Sub-Clause 21.4.1 [Reference of a Dispute to the DAAB] of the Conditions of Contract, the DAAB shall proceed in accordance with Sub-Clause 21.4 [Obtaining DAAB's Decision] of the Conditions of Contract and these DAAB Rules. or as otherwise agreed by the Parties in

writing.

- 6.2 The DAAB shall act fairly and impartially between the Parties and, taking due regard of the period under Sub-Clause 21.4.3 [The DAAB's decision] of the Conditions of Contract and other relevant circumstances, the DAAB shall:
- a. give each Party a reasonable opportunity (consistent with the expedited nature of the DAAB proceeding) of putting forward its case and responding to the other Party's case; and
 - b. adopt a procedure in coming to its decision that is suitable to the Dispute, avoiding unnecessary delay and/or expense.

Rule 7 Hearings

- 7.1 In addition to the powers under Rule 5.1 above, and except as otherwise agreed in writing by the Parties, the DAAB shall have power to:
- a. decide on the date and place for any hearing, in consultation with the Parties;
 - b. decide on the duration of any hearing;
 - c. request that written documentation and arguments from the Parties be submitted to it prior to the hearing;
 - d. adopt an inquisitorial procedure during any hearing;
 - e. request the production of documents, and/or oral submissions by the Parties, at any hearing that the DAAB considers may assist in exercising the DAAB's power under sub-paragraph (g) of Rule 5.1 above;
 - f. request the attendance of persons at any hearing that the DAAB considers may assist in exercising the DAAB's power under sub-paragraph (g) of Rule 5.1 above;
 - g. refuse admission to any hearing, or audience at any hearing, to any persons other than representatives of the Employer, the Contractor and the Engineer;
 - h. proceed in the absence of any party who the DAAB is satisfied received timely notice of the hearing;
 - i. adjourn any hearing as and when the DAAB considers further investigation by one Party or both Parties would benefit resolution of the Dispute, for such time as the investigation is carried out, and resume the hearing promptly thereafter.
- 7.2 The DAAB shall not express any opinions during any hearing concerning the merits of any arguments advanced by either Party in respect of the Dispute.
- 7.3 The DAAB shall not give any Informal Assistance during a hearing, but if the Parties request Informal Assistance during any hearing:

- a. the hearing shall be adjourned for such time as the DAAB is giving Informal Assistance;
- b. if the hearing is so adjourned for longer than 2 days, the period under Sub-Clause 21.4.3 [The DAAB's decision] of the Conditions of Contract shall be temporarily suspended until the date that the hearing is resumed; and
- c. the hearing shall be resumed promptly after the DAAB has given such Informal Assistance.

Rule 8 The DAAB's Decision

8.1 The DAAB shall make and give its decision within the time allowed under Sub- Clause 21.4 [Obtaining DAAB's Decision] of the Conditions of Contract, or other time as may be proposed by the DAAB and agreed by the Parties in writing.

8.2 In the case of a three-member DAAB:

- a. it shall meet in private (after the hearing, if any) in order to have discussions and to start preparation of its decision;
- b. the DAAB Members shall use all reasonable endeavours to reach a unanimous decision;
- c. if it is not possible for the DAAB Members to reach a unanimous decision, the applicable decision shall be made by a majority of the DAAB Members, who may require the minority DAAB Member to prepare a separate written report (with reasons and supporting particulars) which shall be issued to the Parties; and
- d. if a DAAB Member fails to:
 - i. attend a hearing (if any) or a DAAB Members' meeting; or
 - ii. fulfil any required function (other than agreeing to a unanimous decision)

the Other Members shall nevertheless proceed to make a decision, unless:

- such failure has been caused by exceptional circumstances, of which the Other Members and the Parties have received a Notification from the DAAB Member;
- the DAAB Member has suspended his services under sub- paragraph (a) of Sub-Clause 9.7 of the GCs; or
- otherwise agreed by the Parties in writing.

8.3 If, after giving a decision, the DAAB finds (and, in the case of a three-member DAAB, they agree unanimously or by majority) that the decision contained any error:

- a. of a typographical or clerical nature; or
- b. of an arithmetical nature

the chairperson of the DAAB or the sole DAAB Member (as the case may be) shall, within 14 days after giving this decision, advise the Parties of the error and issue an addendum to its original decision in writing to the Parties.

- 8.4 If, within 14 days of receiving a decision from the DAAB, either Party finds a typographical, clerical or arithmetical error in the decision, that Party may request the DAAB to correct such error. This shall be a written request and shall clearly identify the error.
- 8.5 If, within 14 days of receiving a decision from the DAAB, either Party believes that such decision contains an ambiguity, that Party may request clarification from the DAAB. This shall be a written request and shall clearly identify the ambiguity.
- 8.6 The DAAB shall respond to a request under Rule 8.4 or Rule 8.5 above within 14 days of receiving the request. The DAAB may decline (at its sole discretion and with no requirement to give reasons) any request for clarification under Rule 8.5. If the DAAB agrees (in the case of a three-member DAAB they agree unanimously or by majority) that the decision did contain the error or ambiguity as described in the request, it may correct its decision by issuing an addendum to its original decision in writing to the Parties, in which case this addendum shall be issued together with the DAAB's response under this Rule.
- 8.7 If the DAAB issues an addendum to its original decision under Rule 8.3 or 8.6 above, such an addendum shall form part of the decision and the period stated in subparagraph (c) of Sub-Clause 21.4.4 [Dissatisfaction with DAAB's decision] of the Conditions of Contract shall be calculated from the date the Parties receive this addendum.

Rule 9 In the event of Termination of DAA Agreement

- 9.1 If, on the date of termination of a DAAB Member's DAA Agreement arising from resignation or termination under Clause 10 of the GCs, the DAAB is dealing with any Dispute under Sub-Clause 21.4 [Obtaining DAAB's Decision] of the Conditions of Contract:
- a. the period under Sub-Clause 21.4.3 [The DAAB's decision] of the Conditions of Contract shall be temporarily suspended; and
 - b. when a replacement DAAB Member is appointed in accordance with Sub-Clause 21.1 [Constitution of the DAAB] of the Conditions of Contract, the full period under Sub-Clause 21.4.3 [The DAAB's decision] of the Conditions of Contract shall apply from the date of this replacement DAAB Member's appointment.

- 9.2 In the case of a three-member DAAB and if one DAAB Member's DAA Agreement is terminated as a result of resignation or termination under Clause 10 of the GCs, the Other Members shall continue as members of the DAAB except that they shall not conduct any hearing or make any decision prior to the replacement of the DAAB Member unless otherwise agreed jointly by the Parties and the Other Members.

Rule 10 Objection Procedure

- 10.1 The following procedure shall apply to any objection against a DAAB Member:
- a. the objecting Party shall, within 7 days of becoming aware of the facts and/or events giving rise to the objection, give a Notification to the DAAB Member of its objection. This Notification shall:
 - i. state that it is given under this Rule;
 - ii. state the reason(s) for the objection;
 - iii. substantiate the objection by setting out the facts, and describing the events, on Which the objection is based, with supporting particulars; and
 - iv. be simultaneously copied to the other Party and the Other Members;
 - b. within 7 days after receiving a notice under sub-paragraph (a) above the objected DAAB Member shall respond to the objecting Party. This response shall be simultaneously copied to the other Party and the Other Members. If no response is given by the DAAB Member within this period of 7 days, the DAAB Member shall be deemed to have given a response denying the matters on which the objection is based;
 - c. within 7 days after receiving the objected DAAB Member's response under subparagraph (b) above (or, if there is no such response, after expiry of the period of 7 days stated in sub-paragraph (b) above) the objecting Party may formally challenge a DAAB member in accordance with Rule 11 below;
 - d. if the challenge is not referred within the period of 7 days stated in subparagraph (c) above, the objecting Party shall be deemed to have agreed to the DAAB Member remaining on the DAAB and shall not be entitled to object and/or challenge him/her thereafter on the basis of any of the facts and/or evidence stated in the notice given under sub-paragraph (a) above;

Rule 11 Challenge Procedure

- 11.1 If and when the objecting Party challenges a DAAB Member, within 21 days of learning of the facts upon which the challenge is based, the provisions of this Rule shall apply. Any challenge is to be decided by the International Chamber of Commerce (ICC) and administered by the ICC International Centre for ADR.

PARTICULAR CONDITIONS (PC)

Part A – Contract Data

Serial No.	Conditions of Contract.	GC/PC Sub-Clause	Data
1.	Country	1.1.21	India
2.	Defects Notification Period	1.1.27, 11.1 and 11.3	60 months from the Commercial opening date of last ropeway line.
3.	Employer	1.1.30	“Employer” replaced with “Authority” Ropeways And Rapid Transport System Development Corporation H.P Limited (RTDC)
4.	Engineer	1.1.35	i. To be announced ii. The Authority may appoint an Independent Engineer in addition to the Engineer to act independently on behalf of RTDC to review all activities of the project.
5.	Section	1.1.76	NIL
6.	Time for Completion	1.1.86	i. 48 months for construction works. ii. 60 months for O&M works from the Commercial Opening Date of the last ropeway line.
7.	The system of electronic transmission	1.3 (a) (ii)	Any integrated information system, e.g., a “Project Management and Information System (PMIS)” etc., acceptable to the Engineer.
8.	The address(’s) for communication	1.3 (d)	The Authority: Ropeways and Rapid Transport System Development Corporation HP Ltd. US Club, Shimla, 171001 (H.P.), India. The Engineer: To be announced The Contractor:

Serial No.	Conditions of Contract.	GC/PC Sub-Clause	Data
			To be included in signed Contract Agreement
9.	Law of the country	1.4	India
10.	The ruling language	1.4	English
11.	Care and Supply of Documents	1.8	Additional number of physical copies: 4 (Properly bound)
12.	Period for giving Notice of errors in Authority's Requirements	1.9	60 days
13.	Limitation of Liability	1.15	110% (One Hundred Ten percent) of the Contract Price).
14.	Right of Access to the Site	2.1	To be announced.
15.	Performance Security	4.2	The Performance Security shall be five percent (5%) of the Accepted Contract Amount, in the currency(ies) and proportions of the Accepted Contract Amount, in the form of a "Bank Guarantee" issued by a Scheduled Bank in India (meaning a bank which is included in the Second Schedule of Reserve Bank of India Act, 1934. In the case of joint venture/consortium, the Performance Security is to be submitted in the name of the JV / Consortium. The Performance Security shall remain valid and enforceable at least six (6) months longer than the anticipated expiry date of Defect Notification Period.
16.	Claims under the Performance Security	4.2.2	The following point (f. and g.) is added under point(e.) f. If it is observed that the actual power consumption is higher than the power consumption guaranteed by the Contractor during the bid, the difference shall be calculated as per Annexure – A, Vol. I (RFP)

Serial No.	Conditions of Contract.	GC/PC Sub-Clause	Data
			and the same shall be recovered. g. If the Contractor fails to pay dues to staff, labour, suppliers and utility agencies, the dues shall be paid directly by the Authority to them and the same shall be adjusted with principal and interest at the rate of current State Bank of India (SBI) Benchmark Prime Lending Rate (BPLR) plus 1%.
17.	Subcontractors	4.4 (a)	The Contractor under no circumstances shall sublet the entire Works. Not more than thirty percent (30%) of the Accepted Contract Amount (excluding the amount for Detailed Design Services and Provisional Sums, if any) shall be subcontracted.
18.	Part of the Works for which subcontracting is not permitted	4.4 (b)	Installation of aerial ropeway as per CEN Standard as per the requirements and standards mentioned in this RFP.
19.	Progress Reports	4.20	Additional number of physical (bound) copies: 4
20.	Working Hours and Inspection	6.5 and 7.3	Normal working hours: day hours However, the Contractor, if required, shall carry out work outside the normal working hours and/or in shifts, unless specifically provided otherwise in the Contract. No increase in rates or extra payments shall be admissible for work outside the normal working hours. The Contractor shall provide adequate lighting, safety arrangements and fulfil other prevailing statutory norms.
21.	Programme	8.3	Additional number of physical copies (bound): 4
22.	Delay Damages	8.8	Refer to the Annexure – 1 to Part A –Contract Data of Particular Conditions.

Serial No.	Conditions of Contract.	GC/PC Sub-Clause	Data
23.	Maximum amount of delay damages	8.8 and 15.2.1 (c)	Ten percent (10%) of the Contract Price.
24.	Adjustments for Changes in Cost	13.7	Refer Part B – Special Provisions, Sub Clause PC 13.7.
25.	Advance Payment	14.2	Five percent (5%) of the Accepted Contract Amount, for mobilisation and design, payable in the currencies and proportions of the Accepted Contract Amount. (A) The Advance Payment shall be paid in two equal instalments, each of two and half percent (2.5%), of the Accepted Contract Amount. i. The first instalment shall be paid upon start of mobilisation process as certified by the Engineer. It shall be paid against an Advance Payment Certificate, under Sub- Clause 14.2.2. ii. Upon satisfactory utilisation of first instalment, the second instalment shall be paid after the Engineer's approval of the Detailed Baseline Programme (GC Sub-clause 8.3). The Contractor shall submit utilisation statement supported or endorsed by certified Chartered Accountant under their seal and stamp. It shall be paid against an Advance Payment Certificate, under Sub-Clause 14.2.2. (B) A maximum of five percent (5%) of the Accepted Contract Amount for the Contractor's Equipment, payable in the currencies and proportions of the Accepted Contract Amount. This advance is payable against the Contractor's Equipment, provided that the Contractor's Equipment have

Serial No.	Conditions of Contract.	GC/PC Sub-Clause	Data
			reached the Site or in the case of new items meant specifically for the work with the confirmed purchase order has been placed and the invoices received. This advance will be given only if the Contractor's Equipment has been purchased for this Contract and not for those which are already in the books of the Contractor. This advance shall be paid towards the Contractor's Equipment as follows: - For New Item: 80% of purchase price as assessed by the Engineer; - for used items in working order: 80% of the depreciated value certified and endorsed by the Contractor's Chartered Accountant in original and as assessed by the Engineer; - Items valued at less than Rs. 10,00,000/- per unit: Not to be considered (C) (The Advance Payment as stated in (A) and (B) above shall be payable against submission of Advance Payment Guarantee in the form of Bank Guarantee equivalent to one hundred and ten percent (110%) of the Advance Payment, in the same currencies and proportions; and shall remain valid initially until the Time for Completion. This Bank Guarantee shall be issued by a Scheduled Bank in India (meaning a bank which is included in the Second Schedule of Reserve Bank of India Act, 1934.
26.	Percentage for commencement of recovery of Advance Payment	14.2.3 (a)	Exceeds twenty percent (20%) of the portion of the Accepted Contract Amount.

Serial No.	Conditions of Contract.	GC/PC Sub-Clause	Data
27.	Repayment amortisation rate of advance payment	14.2.3 (b)	The recovery of advances shall be twenty percent (20%) of the work done amount of each IPC.
28.	Application for Interim Payment	14.3 (b)	Additional number of paper copies: 4
29.	Percentage of Retention	14.3 (iii)	Five percent (5%) from each IPC
30.	Limit of Retention Money	14.3 (iii)	Five percent (5%) of Contract Price
31.	Schedule of Payments	14.4	Refer Appendix 17 - Payment Milestones and Weightages (Vol. – III - Part -1)
32.	Plant and Materials intended for the Works	14.5	List of Plant for payment: NIL List of Materials for payment: NIL
33.	Minimum withholding Amount of Interim Payment Certificates	14.6.2	One percent (1%) of the Contract Price in the currency(ies) and proportions of the Accepted Contract Amount.
34.	Period of Advance Payment	14.7 (a)	Twenty-eight (28) days
35.	Period of Interim Payment	14.7 (b) (i)	For eighty percent (80%) of the amount certified in each IPC: within twenty-eight (28) days and For balance twenty percent (20%) of the amount certified in each IPC: within forty-five (45) days. However, next interim payment shall be made only after one hundred percent (100%) of the preceding amount of IPC has been paid.
36.	Period of Final Payment	14.7 (c)	Ninety (90) days
37.	Final Statement	14.11.1 (b)	Additional number of paper Copies: 4
38.	Currencies of Payment	14.15	In the same currencies and proportions of the Accepted Contract Amount.
39.	Fixed rate of exchange	14.15 (a)	Not Applicable

Serial No.	Conditions of Contract.	GC/PC Sub-Clause	Data
		(i) and (g)	
40.	Currencies of Payment for Delay Damages	14.15 (c)	In the same currencies and proportions of the Accepted Contract Amount.
41.	Maximum amount of deductibles for insurance of the Authority's risks	19.1	NIL
42.	List of risks which shall not be excluded from the insurance arising from Exceptional Events	19.2.1 (iv)	All the Exceptional Events under Sub- Clause 18.1 of the General Conditions.
43.	Insurance to be provided by the Contractor for the Works	19.2.1	100% (One hundred percent) of the Contract Price.
44.	Liability for breach of professional duty	19.2.3, 19.2.3 (a) and 19.2.3 (b)	This Professional Indemnity Insurance (PII) policy shall be valid for five years after date of issue of 'Performance Certificate' or three (3) years after commencement of commercial operation of ropeway whichever is later. Wherever the Contractor submits policy for shorter period / annual renewable policy, the same shall be renewed before its expiry date. In such a situation, the Performance Guarantee shall be retained till required validity period. The Contractor's submission of such shorter period / renewable policy shall be construed as their irrevocable consent for retention of the Performance Guarantee.
45.	Insurance against liability for fitness for purpose	19.2.3 (b)	shall be applicable and included
46.	Injury to persons and damage to property	19.2.4.	Minimum amount of Insurance for injury to persons and damages to property: Indian Rupees ten (10) Lakh for any one incident, with unlimited number of incidents or any amount as per applicable laws,

Serial No.	Conditions of Contract.	GC/PC Sub-Clause	Data
			whichever is higher.
47.	Other insurances required by local practice	19.2.6	All insurances in terms of Clause 19 of General Conditions shall include risks related to relocation/ shifting/ removal of Utilities, including utility owning agency's subcontractor if any (except overhead and underground electric transmission lines above 33kV and tree cutting, relocation or plantation) All the other insurances as per the Laws.
48.	Periods for submission of evidence(s) and relevant policy(ies) of insurance(s):	19.2.7	Evidence(s): Within twenty-eight (28) days from the date of receipt of the Letter of Acceptance. Policy(ies): Within forty-five (45) days from the date of receipt of the Letter of Acceptance.
49.	Time for appointment of DAAB	21.1	28 days
50.	The DAAB shall comprise of	21.1	Three members
51.	List of proposed members of DAAB	21.1	The Authority shall notify the list of proposed members of DAAB, who shall be from retired officers of Government, retired judges and/ or serving or retired Engineers of Government Departments, or of Public Sector Undertakings. The Contractor shall not have any objection for any proposed member of DAAB, so nominated is a serving employee of the Authority, who shall be Director level officer and above.
52.	Appointing entity (official) for DAAB members	21.2	Director of RTDC

Annexure - 1 to Part A - Contract Data

Schedule of Key Dates

The Contractor shall prepare and submit their detailed Programme of Work so as to achieve key dates of various activities on time. The Contractor shall complete the work in a phased manner by fixing priorities to different stretches of work as per the requirement of project from time to time and as per the key dates (milestones) indicated below:

Project Milestone	Day of occurrence of Milestone from date of commencement of work	Description of works to be done (Minimum)	Delay damages for not achieving the Milestone.
I	180 th	- Completion of Temporary works and Barricading. - Setting up of Batching Plants and Establishment of offices and construction depots. - Mobilization of the contractor's team and machinery to the site. - Submission of Baseline program. - Completion of Survey verification, Geotechnical Investigation of all three lines. - Obtaining all mandatory clearances from local authorities to carry out work in Shimla City for all three lines i.e. Red, Green and Bule. RTDC will support/facilitate the Contractor in getting the above permissions. Red line - Completion of Design of permanent Civil Works. - Completion of Design of E&M works and other structural works. - Foundation work of stations to be started.	0.1% of the Contract Price per week of delay or part thereof;

Project Milestone	Day of occurrence of Milestone from date of commencement of work	Description of works to be done (Minimum)	Delay damages for not achieving the Milestone.
II	365 th	Red line • Completion of foundation work of stations up to ground floor. • Completion of foundation work of 50% towers. • Fabrication and supply 50% of towers. • Completion of framed structure of Taradevi, Chakkar, and ZPTH stations. Green Line • Completion of Design of permanent Civil Works. • Completion of Design of E&M works. • Completion of foundation work of ISBT, Railway Station and Old Bus Stand stations up to ground floor level. • Completion of foundation work of all towers falling between ZPTH and Old Bus Stand Station.	0.1% of the Contract Price per week of delay or part thereof; and

Project Milestone	Day of occurrence of Milestone from date of commencement of work	Description of works to be done (Minimum)	Delay damages for not achieving the Milestone.
III	545 th	Red line • Completion of foundation work of 100% towers. • Fabrication and supply of 50% towers. • Erection of 50% towers. • Completion of completion of finishing work of Taradevi, Chakkar, and ZPTH stations. • Erection of 100% towers. Green Line • Fabrication and supply of towers falling between ZPTH and Old Bus Stand Station. • Completion of framed structure of ISBT, Railway Station and Old Bus Stand stations up to ground floor level. • Erection of towers falling between ZPTH and Old Bus Stand Station. • Completion of foundation work up to Ground Floor level of Lift Point and Secretariat Stations. • Completion of foundation work of towers falling between Lift Point and Secretariat. Blue Line • Completion of Design of permanent Civil Works. • Completion of Design of E&M works. • Completion of Foundation work of 103 Tunnel and Victory Tunnel station. • Completion of foundation work of towers falling between ISBT and Victory Tunnel.	0.1% of the Contract Price per week of delay or part thereof; and

Project Milestone	Day of occurrence of Milestone from date of commencement of work	Description of works to be done (Minimum)	Delay damages for not achieving the Milestone.
IV	730 th	Red line • Completion of external development of Taradevi, Chakkar, and ZPTH stations including Road, Earth Retaining Structures, Gondola Parking, Vehicular Parking and Access Path to towers etc. • Erection of Wire Rope. • Installation, Testing and Commissioning of E&M Equipments. • Safety Certification. • Submission of O&M manuals, As Built Drawings and Training of O&M Staff etc. • Safety Certification. • Opening for Public. Green Line • Fabrication and supply of towers falling between Lift Point and Secretariat Station. • Completion of finishing work of ISBT, Railway Station and Old Bus Stand stations. • Completion of framed Structure of Lift Point and Secretariat Stations. • Erection of towers falling between Lift Point and Secretariat. • Supply of E&M Equipments. Blue Line • Completion of framed Structure work of 103 Tunnel and Victory Tunnel station. • Fabrication and supply of towers falling between ISBT and Victory Tunnel. • Erection of towers falling between ISBT and Victory Tunnel. • Completion of Foundation work upto Ground Floor Level of ICR and IGMC station. Completion of foundation work of towers falling between Victory Tunnel and IGMC.	0.2% of the Contract Price per week of delay or part thereof; and

Project Milestone	Day of occurrence of Milestone from date of commencement of work	Description of works to be done (Minimum)	Delay damages for not achieving the Milestone.
V	910 th	Green Line - Completion of finishing work of Lift Point and Secretariate Station. - Completion of external development of ISBT, Railway Station and Old Bus Stand stations and Access Path to towers etc. - Supply of E&M Equipments and wire rope. - Installation of E&M Equipments and Erection of wire rope between ISBT and Old Bus Stand Station. Blue Line - Completion of Finishing work of 103 Tunnel and Victory Tunnel station. - Fabrication and supply of towers falling between Victory Tunnel and IGMC station. - Erection of towers falling between Victory Tunnel and IGMC station. - Completion of framed Structure of ICR and IGMC station. - Completion of foundation work of the Sanjauli and Navbahar Stations upto Ground Floor level. - Completion of Foundation Work of Towers falling between IGMC and Secretariat Station.	0.1% of the Contract Price per week of delay or part thereof; and

Project Milestone	Day of occurrence of Milestone from date of commencement of work	Description of works to be done (Minimum)	Delay damages for not achieving the Milestone.
VI	1090 th	Green Line • Completion of external development of Lift Point and Secretariate Stations and Access Path to towers etc. • Installation of E&M Equipments and Erection of wire rope between Lift Point and Secretariate Stations Station. • Testing and of Ropeway System of green line. • Submission of O&M manuals, As Built Drawings and Training of O&M Staff etc. • Safety Certification. • Opening for Public. Blue Line • Completion of external development work of 103 Tunnel and Victory Tunnel station and Access path to Towers. • Fabrication and supply of towers falling between IGMC and Secretariat Station. • Erection of towers falling between IGMC and Secretariat Station. • Completion of finishing work of ICR and IGMC station. • Completion of framed structure of the Sanjauli and Navbahar Stations upto Ground Floor level.	0.2% of the Contract Price per week of delay or part thereof; and
VII	1270 th	Blue Line • Completion of external development work of ICR and IGMC Station and Access Path to Towers. • Completion of Finishing Work of Sanjauli, Navbahar and Secretariat Stations. • Supply of E&M equipments. • Installation of E&M Equipments and Erection of wire rope between ISBT and Victory Tunnel Station.	0.1% of the Contract Price per week of delay or part thereof; and

Project Milestone	Day of occurrence of Milestone from date of commencement of work	Description of works to be done (Minimum)	Delay damages for not achieving the Milestone.
VIII	1460 th	Blue Line - Completion of external development work of Snajauli and Navbhar Stations Station and Access Path to Towers. - Supply of E&M equipments. - Installation of E&M Equipments and Erection of wire rope between Victory Tunnel and Secertariat Station. - Testing of Ropeway System of Green line. - Safety Certification - Opening for public.	0.2% of the Contract Price per week of delay or part thereof; and

Notes on Key Dates:

1. The achievement of a Key Date shall be subject to the issuing of a Notice of No Objection from the Engineer.
2. The achievement of a Key Date shall require completion of all the works specified for achievement of the Key Date.
3. Particular “Key Date” shall be considered as achieved, if other associated “Key Date(s)” are achieved in accordance with the Programme [Sub-Clause 8.3]. The Engineer’s decision in this regard shall be final and binding to the Contractor.
4. Coordination with relevant designated bodies/ Project Partners and other agencies for achievement of the Key dates shall be the responsibility of the contractor. The Contractor shall also be bound to complete and arrange for shared access or otherwise a part/section/portion of the identified work completion before the actual key date as and when decided by the Engineer.
5. Cost Centre(s) as mentioned for Delay Damages payable due to failure to complete within the Key Date(s) shall be as per Pricing Document.
6. Delay Damages levied may be considered for refunding if other associated “Key Date(s)” are achieved in scheduled timeline.
7. Delay Damages of all the above Key Dates shall be per week (7 calendar days) or part thereof as applicable.
8. For part week, full week will be considered for this purpose.
9. “Weeks” means 7 days.

- 10.** For each Technical Room or area, the finishes required shall be finished to the degree of completeness.

PARTICULAR CONDITIONS (PC)

Part B – Special Provisions Preamble

Special Provisions are numbered with “PC Clause Number” and are to be read in conjunction with the relevant Clause(s) and/or Sub-Clause(s) of General Conditions. For illustration only, PC Clause Number “PC 3.1” shall be read in conjunction with Sub-Clause 3.1 of General Conditions. An entire clause of General Condition is not replaced unless specifically mentioned in this Special Provisions against the relevant Clause.

PC Clause Number	Special Provisions
PC 1.1 Definitions	
	<u>Replace Sub-Clause 1.1.15 with the following:</u> "Contractor's Equipment" means all apparatus, equipment, machinery, construction plant, vehicles and other items required by the Contractor for the execution of the Works. Contractor's Equipment excludes Temporary Works, Plant, Materials and any other things intended to form or forming part of the Permanent Works. <u>Replace Sub-Clause 1.1.33 with the following:</u> "Authority's Requirements" means the document entitled Authority's requirements, as included in the Contract, and any additions and modifications to such document in accordance with the Contract. Such document describes the purpose(s) for which the Works are intended, and specifies Key Personnel (if any), the scope and/or design and/or other performance, technical and evaluation criteria, for the Works. <u>Replace Sub-Clause 1.1.83 with the following:</u> "Tender" or "Bid" means the Letter of Tender, the Contractor's Proposal, the JV Undertaking (if applicable), and all other documents which the Contractor submitted with the Letter of Tender, as included in the Contract. <u>Replace Sub-Clause 1.1.87 with the following:</u> "Unforeseeable" means not reasonably foreseeable by an experienced contractor by the Base Date. Notwithstanding the foregoing, all subsurface physical conditions described in the GBR are deemed to be foreseeable, and all subsurface physical conditions outside the scope of conditions defined in the GBR excluding climatic conditions, are deemed to be Unforeseeable. <u>Following New Sub-Clauses are added as below:</u> 1.1.91 "Bidder" means the entity submitting the Bid.

	1.1.92 “Key Date” means a date identified as such in the Tender Documents after completion of predecessor activities. A Key Date may be extended 1.1.93 by the Engineer/ Authority pursuant to Sub-Clause 8.5 [Extension of Time for Completion]. 1.1.94 “Utility” or “Utilities” means a public utility above or below ground and include all live water mains, water wells, power cables, street lights, transformers, telephone posts, telecommunication cables, sewers, storm water drains, gas pipelines, and any other as mentioned in Authority’s Requirements and the like all which may or may not be shown on the Tender Drawings. 1.1.95 “Above Ground Utilities” means the utilities (as defined in sub-clause 1.1.93 above), which are existing on or above the ground as on the Base Date and may (or may not) be shown on the Tender Drawings. 1.1.95 “Underground Utilities” means the utilities (as defined in sub-clause 1.1.93 above), which are underground, encountered during identification/ execution of the Works and may (or may not) be shown on the Tender Drawings. 1.1.96 “Geotechnical Baseline Report” or “GBR” means the report entitled geotechnical baseline report that describes the subsurface physical conditions to serve as the basis for the execution of the Excavation Works, including design and construction methods, and the reaction of the ground to such methods. 1.1.97 “Geotechnical Data Report” or “GDR” means the report entitled Geotechnical Data Report containing the geological, geotechnical and hydrogeological data deemed to be in the Authority’s possession at the Base Date. 1.1.98 “Underground Works” means all Works located beneath the natural or man-made surface of the earth, including ancillary surface works. 1.1.99 “Excavation” means those parts of the Works required to excavate, temporarily support and secure the space for the Underground Works, including exploratory investigations, preliminary mitigation measures, ground treatment, ground water management, ground support measures, seepage treatment, temporary and ancillary works (all other works that are required to execute the Excavation) (in each case if any).
PC 1.2 Interpretation	

	<i>New point (k), (l) and (m) to Sub-Clause 1.2 added as below:</i> (k) words indicating member(s) or partner(s); in context of JV/ Consortium, shall be interpreted as referring to member(s) of JV/ Consortium. (l) “ancillary surface Works” means surface facilities and Works inherent and necessary to the Underground Works; and (m) “subsurface” excludes shallow excavations for surface Works, such as but not limited to, items of work for Authority’s and Contractor’s site facilities and buried utilities.
PC 1.4 Law and Language	
	<i>Replace the first paragraph:</i> “The Contract shall be governed by the law of the country (or other jurisdiction) stated in the Contract Data (if not stated, the law of the Country), excluding any conflict of law rules.” <i>with</i> “The Contract shall be governed by the law of the country (or other jurisdiction) stated in the Contract Data (if not stated, the law of the Country).”
PC 1.5 Priority of Documents	
	<i>Replace items (a) to (k) in Sub-Clause 1.5 with the following:</i> (a) the Contract Agreement; (b) the Letter of Acceptance; (c) the Letter of Tender (without Appendices); (d) the Addenda, Corrigendum and clarifications; (e) the Particular Conditions of Contract (Part A – Contract Data); (f) the Particular Conditions of Contract (Part B – Special Provisions); (g) the General Conditions of Contract; (h) the Tender Volumes I to IV; (i) the Contractor’s Proposal; and (j) any other document(s) forming part of the Contract Agreement.
PC 1.6 Contract Agreement	

	<u>Replace entire Sub-Clause 1.6 with the following:</u> The Parties shall sign a Contract Agreement within 35 days after the Contractor receives the Letter of Acceptance, unless they agree otherwise. The Contract Agreement shall be based on the form annexed to the Particular Conditions. The costs of stamp duties and similar charges (if any) imposed by law in connection with entry into the Contract Agreement shall be borne by the Contractor. If the Contractor comprises a JV/ Consortium, the authorised representative of each member of the JV/ Consortium shall sign the Contract Agreement simultaneously.
PC 1.13 Compliance with Laws	
	<u>Replace entire Sub-Clause 1.13 with the following:</u> The Contractor shall in performing the Contract, comply with all applicable Laws. The Contractor shall give all notices, pay all taxes, duties and fees, securities and obtain all other permits, permissions, licenses and/or approvals, as required by the Laws in relation to the execution of the Works. The Contractor shall indemnify and hold the Authority harmless against and from the consequences of any failure to do so unless the failure is caused by the Authority's failure to comply with Sub-Clause 2.2 [Assistance]; If the Authority incurs additional costs as a result of the Contractor's failure to comply with the above paragraphs, the Authority shall be entitled subject to Sub-Clause 20.2 [Claims for Payment and/or EOT] to payment of these costs by the Contractor.
PC 1.17 Authority's Right to Inspect	
	<u>New Sub-Clause 1.17 added as below:</u> 1.17 Authority's Right to Inspect 1.17.1 The Contractor shall, whenever required by the Authority and the Authority's Personnel; the Funding Agencies and auditors appointed by either of them, as well as any authority or European Union Institution or body having competence under European Union law, produce or cause to be produced for examination, any quotation, invoice, cost or other account books, vouchers, receipts, letters, memoranda or any copy of or extract from any such documents and also furnish information and returns, as may be required, relating to the execution of this Contract or relevant for verifying or ascertaining the cost of execution of this Contract or ascertaining the Materials supplied by the Contractor are in

	accordance with the Specifications laid down in the Contract. The Authority's decision on the question of relevancy of any documents, information or returns shall be final and binding on the Parties. 1.17.2 If any part or item of the Works is allowed to be carried out by a Subcontractor, assignee or any subsidiary or allied firm, the Authority and the Authority's Personnel; the Funding Agencies and auditors appointed by either of them, as well as any authority or European Union Institution or body having competence under European Union law, shall have power to secure the books of such Subcontractor, assignee or any subsidiary or allied firm through the Contractor, and shall have power to examine and inspect the same. The above obligations are without prejudice to the obligations of the Contractor under any statute, rules or orders.
PC 2.1 Right of Access to the Site	
	<u>Replace entire Sub-Clause 2.1 with the following:</u> The Authority shall give the Contractor right of access to, and possession of, all parts of the Site within the time (or times) stated in the Contract Data. The right and possession may not be exclusive to the Contractor. If, under the Contract, the Authority is required to give (to the Contractor) possession of any foundation, structure, plant or means of access, the Authority shall do so in the time and manner stated in the Authority's. However, the Authority may withhold any such right or possession until the Performance Security has been received. If no such time is stated in the Contract Data, the Authority shall endeavour to give the Contractor right of access to, and possession of, those parts of the Site within such times as may be required to enable the Contractor to proceed in accordance with the Programme or, if there is no Programme at that time, the initial programme submitted under Sub-Clause 8.3 [Programme]. If the Contractor suffers delay as a result of a failure by the Authority to give any such right or possession within such time, the Contractor shall be entitled to only a reasonable extension of time and no monetary claims whatsoever shall be paid or entertained on this account. However, if and to the extent that the Authority's failure was caused by any error or delay by the Contractor, including an error in, or delay in the submission of, any of the applicable Contractor's Documents, the Contractor shall not be entitled to such EOT and/or Cost Plus Profit.
PC 2.2 Assistance	
	<u>Replace the 1st line of Sub-clause 2.2 with the following:</u> If requested 28 days in advance by the Contractor, the Authority shall

	provide reasonable assistance to the Contractor so as to allow the Contractor to obtain at its own cost: Add the following after sub-paragraph 2.2 (b): The Contractor is responsible for the preparation of necessary documents and, if required, explanations to the relevant authorities to get Permits, Licenses or Approvals from the relevant authorities in the approval process.
PC 2.5 Site Data and Items of Reference	
	<u>Replace entire Sub-Clause 2.5 with the following:</u> The Authority shall have made available to the Contractor with the Tender documents such relevant data in Authority's possession on hydrological, sub-surface conditions, climatic and environmental conditions at the Site and adjacent property, and on the preliminary geological, geotechnical and hydrogeological data of the subsurface of the Site. The accuracy or reliability of the data/studies/reports and of any other information supplied at any time by the Authority or Engineer is not warranted with respect to the viability of his design and execution of Works and the Contractor shall be responsible for interpreting all such data. The Contractor is advised to conduct further investigations considered necessary by him at his own cost and any error, discrepancies if found in Authority's data at any stage will not constitute ground for any claim for extra time and costs. The original survey control points, lines and levels of reference are specified in the Authority's Requirements. The Authority shall have no liability in connection with any Claim, and the Contractor shall have no Entitlement, arising out of, or in connection with this provision of this survey data.
PC 2.6 Authority Supplied Materials and Authority's Equipment	
	<u>Replace first paragraph of Sub-Clause 2.6 with the following:</u> The Authority shall not provide any Authority-Supplied Materials or Authority's Equipment under the Contract.
PC 3.2 Engineer's Duties and Authority	
	<u>Add following at the end of Sub-Clause 3.2:</u> The following provisions shall apply: The Engineer shall obtain the specific approval of the Authority before taking action under the following Sub-Clauses of these Conditions: (a) Sub-Clause 3.4: Delegation by the Engineer, (b) Sub-Clause 4.4: Subcontractors and suppliers in accordance with PC Sub-Clause 4.4,

	(c) Sub-Clause 8.5: Extension of Time for Completion, (d) Sub-Clause 8.8: Delay Damages, (e) Sub-Clause 8.9: Authority's Suspension, (f) Sub-Clause 8.12: Prolonged Suspension, (g) Sub-Clause 10.1: Taking Over of the Works and Sections, (h) Sub-Clause 11.9: Performance Certificate, (i) Sub-Clause 13.1: Instructing a Variation, except in an emergency situation as determined by the Engineer, (j) Sub-Clause 13.3: Approving a proposal for Variation submitted by the Contractor in accordance with Sub Clause 13.1 or 13.2 (k) Sub-Clause 13.4: instructing use of Provisional Sums, (l) Sub-Clause 13.5: instructing a Variation on day work basis, or (m) Sub-Clause 14.13: Issue of Final Payment Certificate. (n) Any matter having financial effect on the Contract Price other than listed above (from (a) to (m)). Notwithstanding the obligation, as set out above, to obtain approval, if, in the opinion of the Engineer, an emergency occurs affecting the safety of life or of the Works or of adjoining property, the Engineer may, without relieving the Contractor of any of his duties and responsibility under the Contract, instruct the Contractor to execute all such work or to do all such things as may, in the opinion of the Engineer, be necessary to abate or reduce the risk. The Contractor shall forthwith comply, despite the absence of approval of the Authority, with any such instruction of the Engineer. The Engineer shall determine an addition to the Contract Price, in respect of such instruction, in accordance with Clause 13 and shall notify the Contractor accordingly, with a copy to the Authority.
PC 3.7.2 Engineer's Determination	
	The Engineer shall make a fair determination of the matter or Claim, in accordance with the Contract, taking due regard of all relevant circumstances with prior approval from the Authority. Within the time limit for determination under Sub-Clause 3.7.3 [Time limits], the Engineer shall give a Notice to both Parties of his/her determination. This Notice shall state that it is a "Notice of the Engineer's Determination" and shall describe the determination in detail with reasons and detailed supporting particulars.
PC 4.1 Contractor's General Obligations	

	<u>Replace fourth paragraph of Sub-Clause 4.1</u> The Contractor shall be responsible for the adequacy, stability and safety of all the Contractor's operations and activities, of all methods of construction and of all the Works. <u>with</u> The Contractor shall be responsible for the adequacy, stability and safety of all the Contractor's operations and activities, of all methods of construction and of all the Works, and shall take whatever measures are necessary for timely progress of Works in accordance with the Contract. The Contractor shall submit to the Engineer on a daily basis their interpretation of the subsurface and surface monitoring results, if any.
PC 4.2 Performance Security	
	<u>Replace first sentence of first paragraph of Sub-Clause 4.2.1</u> “The Contractor shall deliver the Performance Security to the Authority, with a copy to the Engineer, within 28 days after receiving the Letter of Acceptance.” <u>with</u> “The Contractor shall deliver the Performance Security to the Authority, with a copy to the Engineer, within 14 days after receiving the Letter of Acceptance.” And “The Performance Guarantee for the quoted Operation and Maintenance Cost shall be submitted separately at least 90 days prior to the start of Operation and Maintenance works.” <u>Add following new Sub-Clause 4.2.4 at the end of Sub-Clause 4.2:</u> 4.2.4 Guarantees and Warranties In the case, the Contractor (or any member of the JV/ Consortium as applicable) is/are subsidiary company of their parent company, within 30 days after receiving the Letter of Acceptance, the Contractor shall submit to the Authority: (a) An undertaking in the approved format (as provided in Schedule 2) from a Parent Company, the identity of which shall have been submitted in writing to the Authority prior to acceptance of the Tender and against which the Authority shall have raised no objection. (b) A written guarantee in the approved format (as provided in Schedule 3) from a Parent Company, the identity of which shall have been submitted in writing to the Authority prior to acceptance of the Tender and against which the Authority shall have raised no objection.

	In the event that the Contractor shall comprise two or more members, corporations acting in partnership, joint venture, consortium or otherwise each such member or corporation shall submit a Parent Company Undertaking and Guarantee. Notwithstanding any other provision of the Contract: (i) submission by the Contractor of the requisite Performance Security, Parent Company Undertakings and Guarantees shall be condition precedent to the Contractor's entitlement to any payment, under the Contract; and (ii) failure by the Contractor to provide a Performance Security or Parent Company Undertakings or Parent Company Guarantees shall entitle the Authority either to suspend the Works or to terminate the Contract forthwith by notice in writing to that effect, notwithstanding that the Contractor may have been permitted to proceed with the Works, and the Contractor shall not be entitled to any compensation whatsoever as a consequence of such suspension or termination. (c) Contractor's warranty: The Contractor shall be fully responsible, for the suitability, adequacy, integrity, durability and practicality of the Contractor's proposal for which Contractor is required to submit warranty(ies) for Contractor's Warranty and/or Sub-Contractor's Warranty (as the case may be), in the approved format as provided in Schedule 4 and Schedule 5. These applicable Warranties should be made available at the time of signing of the Contract Agreement.
PC 4.4 Sub-Contractors	
	<u>Replace third paragraph of Sub-Clause 4.4</u> "The Contractor shall obtain the Engineer's prior consent to all proposed Subcontractors, except: (i) suppliers of Materials; or (ii) a subcontract for which the Subcontractor is named in the Contract." <u>with</u> "The Contractor shall obtain the Engineer's prior consent to all proposed Subcontractors, except: (i) suppliers of materials which are in accordance with makes specified in the Contract; or (ii) a subcontract for which the Subcontractor is/are proposed in the

	Contract; or a subcontract (or subcontracts of similar nature of work to same subcontractor in aggregate) which is valued up to India Rupees five million.” <u>Replace last sentence of fourth paragraph of Sub-Clause 4.4:</u> “If the Engineer does not respond within 14 days after receiving this submission (or further information if requested), by giving a Notice objecting to the proposed Subcontractor, the Engineer shall be deemed to have given his/her consent.” with “If the Engineer does not respond within 28 days after receiving this submission (or further information if requested), by giving a Notice objecting to the proposed Subcontractor, the Engineer shall be deemed to have given his/her consent.” <u>Add following at the end of Sub Clause 4.4:</u> The Contractor under no circumstances shall sublet the entire Works. No more than fifty percent (50%) of the Accepted Contract Amount (excluding the amount for Detailed Design Services and Provisional Sums; if any) shall be subcontracted. The value of a sub-contract, other than for Design work and Provisional Sums items, should be confirmed by the Contractor to the Engineer. For each submittal the Contractor shall certify the cumulative value of the sub- contracts awarded to date is within the limit as stated above. A copy of the Contract between the Contractor and sub-contractor shall be submitted to the Engineer within 15 days of signing, and this shall be a minimum of seven days before work commences on site. The Contractor shall not carry any modification to the sub-contract without the consent in writing of the Engineer. The Contractor shall submit a copy of the contract agreement entered with the designer, if not part of the JV/ Consortium/ entity. The terms and conditions of sub-contracts and the payments that are made to all sub-contractors and suppliers shall be the sole responsibility of the Contractor. Payments to be made to such sub-contractors and suppliers will be deemed to have been included in the Contract Price. For major sub-contracts (valued over Rs. five million) with respect to sub-paragraph (ii) above (i.e. other than a subcontract for which the Subcontractor is named in the Contract), the Contractor shall obtain consent of the Engineer. The Engineer will give his consent or rejection after assessing and satisfying himself of the capability, experience and equipment resources of the sub-contractor. In case the Engineer intends to withhold his consent, he shall inform the Contractor within 28 days to enable him to make alternative arrangements to fulfil his programme. The Contractor shall provide sufficient superintendence, whether on the site or

	elsewhere, to ensure that all work carried out by a sub-contractor complies with the Authority's Requirements. The proposed sub-contract terms and conditions shall impose on the sub-contractor such terms of the Contract as are applicable and appropriate to the Works to be sub-contracted. The Engineer shall have full authority to instruct the removal of any sub-contractor from the Project for non-performance. If obligations of any Subcontractor or material/ equipment supplier or consultant, extend beyond the expiry date of Defects Notification Period then the Contractor shall assign the benefits of such obligations to the Authority. The Contractor shall submit to the Authority warranty (or warranties) in the approved format (as provided in Schedule 5) from the Subcontractor(s), vendor(s) and/or any other agencies (as the case may be).
PC 4.5 Nominated Subcontractors	
	<u>Entire Sub-Clause 4.5 is deleted.</u>
PC 4.6 Co-operation	
	<u>Replace the last paragraph of Sub-Clause 4.6</u> "If the Contractor suffers delay and/or incurs Cost as a result of an instruction under this Sub-Clause, to the extent (if any) that co-operation, allowance of opportunities and coordination was Unforeseeable having regard to that specified in the Authority's Requirements, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to EOT and/ or payment of such Cost Plus Profit." <u>with</u> "If the Contractor suffers delay and/or incurs Cost as a result of an instruction under this Sub-Clause, to the extent (if any) that co-operation, allowance of opportunities and coordination was though unforeseeable having regard to that specified in the Authority's Requirements, the Contractor shall not be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to EOT and/ or payment of such Cost Plus Profit."
PC 4.7 Setting Out	
	The Contractor shall set out the Works in relation to the items of reference under PC Sub-Clause 2.5 [Site Data and Items of Reference]. 4.7.1 Accuracy a. verify the accuracy of all these items of reference before they are used for the Works;

	b. promptly deliver the results of each verification to the Engineer; c. rectify any error in the positions, levels, dimensions or alignment of the Works; and d. be responsible for the correct positioning of all parts of the Works. e. All proactive measures to avoid any errors during TBM driving. <i>Sub-Clauses 4.7.2 and 4.7.3 are deleted.</i>
PC 4.8 Health and Safety Obligations	
	<i>Replace the second paragraph of Sub-Clause 4.8</i> “Within 21 days of the Commencement Date and before commencing any construction on the Site, the Contractor shall submit to the Engineer for information a health and safety manual which has been specifically prepared for the Works, the Site and other places (if any) where the Contractor intends to execute the Works. This manual shall be in addition to any other similar document required under applicable health and safety regulations and Laws.” <i>with</i> “Within 28 days of the Commencement Date and before commencing any construction on the Site, the Contractor shall submit to the Engineer for information a health and safety manual which has been specifically prepared for the Works, the Site and other places (if any) where the Contractor intends to execute the Works. This manual shall be in addition to any other similar document required under applicable health and safety regulations and Laws.”
PC 4.10 Use of Site Data	
	<i>Add following after Sub Clause 4.10 (e):</i> (f) Geological, hydrological and climatic conditions and effects of climatic conditions at the site. (g) the risk of injury or damage to property adjacent to the Site and to the occupiers of such property or any other risk. The Geotechnical and other related data provided by the Authority are based on an investigation conducted by the Authority and are for reference purposes only. The Tenderer should satisfy himself with the data furnished and make his own investigations if required before submitting his offer. If any change in the Geotechnical and other related data provided by the Authority, design or construction methodology occurs later during execution, the cost of this change will be borne by the Contractor.

	The Contractor shall not be relieved from any risk or obligation imposed on or undertaken by him under the Contract on any such ground that he did not or could not foresee any matter which may affect or have affected the execution of the Works, or compliance with the Authority's Requirements.
PC 4.12 Unforeseeable Physical Conditions	
	<u>Replace entire Sub-Clauses 4.12 with the following:</u> In this Sub-Clause, "physical conditions" means natural physical conditions and physical obstructions (natural or man-made) and pollutants, which the Contractor encounters at the Site during execution of the Works, including sub-surface and hydrological conditions but excluding climatic conditions at the Site and the effects of those climatic conditions. The Authority makes no representations or warranties of any type regarding the physical conditions at the Site. Any information provided by the Authority to the Contractor regarding the physical conditions at the Site shall be interpreted and verified by the Contractor. The Contractor bears the entire risk of any and all physical conditions at the Site. The Contractor represents and warrants to the Authority that it has fully assessed all possible physical conditions and has priced and allowed for their risks, if any, in the Accepted Contract Amount. If the Contractor encounters physical conditions which he considers to have been Unforeseeable, the Contractor shall give notice to the Engineer as soon as possible. This notice shall describe the physical conditions, so that these can be inspected by the Engineer (subject to the Safety of access) and shall confirm the reasons why the Contractor considers them to be Unforeseeable. The Contractor shall continue executing the Works, until such time proper and reasonable measures as are appropriate for the physical conditions. The Contractor shall if so required comply with any instructions issued by the Authority or the Engineer.
PC 4.13 Right of Way and Facilities	
	<u>Replace entire Sub-Clause 4.13 with the following:</u> The Contractor shall bear all costs and charges for special and/or temporary rights-of-way which may be required for the purposes of the Works, including those for access to the Site. Any tax(es) and lease rent if applicable for the land provided by the Authority outside the construction ROW (except logistics area) shall be recovered from

	the Contractor. The Contractor shall also obtain, at the Contractor's risk and cost, any additional facilities outside the Site which may be required for the purposes of the Works.
PC 4.15 Access Route	
	<u>Replace the last paragraph of Sub-Clause 4.15</u> “To the extent that non-suitability or non-availability of an access route arises as a result of changes to that access route by the Authority or a third party after the Base Date, and as a result the Contractor suffers delay and/or incurs Cost, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to EOT and/or payment of such Cost.” <u>with</u> “All operations for the execution of the Works shall be carried out so as not to interfere unnecessarily with the convenience of the public or the access to public or private roads or footpaths or properties owned by the Authority or by any other person. The Contractor shall select routes and choose and use vehicles so that movement of Contractor's Equipment, Plant and Materials to and from the Site is limited so that traffic is not delayed, and damage to highways and bridges is prevented. If there is any delay, damage or injury, the cost of rectification or reconstruction of highways or bridges shall be borne by the Contractor. The Contractor shall indemnify the Authority in respect of all claims, demands, proceedings, damages, costs, charges and expenses whatsoever arising out of or in relation to any such matters. If during the execution of the Works the Contractor receives any claim arising out of the execution of the Works in respect of damage to highways or bridges, he shall immediately report the facts to the Engineer. The Contractor shall negotiate a settlement in respect of such claims and indemnify the Authority in respect of all claims, proceedings, damages, costs, charges and expenses in relation thereto.”
PC 4.17 Contractor's Equipment	

	<u>Replace the first paragraph of Sub-Clause 4.17</u> “The Contractor shall be responsible for all Contractor's Equipment. When brought on to the Site, Contractor's Equipment shall be deemed to be exclusively intended for the execution of the Works. The Contractor shall not remove from the Site any major items of Contractor's Equipment without the Engineer's consent. However, consent shall not be required for vehicles transporting Goods or Contractor's Personnel off Site.” <u>with</u> “The Contractor shall be responsible for all Contractor's Equipment. When brought on to the Site, Contractor's Equipment and Temporary Works shall be deemed to be exclusively intended for the execution of the Works. The date of delivery to the Site of each item of the Contractor's Equipment, and the duration of its presence on the Site, shall be consistent with the Completion Schedule. The Contractor shall not remove from the Site any major items of Contractor's Equipment and/or Temporary Works without the Engineer's consent. However, consent shall not be required for vehicles transporting Goods or Contractor's Personnel off Site.”
PC 4.18 Protection of the Environment	
	<u>Replace Sub-Clause 4.18 (b) as below:</u> “(b) comply with the environmental impact statement for the Works (if any); and” <u>with</u> “(b) comply with the environmental impact assessment for the Works (if any); and” <u>Add following at the end of Sub Clause 4.18:</u> The Contractor shall comply with the Authority's Requirements set out in Volume - III APPENDIX 20. The Contractor's Outline Environmental Action Plan shall confirm the Contractor's proposed means of complying with his obligations in relation to environmental management.
PC 4.20 Progress Reports	
	under a Sub-Clause of these Conditions The Contractor shall issue to the Engineer (in a format acceptable to the Engineer) a weekly report before 10am on the first day of the following week which shall include a 15-day look-ahead programme.

	The Contractor shall issue to the Engineer including but not limited to Contractor's Personnel and Contractor's Equipment mobilised at Site (in a format acceptable to the Engineer) a daily report before 10am the following working day.
PC 4.21 Security of the Site	
	<u>Add following at the end of Sub-Clause 4.21:</u> (c) The Contractor shall be responsible for the Security of the Site in his possession. The Contractor shall take all measures necessary to ensure such security, including exercising control over all persons and vehicles which are employed or engaged on the Site or in connection with the Works. (d) The Contractor shall arrange the issue of passes for the admission of all persons and vehicles to the Site. If required by the Engineer, the Contractor shall submit a list identifying all persons to whom passes have been issued together with two photographs of each person. (e) Site entry shall be restricted through authorised gates. The Contractor shall provide complete 24/7 Site security and provide such fencing, barricades etc. as are necessary to prevent any unauthorized access to persons or vehicles to the Site. The Contractor shall ensure that all suppliers and subcontractors vehicles supplying goods to the Site comply with the Contractor's security protocols.
PC 4.22 Contractor's Operations on Site	
	<u>Add following at the end of Sub-Clause 4.22:</u> For the purposes of this Sub-Clause only, "Site" shall include off-Site places of manufacture or storage and the Contractor's Work Areas and shall include areas provided to the Contractor by others. All work-sites required by the Contractor outside the Right-of-Way (ROW) shall require approvals of relevant parties, and the Authority may support the Contractor to obtain such approvals without any cost and time implications to the Authority.
PC 4.23 Archaeological and Geological Findings	
	<u>Replace the last paragraph of Sub-Clause 4.23</u> "If the Contractor suffers delay and/or incurs Cost from complying with the Engineer's instructions, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to EOT and/or payment of such Cost." <u>with:</u>

	“If the Contractor suffers delay and/or incurs Cost from complying with the Engineer's instructions, the Contractor shall not be entitled to EOT and/or payment of such Cost.”
PC 5.1 General Design Obligations	
	<u>Replace entire Sub-Clauses 5.1 with the following:</u> The Contractor shall carry out, and be responsible for, the design of the Work to the extent specified in the Authority's Requirements, and, where applicable, in accordance with the Geotechnical Baseline Report. Design shall be prepared by designers who: - are engineers or other professionals, qualified, experienced and competent in the disciplines of the design for which they are responsible; - comply with the criteria (if any) stated in the Authority's Requirements; and - are qualified and entitled under applicable Laws to design the Works. Unless otherwise stated in the Authority's Requirements, the Contractor shall submit to the Engineer for consent the name, address, detailed particulars and relevant experience of each proposed designer/design Subcontractor. The Contractor warrants that the Contractor, the Contractor's designers and design Subcontractors have the experience, capability and competence necessary for the design. The Contractor undertakes that the designers and design Subcontractors shall be available to attend discussions with the Engineer and/or the Authority at all reasonable times (on or off the Site), until the issue of the Performance Certificate. The Contractor shall furnish Designer's Warranty in favour of the Authority, as per the approved format (as provided in Schedule 6) at the time of signing of the agreement. The Contractor shall appoint the designer in accordance with Sub-clause 1.4 of Authority's Requirements. - The design of all civil structures must undergo thorough proof checking by any Indian Institute of Technology (IIT). Similarly, designs for all ropeway systems must undergo rigorous proof checking conducted by a CEN certified engineer or firm before submission to the engineer for approval. This ensures that both civil structures and ropeway systems meet the required standards of safety and performance before implementation.
PC 5.2.2 Review by Engineer	
	<u>Replace entire Sub-Clauses 5.2.2 with the following:</u> “In this Sub-Clause 5.2.2: “Review Period” for designs that are on the critical path shall not exceeding

	28 days and for designs and other submittals that are not on the critical path; as defined in the Programme; means a reasonable period so as not to delay the progress of the Works, or as otherwise stated in the Authority's Requirements, calculated from the date on which the Engineer receives a Contractor's Document and a Contractor's Notice; • "Contractor's Document" excludes any of the Contractor's Documents which are not specified in the Authority's Requirements or these Conditions as being required to be submitted for Review, but includes all documents on which a specified Contractor's Document relies for completeness; and • "Contractor's Notice" means the Notice which shall state that the relevant Contractor's Document is considered by the Contractor to be ready for Review under this Sub-Clause 5.2.2 and for use, and that it complies with the Authority's Requirements and these Conditions, or the extent to which it does not do so. If the Authority's Requirements or these Conditions specify that a Contractor's Document is to be submitted to the Engineer for Review, it shall be submitted accordingly, together with a Contractor's Notice. The Engineer shall, within the Review Period, give a Notice to the Contractor as follows: a. Statement of No-Objection (SONO); or b. Statement of No-Objection with Comments (NOWC) (concerning minor matters which will not substantially affect the Works); or c. that the Contractor's Document fails (to the extent stated) to comply with the Authority's Requirements and/or the Contract, with reasons. If the Engineer gives no Notice within the Review Period, the Engineer shall be deemed to have given a Notice of No-objection to the Contractor's Document (provided that all other Contractor's Documents on which that Contractor's Document relies (if any) have been given, or are deemed to have been given, a Notice of No-objection). If the Engineer instructs that further Contractor's Documents are reasonably required to demonstrate that the Contractor's design complies with the Contract, the Contractor shall prepare and submit them promptly to the Engineer at the Contractor's cost. If the Engineer gives a Notice under sub-paragraph (b) or (c) above, the Contractor shall: i. revise the Contractor's Document; ii. resubmit it to the Engineer for Review in accordance with this Sub-Clause 5.2.2, and the Review Period shall be calculated from the date that the

	Engineer receives it; and iii. not be entitled to EOT for any delay caused by any such revision and resubmission and/or by subsequent Review by the Engineer. If the Authority incurs additional costs as a result of such resubmission and subsequent Review, the Authority shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment by the Contractor of the costs reasonably incurred.
PC 6.4 Labour Laws	
	<u>Add following at the end of Sub Clause 6.4:</u> The Contractor shall make himself aware of all the Laws related to Labour and must fully comply with the provisions of all relevant Laws. The major applicable Laws (as amended from time to time) includes but are not limited to the following: Workmen Compensation Act 1923 Payment of Gratuity Act 1972 Employees P.F. and Miscellaneous Provision Act 1952 Maternity Benefit Act 1951 Contract Labour (Regulation & Abolition) Act 1970 Minimum Wages Act 1948 Payment of Wages Act 1936 Equal Remuneration Act 1979 Payment of Bonus Act 1965 Industrial Disputes Act 1947 Industrial Employment (Standing Orders) Act 1946 Trade Unions Act 1926 Child Labour (Prohibition & Regulation) Act 1986 Inter-State Migrant workmen's (Regulation of Employment & Conditions of Service) Act 1979 The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act 1996 and the Cess Act of 1996 Factories Act 1948 Employees State Insurance ESI Act, 1948. In addition to the above, the Contractor must comply with any other applicable

	statutory requirement concerned with Labour engagement and welfare, in the jurisdiction of relevant authority where the Works are to be carried out.
PC 6.6 Facilities for Staff and Labour	
	<u>Add following at the end of Sub Clause 6.6:</u> The Contractor shall obtain prior permission from the Authority (at his sole discretion) for any accommodation and welfare facilities for the Contractor's personnel including labour camps within the areas arranged by the Contractor.
PC 7.4 Testing by the Contractor	
	<u>Replace the fifth paragraph of Sub-Clause 7.4</u> "The Engineer shall give a Notice to the Contractor of not less than 72 hours of his/her intention to attend the tests. If the Engineer does not attend at the time and place stated in the Contractor's Notice under this Sub-Clause, the Contractor may proceed with the tests, unless otherwise instructed by the Engineer, which tests shall then be deemed to have been made in the Engineer's presence. If the Contractor suffers delay and/or incurs Cost from complying with any such instruction or as a result of a delay for which the Authority is responsible, the Contractor shall be entitled subject to Sub- Clause 20.2 [Claims for Payment and/or EOT] to EOT and/or payment of Cost Plus Profit." <u>with:</u> "The Engineer shall give a Notice to the Contractor of not less than 72 hours of his/her intention to attend the tests. If the Engineer does not attend at the time and place stated in the Contractor's Notice under this Sub-Clause, the Contractor may proceed with the tests, unless otherwise instructed by the Engineer, which tests shall then be deemed to have been made in the Engineer's presence."
PC 7.7 Ownership of Plant and Materials	
	<u>Add the following at the end of this Sub-Clause 7.7:</u> "The Plant and Materials not finally taken over by the Authority as per GCC Sub-Clause 10, but payment against which have been made in part or full shall remain under the Contractor's custody. The Contractor shall be responsible for its safety and shall bear all the risks in respect of such items till the time it is taken over by the Authority."
PC 8.1 Commencement of Works	
	<u>Replace the first paragraph of Sub-Clause 8.1</u> "The Engineer shall give a Notice to the Contractor stating the Commencement

	Date, not less than 14 days before the Commencement Date. Unless otherwise stated in the Particular Conditions, the Commencement Date shall be within 42 days after the Contractor receives the Letter of Acceptance.” <u>with:</u> “Unless otherwise stated in the Letter of Acceptance, the Engineer shall give a Notice to the Contractor stating the Commencement Date, not less than 14 days before the Commencement Date. Unless otherwise stated in the Particular Conditions, the Commencement Date shall be within 42 days after the Contractor receives the Letter of Acceptance.”
PC 8.2 Time for Completion	
	<i>Add new Sub-Clause 8.2.1 at the end of Sub-Clause 8.2</i> (a) The Contractor shall complete those parts of the Works, which are subject to Key Dates as specified in “Annexure-1” of PC Part-A, Contract Data of this Contract. Those parts of the Works subject to Key Dates shall be completed to a state whereby any Interfacing Contractor can immediately commence his works without the need to make any change, addition or modification to the Contractor’s Works. (b) The Contractor may apply, by Notice to the Engineer for Key Date achievement certificate for a Key Date not earlier than 14 days before the part of the works which are subject to the Key Date will, in the Contractor’s opinion, be complete. The Engineer acting reasonably within 28 days of receiving this Notice of application: (i) <u>Issue</u> a Key Date achievement certificate to the Contractor confirming the date on which any part of the Works subject to a Key Date is completed in accordance with the requirements of the Contract; or (ii) The Engineer may reject the application, giving reasons and specifying the work required to be completed and defects required to be remedied by the Contractor to enable the Key Date achievement Certificate to be issued. The Contractor shall then complete the work referred to in (ii) above before issuing a further application for Notice of No Objection from the Engineer. (c) The Contractor shall give written notice to the Engineer as soon as he can reasonably foresee an event occurring which is liable to cause any delay in the achievement of a Key Date. Such notice, which may, if applicable, be combined with a notice given in regard to the Works or any Section in

	accordance with Clause 8.4 <i>[Advance Warning]</i> of the General Conditions. However, such notice shall not in any event be given later than 28 days after the commencement of such an event which is liable to cause delay to the Key Date.
PC 8.3 Programme	
	<u>Replace the third paragraph of Sub-Clause 8.3</u> “The Engineer shall Review the initial programme and each revised programme submitted by the Contractor and may give a Notice to the Contractor stating the extent to which it does not comply with the Contract or ceases to reflect actual progress or is otherwise inconsistent with the Contractor’s obligations. If the Engineer gives no such Notice: • within 21 days after receiving the initial programme; or • within 14 days after receiving a revised programme, the Engineer shall be deemed to have given a Notice of No-objection and the initial programme or revised programme (as the case may be) shall be the Programme.” <u>With;</u> “The Engineer shall Review the initial programme and each revised programme submitted by the Contractor and may give a Notice to the Contractor stating the extent to which it does not comply with the Contract or ceases to reflect actual progress or is otherwise inconsistent with the Contractor’s obligations. If the Engineer gives no such Notice: • within 28 days after receiving the initial programme; or • within 21 days after receiving a revised programme, the Engineer shall be deemed to have given a Notice of No-objection and the initial programme or revised programme (as the case may be) shall be the Programme.”
PC 8.5 Extension of Time for Completion	
	<u>Replace entire Sub-Clause 8.5 with following:</u> The Contractor shall be entitled subject to Sub-Clause 20.2 [Claims for Payment and/or EOT] to Extension of Time if and to the extent that completion for the purposes of Sub-Clause 10.1 [Taking Over the Works and Sections] is or will be delayed by any of the following causes: (a) a Variation (except that there shall be no requirement to comply with Sub-Clause 20.2 [Claims For Payment and/or EOT]);

	(b) a cause of delay giving an entitlement to EOT under a Sub-Clause of these Conditions; When determining each EOT under Sub-Clause 20.2 [Claims for Payment and/or EOT], the Engineer shall review previous determinations under Sub-Clause 3.7 [Agreement or Determination] and may increase, but shall not decrease, the total EOT. If a delay caused by a matter which is the Authority's responsibility is concurrent with a delay caused by a matter which is the Contractor's responsibility, the Contractor's entitlement to EOT shall be assessed in accordance with the rules and procedures stated in the Special Provisions (if not stated, as appropriate taking due regard of all relevant circumstances). In order for the Engineer to determine the amount of an extension, no later than 28 days after the Contractor gives the notice required by Sub-Clause 8.5, the Contractor shall Submit a "Time Impact Analysis" for adjustment of the Time for Completion. Each Time Impact Analysis shall define the extent of adjustment and the basis thereof in a form acceptable to the Engineer, and include; (c) any delay, impediment or prevention caused by or attributable to the Authority, the Authority's Personnel, or the Authority's other contractors on the Site; (d) factual events, cause and effect, and activities that materially affect the critical path of the Works; (e) identification of activities which will require change; (f) an analysis of how float or other measures have been used to minimise the additional time required; (g) any appropriate additional supporting information The Time Impact Analysis shall indicate the date(s) when any extra or additional work or other special circumstances occurred, the status of the work at that time, and the resultant impact on the Time for Completion. The Time Impact Analysis shall form an integral part of the relevant application for any extension of Time for Completion pursuant to Sub-Clause 8.5 (Extension of Time for Completion). If the Contractor fails to submit the Time Impact Analysis within the time period stipulated, the Time for Completion shall not be extended, no adjustment to the Contract Price shall be made and the Contractor shall have no Entitlement. The Contractor shall not be Entitled to any extension of time where the instructions or acts of the Authority or the Engineer are necessitated by or intended to cure any default of or breach of Contract by the Contractor, or where

	any delay is due to; (h) the failure of a sub-contractor, to commence or to carry out work in due time, (i) non-availability, or shortage of Contractor's equipment, labour, utility services, Plant and Materials, (j) inclement weather conditions.
PC 8.6 Delays Caused by Authorities	
	<u>Replace entire Sub-Clause 8.6 with following:</u> "If: a. the Contractor has diligently followed the procedures laid down by the relevant legally constituted public authorities (excluding public/ private utility entities, utility owning agencies/ authorities) in the Country; b. these authorities or entities delay or disrupt the Contractor's work evidently; and c. the delay or disruption was Unforeseeable, then this delay or disruption will be considered as a cause of delay under sub-paragraph (b) of Sub-Clause 8.5 [Extension of Time for Completion]." In the above cases the Contractor shall give notice to the Engineer whenever the works are likely to be delayed or disrupted for delay caused by authorities, reasonably in advance and/or within 7 days of suffering such delay as advance warning under Sub-Clause 8.4 [Advance Warning].
PC 8.10 Consequences of Authority's Suspension	
	<u>Add the following at the end of Sub-Clause 8.10:</u> The Contractor shall not be entitled to EOT and claim extra cost (if any) incurred by him during the period of suspension of Work, if such suspension is, a. provided for in the Contract, or b. such suspension is necessary for the safety of Works or any part thereof, or c. such suspension is necessary for the safety of adjoining public or other property or safety of the public or workmen or those who have to be at the site, or d. to ensure safety and to avoid disruption of traffic and utilities, as also to permit fast repairs and restoration of any damaged utilities.
PC 13.3.2 Variation by Request for Proposal	
	<u>Replace the last paragraph of Sub-Clause 13.3.2</u>

	“If the Engineer does not give consent to the proposal, with or without comments, and if the Contractor has incurred Cost as a result of submitting it, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment of such Cost.” <u>With;</u> “If the Engineer does not give consent to the proposal, with or without comments, and if the Contractor has incurred Cost as a result of submitting it, the Contractor shall not be entitled to payment of such Cost.”
PC 13.6 Adjustments for Changes in Laws	
	<i>Replace entire Sub-Clause 13.6 with following:</i> 13.6 Adjustments for Changes in Laws and Taxes Subject to the following provisions of this Sub-Clause, the Contract Price shall be adjusted to take account of any increase or decrease in Cost resulting from a change in: (a) any new tax which is imposed on Composite Works Contracts applicable on Urban Transportation Project; and (b) change in the rate of Goods & Service Tax (GST) and/or Custom Duty on Composite Works Contracts applicable on Urban Transportation Project as per GST Act. made and/or officially published after the Base Date, which affect the Contractor in the performance of obligations under the Contract. In this Sub-Clause “change in Taxes” means any of the changes under sub-paragraphs (a) and/or (b) above. If the Contractor incurs an increase in Cost as a result of any change in Taxes, the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to payment of such Cost, up to the Time for Completion. However, the Contractor shall not be entitled for any increase in Cost as a result of any change in Taxes, if the EOT is granted on account of any Contractor’s default. If there is a decrease in Cost as a result of any change in Taxes, the Authority shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to a reduction in the Contract Price, up to the Time for Completion (including all EOT, if any). Any other changes (except on account of sub-paragraphs (a) and/or (b) above) in existing taxes/new taxes (also including any royalties, levies, cess, duties, etc.) on supply of materials/services/works etc. shall not be considered and its impact(s) shall be deemed to be included either in Sub- Clause 13.7 [Adjustments for Changes in Cost] and/or in the Accepted Contract Amount/

	Contract Price. If any adjustment to the execution of the Works becomes necessary as a result of any change in Taxes: (i) the Contractor shall promptly give a Notice to the Engineer, or (ii) the Engineer shall promptly give a Notice to the Contractor (with detailed supporting particulars). Thereafter, the Engineer shall either instruct a Variation under Sub-Clause 13.3.1 [Variation by Instruction] or request a proposal under Sub-Clause 13.3.2 [Variation by Request for Proposal].
PC 13.7 Adjustment for Changes in Cost	
	<u>Replace entire Sub-Clause 13.7 with following:</u> The rates agreed in the Pricing Document shall be including escalation during construction period and shall be applicable until the completion of the Works and no variation shall be permissible. Price Variation for Varied Items: For new rates determined to execute extra quantities/new items/new works under PC clauses 13.3.1(B), 13.3.1(C) & 13.3.1(D), the base date shall be 28 days prior to the date on which the new rate was approved. i) Price Variation during Extended Period of Completion: No price adjustment will be applicable up to the stipulated date of completion of the work. However, where an extension has been granted under GC Sub-Clause 8.5 the price shall be adjusted as below: a) Where an extension has been granted due to the Contractor's fault or failure, no price adjustment for the period of extension shall be applicable. b) Where an extension has been granted due to the reasons attributed to the Authority, the price adjustment will be as follows. However, the maximum extent of claim of the Contractor shall not exceed 5% of the Contract price. The price adjustment for the period of extension due to the Authority's fault will be as per Sub-Clause 8.5 of GC. Further to the above, the adjustments for Changes in Cost shall be payable only on the Indian currency component (no adjustment for foreign currency component) of the Contract Price. Contractor Payment shall be subject to adjustment in accordance with the following Price Variation formula, and other terms given herein, to provide for variation in the market rates of labour, materials, fuel and energy during the currency of the Contract;

	$V = V_l + V_s + V_c + V_f + V_m$ Where, V = Total adjustment on account of all factors V_l = Adjustment on account of labour component $= p \times R \times (L - L_o) / L_o$ V_s = Adjustment on account of Steel component $= q \times R \times (W_s - W_{so}) / W_{so}$ V_c = Adjustment on account of Cement component $= r \times R \times (W_c - W_{co}) / W_{co}$ V_f = Adjustment on account of Fuel/Lubricant component $= s \times R \times (W_f - W_{fo}) / W_{fo}$ V_m = Adjustment on account of Machinery and Machine Tools $= t \times R \times (W_m - W_{mo}) / W_{mo}$ p = Cost Coefficient of Labour to the Total Cost $= 0.22$ q = Cost Coefficient of Steel to the Total Cost $= 0.25$ r = Cost Coefficient of Cement to the Total Cost $= 0.15$ s = Cost Coefficient of Fuel and Lubricant to the Total Cost $= 0.05$ t = Cost Coefficient of other Machinery and Machine Tools to the Total Cost $= 0.18$ Note $p + q + r + s + t = 0.85$, balance 0.15 shall be fixed component R = Gross value of the work done by the Contractor for the period of work under consideration, after excluding there from the cost of any materials supplied free or at fixed rate to the Contractor. L_o = Consumer Price Index for Industrial workers, as published by Ministry of Labour & Employment, Government of India, as applicable to Shimla (H.P) area, for the month in which the tender was opened. L = Average of monthly Consumer Price Index for Industrial workers, as published by Ministry of Labour & Employment, Government of India, as

	applicable to Shimla (H.P) area, for the period of work under consideration. Wso = Whole sale Price Index for “Mild Steel-Long products” (Base Month shall be one month prior of the stipulated date of completion of the Project = 100), as published by Office of the Economic Adviser (OEA), Ministry of Commerce and Industry, Government of India, for the month in which the tender was opened. Ws = Whole sale Price Index for “Mild Steel-Long products” (Base Month shall be one month prior of the stipulated date of completion of the Project = 100), as published by Office of the Economic Adviser (OEA), Ministry of Commerce and Industry, Government of India, for the period of work under consideration. Wco = Whole sale Price Index for Ordinary Portland Cement (Base Month shall be one month prior of the stipulated date of completion of the Project = 100), as published by Office of the Economic Adviser (OEA), Ministry of Commerce and Industry, Government of India, for the month in which the tender was opened. Wc = Whole sale Price Index for Ordinary Portland Cement (Base Month shall be one month prior of the stipulated date of completion of the Project = 100), as published by Office of the Economic Adviser (OEA), Ministry of Commerce and Industry, Government of India, for the period of work under consideration. Wfo = Whole Sale Price Index (Averages) for Fuel & Power (Base Month shall be one month prior of the stipulated date of completion of the Project = 100), as published by Office of the Economic Adviser, Ministry of Commerce and Industry, Government of India, for the month in which the tender was opened. Wf = Wholesale Price Index (Averages) for Fuel & Power ((Base Month shall be one month prior of the stipulated date of completion of the Project = 100), as published by Office of the Economic Adviser, Ministry of Commerce and Industry, Government of India, for the period of work under consideration. Wmo = Whole Sale Price Index (Averages) for “Manufacture of Machinery and Equipment” (Base Month shall be one month prior of the stipulated date of completion of the Project = 100), as published by Office of the Economic Adviser, Ministry of Commerce and Industry, Government of India, for the month in which the tender was opened. Wm = Wholesale Price Index (Averages) for “Manufacture of Machinery and Equipment” (Base Month shall be one month prior of the stipulated date of completion of the Project = 100), as published by Office of the Economic Adviser, Ministry of Commerce and Industry, Government of India, for the period of work under consideration. Note: Responsibility of arranging the published indices as desired by the Authority or the Engineer shall rest with the Contractor.
PC 14.1 The Contract Price	

	<u>Replace sub-paragraph (b) of Sub Clause 14.1</u> “the Contractor shall pay all taxes, duties and fees required to be paid by the Contractor under the Contract, and the Contract Price shall not be adjusted for any of these costs, except as stated in Sub-Clause 13.6 [Adjustments for Changes in Laws];” <u>with</u> “the Contractor shall pay all taxes, Goods and Service Tax (GST), duties and fees required to be paid by the Contractor under the Contract, and the Contract Price shall not be adjusted for any of these costs, except as stated in Sub-Clause 13.6 [Adjustments for Changes in Taxes];” <u>Add following at the end of Sub Clause 14.1:</u> The Contractor shall be solely responsible to find out and ascertain whether the Works or any part thereof will qualify and be eligible for the concessional duty benefits under Chapter 98.01 of Custom Tariff Act for project Imports. The Contractor shall also ascertain the applicability of Custom Duty and any other taxes, duties cess, etc. and inclusion of the same in their quoted price. After award of the Contract, the Authority at the written request of a Contractor shall facilitate for obtaining sponsoring/ recommendation letter from the Ministry of Urban Development (MoUD) for getting themselves registered for availing Project Import benefits. However, the responsibility to avail the concessional benefits under Project Import or otherwise as extended in accordance with the law of the land shall solely rest with the Contractor. The Contractor shall submit an undertaking within 30 days from the commencement date that neither they nor their sub-contractors or vendors shall avail any deemed export benefit, in case the Contractor avails such benefits then those benefits shall be passed on to the Authority.
PC 14.2.1 Advance Payment Guarantee	
	<u>Replace second paragraph of Sub Clause 14.2.1</u> “The Contractor shall ensure that the Advance Payment Guarantee is valid and enforceable until the advance payment has been repaid, but its amount may be progressively reduced by the amount repaid by the Contractor as stated in the Payment Certificates.” <u>with</u> “The Contractor shall ensure that the Advance Payment Guarantee is valid and enforceable until the advance payment has been repaid. Once fifty percent (50%) of the advance(s) has been recovered, the Contractor shall have a onetime option to reduce the equivalent recovered amount of the Advance Payment Guarantee.”

PC 14.2.3 Repayment of Advance Payment

Replace entire Sub Clause 14.2.3 (b) with following:

(b) deductions shall be made at the amortisation rate of twenty percentage (20%) of the amount of each IPC (excluding the advance payment and deductions and release of retention moneys) in the currencies and proportions of the advance payment, until such time as the advance payment has been repaid. However, the recovery of mobilisation and /or any other advances will be completed before eighty five percent (85%) of the Contract Price has been paid or by the time of original Completion Date (including EOT granted pursuant to Sub-clause 8.5 [Extension of Time]), whichever is earlier and the whole of the balance then outstanding shall immediately become due and payable by the Contractor to the Authority.

Add following at the end of Sub Clause 14.2.3

“If the Authority does not receive repayment of the balance outstanding advance payment before the due date, in case of delay in the progress and completion of Work, as a result of which it is not possible to recover the advance payments and interest thereon, then the Authority shall be entitled to receive financing charges on the outstanding advance payment amount unpaid during the period of delay. These financing charges shall be calculated at the annual rate of three percent (3%) above “State Bank of India’s Marginal Cost of fund-based Lending Rate (MCLR)” applicable for the tenure of 01 year, prevailing on the due date.

The Authority shall always have the option to commence and/or complete the repayment earlier, and/or to recover by higher deductions from IPC and also recover part or whole of the advance payment by direct payment rather than through on-account bills, at the discretion of the Authority.”

PC 14.3 Application for Interim Payment

Replace sub-paragraph (ii) of second paragraph of Sub-Clause 14.3

“any amounts to be added and/or deducted for changes in Laws under Sub-Clause 13.6 [Adjustments for Changes in Laws], and for changes in Cost under Sub-Clause 13.7 [Adjustments for Changes in Cost];”

with

“any amounts to be added and/or deducted for changes in Taxes under Sub-Clause 13.6 [Adjustments for Changes in Taxes], and for changes in Cost under Sub-Clause 13.7 [Adjustments for Changes in Cost];”

PC 14.8 Delayed Payment

Replace entire Sub Clause 14.8 with following:

If the Contractor does not receive payment in accordance with Sub-Clause

	14.7 [Payment], the Contractor shall not be entitled to receive any financing charges.
PC 14.9 Release of Retention Money	
	<u>Replace the second paragraph of Sub-Clause 14.9</u> “After the latest of the expiry dates of the Defects Notification Periods, the Contractor shall include the second half of the Retention Money in a Statement promptly after such latest date. If a Taking-Over Certificate was (or was deemed to have been) issued for a Section, the Contractor shall include the relevant percentage of the second half of the Retention Money in a Statement promptly after the expiry date of the DNP for the Section.” <u>With</u> “After the latest of the expiry dates of the Defects Notification Periods, the Contractor shall include the second half of the Retention Money in a Statement promptly after such latest date, and the second half of the Retention Money shall be released upon expiration of 365 days after the latest of the expiry dates of the Defects Notification Periods or final payment, whichever is earlier, on certification of the Engineer. If a Taking-Over Certificate was (or was deemed to have been) issued for a Section, the Contractor shall include the second half of the Retention Money in a Statement promptly after the latest of the expiry dates of the DNPs for the Sections.” <u>Add the following at the end of Sub-Clause 14.9</u> “The Contractor may, at his option, replace the Retention Money with an unconditional bank guarantee from a Scheduled Bank in India (meaning a bank which is included in the Second Schedule of Reserve Bank of India Act, 1934, in the form acceptable to the Authority (generally similar to the Performance Security) at the following stages: i. after the cumulative amount of Retention Money reaches to half the equivalent value of five (5%) of the Accepted Contract Amount; and ii. after the issue of the Taking-Over Certificate for the Works (or last Section as the case may be). The bank guarantees against release of Retention Money shall remain valid and enforceable at least three hundred and sixty-five (365) days longer than the anticipated date of, issue of Taking-Over Certificate in case of (i), and Defect Notification Period in case of (ii) above. If the terms of the bank guarantees specify its expiry date, and the Taking-Over has not been happened or Defect Notification Period has not been completed by the date 28 days before the expiry date: the Contractor shall extend the validity of this guarantee, immediately submit evidence of this extension to the Authority, with a copy to

	the Engineer and if the Authority does not receive this evidence 7 days before the expiry date of this guarantee, the Authority shall be entitled to claim under the guarantee the amount of Retention Money which has to be retained. The bank guarantees replaced against the Retention Money shall be released in terms of first and second paragraphs of this sub-clause.
PC 14.15 Currencies of Payment	
	<i>Replace sub-paragraph (ii) of sub-paragraph (a) of Sub-Clause 14.15</i> “payments and deductions under Sub-Clause 13.4 [Provisional Sums] and Sub-Clause 13.6 [Adjustments for Changes in Laws] shall be made in the applicable currencies and proportions; and” <i>with</i> “payments and deductions under Sub-Clause 13.4 [Provisional Sums] and Sub-Clause 13.6 [Adjustments for Changes in Taxes] shall be made in the applicable currencies and proportions; and”
PC 15.2 Termination for Contractor's Default	
	<i>Replace following of first paragraph of Sub-Clause 15.2.1</i> “The Authority shall be entitled to give a Notice (which shall state that it is given under this Sub-Clause 15.2.1) to the Contractor of the Authority's intention to terminate the Contract or, in the case of sub-paragraph (f), (g) or (h) below a Notice of termination, if the Contractor:” <i>with</i> “The Authority shall be entitled to give a Notice (which shall state that it is given under this Sub-Clause 15.2.1) to the Contractor of the Authority's intention to terminate the Contract (or part thereof) or, in the case of sub-paragraph (f), (g) or (h) below a Notice of termination, if the Contractor:” <i>Replace first paragraph of Sub-Clause 15.2.2</i> “Unless the Contractor remedies the matter described in a Notice given under Sub-Clause 15.2.1 [Notice] within 14 days of receiving the Notice, the Authority may by giving a second Notice to the Contractor immediately terminate the Contract. The date of termination shall be the date the Contractor receives this second Notice.” <i>with</i> “Unless the Contractor remedies the matter described in a Notice given under Sub-Clause 15.2.1 [Notice] within 14 days of receiving the Notice, the Authority may by giving a second Notice to the Contractor immediately terminate the Contract (or part thereof). The date of termination shall be the date the

	Contractor receives this second Notice” <u>Add following at end of Sub-Clause 15.2.4:</u> On termination of the Contract due to the Contractor’s default the Performance Security and other bank guarantee(ies) shall be forfeited by encashing the bank guarantee(ies) and the balance work shall be executed independently without risk and cost of the failed Contractor.
PC 16.1 Suspension by Contractor	
	<u>Replace Sub-Clause 16.1 (b) with following:</u> [Not Used]
PC 17.2 Liability for Care of the Works	
	<u>Replace Sub-Clause 17.2 (e)</u> “(e) any of the events or circumstances listed under sub-paragraphs (a) to (f) of Sub-Clause 18.1 [Exceptional Events]; and/or” <u>with</u> “(e) [Not Used]; and/or”
PC 18.4 Consequences of an Exceptional Event	
	<u>Replace entire Sub-Clause 18.4 with following:</u> “If the Contractor is the affected Party and suffers delay and/or incurs Cost by reason of the Exceptional Event of which he/she gave a Notice under Sub-Clause 18.2 [Notice of an Exceptional Event], the Contractor shall be entitled subject to Sub-Clause 20.2 [Claims For Payment and/or EOT] to reasonable EOT and no monetary claims whatsoever shall be paid or entertained on this account.”
PC 18.5 Optional Termination	
	<u>Replace Sub-Clause 18.5 (d) and (e)</u> “(d) the Cost of removal of Temporary Works and Contractor's Equipment from the Site and the return of these items to the Contractor's place of business in the Contractor's country (or to any other destination(s) at no greater cost); and (e) the Cost of repatriation of the Contractor's staff and labour employed wholly in connection with the Works at the date of termination.” <u>with</u> “(d) [Not Used]; and (e) [Not Used].”
PC 19.2 Insurance to be provided by the Contractor	

	<u>Replace first paragraph of Sub-Clause 19.2.4</u> “The Contractor shall insure, in the joint names of the Contractor and the Authority, against liabilities for death or injury to any person, or loss of or damage to any property (other than the Works) arising out of the performance of the Contract and occurring before the issue of the Performance Certificate, other than loss or damage caused by an Exceptional Event.” <u>with</u> “The Contractor shall insure, in the joint names of the Contractor and the Authority, against liabilities for death or injury to any person, or loss of or damage to any property (other than the Works) arising out of the performance of the Contract and occurring before the issue of the Performance Certificate, also including loss or damage caused by an Exceptional Event to the extent they are insurable in each case.” <u>Add a new Sub-Clause 19.2.7 as following:</u> 19.2.7 The Contractor shall submit all evidence(s) of insurances and policies within the period stated in the Contract Data. <u>Add a new Sub-Clause 19.2.8 as following:</u> 19.2.8 The Contractor shall obtain all required insurances for this Contract from the insurance companies registered under Insurance Regulatory and Development Authority of India (IRDAI).
PC 21 Disputes and Arbitration	
	<u>Add following at end of Sub-Clause 21.2:</u> The DAAB Member shall submit invoices for payment to the Contractor and shall be addressed to the Contractor. The Contractor shall pay each of the DAAB Member’s invoices in full within twenty-eight (28) days after receiving each invoice. Thereafter, the Contractor shall apply to the Authority (in the Statement under the Contract) for reimbursement of one-half of the amounts of these invoices. The Authority shall then pay the Contractor in accordance with the Contract. If the Contractor fails to pay the DAAB Member the amount to which he/she is entitled within the period of twenty-eight (28) days as stated above, the DAAB Member shall inform the Authority who shall promptly pay the amount due to the DAAB Member and any other amount which may be required to maintain the function of the DAAB. Thereafter the Authority shall, by written request, be entitled to payment from the Contractor of: (a) all sums paid in excess of one-half of these amounts; (b) the reasonable costs of recovering these amounts from the Contractor; and

	(c) financing charges calculated at the annual rate of three percent (3%) above “State Bank of India’s Marginal Cost of fund-based Lending Rate (MCLR)” applicable for the tenure of 01 year, prevailing on the due date. The Authority shall be entitled to such payment from the Contractor without any requirement to comply with Sub-Clause 20.2 [Claim For Payment and/or EOT], and without prejudice to any other right or remedy. <u>Add following new Sub-Clause 21.4.5 at end:</u> <u>21.4.5 The place of conciliation/ DAAB’s proceedings:</u> The place of conciliation/ DAAB’s proceedings shall be in Shimla (H.P), India. <u>Replace entire Sub Clause 21.6 with following:</u> Unless settled amicably, and subject to Sub-Clause 3.7.5 [Dissatisfaction with Engineer’s determination], Sub-Clause 21.4.4 [Dissatisfaction with DAAB’s decision], Sub-Clause 21.7 [Failure to Comply with DAAB’s Decision] and Sub-Clause 21.8 [No DAAB In Place], any Dispute in respect of which the DAAB’s decision (if any) has not become final and binding shall be finally settled by Arbitration. Unless otherwise agreed by both Parties: - the Dispute shall be finally settled under “The Arbitration and Conciliation Act, 1996” of India, as amended by “The Arbitration and Conciliation (Amendment) Act, 2015”, “The Arbitration and Conciliation (Amendment) Act, 2019”, “The Arbitration and Conciliation (Amendment) Act, 2020” and from time to time, and any statutory modification or re-enactment thereof; - the Dispute shall be settled by one or three arbitrators appointed in accordance with Sub-Clause 21.6.1; the arbitration shall be conducted in the ruling language defined in Sub-Clause 1.4 [Law and Language]; - the arbitration shall be held at Shimla (H.P), India; and - the following provisions shall apply. <u>21.6.1 Number of Arbitrators</u> The Arbitral Tribunal shall consist of: - Sole Arbitrator in cases where the total value of all claims in question added together does not exceed INR 10.00 Crore; - Three (3) Arbitrators in all other cases. <u>21.6.2 Procedure for Appointment of Arbitrators</u> The Arbitrators shall be appointed as per following procedure: - In case of Sole Arbitrator: Within thirty (30) days from the day when

	a written and valid demand for Arbitration is received by either Party, the Authority will forward a panel of three (3) names to the Contractor. The Contractor shall have to choose one Arbitrator from the panel of three, to be appointed as Sole Arbitrator within thirty (30) days of dispatch of the request by the Authority. In case the Contractor fails to choose one Arbitrator within thirty (30) days of dispatch of the request of the Authority, then Director of RTDC shall appoint any one Arbitrator from the panel of three (3) Arbitrators, as sole Arbitrator. b. In case of three (3) Arbitrators: i. Within thirty (30) days from the day when a written and valid demand for Arbitration is received by either Party, the Authority will forward a panel of five (5) names to the Contractor. The Contractor will then give his consent for anyone name out of the panel to be appointed as one of the Arbitrators within thirty (30) days of dispatch of the request by the Authority. The Authority will decide the second Arbitrator. Director of RTDC shall appoint the two Arbitrators, including the name of one Arbitrator for whom consent was given by the Contractor, within thirty (30) days from the receipt of the consent for one name of the Arbitrator from the Contractor. In case the Contractor fails to give his consent within thirty (30) days of dispatch of the request of the Authority then Director of RTDC shall nominate both the Arbitrators from the panel. iii. The third Arbitrator shall be chosen by the two Arbitrators so appointed by the Parties out of the panel of five (5) Arbitrators provided to Contractor or from the larger panel of Arbitrators to be provided to them by the Authority at the request of two appointed Arbitrators (if so desired by them) and who shall act as Presiding Arbitrator. In case of failure of the two appointed Arbitrators to reach upon consensus within a period of thirty (30) days from their appointment date, then, upon the request of either or both Parties, the Presiding Arbitrator shall be appointed by the Director of RTDC. iv. If one or more of the Arbitrators appointed as above refuses to act as Arbitrator, withdraws from his office as Arbitrator, or vacates his/their office/offices or is/are unable or unwilling to perform his functions as Arbitrator for any reason whatsoever or dies or in the opinion of the Director of RTDC fails to act without undue delay, the Director of RTDC shall appoint new Arbitrator/Arbitrators to act in his/their place except in case of new Presiding Arbitrator who shall be chosen following the same procedure as mentioned in para (ii)(3) above. Such re-

	constituted Tribunal may, at its discretion, proceed with the reference from the stage at which it was left by the previous Arbitrator(s). v. The Authority at the time of offering the panel of Arbitrator(s) to be appointed as Arbitrator shall also supply the information with regard to the qualifications of the said Arbitrators nominated in the panel along with their professional experience, phone nos. and addresses to the Contractor. 21.6.3 Qualification and Experience of Arbitrators The Arbitrators to be appointed as per Sub-Clause 21.6.2 above, shall have minimum qualification and experience as under: Arbitrator shall be a Working / Retired Officer (in any PSU of Govt. of India/Govt. of Himachal Pradesh with which RTDC has no business relationship) of any discipline of Engineering or Accounts / Finance department, having experience in Contract Management of Construction Contracts; or retired judge of any High Court or Supreme Court of India or reputed Chartered Accountant & should be member of ICAI. No person other than the persons appointed as per the above procedure and having above qualification and experience shall act as Arbitrator. 21.6.4 The arbitrator(s) shall have full power to open up, review and revise any certificate, determination (other than a final and binding determination), instruction, opinion or valuation of the Engineer, and any decision of the DAAB (other than a final and binding decision) relevant to the Dispute. Nothing shall disqualify the Engineer from being called as a witness and giving evidence before the arbitrator(s) on any matter whatsoever relevant to the Dispute. 21.6.5 In any award dealing with costs of the arbitration, the arbitrator(s) may take account of the extent (if any) to which a Party failed to cooperate with the other Party in constituting a DAAB under Sub-Clause 21.1 [Constitution of the DAAB] and/or Sub-Clause 21.2 [Failure to Appoint DAAB Member(s)]. 21.6.6 Neither Party shall be limited in the proceedings before the arbitrator(s) to the evidence or arguments previously put before the DAAB to obtain its decision, or to the reasons for dissatisfaction given in the Party's NOD under Sub-Clause 21.4 [Obtaining DAAB's Decision]. Any decision of the DAAB shall be admissible in evidence in the arbitration. 21.6.7 It is agreed by both the Parties that in the cases where Arbitral Tribunal is consist of Sole Arbitrator, their disputes shall be resolved by fast-track procedure specified in sub-section (3) of 29B of the Arbitration and Conciliation (Amendment) Act, 2019 or as amended up to date.

	21.6.8 Arbitration may be commenced before or after completion of the Works. The obligations of the Parties, the Engineer and the DAAB shall not be altered by reason of any arbitration being conducted during the progress of the Works. Neither Party shall be entitled to suspend the Work or part of the Work to which the dispute relates on account of Arbitration and payments to the Contractor shall continue to be made in terms of the Contract. 21.6.9 If an award requires a payment of an amount by one Party to the other Party, this amount shall be immediately due and payable without any further certification or Notice. 21.6.10 Where recourse to a Court is to be made in respect of any matter, dispute, issue arising out of or under the Contract or connected with the Contract the appropriate court at Shimla (H.P), India shall have the exclusive jurisdiction to try all disputes issues, dispute arising out of or under the Contract or connected with the Contract between the Parties.

Schedule 1: Contract Agreement

CONTRACT NO: XXXX

(Refer Sub Clause 1.6 of GC)

This Agreement is made at Shimla (H.P) on day of by and between:

Ropeway and Rapid Transport System Development Corporation H.P. Limited, a company registered under the Companies Act, 2013 existing under the laws of India, vide Corporate Identification Number [CIN]: and having its registered office located at represented by Mr of the Company, by virtue of his designation and on authorization by Mr of the Company (hereinafter referred to as the **“RTDC”** or the **“Authority”**, as the case may be, which expression shall unless excluded by or repugnant to the context or meaning thereof be deemed to include its successors and permitted assigns) of the one part,

and

..... [Note 1] comprising:

a. a company registered under the Companies Act, 1956/ 2013 existing under the laws of India, vide Corporate Identification Number [CIN]: and having its registered office at and principle place of business at , represented by Mr. & Mr. authorised to sign and bind the company, under the Power of Attorney dated and the Board Resolution dated [Note 5];

b. a company registered under the Companies Act, 1956/ 2013 existing under the laws of India, vide Corporate Identification Number [CIN]: and having its registered office at / and principle place of business at , represented by Mr. & Mr. authorised to sign and bind the company, under the Power of Attorney dated and the Board Resolution dated [Note 5]; and

[Note 2] who shall be jointly and severally liable for the undertaking of this Contract; (hereinafter [Note 3] collectively referred to as the **“Contractor”** which expression unless excluded by or repugnant to the context or meaning thereof, be deemed to

include its executors, administrators, successors and assigns) of the other part.

In this Contract Agreement, as the context may require, both the Authority and the Contractor shall hereinafter be collectively referred to as **“Parties”** and individually as **“Party”**.

WHEREAS the Authority is desirous of executing the Project, and as part of it, the Authority

intends to engage a Contractor to execute the Works, and

WHEREAS the Contractor has declared that the Contractor has valuable and specialised knowledge and expertise in “.....” and submitted a Tender for execution and completion of “.....”
.....”, and agrees to undertake performance of the Works under the terms and conditions set forth in this Contract.

Now THEREFORE the **Parties** hereby agree as follows:

Clause 1 The Contract Documents

The Authority agrees to hire and the Contractor agrees to be hired to implement the “.....” under the terms and conditions specified in this Contract Agreement and the other Contract Documents attached hereto as follows:

1. the Contract Agreement;
2. the Letter of Acceptance;
3. the Letter of Tender (without Appendices);
4. the Addenda, Corrigendum and clarifications;
5. the Particular Conditions of Contract (Part A – Contract Data);
6. the Particular Conditions of Contract (Part B – Special Provisions);
7. the General Conditions of Contract;
8. the Authority’s RFP & other documents;
9. the Priced Financial Envelope (Pricing Document), as submitted by the Contractor and accepted by the Authority and included in this Contract Agreement.
10. the Contractor’s Proposal;
11. any other document(s) forming part of the Contract Agreement.

All of the foregoing documents, together with this Contract Agreement, are referred to herein as the Contract Documents. Also incorporated into these Contract Documents, and made part hereof, are all codes, standard specifications, and similar requirements that are referred to therein. In the event of a conflict, ambiguity or discrepancy between the contents of the Contract Documents, the order of precedence shall be according to the Conditions of Contract.

The Contractor has submitted Performance Bank Guarantees Nos..... dated for the total value of

(.....) with a validity and claim up to..... issued by for due performance of this Contract.

Clause 2 Obligation of the Contractor

The Contractor agrees, subject to the terms and conditions of the Contract Documents, to perform efficiently and faithfully all of the Works, namely, “.....” and other facilities requisite for or incidental to the successful completion of the Works and in carrying out all duties and obligations imposed by the Contract Documents.

Clause 3 Obligation of the Authority

The Authority agrees, subject to the terms and conditions of the Contract Documents, to pay the Contractor the amount specified, and at the rates and terms and in the manner set forth in the Contract Documents.

Clause 4 Contract Price and Time for Completion

The Authority agrees to pay for the total cost of the Works and the Contractor agrees to accept the sums mentioned below in the following currencies, to be the total cost for the Works carried out by them as part of his obligations, responsibilities and liabilities under and according to the provisions and obligations imposed on them by the Contract.

The Contract Price of

- (i) INR (Rupees..... only); and
- (ii) In the foreign currency (..... only)

comprising Total Lumpsum Contract Price, subject to adjustment in accordance with the provisions of the Conditions of Contract.

The above amounts include all taxes (as applicable), duties, royalties, GST, and other cess, levies etc.

The Contractor shall complete the whole of the Works within (.....) months from the Commencement Date stipulated in the Letter or Acceptance No. (including Notice to Commence).

Clause 5 Notices

All notices called for by the terms or the Contract Documents shall be in writing in the English language and shall be delivered by hand or by registered mail, acknowledgement due to the parties' addresses given below. All notices shall be deemed to be duly made when received by the Party to whom it is addressed at the following addresses or such

other addresses as such Party may subsequently notify to the other Party:

Ropeways And Rapid Transport System Development Corporation. (RTDC)

US Club, Shimla, 171001 (H.P.), India.

Contractor:.....

.....

.....

Clause 6 Integration

The Authority and the Contractor agree that this Contract Agreement, together with the other Contract Documents, expresses all of the agreements, understandings, promises and covenants of the parties, and that it integrates, combines, and supersedes all prior and contemporaneous negotiations, understandings, and agreements, whether written or oral and that no modification or alteration of the Contract Documents shall be valid or binding on either party, unless expressed in writing and executed with the same formality as this Contract Agreement, except as may otherwise be specifically provided in the Contract Documents.

Clause 7 Governing Law

This Contract is enforceable and construed under the laws of the Republic of India.

Clause 8 Language

This Contract Agreement and the other Contract Documents are made in the English language.

Clause 9 Jurisdiction of Court

The Courts at Shimla shall have the exclusive jurisdiction to try all disputes arising out of this agreement between the parties.

In WITNESS WHEREOF, the Authority and the Contractor have caused this Contract Agreement to be duly executed by their duly authorized representatives the day and year first above written.

The Authority

The Contractor [Note 6]

(a)

RTDC

(b)

(c)

Witnesses

(1) _____

(1) _____

(2) _____

(2) _____

Notes: (for preparation of but not for inclusion in the engrossment of Contract Agreement)

1. If the Contractor comprises a partnership, consortium or joint venture; liability will be joint and several, and each member thereof must be identified.
2. In the case that the Contractor comprises a single company, this line should be deleted entirely as also should be paragraphs (b) and (c) above.
3. In the case that the Contractor comprises a single company, the word “collectively” should be deleted from this line.
4. Enter the appropriate nature of the Contractor: company, partnership, consortium or joint venture as the case may be.
5. Enter the date of the appropriate resolution
6. If the Contractor comprises a partnership, consortium or joint venture, each member thereof must execute.

Schedule 2: Parent Company Undertaking

CONTRACT NO: XXXXX

(Refer Sub Clause 4.2 of GC/PC)

This Undertaking is made on the day of

By [] [whose registered office is at]/[of] [] (“the Parent Company”).

To the Ropeways and Rapid Transport System Development Corporation Limited (RTDC), together with its successors and assigns, “the Authority”) of
US Club, Shimla, 171001 (H.P.), India.

WHEREAS

- (A) By a contract [] dated [] (“the Contract”) made between (1) the Ropeways and Rapid Transport System Development Corporation Limited (“the Authority”) and
(2) [] (“the Contractor”) has agreed to design, execute, complete and remedy any defects in the works (“the Works”) upon the terms and conditions contained in the Contract.
- (B) Pursuant to the terms of the Contract, the Contractor has agreed to procure the provision of an undertaking in the terms hereof.
- (C) The Parent Company is the beneficial owner of [] % [See Note 1] of the issued share capital of [the Contractor [See Note 2].
- (D) At the request of the Contractor, the Parent Company has agreed to provide this undertaking.

NOW IT IS HEREBY UNDERTAKEN AND AGREED as follows:

1. In consideration of the Authority entering into the Contract with the Contractor, the Parent Company hereby undertakes to the Authority that:
 - (a) the parent company will inform the Authority in the event that it sells, transfers, assigns, or otherwise disposes of or deals with ownership of the whole or any part of [the shareholding or other interests in the subsidiary (the Contractor) of the parent company;
 - (b) in case of transfer of ownership/control of the subsidiary or of the parent company, an updated parent company guarantee and parent company undertaking will be provided from the new holding/ Parent company;
 - (c) not take any action which may result in the Contractor being unable to comply with his

- obligations or perform in any way his duties under the Contract [or take any action which may result in [the subsidiary forming part of the contractor] [See Note 3] being unable to comply with his obligations or perform in any way his duties under the [joint venture or other relevant] agreement] [See Note 6] without the written consent of the Authority; and
- (d) to provide full technical support including providing support with available patent rights, registered design, copyright, design, trademark, Trade Name, know how or other intellectual property right to our subsidiary during currency of the Contract which may be deemed necessary to successfully comply with all obligations under this contract and for the service life of system/ equipment,
- until such time as the Works shall have been completed, all the Contractor's obligations under the Contract shall have been performed and the Maintenance and Defects Notification Period (as defined in the Contract) for the whole and every part of the Works shall have elapsed and further that it will ensure [that the subsidiary forming part of the Contractor will take all steps necessary to ensure [See Note 6]] compliance by the Contractor with the provisions of the Contract.
2. The obligations of the Parent Company under this Undertaking shall remain in full force and effect and shall not be affected or discharged in any way and the Parent Company hereby waives notice of:
- (a) any suspension of the Works, variation or amendment to the Contract (including without limitation extension of time for performance) or any concession or waiver by the Authority in respect of the Contractor's obligations [and/or the obligations of [_____]] [See note 7];
- (b) any provision of the Contract being or becoming illegal, invalid, void, voidable or unenforceable;
- (c) the termination of the Contract or of the employment of the Contractor [and/or [_____]] [See Note 7] under the Contract for any reason;
- (d) any forbearance or waiver of any right of action or remedy the Authority may have against the Contractor [and/or [_____]] [See Note 7] or negligence by the Authority in enforcing any such right of action or remedy;
- (e) any bond, undertaking, security or other guarantee held or obtained by the Authority for any of the obligations of the Contractor [and/or [_____]] [See Note 7] under the Contract or any release or waiver thereof.
3. This Undertaking shall extend to any variation of or amendment to the Contract and to any agreement supplemental thereto agreed between the Authority and the Contractor [and/or [_____]] [See Note 7] and for the avoidance of doubt the Parent Company hereby authorises the Authority and the Contractor [and/or [_____]] [See Note 7] to make any

such amendment, variation or supplemental agreement.

4. All documents arising out of or in connection with this Undertaking shall be served:
 - (a) upon the Authority, at [] marked for the attention of [];
 - (b) upon the Parent Company, at [] India [Note 8].
5. The Authority and the Parent Company may change their respective nominated addresses for service of documents to another address in India but only by prior written notice to each other. All demands and notices must be in writing.
6. This Undertaking shall be governed by and construed according to the laws for the time being in force in India and the Parent Company agrees to submit to the jurisdiction of the courts of Shimla, H.P, India.

IN WITNESS where of this Undertaking has been executed as a deed on the date first before written.

THE COMMON SEAL of)
[])
was affixed hereto)
in the presence of:)

Notes: (for preparation of but not for inclusion in the engrossment of this undertaking)

- (1) If the parent Company is not the immediate parent company, the chain of ownership must be recited, identifying each company in the chain and the shareholdings or other interests in each subsidiary.
- (2) If the Contractor comprises more than one company, the fact and the Joint Venture or other relevant agreement must be recited. In such case, insert the name of the subsidiary firm forming part of the Joint Venture, Partnership or Consortium, and in respect of which the parent company undertaking is being given.
- (3) If note 2 applies, referred to the subsidiary of the parent company and not the contractor.
- (4) If note 1 applies, use this alternative.
- (5) If note 1 applies, add this provision.

- (6) If note 2 applies, add this provision.
- (7) If note 2 applies, add this provision and insert the name of subsidiary.
- (8) The address for service shall be India.

Schedule 3: Parent Company Guarantee

CONTRACT NO: XXXXXX

(Refer Sub Clause 4.2 of GC/PC)

This Guarantee is made on the day of between

- (1) [] whose registered office is at [] and [] whose registered office is at [] (“the Guarantor”).
- (2) the Ropeways and Rapid Transport System Development Corporation Limited , together with its successors and assigns, “the Authority”) of
US Club, Shimla, 171001 (H.P.), India.

WHEREAS

- (A) By a contract [] dated [] (“the Contract”) made between (1) the Ropeways and Rapid Transport System Development Corporation Limited (“the Authority”) and

(2) [] (“the Contractor”) has agreed to design, execute, complete and remedy any defects in the works (“the Works”) upon the terms and conditions contained in the Contract.
- (B) Pursuant to the terms of the Contract, the Contractor has agreed to procure the provision of an undertaking in the terms hereof. [see Note 1]
- (C) At the request of the Contractor, the Guarantor has agreed to guarantee performance of the Contract by the [Contractor] [see Note 2] as set out herein.

IT IS HEREBY AGREED as follows:

1. In consideration of the Authority entering into the Contract with the Contractor, the Guarantor irrevocably and unconditionally guarantees to the Authority as a primary obligation and not as a surety due performance by the [Contractor] [see Note 2] of all of its obligations and liabilities under and in accordance with the Contract save that nothing herein shall be construed as imposing greater obligations or liabilities on the Guarantor than are imposed on the [Contractor] [see Note 2] in the Contract.
2. The obligations of the Guarantor under this Guarantee shall remain in full force and effect and shall not be affected or discharged in any way and the Guarantor hereby waives notice of:
 - (a) any suspension of the Works, variation or amendment to the Contract (including without limitation extension of time for performance) or any concession or waiver by the

- Authority in respect of the Contractor's obligations [and/or the obligations of [_____]] [See note 3];
- (b) any provision of the Contract being or becoming illegal, invalid, void, voidable or unenforceable;
- (c) the termination of the Contract or of the employment of the Contractor [and/or [_____]] [See Note 3] under the Contract for any reason;
- (d) any forbearance or waiver of any right of action or remedy the Authority may have against the Contractor [and/or [_____]] [See Note 3] or negligence by the Authority in enforcing any such right of action or remedy;
- (e) any bond, undertaking, security or other guarantee held or obtained by the Authority for any of the obligations of the Contractor [and/or [_____]] [See Note 3] under the Contract or any release or waiver thereof.
3. This Guarantee shall extend to any variation of or amendment to the Contract and to any agreement supplemental thereto agreed between the Authority and the Contractor [and/or [_____]] [See Note 3] and for the avoidance of doubt the Guarantor hereby authorises the Authority and the Contractor [and/or [_____]] [See Note 3] to make any such amendment, variation or supplemental agreement.
4. This Guarantee is a continuing guarantee and accordingly shall cover all of the obligations and liabilities of the [Contractor] [see Note 2] under the Contract and remain in full force and effect until all the said obligations and liabilities of the Contractor shall have been carried out, completed and discharged in accordance with the Contract. This Guarantee is in addition to any other security which the Authority may at any time hold and may be enforced without first having recourse to any such security or taking any steps or proceedings against the Contractor.
5. Until expiry of the Maintenance and Defects Notification Period (as defined in the Contract) for the whole and every part of the Works, the Guarantor shall not on any ground whatsoever make any claim or threaten to make any claim whether by proceedings or otherwise against the Contractor [and/or [_____]] [see Note 3] for the recovery of any sum paid by the Guarantor pursuant to this Guarantee. Any such claim shall be subordinate to any claims (contingent or otherwise) which the Authority may have against the Contractor [and/or [_____]] [see Note 3] arising out of or in connection with the Contract until such time as such claims shall be satisfied by the Contractor [and/or [_____]] [see Note 3] or the Guarantor as the case may be. To that intent the Guarantor shall not claim or have the benefit of any security which the Authority holds or may hold for any monies or liabilities due or incurred by the Contractor [and/or [_____]] [see Note 3] to the Authority and, in case the Guarantor receives any sum from the Contractor [and/or [_____]] [see Note 3] in respect of any payment by the Guarantor hereunder, the Guarantor shall hold such sum in trust for the Authority for so long as any sum is payable (contingently or

otherwise) under this Guarantee.

6. The Authority shall be entitled to assign the benefit of this Guarantee at any time without the consent of the Guarantor or the [Contractor] [see Note 2] being required.
7. All documents arising out of or in connection with this Guarantee shall be served:
 - (c) upon the Authority, at [] marked for the attention of [];
 - (d) upon the Guarantor, at [] India [Note 4].
8. The Authority and the Guarantor may change their respective nominated addresses for service of documents to another address in India but only by prior written notice to each other. All demands and notices must be in writing.
9. This Guarantee shall be governed by and construed according to the laws for the time being in force in India and the Contractor agrees to submit to the jurisdiction of the courts of India.

IN WITNESS where of this Guarantee has been executed as a deed on the date first before written.

THE COMMON SEAL of)
[])
was affixed hereto)
in the presence of:)

Notes: (for preparation of but not for inclusion in the engrossment of this Guarantee)

- (1) If the Contractor comprises more than one company, that fact, the joint venture or other relevant agreement and the relationship of the Guarantor to its subsidiary forming part of the Contractor must be recited.
- (2) If Note 1 applies, replace the word “Contractor” with name of the subsidiary being guaranteed.
- (3) If Note 1 applies, add additional wording and insert the name of the subsidiary being guaranteed.
- (4) The address for service shall be in India

Schedule 4: Contractor's Warranty

CONTRACT NO: XXXXX

(Refer Sub Clause 4.2 of GC/PC)

This Agreement is made on the day of between

- (1) [] of [] [and [see Note 1]] ([jointly] “the Contractor”).
- (2) the Ropeways and Rapid Transport System Development Corporation Limited, together with its successors and assigns, “the Authority”) of
US Club, Shimla, 171001 (H.P.), India.

WHEREAS

(A) By a contract [] dated [] (“the Contract”) made between (1) the RTDC (“the Authority”) and

(2) [] (“the Contractor”) has agreed to design, execute, complete, test and commission (including Integrated Testing and Commissioning) and remedy any defects in the works (“the Works”) upon the terms and conditions contained in the Contract.

(B) At the request of the Authority and pursuant to the terms of the Contract the Contractor has agreed to enter into this Warranty.

NOW IT IS AGREED as follows:

1. The Contractor hereby warrants and undertakes that:
 - (a) he will design, execute, complete, test and commission (including Integrated Testing and Commissioning) and remedy any defect in the Works in accordance with the terms of the Contract; and;
 - (b) he owes a duty of care to the Authority in relation to the performance of its duties under the Contract; and
 - (c) he will replace free of cost to the Authority any defect or failure of equipment provided in the Works for the duration of Defect Notification Period as per the Contract; and
 - (d) he agrees that should any design modification be required to any equipment or component as a consequence of failure analysis, for the duration of Defect Notification Period as per the Contract, shall re-commence from the date when the modified part is commissioned into service, and such modification shall be carried out free of cost to the Authority in all sub-systems and systems for all sections; and

- (e) he shall maintain the manufacture or spare of replacement parts for at least 10 years.
2. The liability of [the companies comprising [see Note 3]] the Contractor under this Warranty [shall be joint and several and [see Note 3]] shall not be released, diminished or in any way affected by any independent inquiry or investigation into the Works or any matter related to the Contract whether carried out by or on behalf of the Authority or any liability or right of action which may arise out of such inquiry or investigation.
 3. Insofar as the copyright or other intellectual property rights in any plans, calculations, drawings, documents, materials, plant, know-how and other information relating to the Works shall be vested in the Contractor, the Contractor grants to the Authority his successors and assigns a royalty free, non-exclusive and irrevocable license (carrying the right to grant sub-licenses) to use and reproduce any of the works designs or inventions incorporated and referred to in such documents or materials and any such know-how and information for all purposes relating to the Works or the Project including without limitation the design, manufacture, supply, installation, testing and commissioning (including Integrated Testing and Commissioning) reinstatement, extension and the remedy of any defect in the Works. To the extent that beneficial ownership of any such copyright or other intellectual property rights is vested in anyone other than the Contractor, the Contractor shall use best endeavours to procure that the beneficial owner thereof shall grant a like license to the Authority. For the avoidance of doubt, any such license granted shall not be determined if the Contractor shall for any reason cease to be employed in connection with the Works.
 4. The provisions of this Warranty shall be without prejudice to and shall not be deemed or construed so as to limit or exclude any rights or remedies which the Authority may have against the Contractor, whether in tort or otherwise.
 5. Nothing contained in this Warranty shall vary or affect the Contractor's rights and obligations under the Contract.
 6. The address for service of all documents arising out of or in connection with this Warranty shall be:
 - (a) upon the Authority, at [_____] marked for the attention of [____];
 - (b) upon the Contractor, at [_____] India [Note 4].
 7. The Authority and the Contractor may change their respective nominated addresses for service of documents to another address in India but only by prior written notice to each other. All demands and notices must be in writing.
 8. This Warranty shall be governed by and construed according to the laws for the time being in force in India.
 9.
 - (1) Any dispute or difference of any kind whatsoever between the Authority and the

Contractor arising under out of or in connection with this Warranty shall be referred to arbitration in accordance with the Conciliation and Arbitration rules set out in the General Conditions of Contract. “Dispute” as defined in the Contract

shall be deemed to include any such dispute or difference between the Authority and Contractor.

- (2) In the event that the Authority is of the opinion that the issues in such a dispute or difference will or may touch upon or concern a dispute or difference arising under out of or in connection with the Contract (“the Contract Dispute”) then provided that an arbitrator has not already been appointed pursuant to Clause 9(1), the Authority may by notice in writing to the Contractor require and the Contractor shall be deemed to have consented to the referral of such dispute or difference to the arbitrator to whom the Contract Dispute has been or will be referred.
- (3) Save as expressly otherwise provided, the arbitrator shall have full power to open up, review and revise any decision, opinion, instruction, notice, order, direction, withholding of approval or consent, determination, certificate, statement of objections relating to the dispute.
- (4) Subject to the foregoing provisions of this clause 9, the Authority and the Contractor agree to submit to the jurisdiction of the Courts of India at Shimla (H.P).

IN WITNESS where of this Warranty has been executed as a deed on the date written at the head hereof.

THE COMMON SEAL of)

[_____])

was affixed hereto)

in the presence of:)

Notes: (for preparation of but not for inclusion in the engrossment of this Warranty)

- (1) If the Contractor comprises more than one company, each such company shall be a party and liability under this warranty will be joint and several, with consequential grammatical changes.
- (2) If Note 1 applies, that fact and the joint venture or other relevant agreement must be recited.
- (3) Delete if Note 1 does not apply.
- (4) The address for service shall be in India.

Schedule 5: Subcontractor's / Vendor's Warranty

CONTRACT NO: XXXXXX

(Refer Sub Clause 4.4 of GC/PC)

This Agreement is made on the day of between

- (1) [] [whose registered office is at]/[of] [] (“the Subcontractor”) and
- (2) the Ropeways and Rapid Transport System Development Corporation Limited, together with its successors and assigns, “the Authority”) of
US Club, Shimla, 171001 (H.P.), India.

WHEREAS

- (A) By a contract [] dated [] (“the Contract”) made between
(1) the Ropeways and Rapid Transport System Development Corporation Limited (“the Authority”) and
- (B) (2) [] (“the Contractor”) has agreed to design, execute, complete, test and commission (including Integrated Testing and Commissioning) and remedy any defects in the works (“the Works”) upon the terms and conditions contained in the Contract.
- (C) The Sub-contractor/Vendor has had an opportunity of reading and noting the provisions of the Contract (other than details of the Contractor's prices and rates).
- (D) Pursuant to the Contract, the Contractor wishes to enter into an agreement with the Sub-contractor/Vendor (“the Sub-contract”) for the Sub-contractor to carry out and complete a part of the Works as more particularly described in the Sub-contract (“the Sub-contract Works”).
- (E) The Contract stipulates that the Contractor shall obtain the consent of the Authority's Representative before entering into the Sub-contract, and that the Contractor shall procure that the Sub-contractor executes a warranty agreement in favour of the Authority.

NOW IT IS HEREBY AGREED as follows:

1. In consideration of the Authority's Representative consenting to the Contractor and the Sub-contractor/Vendor entering into the Sub-contract, the Sub-contractor/Vendor warrants and undertakes to the Authority that:
 - (a) he will execute and complete the Sub-contract works/supply, and will carry

out each and all of the obligations, duties and undertakings of the Sub-contractor/Vendor under the Sub-contract when and if such obligations, duties and undertakings shall become due and performable, in accordance with the terms of the Sub-contract (as the same may from time to time be varied or amended with the consent of the Authority); and;

- (b) he will supply to the Contractor and in specific cases wherever required to the Authority's Representative with all information as may be required from time to time in relation to progress of the Sub-contract works/supply.
2. The Sub-contractor/Vendor undertakes to indemnify the Authority against each and every liability which the Authority may have to any person whatsoever and against any claims, demands, proceedings, loss, damages, costs and expenses sustained, incurred or payable by the Authority provided that the Sub-contractor/Vendor shall have no greater liability to the Authority by virtue of this Warranty than the liability of the Contractor to the Authority under the Contract insofar as and to the extent that the same has arisen by reason of any breach by the Sub-contractor/Vendor of his obligations under the Sub-contract.
3. No allowance of time by the Authority hereunder or by the Contractor under the Sub-contract nor any forbearance or forgiveness in or in respect of any matter or thing concerning this Warranty or the Sub-contract on the part of the Authority or the Contractor, nor anything that the Authority or the Contractor may do or omit or neglect to do, shall in any way release the Sub-contractor/Vendor from any liability under this Warranty.
4. The Sub-contractor/Vendor agrees that he will not without first giving the Authority not less than 21 day's prior notice in writing exercise any right he may have to terminate the Sub-contract or treat the same as having been repudiated by the Contractor or withhold performance of his obligations under the Sub-contract.
5.
 - (a) In the event that the Contract or the employment of the Contractor under the Contract is terminated for any reason whatsoever and if so requested by the Authority in writing within 21 days of such termination, the Sub-contractor/Vendor shall carry out and complete his obligations under this Warranty and shall enter into a novation agreement with the Authority and the Contractor in which the Sub-contractor/Vendor will undertake inter alia to perform the Sub-contract and be bound by its terms and conditions as if the Authority had originally been named as a contracting party in place of the Contractor. The said novation agreement will be in such form as the Authority may reasonably require.
 - (b) In the event that the Authority does not require the Sub-contractor/Vendor to enter into a novation agreement as required by Sub-clause 5(1), the Sub-

contractor/Vendor shall have no claim whatsoever against the Authority for any damage, loss or expense howsoever arising out of or in connection with this Warranty.

6. Insofar as the copyright or other intellectual property rights, in any plans, calculations, drawings, documents, materials, know-how and information relating to the Sub-contract works/supply shall be vested in the Sub-contractor/Vendor, the Sub-contractor/Vendor grants to the Authority, his successors and assignees a royalty free, non-exclusive and irrevocable license (carrying the right to grant sub licenses) to use and reproduce any of the works designs or inventions incorporated and referred to in such documents or materials and any such know-how and information for all purposes relating to the works of the Works of the Project, without limitation the design, manufacture, installation, reconstruction, completion, reinstatement, extension, remedy of any defect of the works. To the extent beneficial ownership of any such copyright or other intellectual property right is vested in anyone other than the Sub-contractor/Vendor, the Sub-contractor/Vendor shall use best endeavours to procure that the beneficial owner thereof shall grant a like license to the Authority. For the avoidance of doubt, any such license granted shall not be determined if the Sub-contractor/Vendor shall for any reason cease to be employed in connection with the Sub-contract Works.
7. In the event of any ambiguity or conflict between the terms of the Sub-contract and this Warranty, the terms of this Warranty shall prevail.
8. The provisions of this Warranty shall be without prejudice to and shall not be deemed or construed so as to limit or exclude any rights or remedies which the Authority may have against the Sub-contractor/Vendor whether in tort or otherwise.
9. Nothing contained in this Warranty shall vary or affect the Sub-contractor's/Vendor's rights and obligations under the Sub-contract.
10. The Authority shall be entitled to assign the benefit of this Warranty at any time without the consent of the Sub-contractor/Vendor being required.
11. All documents arising out of or in connection with this Warranty shall be served:
 - (a) upon the Authority, at [_____] marked for the attention of [____];
 - (b) upon the Contractor, at [_____] India.
12. The Authority and the Sub-contractor/Vendor may change their respective nominated addresses for service of documents to another address in India but only by prior written notice to each other. All demands and notices must be in writing.
13. This Warranty shall be governed by and construed according to the laws for the time being in force in India.

14.

- (a) Any dispute or difference of any kind whatsoever between the Authority and the Sub-contractor/Vendor arising under out of or in connection with this Warranty shall be referred to arbitration in accordance with the Arbitration as described in the Contract.
- (b) In the event that the Authority is of the opinion that the issues in such a dispute or difference will or may touch upon or concern a dispute or difference arising under out of or in connection with the Contract ("the Contract Dispute") then provided that an arbitrator has not already been appointed pursuant to Clause 14(1), the Authority may by notice in writing to the Sub-contractor/Vendor require and the Sub-contractor/Vendor shall be deemed to have consented to the referral of such dispute or difference to the arbitrator to whom the Contract Dispute has been or will be referred.
- (c) Save as expressly otherwise provided, the arbitrator shall have full power to open up, review and revise any decision, opinion, instruction, notice, order, direction, withholding of approval or consent, determination, certificate, statement of objection, assessment or valuation by the Authority's Representative or the Contractor relating to the dispute or difference.

IN WITNESS where of this Warranty has been executed as a deed on the date first before written.

THE COMMON SEAL of _____)

[_____] _____)

was affixed hereto)

in the presence of: _____)

Schedule 6: Designer's Warranty

CONTRACT NO: XXXXXX

(Refer Sub Clause 5.1 of GC/PC)

This Agreement is made on the day of between

- (1) [] [whose registered office is at]/[of] [] ("the Designer") and
- (2) the Ropeways and Rapid Transport System Development Corporation Limited, together with its successors and assigns, "the Authority") of
US Club, Shimla, 171001 (H.P.), India.

WHEREAS

- (A) By a contract [] dated [] ("the Contract") made between (1) the Ropeways and Rapid Transport System Development Corporation Limited, ("the Authority") and (2) [] ("the Contractor") has agreed to design, execute, complete, test and commission (including Integrated Testing and Commissioning) and remedy any defects in the works ("the Works") upon the terms and conditions contained in the Contract.
- (B) The Designer has had an opportunity of reading and noting the provisions of the Contract (other than details of the Contractor's prices and rates).
- (C) Pursuant to the Contract, the Contractor wishes to enter into an agreement with the Designer and Designer agrees to the wishes of the Contractor (the Consultancy agreement) to carry out the Contractor's obligations under the Contract in relation to the design and functions ascribed to the Designer in the Contract.
- (D) The Contract stipulates that the Contractor shall ensure that the Designer executes a warranty agreement in favour of the Authority.

NOW IT IS HEREBY AGREED as follows:

1. In consideration of the Authority not objecting to the Contractor and the Designer entering into the Consultancy Agreement, the Designer warrants and undertakes to the Authority that he has exercised and will continue to exercise all the skill and care to be expected of a professionally qualified and competent designer experienced in work of similar nature and scope as the Works in carrying out the design of the Works and in performing the other duties and functions ascribed to him in the Contract.
2. The Designer agrees that, in the event of the termination of the Contract by the Authority, the Designer will, if so required by notice in writing given by the Authority, accept subject to Clause 4 the instructions of the Authority or his appointee to the exclusion of the Contractor in respect of the carrying out and completion of the Works upon the terms and conditions of the Consultancy Agreement.
3. The Designer further agrees that he will not, without first giving the Authority not less than 21 days' previous notice in writing, exercise any rights it may have to terminate the Consultancy Agreement or to treat the same as having been repudiated by the Contractor or to discontinue the performance of any duties to be performed by the Designer pursuant thereto. The Designer's right to terminate the Consultancy Agreement or to treat the same as having been repudiated or to discontinue the performance

thereof shall cease if, within such period of notice and subject to Clause 4, the Authority shall give notice in writing to the Designer requiring the Designer to accept the instructions of the Authority or his appointee to the exclusion of the Contractor in respect of the carrying out and completion of the Contract Works upon the terms and conditions of the Consultancy Agreement.

4. Any notice given by the Authority under **Clause 2 or 3** shall state that the Authority or his appointee accepts liability for payment of the fees payable to the Designer under the Consultancy Agreement and for performance of the Contractor's obligations under the Consultancy Agreement, including payment of any fees outstanding at the date of such notice.
5. The Authority shall be entitled to assign the benefit of this Warranty at any time without the consent of the Designer being required.
6. All documents arising out of or in connection with this Warranty shall be served:
 - (a) upon the Authority, at [_____] marked for the attention of [_____];
 - (b) upon the Contractor, at [_____] India.
7. The Authority and the Designer may change their respective nominated addresses for service of documents to another address in India but only by prior written notice to each other. All demands and notices must be in writing.
8. This Warranty shall be governed by and construed according to the laws for the time being in force in India.
9. Except to the extent (if any) expressly permitted by the Consultancy Agreement, the Designer shall not sub-contract any of the Designer's obligations under the Consultancy Agreement without the prior written consent of the Authority's Representative.
10. Without prejudice to its obligations under this Warranty, the Designer shall maintain with well-established underwriters of repute and on terms and conditions reasonably acceptable to the Authority, professional indemnity insurance (as per sub-clause 19.2 of the General Conditions and/or Particular Conditions) in respect of the Designer and its sub-consultants for Indian Rupees..... [refer Part A – Contract Data of Particular Conditions] in relation to his design of the Works for any one occurrence or series of occurrences arising out of any one event from the date of notification of acceptance until 5 years after the issue of Performance Certificate for the whole of works. The Designer shall immediately inform the Authority if for any reason professional indemnity insurance is not maintained in accordance with this Warranty or becomes void or unenforceable.
11. Insofar as the patent, copyright or other intellectual property rights in any Design Data (as defined in the Contract), plans, calculations, drawings, documents, materials, computer software, know-how and information relating to the Works shall be vested in the Designer, the Designer grants to the Authority his successors and assigns a royalty-free, non-exclusive and irrevocable license (carrying the right to grant sub-licenses) to use and reproduce any of the works designs or inventions incorporated and referred to in such documents or materials and any such know-how and information for all purposes relating to the Works (including without limitation the design, construction, reconstruction, completion, reinstatement, extension, repair and operation of the Works). To the extent beneficial

ownership of any such patent, copyright or other intellectual property right is vested in anyone other than the Designer or the Contractor, the Designer shall use his best endeavours to procure that the beneficial owner thereof shall grant a like license to the Authority. Any such license granted shall not be determined if the Designer shall for any reason cease to be employed in connection with the Works.

12.

- (1) Any dispute or difference of any kind whatsoever between the Authority and the Designer arising under out of or in connection with this Warranty shall be referred to arbitration in accordance with Clause 21 of PC/GC "Dispute" as defined in the Contract shall be deemed to include any such dispute or difference between the Authority and the Designer.
- (2) In the event that the Authority is of the opinion that the issues in such a dispute or difference will or may touch upon or concern a dispute or difference arising under out of or in connection with the Contract ("the Contract Dispute") then provided that an arbitrator has not already been appointed, the Authority may by notice in writing to the Designer require and the Designer shall be deemed to have consented to the referral of such dispute or difference to the arbitrator to whom the Contract Dispute has been or will be referred.
- (3) Save as expressly otherwise provided, the arbitrator shall have full power to open up, review and revise any decision, opinion, instruction, notice, order, direction, withholding of approval or consent, statement of objection, determination, certificate, assessment or valuation by the Authority's Representative or the Contractor, relating to the dispute or difference.

IN WITNESS where of this Warranty has been executed as a deed on the date first before written.

THE COMMON SEAL of _____)

[_____])

was affixed hereto)

in the presence of: _____)



Ropeways and Rapid Transport System Development Corporation HP Ltd.

प्रदूषण मुक्त यातायात के लिए हिमाचल की पहल



“Design, Supply, Construction, Installation, Testing, Commissioning and Operation & Maintenance for 5 (five) years of Seamless Innovative Urban Transportation (Ropeways, Lifts & Escalators Etc.) Network in Shimla City (Himachal Pradesh) on Engineering Procurement and Construction (EPC) Mode.”

AUTHORITY’S REQUIREMENTS FOR

General, Functional, Design, Construction and Appendices

Volume III (Part – 1)

October-2024

Externally Aided Project

(Under Consideration for funding by New Development Bank)

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1. GENERAL

1. INTRODUCTION

These Authority's Requirements are divided into four sections as follows:

- (a) General: these apply throughout the Contract.
- (b) Functional: these include the specific core requirements for the design and performance of the Works.
- (c) Design: these apply in respect of duties & requirements relating to the design of the Permanent Works.
- (d) Construction: these apply in respect of duties and other requirements relating to the construction of the Works.

Note: All works as mentioned in Authority's Requirement General, Functional, Design, Construction & Schedules unless otherwise specified shall be included in the quoted price of Contract.

2. DEFINITIONS AND INTERPRETATIONS

In addition to the words and expressions defined in the General Conditions of Contract (GCC), further following words and expressions shall have the meaning assigned to them except where the context otherwise requires:

- a. **"As-Built Drawings"**: means those drawings produced by the Contractor and endorsed by him as true records of construction of the Permanent Works and which have been agreed with the Engineer.
- b. **"Combined Services Drawings" (CSD)**: means drawings showing the locations, layouts and sizes of all services including those of other contractors co-ordinated so as to eliminate all clashes.
- c. **"Construction Phase"**: has the meaning identified in Clause 4 of the Authority's Requirements - General.
- d. **"Construction Reference Drawings"**: means those drawings referred to in Clause 2(viii) of the Authority's Requirements - Design in respect of which a Notice has been issued.
- e. **"Construction Reference Drawings Submission"**: means the submission of Construction Reference Drawings representing elements of the Permanent Works and for which the Contractor seeks a Notice.
- f. **"Construction Specification"**: means those parts of the Standard Outline Specification which relate to construction.
- g. **"Definitive Design Submission"**: means the submission of documents which comprise

the whole or parts of the proposed Definitive Design and for which the Contractor seeks a Notice.

- h. **"Design Manual"**: means the manual to be prepared and submitted by The Contractor as part of the Definitive Design and as described in the Authority's Requirements - Design.
- i. **"Design Package"**: has the meaning identified in Clause 2(v) of the Authority's Requirements - Design.
- j. **"Design Phase"**: has the meaning identified in Clause 4 of the Authority's Requirements - General.
- k. **"Design Criteria"**: means those parts of the Standard Outline Specification which relate to design.
- l. **"Final Design"**: has the meaning identified in Clause 3(v) of Authority's Requirements – Design.
- m. **"Notice"**: means a Notice of No Objection.
- n. **"Particular Specification"**: means the combined specifications prepared by the Contractor in Construction Specifications Institute (CSI) format which combines the Authority's Design Criteria, the Authority's Outline Construction Specifications for Civil Works and those parts of the Contractor's Technical Proposals which specify standards for design and construction which are developed during the Design Phase.
- o. **"Preliminary Design"**: means the submission of documents which comprise the initial stage of the design phase.
- p. **"Ropeway Envelope"**: means the zone or zones within the Works containing the ropeway and equipment necessary for the operation of the ropeway.
- q. **"Services, Electrical, Mechanical Drawings" (SEM)**: means those drawings produced by the contractor executing the service works showing the locations, sizes and details for openings in structural elements for mechanical and electrical facilities and other related contracts.
- r. **"Standard Outline Specification"**: means the Design Criteria and the Outline Construction Specifications for Civil and E&M Works that specify standards issued by the Authority for development by the Contractor for design and construction.
- s. **"Specification"**: has the meaning identified in Clause 5 of the Authority's Requirements - General.
- t. **"Working Drawings"**: comprise the Construction Reference Drawings and such other drawings and documents, such as bar bending schedules and manufacturing drawings, as are necessary to amplify the Construction Reference Drawings for construction purposes and endorsed as required by the Engineer.

3. RELEVANT DOCUMENTS

The Design Criteria shall be read in conjunction with the General Conditions of (GC), the Particular Conditions of (PC) of the contract, the Authority's Requirements, the Drawings and any other document forming part of the Contract.

In the event of a conflict between the Authority's Requirements and any Design Criteria, the Design criteria shall prevail.

In the event of a conflict between any Design Criteria and any other standards or specifications quoted, the requirement of the Design Criteria shall prevail.

Notwithstanding the precedence specified above the Contractor shall always immediately seek advice from the Engineer in the event of conflicts between Specifications. The order of precedence is:

- (i) Design Criteria
- (ii) Authority's Requirements
- (iii) Indian and other International Standards referenced herein.
- (iv) Indian and other International Standards.

4. PHASES (DESIGN AND CONSTRUCTION)

- (i) The Contractor shall execute the Works in two phases, the Design Phase and the Construction Phase.
- (ii) The Design Phase shall commence upon the date of issue of Letter of Acceptance. This phase shall include the preparation and submission of:
 - (a) the Preliminary Design
 - (b) the Definitive Design; and
 - (c) the Construction Reference Drawings.

The Design Phase will be complete upon the issue of a Notice in respect of the comprehensive and complete Construction Reference Drawings Submission for the whole of the Permanent Works.

- (iii) The requirements for the Preliminary Design, Definitive Design and Construction Reference Drawings are stated in the Authority's Requirements -Design.
- (iv) The Construction Phase for the whole or a part of the Permanent Works shall commence immediately upon the issue of a Notice by the Engineer/Authority in respect of the relevant Construction Reference Drawings Submission. Such Notice

may be issued by the Engineer in respect of a Construction Reference Drawing Submission covering a major and distinctive part of the Permanent Works. However, construction shall not be commenced until the “original negatives” of the appropriate Working Drawings have been endorsed:

- (a) by the Contractor as "Good for Construction"; and
- (b) by the Engineer that he has no objections to the drawing.

The Construction Phase shall include the completion and submission of the Final Design, and the preparation and submission of the As Built Drawings and other records as specified.

- (v) Notwithstanding Clause 4(iv) above, for those elements identified under Clause 2(vi) of the Authority's Requirements - Design, the Construction Phase may commence immediately upon the issue of the Notice in respect of the Definitive Design Submission in respect of each such element subject to availability of the site in accordance with agreed programme.

5. SPECIFICATIONS

In accordance with the provisions of these Authority's Requirements, the Contract Specification contained in the Contract shall be incorporated during the design stage and submitted as part of the Definitive Design Submission. When the Specification has received a Notice of No Objection from the Engineer it shall become the Particular Specifications.

6. SPECIFICATIONS IN METRIC AND IMPERIAL UNITS

- (i) The Contract shall utilise the SI system of units. Codes and Standards in imperial units shall not be used unless the Engineer has given his consent.
- (ii) Conversion between metric units and imperial units shall be in accordance with the relevant Indian Standards.

7. WORKS PROGRAMME

- (i) The Project Completion Schedule is given in Appendix 2B as Authority's Requirements.
- (ii) The Contractor shall prepare and submit its Works Programme and three-month rolling programmes and the detailed requirements contained in Appendices 3 and 4 to these Authority's Requirements.
- (iii) In compiling its Works Programme and in all subsequent updating and reporting, the Contractor shall make provision for the time required for co-ordinating and completing the design, testing, commissioning and integrated testing of the Works, including, inter alia, design co-ordination periods during which the Contractor shall co-ordinate its design with those of Designated Contractors,

the review procedures, determining and complying with the requirements of all Government Departments and all others whose consent, permissions, authority or licence is required prior to the execution of any work.

- (iv) The Works Programme shall take full account of the Design Submission Programme.

8. MONITORING OF PROGRESS

- (i) The Contractor shall submit to the Engineer four copies (along with an additional copy in digital format) of a Monthly Progress Report (MPR), as described in **Appendix 5** to these Authority's Requirements, describing the progress and current status of the Works. The MPR shall address the matters set out in the Works Programme.
- (ii) The MPR shall be submitted by the fifth day of each calendar month. It shall account for all works actually performed from 1st day of previous month and up to last day of previous month.
- (iii) The MPR shall be divided into two sections. The first section shall cover progress and current status relating to design and the second section shall cover progress and current status relating to construction.
- (iv) A monthly meeting to monitor & review the progress of the project shall be convened by the Engineer. Contractor's site Representative & Designer Representative of Contractor and site agent of all interfacing team shall also attend the meeting. The Authority may also be present in the meeting.
- (v) The Engineer or Authority may also conduct progress review meetings and interface meeting on weekly /bi-weekly intervals depending upon the requirements or urgency of works. In these review meetings Engineer may call Contractor's Supplier/Sub- Contractor/Designer etc. as per the requirements.
- (vi) All construction location to be monitored through CCTV and also be linked with Authority office. Videography by drone shall also be done at all workplaces once in a month as per Outline Construction Specifications for Civil works.

9. QUALITY ASSURANCE

The Contractor shall establish and maintain a Quality Assurance System in accordance with Appendix 6 to these Authority's Requirements for design and construction procedures and the interfaces between them. This Quality Assurance system shall be applied without prejudice to, or without in any way limiting, any Quality Assurance Systems that the Contractor already maintains.

10. SOFTWARE SUPPORT

10.1 GENERAL

- (i) The Contractor shall provide full support to the Authority and Engineer for all computer programs provided by the Contractor under the Contract.
- (ii) The Contractor shall submit a software support plan at least 90 days before commencement of software installation. This plan shall require the Contractor to provide all changes, bug fixes, updates, modifications, amendments, and new versions of the program as required by the Engineer.
- (iii) The Contractor shall provide all tools, equipment, manuals and training necessary for the Authority / Engineer to maintain and re-configure all the software provided under the Contract.
- (iv) The Contractor shall submit all new versions to the Engineer for review at least 2 weeks prior to their installation. New Versions of any program shall not result in any non- conformance with the Specification or degrade the operation of the System. The Contractor shall:
 - (a) Ensure that all new versions are fully tested and validated on the simulation and development system prior to installation.
 - (b) Ensure that all new versions are fully tested and commissioned once installed on the Site.
 - (c) Deliver to the Authority/Engineer any new version, together with the updated Operation and Maintenance Manuals.
 - (d) The Engineer shall not be obliged to use any new version and that shall not relieve the Contractor of any of its obligations. Any effect upon the performance or operation of the computer-controlled system that may be caused by a new version shall be brought to the Engineer attention including updating the files to suit new version.
 - (e) Implementation of software-based billing such as Vendor payment portal (VPP) & labour Management system.

10.2 IMPLEMENTATION OF BIM SYSTEM

- (i) The Contractor shall implement BIM system (BIM 360) as per Appendix-7 of Authority's Requirement for executing and delivering the services set out in this Agreement. Building Information Modelling (BIM) uses computing power and systems to create 3D models of all kinds of buildings and infrastructure, with information about its design, operation and current condition. At the planning and design stage it enables designers, owners and users to work together to produce the best possible designs and to test them virtually before they are constructed. During construction, it enables AUTHORITY, contractors and suppliers to integrate all components, cutting out waste and reducing the risk of errors. Further, it works as an integrated document Management System for the

Project. In operation it provides users with real-time information about available services and facility managers with accurate assessments of the condition of assets.

- (ii) All station structure designs as well as Towers, proof checking shall be done by the designer using BIM modelling. Civil Contractor shall implement the necessary hardware, software and human resources towards this end. 3D Coordination between all disciplines shall be achieved by incorporating them in a single model. BIM 360 for BIM collaboration, Auto Desk AEC collection including Navis works software's for BIM model development and clash detection.
- (iii) Contractor shall be required to produce, update and present to Authority on a fortnightly basis an integrated 3D BIM model incorporating towers, topography, architecture, structure, plumbing and all other building services and system wide requirements in design review meetings based upon inputs from Designer. These models shall be 3D rendered and shall help in design visualization and clash detection of elements as well as finalization of design.

In addition, Contractor shall also provide following individual models: -

1. Tower and Station Modeling
 2. Terrain modelling
 3. Quantity take-off from BIM model
 4. Visualization and Animated Walkthrough
 5. Station Plumbing Modeling
 6. Clash Detection
- (iv) Final coordinated GFC drawings of all disciplines shall only be generated from the BIM model.
 - (v) The contractor shall develop "As built" BIM Model upto LOD 500 level and submit the same to Authority at the time of completion of the project. Schedule of BIM implementation Plan and standards to be adhered to, shall be provided after award of contract.
 - (vi) The project monitoring shall be done through System for Tracking and Monitoring Projects (BIM SOFTWARE). The BIM SOFTWARE will integrate with Primavera schedules and BIM models of all the contract of different disciplines of the corridor. To facilitate the integration of BIM SOFTWARE with various Primavera schedules, BIM models, and linking of Primavera Schedule with BIM Model, contractor may refer guidelines to be adopted for preparation of Construction Programmes in Primavera and BIM models detailed in Appendix-4 of Authority's Requirement.

- (vii) The BIM Models should be prepared in Revit version 2024 or latest version, for mobile app for mobile phones should be, in case of Android phones versions 5.0 Lollipop (API 21) and higher version and in case of I-Phones version 9.1 and higher version.

10.3 SECURITY OBLIGATIONS

- (i) Within 14 days of the installation of any software into the Permanent Works by the Contractor, the Contractor shall submit to the Engineer for retention by the Authority/Engineer two backup copies of the software, which shall include, without limitation:
 - (a) All licenses in favour of Authority for their use.
 - (b) all source and executable code;
 - (c) all design documentation relating to the software; and
 - (d) Any specified development tools required for maintenance of the software, including, but not limited to, editors, compilers and linkers.

10.4 ERROR CORRECTION

- (i) When a fault is discovered within delivered software or documentation, the Contractor shall take necessary steps to rectify errors or faults at the earliest.
- (ii) The Contractor shall provide written details as to the nature of the proposed correction to the Engineer.
- (iii) The Contractor shall notify the Authority promptly of any fixes or patches that are available to correct or patch faults.
- (iv) The Contractor shall detail any effect such fixes or patches are expected to have, upon the applications.

10.5 TRAINING

- (i) The Contractor shall provide training for the Authority's and Engineer's staff to enable the Authority to make proper use of any software (including BIM) and its new versions. In case Contractor fails or unable to provide training, the Engineer may ask for value engineering proposal.

11. CO-ORDINATION WITH DESIGNATED AND OTHER CONTRACTORS/TEAMS

11.1 General

- (i) The Contractor is responsible for detailed co-ordination of his design and construction activities with those of the Designated Contractors, Civil

Contractors, system wide contractors, finishing contractors, Utility Agencies, Statutory Authorities, Private Service Providers, Developers, Consultants and other Contractors whether or not specifically mentioned in the contract, that may be working on or adjacent to the site for the purpose of the Project. For the purpose of this Specification, all of the above parties shall be referred to as Interfacing teams. The Contractor shall note that there are other contractors, consultants, etc. which the Authority will engage from time to time with whom the Contractor shall have to similarly co-ordinate. Such co-ordination responsibilities of the Contractor shall include the following:

- (a) To provide all information reasonably required by the Interfacing teams in a timely and professional manner to allow them to proceed with their design or construction activities, and specifically to meet their contractual obligations.
- (b) To ensure that the Contractor's requirements are provided to all other Interfacing teams before the cut-off dates to be identified in the Interface Management Plan (IMP).
- (c) To obtain from the Interfacing teams' information reasonably required to enable the Contractor to meet the design submission dates in compliance of completion schedule as described in Appendix 2B of Authority's Requirement.
- (d) Where the execution of the work of the Interfacing teams depends upon the site management or information to be given by the Contractor, the Contractor shall provide to such Interfacing teams the services or correct and accurate information required to enable them to meet their own programme or construct their work.
- (e) To co-ordinate access and delivery routes, and to ensure that all provisions for access and delivery of Plant is co-ordinated with and reflected in the Interfacing team's Delivery Route Drawings. The Interfacing teams shall ensure that all Plants are delivered at the time agreed to allow openings left in the structure for such delivery to be sealed in accordance with the Contractor's programme.
- (f) To co-ordinate with the Interfacing teams on attendance.
- (g) To attend regular co-ordination meetings convened by the Engineer with the Interfacing teams. The Contractor shall conduct separate meetings with the Interfacing teams as necessary to clarify particular aspects of the interfacing requirements of the Works. The party who convenes the meeting shall prepare minutes recording all matters discussed and agreed at the meeting.
- (h) To ensure that copies of all correspondence, drawings, meeting minutes, programmes, etc. relating to the Contractor's co-ordination with the Interfacing teams are issued to all concerned parties and four (4) copies

issued to the Engineer no later than two (2) calendar days from the date of such correspondence and meetings.

- (ii) The Contractor, shall in carrying out his co-ordination responsibilities, raise in good time and provide sufficient information for the Engineer to decide on any disagreement between the Contractor and the Interfacing teams as to the extent of services or information required to pass between them.
- (iii) Where an Interfacing Contract is yet to be awarded the Contractor shall proceed with the co-ordination activities with the Engineer until such time when the Interfacing team is available. The Contractor shall provide the Interfacing team with all information necessary to enable the Interfacing team to follow-on and proceed with their co-ordination.
- (iv) The cut-off dates to be identified in the IMP are the latest dates. Any claim of additional costs by the Interfacing teams as a result of the Contractor's failure in adhering to these dates shall be borne by the Contractor. The Contractor shall note that the information exchange is an iterative process requiring the exchange and update of information at the earliest opportunity and shall be carried out on a regular and progressive basis so that the process is completed for each design stage by the cut-off dates.
- (v) The Contractor shall co-ordinate with the Engineer on all matters relating to works that may affect the Operation & Maintenance of the already operational Section corridor of the Authority in general. Such work shall be subject to the rules and regulations imposed by the Authority.

11.2 Dedicated co-ordination team

- (i) The Contractor shall establish a dedicated co-ordination team, led by a Chief Coordinator in Shimla reporting to the Contractor's Site Agent (Project Manager). The primary function of the team is to provide a vital link between the Contractor's design and construction teams and the Interfacing teams.
- (ii) The Chief Coordinator shall assess the progress of the co-ordination with Interfacing teams by establishing lines of communications as indicated in the co-ordination model shown in Figure 1 and promote regular exchange and updating of information so as to maintain the Contractor's programme.
- (iii) The complexity of the Project and the importance of ensuring that work is executed within time limitations require detailed programming and monitoring of progress so that early programme adjustments can be made in order to minimise the effects of potential delays.
- (iv) The Chief Co-ordinator in conjunction with the Interfacing teams shall identify necessary provisions in the Works for plant, equipment and facilities of the Interfacing teams. These provisions shall be allowed by the Contractor in his design of the Works.

- (v) During the course of the contract, information will be obtained in a number of ways. These may include direct inspection, regular site meetings, the obtaining of progress reports and the use of turn-round documents to obtain design and programme data. Turn round document shall be issued to the Interfacing teams to be returned giving the current positions on their programme.

11.3 Design & Construction Interface

- (i) The Completion Schedule is shown in Authority's Requirements Appendix 2B are critical to the timely completion of the project. The Contractor shall commence design interface with the Interfacing teams as soon as he has been notified by the Engineer that such Interfacing Contract has been awarded. In the case of utility agencies and other statutory boards, interface shall commence as soon as it is practicable. Where no design interface date has been established because the Interfacing team(s) have not been identified or for whatever reason, the Contractor shall liaison with such Interfacing team/s as soon as they have been awarded.
- (ii) The Contractor shall immediately upon award of the Contract gather all necessary information and develop his design to a level where meaningful interaction can take place as soon as the Interfacing Contracts are available. The Contractor shall submit together with each of his Design Submissions a joint statement from the Contractor and the relevant Interfacing team confirming that design co-ordination has been completed and that they have jointly reviewed the appropriate document to ensure that a consistent design is being presented.
- (iii) The design interface is an iterative process requiring regular exchange and update of interfacing information. The Contractor shall ensure that the information he requires from the Interfacing teams is made known at the outset of each design interface and vice versa so that the information can be provided in time for the Contractor and the Interfacing teams to complete their design to meet their various design submission stages.

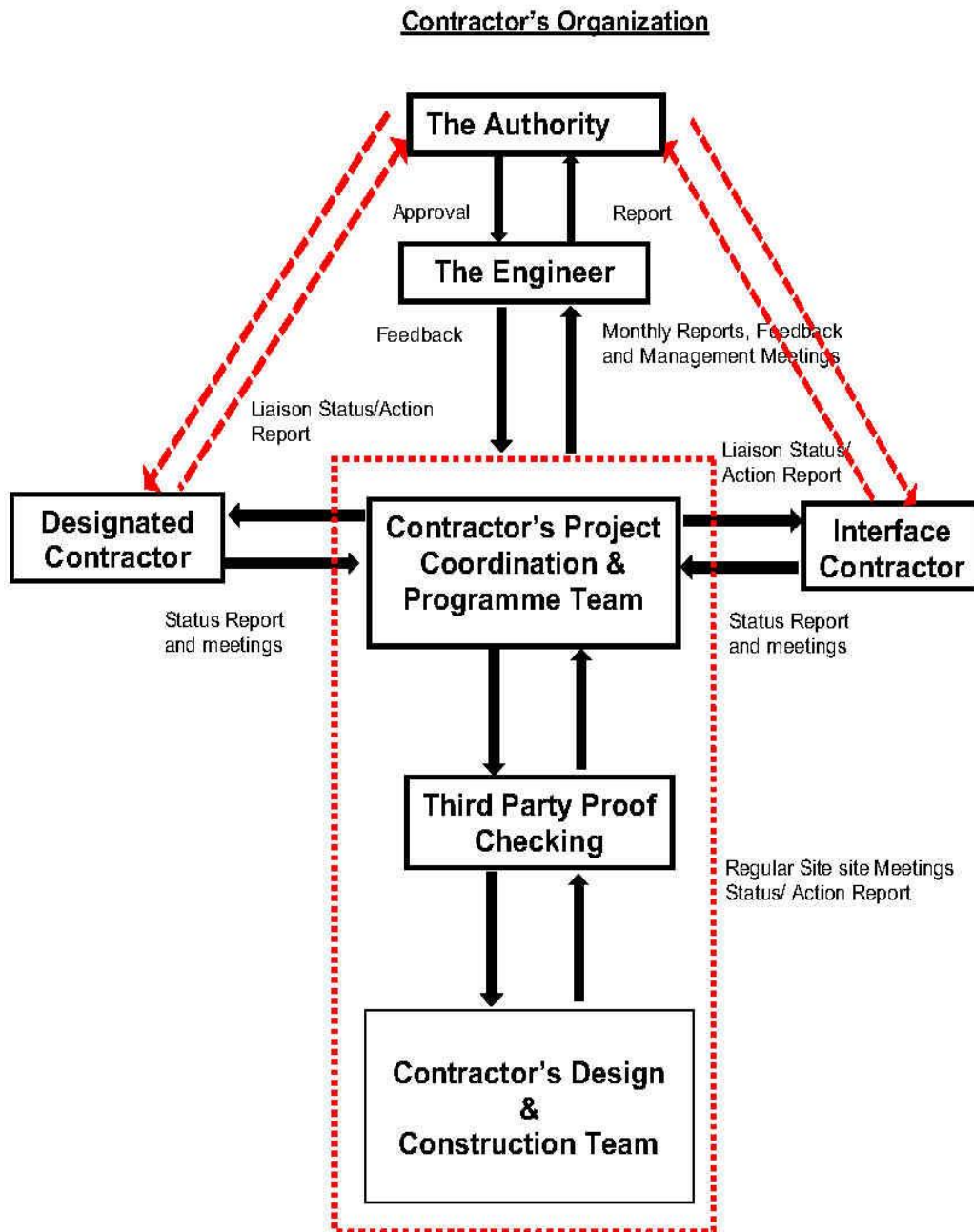
11.4 Construction Interface

- (i) Construction interface will be necessary throughout the duration of the Works commencing from the time the Contractor mobilises to the Site to the completion of the Works. Construction interface will overlap design interface, involving cast-in and buried items such as pipes for electrical and mechanical services, supports, brackets, plinths, ducts, service buildings, openings, cableways, trenches etc. that are to be incorporated at the early stage of the construction up to provision of attendance during the testing and commissioning stage.
- (ii) The Contractor shall ensure that there is no interference with the Works of the Interfacing teams and shall maintain close co-ordination with them to ensure that his work progresses in a smooth and orderly manner. The Contractor shall carry out and complete the Works, or any part thereof, in such order as may be agreed by the Engineer or in such revised order as may be requested by the

Engineer from time to time. The Contractor shall, unless otherwise provided, be liable for and shall indemnify the Authority against all costs, charges, expenses and the like resulting from the failure of the Contractor to co-ordinate the Works as specified.

(iii) BIM Expert – cum - Auto CAD Operator: -

- (a) The contractor shall provide one experienced BIM Expert- cum- AutoCAD operator along with computer compatible with latest versions of both softwares exclusively for the office of the Engineer till six months beyond the date of completion of project. The contractor shall also provide office supplies required for related works. In addition, the contractor shall provide one experienced person for digitization of all the documents/records along with one PC, Printer- cum-scanner of A- 3 size including cartridges, papers and other consumables etc. exclusively for the Office of the Engineer till six months beyond the date of completion of project.



12. SURVEY AND SITE INVESTIGATIONS

- i. The datum used for the Contract shall be Mean Sea Level Datum
- ii. The Contractor shall carry out all further site investigations (such as detailed utility identification, detailed geo technical investigation, detailed survey of alignment etc.) necessary for the design of the Permanent Works and to enable the determination of the methods of construction and the nature, extent and design of the Temporary Works.

13. CLIMATIC CONDITIONS

Shimla experiences extreme climatic conditions and contractors must acquaint themselves about the same before submitting the tender. The Authority shall in no way be responsible on this account.

14. PROJECT MANAGEMENT INFORMATION SYSTEM (PMIS)

The Contractor shall devise and utilize a PMIS such that all documents generated by the Contractor can be transmitted to the Engineer by electronic means (and vice versa) and that all documents generated by either party are electronically captured at the point of origin and can be reproduced later, electronically and in hard copy. A similar link shall also be provided between the Engineer office at site and the Authority's Office by the Contractor.

15. CONTRACTOR'S PROJECT ORGANISATION

- i. The Contractor shall have a competent team of Managers, Engineers, Technical staff etc so as to complete the work satisfactory as per various requirements of the contract.
- ii. A control room with round the clock radio communication or telephone switch board links with all safety offices, works sites, site offices, batching plants, casting yards, workshops, fabrication yard, off site offices, Engineers site office, Authority office, testing labs etc shall be maintained and manned round the clock. Residences of all senior project team members shall also be linked with the control room. Vehicles for emergency use should be on stand-by at the control room round the clock along with one dedicated vehicle for use of engineer during night time.
- iii. The designations of the various project organizations team members shall be got approved by the Engineer before adoption so as to avoid any duplication of the designations with those of the Authority or the Engineer.

16. TECHNOLOGY TRANSFER

- i. The Contractor shall ensure that all local contractors and sub- contractors engaged in the works are given training, guidance and the necessary opportunity for transfer of technology in various areas of construction such as instrumentation, safety, quality assurance, Towers and station etc.

17. MAINTENANCE REPORT

- i. The Maintenance Report shall be submitted as part of the Definitive Design and shall include full details of the long-term inspection and maintenance operations for each major component of Ropeway, station, water supply etc.
- ii. The Contractor shall provide inspection and maintenance manuals for the Towers and E&M Works, civil, structural and building works covering the following areas.
 - Ropeway System (Towers and E&M Works)
 - Station Structures (separated into the main structural elements)
- iii. For each area an inspection checklist shall be supplied giving inspection frequency, items to be inspected, criteria for acceptance, criteria for remedial works and details of the remedial works, including proposed materials and method statements. The recommended regular maintenance regime of each area shall also be given including cleaning methods and frequency for different surfaces; removal of leakage borne salts from concrete surfaces; cleaning of drainage channels, sumps and pipes; repainting of metallic items;
- iv. A long-term monitoring regime shall also be included covering items such as
 - Station water leakage
 - Differential movement at station junctions or other areas identified in the design
- v. All instruments necessary to carry out the inspections and monitoring that are identified in the report shall be provided by the Contractor within the EPC tender price.

18. CONTACTOR'S CERTIFICATE:

- i. The Contractor shall provide his registration details for GST registration, EPF registration, ESI registration, Statutory certificate, Certificate as per SHE manual etc. as required for the execution & completion of the work.

2. **FUNCTIONAL**

OBJECTIVE

The objective of the contract is the design, manufacturing, construction, testing and commissioning of the permanent works by the Contractor (including without limitation, the design, construction and removal of the Temporary Works) and the rectification of defects appearing in Permanent Works in the manner and to the standards and within the time stipulated by the Contract. In full recognition of this objective, and with full acceptance of the obligations, liabilities and risks which may be involved, the Contractor shall undertake the execution of the Works.

1. GENERAL

- 1.1 The design and performance of the Permanent Works shall comply with the specific core requirements contained in these Authority's Requirements -Functional.
- 1.2 The design of the Permanent Works shall be developed in accordance with these Authority's Requirements - Functional, the Contractor's Technical Proposals and the other requirements of the Contract.
- 1.3 The Permanent Works shall be designed and constructed to the highest standards available using proven up-to-date good Engineering practices. The Specification shall in any case not specify standards which, in the Engineer's opinion, are less than or inferior to those described in the Outline Design Specifications (Design Criteria) and Outline Construction Specifications contained in the Tender Documents. Construction shall be carried out employing the procedures established by the Contractor in his Quality, Safety Health and Environmental management plans.
- 1.4 The Contractor shall be responsible for obtaining all necessary approvals from the relevant Public/Government/Local/Statutory or any agencies in the design and construction of the works.

2. SCOPE OF WORKS

The scope of work in brief is given below.

- (i) Alignment Survey and Geotechnical Investigation, Design, Engineering, Procurement, Development, Construction, Manufacturing, Erection and Installation, Testing and Commissioning, Operation & Maintenance of a CEN Standard Ropeway System for Implementation of Innovative Urban Transportation (Ropeways, Lifts & Escalators etc.) Project in Shimla City on CEN Standards in Himachal Pradesh with approx., length of 13.79km on EPC Basis.
- (ii) Performance and fulfillment of all other obligations of the Contract in accordance with the provisions of this RFP & EPC Agreement and matters incidental thereto or necessary for the performance of any or all the obligations of the Contractor of the Project during the Defect Notification Period, which shall be for period of 5 years

(60 Months) from completion of Construction work and on issuance of Completion Certificate.

The scope also includes all other requirements stipulated in various parts/volumes of the contract document including schedules, appendices and annexure thereto. The entire scope of works shall be included in the quoted price. The entire scope of works for towers and Stations includes finishing work of stations and approach roads to the stations. The detailed scope of the work shall be as described in clause **2.1.A** and **2.2.B** respectively.

2.1.A Ropeway Towers:

- (i) Detailed survey along ropeway alignment, Geotechnical/soil investigation, Utility checking, fixing an optimized span configuration avoiding shifting of utilities as per contractor's design subject to the obligatory requirements as shown in alignment plan and profile.
- (ii) Design & construction of foundation of towers, design, fabrication and erection of all type of towers.
- (iii) The method of construction shall be approved by Authority/Engineer prior to execution of work. This includes all temporary works required for proper execution of work as per the site conditions / authority or civic requirement.
- (iv) There may be adjustment to alignment owing to requirement of Land-owning agencies with horizontal shifts which shall have to be undertaken without any financial Impact/cost.
- (v) The Final location survey of the alignment and stations given in General Arrangement Drawings (GAD) to accommodate the statutory & other requirements including adjustments to Vertical and horizontal alignments without any financial impact/cost.
- (vi) The Contractor may require modifying the normal pile spacing and pile cap dimension at some locations to avoid shifting of utilities running along the alignment where utility cannot be avoided by span adjustment. The decision of Engineer shall be final as to whether utility is to be shifted, or pile cap is to be modified.
- (vii) The contractor shall utilize the executed structure in their design and construction and also consider the structural arrangement of adjacent structure in their design.
- (viii) Piles for foundations may be with or without permanent liners as per site requirements except at locations met with hard/rocky strata with adequate bearing capacity in which open / raft foundation may be provided duly anchored in rock. All piles shall be bored cast in-situ concrete driven by hydraulic rotary rig only.
- (ix) The cost of liners shall be included in EPC cost and nothing extra shall be

payable on this account.

- (x) Pile caps / Open Foundations resting at any depth depending upon the site condition shall include excavation, disposal of excavated earth, levelling course, PCC, dewatering, sheet piling/ soldier piling & wooden lagging, if required. Earth filling of pile cap up to levelling coarse area falling off the road to be done with proper compaction with good earth wherever required. For the area falling on the road, backfilling shall be done with sand as per Outline Construction Specifications.
- (xi) Earthing arrangement in foundation, Sub-structure & Superstructure. This shall be finalized and provided in co-ordination with the system Experts.
- (xii) Demolition/dismantling/Restoration of any structure.
 - (a) Demolition/dismantling of RCC/Framed/Steel structure buildings, masonry buildings, basement, ground and above floors as existing at site on the alignment and making provision of any utility infringing the pile cap area, without making damages to the adjacent structures/ utilities etc. including disposing off retrieved materials out of site.
 - (b) Demolition/dismantling & restoration of existing FOB's, Bus Shelters, Signages & traffic signals, drainage systems etc.
 - (c) Demolition/dismantling & restoration of existing street light is not in the scope of this Contract.
 - (d) Demolition/dismantling of road, footpath, RCC drain or any type of drain, kerb stone, pavers, central verge, boundary wall, grill, footpath etc. and restoration of same including restoration of existing demolished footpath, kerb stone etc. with new material of similar/acceptable specifications. Contractor must visit the site and ascertain actual magnitude of quantum of work involved for road, footpath, RCC Drain, kerb stone, pavers, overhead utilities & underground, central verge, boundary wall, signages, grill, bus shelters etc. and nothing shall be payable on this account. Restoration of area due to re-designing of any structure to save utilities. Retrieved materials obtained from demolition/dismantling shall be property of the contractor. The pile cap level shall have to be kept below the drain wherever the same is fouling with drain and the drain demolished shall have to be restored back with similar specifications after casting the pile cap, till such time arrangement of temporary drainage shall also be made to ensure proper drainage of water.
 - (e) Restoration of damaged horticulture, landscaping & green area during currency of contract to its original condition.
- (xiii) Necessary permission/ NOC from Forest/Railway/ Road and other concerned regulatory authorities for block and working in such locations. Authority will facilitate for getting them permission from concerned regulatory authorities for working in such locations. Necessary documents w.r.t tree cutting permission including land for compensatory forestation shall be ensured by Authority.

Contractor shall facilitate/ liaison with the respective department.

- (xiv) Making access to site to facilitate movement of vehicles and preparation of area for positioning of cranes and any other machinery for construction etc. These areas shall be checked for desired load carrying capacity & ensure safety of any underground/ adjacent structures, utilities for which nothing extra will be payable also Authority shall be indemnified against any damage at No extra cost.
- (xv) During construction at drain location, required arrangements to be made to facilitate movement of vehicles, cranes, machineries etc. and preparation of area for positioning of cranes and any other machinery to facilitate construction & execution including removal of any construction material from the drain location and restoration of area to its original condition. Also, view cutter arrangement of sufficient height above barricading board to be made drain location as instructed by the Engineer.
- (xvi) Dynamic Integrity test on 100% piles and cross hole sonic integrity test on 25% of piles as per Outline Construction Specifications.
- (xvii) Design & Construction of temporary structures/ construction methodology shall be proof checked from third party.

Notes: -

- 1) Piles may be with or without permanent liners with hydraulic rotary piling rigs or open foundation in case of Pile driving is not feasible.
- 2) Earth filling of pile cap area shall be done with proper compaction with Contractor's own good earth wherever required.

2.1.A.1 There is a possibility of some of the items not getting mentioned in the above list of works. Contractors are requested to go through the tender drawings also in detail as the works listed in 2.1. A above as well as indicated in the tender drawings would be considered inclusive in the scope of work under EPC quoted price. The authority's decision shall be final in this regard in case of dispute.

2.1.A.2 The Designer for structural designs for sub structure/super structure of the Ropeway towers shall be engaged by the contractor subject to having executed similar one work in last 7 years and their concerned structural engineer having minimum 15 years relevant experience of designing similar structures. All documentation pertaining to the DDC having the relevant experience shall be submitted to Engineer for approval prior to engagement. The work is to be designed, constructed and maintained as per relevant codes, Outline Design Specifications, Special Specifications and drawings and/or as directed by the Engineer.

2.1.A.3 The work content of the work shall also include but not limited to the following:

- (i) Though Alignment plans (both vertical and horizontal) and tower locations are provided by the Authority to the Contractor. The contractor would however design the span configuration (only) based upon his proposal subject to obligatory requirements. Utility identification at all the foundation locations will be done by the Contractor before starting piling/excavation and in case utility(s) is encountered or obligatory requirements of Local Authorities are to be met out, the Contractor would modify the span configuration at such locations to save the utility(s) or to meet out the obligatory requirements within the accepted price. The shifting of the utility(ies) would be undertaken only in exceptional circumstances where in the opinion of the Engineer no other option is available. The carriage of excavated earth involved in utility diversion is covered under quoted price. No claim as regard to delay on account of execution of utility diversion will be entertained. All temporary diversion of any utilities done to facilitate the construction activity shall also be the part of the quoted price. No payment shall however be made for supporting the utilities, carriage of excavated earth during execution of work.
- (ii) Site clearance and dismantling of obstructions etc., before commencement of work as specified or as directed;
- (iii) True and proper setting out and layout of the Works, benchmarks and provision of all necessary labour, instruments and appliances in connection therewith as specified or as directed;
- (iv) Conducting initial and routine load test on piles as per frequency given in Outline Construction Specifications.
- (v) All aspects of quality assurance, including testing of materials and other components of the work, as specified or as directed. The payment is included in quoted price.
- (vi) The Contractor has to ensure cleanliness of the roads and footpaths by deploying manpower for the same. The Contractor shall have to ensure proper brooming, cleaning and washing of roads and footpaths at regular interval or as and when required or directed throughout the entire stretch (including the stretch where work is not being carried out) till the currency of the contract including desilting of drains & disposal of sewage. Nothing extra shall be payable on this account.
- (vii) Day to day cleaning, housekeeping & security of worksite throughout the execution period.
- (viii) Clearing of site and handing over of all the Works, as specified or as directed.
- (ix) Maintenance of the completed Work during the period as specified;
- (x) Submission of completion (i.e. 'As-Built') drawings and other related documents as specified. (6 sets in hard copy (A-2 Size) and soft copy in excel hyperlinked with piers numbers/stations name. All towers to be marked with specific tower number as directed by Engineer.

- (xi) Preparing detailed designs, general drawings and working drawings for various components of the works and obtaining proof checked in respect thereof from the IIT/CEN certified firm/engineer and Engineer, inclusive of incorporation of all modifications, alterations, changes, etc. that may be required to be carried as directed.
- (xii) The contractor shall have to provide barricading board as per the specification as provided in tender drawing at all the land to be used for Construction Depot, store, site office & fabrication yard. The total working space within the barricading at tower locations shall not be more than 9X9m. Nothing extra shall be payable in this account. Requirements of Safety, Health & Environment as specified in condition of contract. The fixing of barricade boards includes nailing/ nuts & bolts/ rope lights & blinkers and shifting of barricading boards from one location to another at any number of times. Painting of the barricades shall be carried out to the design and colours as directed by the Engineer and the Contractor shall carry out re-painting of the entire barricades on regular basis, nothing extra shall be payable on this account.
- (xiii) Locations where road vehicles / pedestrians are moving, along the alignment / Stations / Construction sites as directed by Engineer, the contractor shall provide & maintain barricading as per requirement.
- (xiv) Results of sub-surface investigations conducted at project site are enclosed with the tender document. This information about the soil and sub-soil water conditions is being made available to the contractor in good faith.

However, if the contractor undertakes additional Geo-Technical Investigation independently, nothing extra shall be payable in this regard. No claim whatsoever on account of any discrepancy between the sub surface conditions that may be actually encountered at the time of execution of the work and those given in these tender documents shall be admissible to the contractor under any circumstances. Provisions made in Outline Design Specifications shall prevail in this regard.
- (xv) Road Construction / Maintenance / Reinstatement to the original position Maintaining roads, road signage's, central verge, drainage , Footpaths and any other services is in the scope of contract till contract period / handing over to the owning agencies. Reinstatement of roads, road signage's, central verge , drainage , Footpaths and any other services to the original shape/ position is also included in EPC scope of work.

Maintenance of the constructed diversion, footpath during the contract period / up to handing over to road owning agencies shall be responsibility of contractor. Contractor has to maintain diverted road /widened road and footpath free of cost during contract period/ handing over to road owning agencies. No separate maintenance charges will be payable.

Any other item of work as may be required to be carried out for completing the construction of towers of specified height including all necessary interfaces works

with station and system-wide Contractors in all respects in accordance with the provisions of the Contract and/or to ensure the structural stability and safety during and after construction Works to be performed shall also include all general works, preparatory works of any kind necessary for satisfactory construction, completion and maintenance of the works to the intent and meaning to best Engineering standards and orders that may be issued by the Engineer from time to time, compliance by the agency with all Conditions of Contract, supply of all materials, apparatus, plants, equipment, tools, fuel, water, strutting, timbering, transport, offices, stores, workshop, staff, labour and the provision of proper and sufficient protective works, diversion, temporary fencing, lighting and watching required for the safety of the public and protection of works on adjoining land; first –aid equipment, sanitary accommodation for the staff and workmen, effecting and maintenance of all insurances, the payment of all wages, salaries, fees, royalties, duties or the other charges arising out of the execution of works and the regular clearance of rubbish, clearing up, leaving the site perfect and tidy on completion.

2.1.B OTHER WORKS

2.1.B.1 Co-ordination with other Contractors & Agencies (External/Internal)

- (i) In addition, the Contractor shall be required to carry out various miscellaneous works as per interfacing requirements. The contractor shall carry out necessary co-ordinations with various system pertaining to lift, escalator, power supply, telecommunication, AFC and E&M, finishing, signage, PEB etc. for keeping provisions pertaining to cut outs, shafts, raceways, concealed conduits, other conduits, fixtures, inserts, clearances etc. all complete for the scope of work. Temporary door with locking arrangements to be provided in all rooms in station building & Ancillary building.
- (ii) Earthing and lightening protection wherever required.
- (iii) The contractor shall cooperate with the other contractors appointed by the Authority so that the work proceeds smoothly to the satisfaction of the engineer. The contractor shall plan & execute the work with proper interfacing with various agencies.
- (iv) NOC & Approval of schemes of Diversion of Utilities from the concerned regulatory / statutory/ Local Authority is the responsibility of the Contractor.
- (v) The contractor shall attend regular coordination meetings convened by the Authority/engineer for interface and adhere to the decisions taken in the meeting.
- (vi) Access will be provided to the staff of the other Contractor appointed by the Authority for carrying out their works and bringing materials and equipments at the site. However, the security of materials and Equipments brought at the site will be the responsibility of the respective Contractors.

2.1.2 TRAFFIC MANAGEMENT

The Contractor shall make the detailed traffic diversion plans in consultation with

traffic police. The work is to be executed with proper liaisoning with traffic police. Necessary assistance will be given by Authority/Engineer. The scheme should be such that minimum one lane for traffic on each direction of the road should be available for the smooth flow of traffic. The Contractor should inspect the site.

- 2.1.3 Any other item of work as may be required to be carried out for completing the construction of elevated structure of specified length including all necessary interfaces works with station and system Contractors in all respects in accordance with the provisions of the Contract and/or to ensure the structural stability and safety during and after construction.

2.2.B SCOPE OF WORK UNDER STATIONS

2.2.B.1 Stations:

- (i) Detailed survey of stations for execution of work.
- (ii) Design and construction of all station building, all floors within station premises, Ground, Station floor, Gondola Parking, Platform, floor above platform, entry/exit structures, connecting roads, connecting passage, ancillary building i.e. Underground & surface water tanks, Pump room & DG room, Lift shafts, escalator pits and all staircases etc. as shown in bid drawings is covered.
- (iii) The necessary provisions of load imposed in design of stations for connecting of proposed FOB's in stations as shown in the tender drawings and design & construction of brackets for supporting FOB. The cost of the same including brackets for supporting FOB is covered. Load of Radio Mast shall also be considered in the design of Entry/Exit Structures as per tender drawing to ensure safety of pedestrians and passengers.
- (iv) Design & Construction of foundation structures on piles/open foundation.
- (v) Pile caps / Open Foundations resting at any depth depending upon the site condition shall include excavation, disposal of excavated earth, leveling course, PCC, dewatering, sheet piling/ soldier piling & wooden lagging, if required. Earth filling of pile cap area falling off the road to be done with proper compaction with good earth wherever required. For the area falling on the road, backfilling shall be done with sand only. The Demolition/Dismantling/Restoration of any structures as mentioned in para 2.1.A.(xii) of Authority's Requirement (Functional) shall also be applicable for all stations, entry-exit and connecting corridor area.
- (vi) Design & Construction of all structural works of stations including ground, concourse, platforms, additional floors, columns, beams, tie beams, plinth beams, slabs, staircases, parapets, canopies, RCC Screed slab, screed, Mullions, Stub columns, lintel beams, Band beams, Plinth beams, toe wall,

gutters and other miscellaneous structures at all levels as shown in tender drawings.

- (vii) Design and construction of shaft from ground level to Service level for wastewater/drainage pipes near toilet location.
- (viii) Design & Construction of Lift shafts and escalators pits and other fixtures in stations in coordination with respective system contractors including water proofing of lift pits and escalator pits as per specifications and as per tender drawing.
- (ix) Design, Providing & Fixing of insert plate & bolting arrangement for façade in the station building for finishing works including finishing work and facade work.
- (x) Waterproofing in the underground structures, water tanks & overhead terrace tank with injection grouting & waterproofing plaster and finishing of water tanks with ceramic tiles. Providing and fixing of MS Manhole duly painted covers along with necessary locking arrangement in water tanks at all stations.
- (xi) Design & Construction of Manholes, Sumps, drain, buttle flanges, sleeves as required for automation-based water supply scheme in Ancillary Building for E&M works & finishing works.
- (xii) Earth filling with compaction with good earth wherever required. For the area falling on the road, backfilling shall be done with sand as per Outline Construction Specifications.
- (xiii) Foundations for the system equipment (water supply pumps, firefighting pumps, DG, Panels & AC Outdoor/ VRF units).
- (xiv) Design & Construction of ground water recharging /Rainwater harvesting systems two nos. at each station to cater all the station as per guidelines of Central Ground Water Authority for rainwater harvesting. The general arrangement of Rainwater harvesting system. The size of RWH pit & depth of bore shall be as per the guidelines of Central Ground Water Authority, the design shall be submitted to Authority for approval before execution.
- (xv) Construction of Crash barriers as required.
- (xvi) Earthing arrangement for station & ancillary building as per requirement of system contractor.
- (xvii) Provision for cutouts in the stations as required for services with various system & finishing requirement.
- (xviii) Temporary arrangements are to be made for providing working platform at suitable height so that traffic run below it unhindered, and safety of road user

is ensured. This arrangement shall be maintained till completion of work. The working platform has to be covered with suitable material so that nothing falls on the road. A detailed scheme is to be submitted for approval before the start of work. Temporary staging shall be provided by the contractor to facilitate erection of panels, equipments etc.

- (xix) Design & Construction of temporary structures/ construction methodology and getting it approved from third party.

2.2.B.2 All designs shall be disable friendly. There is a possibility of some of the items not getting mentioned in the above list of works of station. The contractor is requested to go through the tender drawings also in detail as the works mentioned above as well as indicated in the tender drawings would be considered inclusive in the scope of work under quoted price. The authority's decision shall be final in this regard in case of dispute.

2.2.B.3 Any other item of work that may be required to be carried out for completing the construction of station building with all necessary finishing and system. Contractors in all respects in accordance with the provisions of the Contract and to ensure the structural stability and safety during and after construction.

2.2.B.4 No payment shall however be made for supporting and protecting the utilities during execution of the work. No claim on account of delay in execution of utility diversion will be entertained. All temporary diversion of any utilities done to facilitate the construction activity shall be the part of the EPC quoted price. No payment shall however be made for supporting the utilities, carriage of excavated earth during execution of work.

2.2.B.5 Inserts/bolts/Supports/Hangers for system & finishing works.

2.2.B.6 All aspects of quality assurance, including testing of materials and other components of the work, as specified or as directed. Arranging & performance dynamic Integrity test on 100% piles and cross hole sonic integrity test on 25% of piles as per Outline Construction Specifications. Conducting initial and routine load tests on piles for stations, entry-exit as per frequency given in Outline Construction Specifications (BIS-2911- Part IV).

2.3 STRUCTURES

2.3.1 The construction of structures will have to be planned in such a manner that they do not obstruct or interfere with the existing roads/railways and other utilities. Where work is required to be carried out at locations adjacent to such roads/railways, utilities, structures, monuments etc. suitable safety and protection arrangements will have to be ensured for which nothing extra will be payable. It should be ensured that no damage is caused to any such element/person/ property and Engineer/ Authority shall be indemnified against such damage at no extra cost.

2.3 DESIGN CRITERIA

2.3.1 Design criteria shall be as per Outline Design Specifications.

- 2.3.2 Results of the sub surface investigations conducted at the project site are enclosed with the tender document. The information about the soil and sub soil water conditions is being made available to the contractor in good faith and the contractor is advised to obtain results independently as may be considered necessary by him before quoting rates in the tender & condition given in Outline Design Specifications will prevail in case of difference in results of two reports.

2.4 REFERENCE TO THE STANDARD CODES OF PRACTICE

- 2.4.A All Standards, Outline Construction Specifications for Civil Works and Codes of practice referred to shall be latest editions including all applicable official amendments and revisions. The Contractor shall make available at site all relevant Indian Standard Codes of practice, BS, ASTM, IRC & IS Codes as applicable.
- 2.4.B Wherever Indian Standards do not cover some particular aspects of design/ construction, relevant British & German Standards will be referred to. The Contractor shall make available at site such standard codes of practice.
- 2.4.C In case of discrepancy among Standard codes of practice, Outline Construction Specifications and provisions in sub clauses of RFP, the order of precedence will be as below:
- Provision in RFP,
 - Outline Design Specifications / Outline Construction Specifications for Civil Works.
 - MORTH Specification for road & Bridges,
 - CPWD specifications,
 - Standard Codes of Practice

In case of discrepancy among Standard Codes of Practice, the order of precedence will be IRS, IRC, IS, BS, DIN ASTM.

2.5 DIMENSIONS

- 2.5.A As regards errors, omissions and discrepancies in Specifications and Drawings, relevant clause of Particular Conditions of Contract will apply.
- 2.5.B The levels, measurements and other information concerning the existing site as shown on the conceptual / layout drawings are indicative, the Contractor should verify them for himself and also examine the nature of the ground as no claim or allowance whatsoever will be entertained on account of any errors or omissions in the levels or strata turning out different from what is shown on the drawings.

2.6 ASSOCIATED WORKS

Works to be performed shall also include all general works, preparatory works for the construction and works of any kind necessary for the design and satisfactory construction, completion and maintenance of the works to the intent and meaning of the drawings adopted and Outline Construction Specifications, to best Engineering standards and orders that may be issued by the Engineer from time to time, compliance by the agency with all Conditions of Contract, supply of all materials, apparatus, plants, equipment, tools, fuel, water, strutting, timbering, transport,

offices, stores, workshop, staff, labour and the provision of proper and sufficient protective works, diversion, temporary fencing, lighting and watching required for the safety of the public and protection of works on adjoining land; first-aid equipment, sanitary accommodation for the staff and workmen, effecting and maintenance of all insurances, the payment of all wages, salaries, fees, royalties, duties or the other charges arising out of the erection of works and the regular clearance of rubbish, clearing up, leaving the site perfect and tidy on completion

2.7 CONSTRUCTION YARD & DUMPING AREA

Land required for construction yard, batching plant and other activities shall be arranged by the contractor and this land should be good for such offsite activities as needed by the Contractor at no extra cost to the Authority. A mechanical tyre washing plant shall have to be installed by the contractor for the vehicles leaving the yard to avoid the spillage on the roads. C&D Waste generated from construction depot, towers, station during construction to be disposed off as directed by Engineer /Authority 20 km lead from the site and cost of the same is also included in quoted cost.

2.8 TIME SCHEDULE & MONITORING OF PROGRESS

- (i) The contractor shall submit with the tender "Time Schedule" for completion of various portions of works. This schedule is to be within the overall completion period of 48 Months. The detailed programme in the form of a quantified bar chart or CPM network shall include all activities starting from design to completion.
- (ii) In compiling its Works Programme and in all subsequent updating and reporting, the Contractor shall make provision for the time required for coordinating and completing the design, testing, commissioning and integrated testing of the Works, including, inter alia, design co-ordination periods during which the Contractor shall co-ordinate its design with those of Designated Contractors, the review procedures, determining

and complying with the requirements of all Government Departments and all others whose consent, permissions, authority or license is required prior to the execution of any work.
- (iii) The Contractor shall submit to the Engineer Four copies of a Monthly Progress Report (MPR), describing the progress and current status of the Works. The MPR shall address the matters set out in the Works Programme. Videography by drone shall also be done at all workplaces every one month as per Outline Construction Specifications. All construction locations including construction yard to be monitored through CCTV and also be linked with Authority and Engineer office.
- (iv) The MPR shall be submitted by the end of each calendar month. It shall account for all works actually performed from **the twenty sixth day of the last month and up to twenty fifth** day of the current month.
- (v) A monthly / biweekly / weekly meeting to monitor the progress of the project shall be convened by the Engineer, Contractor's site agent and site agent of all

interfacing teams shall attend the meeting. The Authority may also be present in the meeting.

2.9 SCOPE OF WORK UNDER MISCELLANEOUS ITEMS

- (i) Tree cutting and (or) transplantation along the alignment after getting permission from forest department/nodal agency.
- (ii) Barricading - Locations where road vehicles / pedestrians are moving, along the Viaduct / Stations / Construction sites directed by Engineer, shall be provided & maintained with barricading as per the drawing provided in the tender drawing. Traffic barricade with blinker, rope lights, reflective tapes and other necessary signage's shall be provided wherever required as per detailed plan. Temporary traffic diversion for smooth flow of traffic will be provided during construction including necessary traffic signs. Traffic marshals shall be deployed for the period of diversion to guide the road user and to avoid traffic congestion.
- (iii) Traffic marshals guide the road users and to avoid traffic congestion.
- (iv) Utility identification at foundation locations will be done by the contractor and in case utility(ies) is encountered, the contractor shall modify the design at such location to meet obligatory requirements within the quoted price. However, if neither the utility(ies) can be diverted/shifted, nor the column location be altered then the substructure will be designed by accommodating the utility(ies). This difference shall be calculated by working out the difference between the cost of actual substructure work executed vis-a-vis the assessed cost of substructure that would have been constructed at this location as per tender requirements and conditions. No additional payment shall be made for re-designing of any structures due to utilities/underground structures etc. Shifting of utility(ies) would be done only in exceptional cases. No claim on account of delay in execution of utility diversion will be entertained. All temporary diversion of any utilities done to facilitate the construction activity shall be the part of the quoted price.
- (v) The utilities are to be diverted with proper liaison and approval of the utility owning agencies. The utilities which are not be diverted but require supporting, proper supporting is be done so that they are not damaged. Precautions to be taken while handling the utilities are mentioned as under:
 - (a) Utilities must not be damaged at any cost. If due to some or the other reason, mishap occurs, it should be rectified immediately by the Contractor at his own cost under intimation of Authority.
 - (b) Till rectification of the damaged trunk sewers, the Contractor shall arrange alternate arrangement for sewer pumping and its disposal as per directions of Engineer or Utility owning agency. A similar arrangement is done for other utilities also.
 - (c) The manholes of Trunk/Sewers should not be covered under the

foundation as these may create hindrances to the annual de-silting/cleaning of sewer lines.

- (d) Sufficient distance of foundation from outer edge of Trunk / Sewers is to be kept in view of further maintenance/Safety of Trunk /Sewers.
- (e) The covers of manholes be saved from heavy machinery movement to avoid any accident/Slippage of debris in manholes etc. into the Trunk /Sewers lines which may cause blockage of lines. In case of damage of manhole cover & frame the same shall be replaced immediately by the Contractor at his own cost with similar specifications.
- (f) Manholes of the trunk sewer should be kept freely accessible for cleaning and removal of blockages and debris should not be dumped over these manholes.
- (g) Branch sewer connections which are connected with the trunk sewers should also be taken care of. If the same are damaged, the same should be restored immediately on priority.

NOC & Approval of schemes of Diversion of Utilities from the concerned regulatory / statutory / Local Authority is the responsibility of the Contractor & Nothing extra is payable on this account.

This is only indicative for one of the utilities. Similarly, necessary precautions which are specified from time to time by the utility owning agencies shall also be ensured.

Contractor should make his own survey for identification of underground/above ground utilities.

3. INSPECTION

Authority may appoint an independent agency to ensure the quality checking of design, supply, fabrication, erection and construction of all works under scope of work. The Contractor shall ensure the complete co-operation with the agency to perform their work satisfactorily. In addition, Authority also reserves right to undertake quality check and inspection directly by itself.

4. ALIGNMENT OF ROPEWAYS

- (i) The alignment has been developed by the Authority to meet operational and technical criteria. The Contractor is not required to evaluate the alignment for compliance with these criteria but shall review it with respect to his own design and construction proposals and shall satisfy himself that there is no conflict with existing structures which are to be preserved.
- (ii) The Contractor is permitted to propose minor deviations in alignment to suit his construction proposals, but he must demonstrate that any such deviations shall comply with good design practice and the alignment requirement of the Design Criteria. Such deviations shall require prior approval of the Authority

subject to following conditions: -

- (a) There is no extra cost to the Authority
- (b) Changes proposed are essentially required to suit the contractor's specific design
- (c) There is no change to the contract boundaries or if there is any, the same is agreed by the contractor of the adjoining section without any extra cost to the Authority.

5. CLEARANCES

- (i) The Permanent Works shall provide for the installation by the Contractor of operating equipment for the ropeway.
- (ii) Construction limits:
 - (a) The limits of land for the Works are shown on the drawings. The Contractor shall design the Works to be contained totally within these limits, respecting the regulations concerning construction and property boundaries of the local authorities such as Shimla Municipal Corporation, HIHUDA, PWD, etc. In the event that the Contractor, having used its best endeavours, is unable to design the permanent works and utilities to be contained totally within these limits, then the Authority will obtain the necessary additional land or the Contractor may be required to redesign the structure as instructed by Engineer
 - (b) The limits of land as shown in the right of way survey drawings may undergo changes after final survey and the Contractor shall make any adjustments necessary to the design to acknowledge the changes to the limits as then defined.

6. DESIGN LIFE

The design life of all the Permanent Works shall be 100 Years.

7. DURABILITY AND MAINTENANCE

- (i) The Permanent Works shall be designed and constructed such that, if maintained reasonably and in accordance with the Contractor's statement of maintainability contained in the Contract, they shall endure in a serviceable condition throughout their minimum lives
- (ii) The Permanent Works shall be designed and constructed so as to minimise the cost of maintenance whilst not compromising the performance characteristics and ride quality of the ropeway.
- (iii) Restoration of roads, utilities and other services dislocated during construction.

- (iv) Survey, Instrumentation, ground treatment, ground and building monitoring, risk analysis, settlement prediction, preventive and corrective actions.
- (v) Traffic management along the worksite including works connected with traffic management.
- (vi) Reinstatement of services (such as signalling system, bus stand, footpath including kerb stone, boundary wall, horticulture work and any other work to bring the site to original position) within barricading area as per similar specifications with new materials (except electrical/signal post which may be reused).
- (vii) The contractor shall be responsible for obtaining relevant certificates or clearance from local civic authorities viz. completion certificate, fire clearance etc.
- (viii) The contractor shall be responsible for obtaining approval by all relevant civic authorities having jurisdictional authority wherever required.

8. OPERATIONAL REQUIREMENTS

- (i) The Permanent Works shall be designed to permit the ropeway to operate satisfactorily at a maximum design capacity (3000PPHPD) where applicable.
- (ii) Particular attention shall be paid to locations where flooding could enter the station structures or otherwise damage the ropeway. In particular,
 - (a) Construction of surface water drainage systems including plinths and ducts shall be avoided in the vicinity of traction substations to obviate any risk of flooding of electrical equipment areas.
 - (b) Entrances and all other points of access to the stations shall be adequately protected against flooding.
- (iii) During construction the contractor shall be responsible for providing and maintaining adequate flood protection to ensure protection of the works.
- (iv) In the design and construction of the Works, the Contractor shall, as a fundamental objective and as a priority, ensure that passengers, staff and the public will, throughout the operational period of the Shimla ropeway, and within the confines thereof, be provided with safe environment as is reasonably possible. The Contractor's attention is drawn to **Clause 13** of this Authority's Requirements - Functional, concerning the role of the Inspector for Ropeway Safety.
- (v) The design of the works shall be such that the Forecast Passenger Flows can be met without congestion occurring and without risk to the safety of passengers or ropeway employees including during any emergencies. Exits

and passages, in particular, should be suitably designed and provided.

- (vi) Escalator pits shall be designed to enable drainage by gravity flow system. However, where length of the drainage is exceptionally long, the pumping system may be considered subject to approval of Authority. Installation of pumps is not in the scope of this contract.

9. FUNCTIONAL REQUIREMENTS OF PUMPING INSTALLATIONS

- (i) Water pump installations shall be designed for unmanned operation, controlled through liquid level controllers, capable of pumping the requisite amount of water to the utility or to the ground / overhead tanks.
- (ii) The pumping installation shall withstand the corrosive effects of normal water supply, seepage water and sewage and serve for the anticipated life of the equipment. The discharge velocity for sewage / seepage pumping shall not be less than 0.75 l/sec.
- (iii) The pipeline size should be such that the velocity head does not exceed the normal static head except for the fire pump which is governed by separate criteria. The valve controls and regulating mechanisms shall be designed for automatic operation.

10. ENVIRONMENTAL CONSIDERATIONS

All provisions and conditions contained in the conditions of contract on Safety & Health and Environment, shall be strictly complied with.

11. URBAN PLANNING FUNCTIONAL REQUIREMENTS

- (i) The Station Site Plans are based on the urban planning design carried out by the Authority and specific land acquisition plans have been submitted to the concerned govt. authority and to the concerned land-owning agencies of Govt. of India/ Govt. of Himachal Pradesh for approval. The land acquisition initiated to date is therefore based on the entrance, ventilation shafts, ancillary buildings and redevelopment of the site areas as shown on the site plans. The Contractor must therefore, if revising the tender drawings for any reason, develop his layouts to suit the available land provided for the metro works.
- (ii) Requests for temporary power supplies for the construction of the works must be submitted by the contractor to the concerned authorities. Alternatively separate power supplies may be arranged by the Contractor independent of concerned electricity distribution/transmission authority subject to compliance with all necessary statutes.
- (iii) In addition, a number of agencies are involved in the reinstatement works, permanent road accesses, temporary road accesses, refuse collection accesses, traffic management and fire hydrant positions. The Contractor is responsible for obtaining the approvals for these other works

- (iv) The Contractor is responsible for obtaining the approval of applications from the above authorities for the design and construction of works. The Authority may provide assistance in order to obtain any permission on clearances.

12. TRAFFIC MANAGEMENT

The Contractor shall carry out the Works so as to minimise disruption to road and pedestrian traffic. The Contractor shall prepare his traffic management plan based on his proposed construction methodology in co-ordination with Engineer and in consultation with Shimla Traffic Police. He shall comply strictly with the approved plan during construction of his works. Minimum number of traffic lanes shall be kept open for the traffic as agreed with Shimla Traffic Police. Necessary approval from Traffic Police shall be arranged by contractor without any extra cost.

13. MISCELLANEOUS

The Contractor shall note that the Inspector appointed by GoHP shall inspect the Works from time to time for the purpose of determining whether the Shimla Ropeway Project complies in terms of operational and infrastructural safety in accordance with the Himachal Pradesh Aerial Ropeway Act 1968. The contractor shall note that Inspector's approval is mandatory for commissioning the system. Notwithstanding other provisions of the Contract, the Contractor shall ensure that the Works comply with the requirements Inspector in terms of construction to the drawings and shall make all necessary arrangements and assist the representatives of O&M of Authority and Inspector in carrying out their inspection duties and also comply with their instructions regarding rectifying any defects and making good any deficiencies. Contractor shall make available all the drawings, sketches including photographs etc. as required for submission of application for inspection of Inspector as instructed by the engineer.

14. STANDARDS

- (i) Equipment, materials and systems shall be designed, manufactured and tested in accordance with the latest issue of International and/or National codes and standards. The Contractor shall submit hard copies in original to the Engineer of all codes and standards used for the work.
- (ii) Reference to standards or to materials and equipment of a particular manufacturer shall be regarded as followed by the words "or equivalent". The Contractor may propose alternative standard materials, or equipment that shall be equal to or better than those specified. If the Contractor for any reason proposes alternatives to or deviations from the specified standards, or desires to use materials or equipment not covered by the specified standards, the Contractor shall apply for the consent of the Engineer. The Contractor shall state the exact nature of the change, the reason for making the change and relevant specifications of the materials and equipment in the English language. The decision of the Engineer in the matter of quality will be final.

3. DESIGN

1. INTRODUCTION

- (i) The Authority's Requirements - Design, specifies the procedural requirements for the preparation of the design of the Permanent Works. These requirements are subdivided into those that are to occur during the Design Phase, those that are to occur during the Construction Phase, and those that are of general application.
- (ii) In addition to the express requirements herein, the Contractor shall, whenever the Engineer so requests, provide information and participate in discussions that relate to design matters.
- (iii) The Contractor shall engage the Designer who shall undertake and prepare the design of the Permanent Works and Temporary Works. The Contractor shall establish an office for his core design team at the Site in Shimla. The core design team shall function from this office and all meetings and discussions relating to design shall be held in this office.
- (iv) The Contractor shall ensure that the Designer continues to be represented in Shimla at all times by staff whose seniority and experience are to the satisfaction of the Engineer and whose representative is available on the Site as necessary or as required by the Engineer.
- (v) The Contractor shall submit his Quality Assurance Plan as required at Appendix 6 for the design required by the Contract.

2. REQUIREMENTS DURING DESIGN PHASE

- (i) The principal requirements of the Design Phase are the production of the Preliminary Design, the Definitive Design and the Construction Reference Drawings.
- (ii) Preliminary Design

The Preliminary Design shall incorporate the Contractor's tender design developed to sufficiently define the main structural elements. In addition, general construction methods and documentation needed to develop the Definitive Design shall be submitted.
- (iii) Definitive Design shall accord with and incorporate the Contractor's Technical Proposals and shall be the design developed to the stage at which all elements of the structures are fully defined and specified and in particular :
 - (a) Calculation and analysis are complete;
 - (b) All main and all other significant elements are delineated;
 - (c) All tests and trials and all selection of materials and equipment are complete;
 - (d) Shall take full account of the effect on the Permanent Works of the proposed methods of construction and of the Temporary Works.

- (iv) During the preparation of the Definitive Design, the Contractor shall complete all surveys investigations and testing necessary to complete the design of the Permanent Works.
- (v) The Contractor shall sub-divide the proposed Definitive Design into Design Packages to be submitted in advance of the Definitive Design Submission and to be identified in the Design Submission Programme. The Design Packages are to relate to the significant and clearly identifiable parts of the proposed Definitive Design and shall address the design requirements as described herein. The Design Packages shall facilitate the review and understanding of the Definitive Design as a whole and shall be produced and submitted in an orderly, sequential and progressive manner.
- (vi) Separate Definitive Design Submissions may be prepared for those major elements to be procured by sub-contract and which sub-contracts include design. Where such work is to be procured by the Contractor on the basis of outline design, design briefs and performance specifications, such documents may be submitted as Definitive Design Submissions.
- (vii) Upon issue of the Notice in respect of the Definitive Design Submission, the Contractor shall complete the design in all respects and produce the Construction Reference Drawings, the purpose of which is to illustrate all the Permanent Works and to be the drawings governing construction.
- (viii) Construction Reference Drawings shall fully detail for the construction of the elements covered by the Definitive Design and shall show in full the works to be constructed.

3. REQUIREMENTS DURING CONSTRUCTION PHASE

- (i) The principal requirements relating to design during the Construction Phase are the production of Working Drawings, the preparation of technical submissions as required under the Contract, the compilation of the Final Design and the production of the As-Built Drawings.
- (ii) Working Drawings shall be prepared as required under the Contract. They shall be endorsed by the Contractor as being in accordance with the Construction Reference Drawings.
- (iii) The Contractor shall endorse the submissions required under the contract that “all effects of the design comprising the submission on the design of adjacent or other parts of the works have been fully taken into account in the design of these parts”
- (iv) At least 3 months but not more than 6 months prior to the anticipated date of substantial completion of the Works, the Contractor shall submit the Final Design to the Engineer.
- (v) The Final Design is the design of the Permanent Works embodied in:
 - (a) The latest revisions of the documents comprised in the Definitive Design, taking account of comments in the schedules appended to Notices of No Objection
 - (b) The latest revisions of the Construction Reference Drawings;

- (c) The calculations (see Clause 11 herein); and
- (d) Such other documents as may be submitted by the Contractor at the request of the Engineer to illustrate and describe the Permanent Works and for which a Notice has been issued.
- (vi) The Contractor shall maintain all records necessary for the preparation of the As-Built Drawings. Upon completion of the Works or at such time as agreed to or required by the Engineer, the Contractor shall prepare drawings which, subject to the Engineer's agreement, shall become the As-Built Drawings. All such drawings shall be endorsed by the Contractor as true records of the construction of the Permanent Works and of all temporary works that are to remain on the site. The Contractor shall also show the locations of utilities exposed and retained as directed.

4. DESIGN INTERFACES

The Contractor shall co-ordinate all design and installation work with the various Designated teams and establish the Co-ordinated Installation Plan (CIP). The coordinated installation Plan (CIP) shall be developed by the contractor in a format acceptable to the Engineer. The Contractor shall co-ordinate with all interfacing Designated Teams to produce a detailed programme of access dates, equipment delivery routes and occupation periods for each room and area inside the station envelope. The CIP shall be signed off by each Designated Team and Submitted to the Engineer not later than 3 (Three) months before basic structure is completed.

5. DESIGN SUBMISSIONS

5.1 PRELIMINARY DESIGN SUBMISSION

5.1.1 GENERAL

The preliminary design shall provide initial design documents for review and shall be sufficiently detailed to show the element of the design main, and documents required for preparation of the definitive design. It shall also include:

- (a) the quality assurance plan for design
- (b) a review of the outline design criteria
- (c) the submission of design manuals
- (d) the submission of proposed software including BIM Software (Autodesk Revit and Navisworks) and BIM360 Lincense.
- (e) the preliminary equipment layouts and details
- (f) the preliminary maintenance analysis
- (g) the preliminary off site testing recommendation
- (h) the submission of specifications proposed for the work
- (i) the identification of design codes and standards
- (j) the BIM coordination procedure
- (k) CAD procedures
- (l) preliminary station sizing
- (m) preliminary viaduct sizing

- (n) an alignment review
- (o) the preliminary construction methodology
- (p) the design submission programme (update)
- (q) the utility diversion plan
- (r) proposed site surveys and other field surveys
- (s) a review of permanent land requirement
- (t) the preliminary ground treatment and building/slope protection proposal.
- (u) The preliminary reinstatement drawings.

5.2 DEFINITIVE DESIGN SUBMISSION

5.2.1 GENERAL

The Definitive Design Submission shall be a coherent and complete set of documents properly consolidated and indexed and shall fully describe the proposed Definitive Design. In particular, and where appropriate, it shall define:

- (a) the dimensions of all major features, structural elements and members;
- (b) all materials;
- (c) Potential forces and movements due to all possible loadings and actions on the structures, and their accommodation;
- (d) all second order effects;
- (e) the layout and typical details of reinforcement in structural concrete members;
- (f) the locations and nature of all relevant joints and connections and details thereof;
- (g) standard details;
- (h) location, geometry and setting-out of all main elements and features;
- (i) electrical and mechanical services and equipment and their interaction with the structures;
- (j) Provisions and proposals for construction interfacing with the Designated Contractors;
- (k) Utilities to be diverted /supported;
- (l) Predictions of effect on structures due to ground movements and the proposed protective measures to limit the effects to a degree not exceeding the limit as defined in design basis report
- (m) Traffic or other civic service affected.
- (n) Prediction of lowering of water table and its effect on (m)& (n) above.

5.2.2 DRAWINGS

The Definitive Design Submission shall include drawings that shall illustrate the proposed Definitive Design and in particular shall include, without limitation:

- (i) general arrangements;
- (ii) layouts and details of structural elements;
- (iii) associated fittings;
- (iv) slopes protection and earthworks;
- (v) structural and surface drainage;
- (vi) existing and proposed utilities;
- (vii) Road works and works related to traffic management.

5.2.3 CONTRACT SPECIFICATION

The Specification included in the Contractor's Technical Proposals together with the Outline Design Specifications and Outline Construction Specifications Civil Works shall be amplified so as to specify comprehensively the design and construction of the Permanent Works. The format of the Contract Specification shall be the Three-Part Format of the Construction Specification Institute (CSI) of America.

(i) DESIGN MANUAL

The Design Manual shall incorporate all design requirements, standards, codes, loading cases, permissible movements and deflections, limit states, design stresses and strains, material properties and all other documents or matters which are relevant to and govern the design. The Design Manual shall refer to all materials, codes and standards used, making clear their specific applications. The Design Manual shall be produced so that it can be used by those involved in the preparation or review of the design of the Permanent Works as a comprehensive reference text and efficient working document.

(ii) INTERFACE REPORT ON DESIGNATED TEAMS

This will include the following:

Details of the design and construction of the Works adjacent to other contracts. Details of provisions for the Designated Contracts, indicating arrangements for accesses, fixings, casting-in, openings, supports, decks, manholes, trenches and the like; updated interface management plan relating to design integration and co-ordination.

(iii) TESTING AND COMMISSIONING REPORT

Details of proposals for testing and commissioning procedures for all relevant elements and equipment contained in the Permanent Works.

(iv) MAINTENANCE REPORT

A report updating the Statement of Maintainability in the Contractor's Technical Proposals and detailing maintenance routines necessary for the achievement of the required lives of the various elements of the Works.

(v) AESTHETICS REPORT

(vi) STATION PLANNING REPORT

5.2.4 SUPPORTING DOCUMENTS

The Definitive Design Submission shall be accompanied by the following documents, which will be considered by the Engineer in his review of the Definitive Design Submission. Where relevant or required, these documents shall be accompanied by a design note stating clearly how information has been used in the design of the Permanent Works.

(i) GEOTECHNICAL INTERPRETATIVE REPORT

A report including site investigation results and covering the geotechnical interpretation of site investigation work including that undertaken by the Contractor in sufficient detail to confirm and justify parameters used in the foundation and geotechnical designs. The report shall include the full logs and descriptions of confirmatory boreholes drilled by the Contractor.

(ii) SURVEY REPORT

A report on all survey work undertaken by the Contractor, including checks on mapping, survey stations, co-ordinates and setting-out. Updated topographical and survey drawings shall also be included.

(iii) UTILITIES REPORT

A report giving details of arrangements and working methods in respect of the existing utilities, including protection measures, diversions, reinstatements and programme allowances.

(iv) TEMPORARY WORKS DESIGN REPORT

A report which provides sufficient information on the design of the Temporary Works to allow the Engineer to assess their effects on the Permanent Works and to enable these to be taken into account in the review of the Definitive Design.

(v) CONSTRUCTION / INSTALLATION ANALYSIS REPORT

A report containing a stage-by-stage construction / installation sequence for all structures / equipment.

(vi) CONSTRUCTION METHOD STATEMENT

A report which provides sufficient information on the methods of construction and Contractor's Equipment to allow the Engineer to assess their effects on the Permanent Works and to enable these to be taken into account in the review of the Definitive Design.

(vii) PROJECT SCHEDULE REVIEW

- (a) The Contractor shall, prior to submitting the Definitive Design Submission, review the Project Schedule against the current version of the Design Submission Programme.

- (b) In the event that the Contractor considers that there are any discrepancies or inconsistencies between the Design Submission Programme and the Project Schedule, the Contractor shall submit with the Definitive Design Submission its proposed revisions to the Project Schedule such that the discrepancies or inconsistencies are removed.
- (c) The Contractor shall provide details of submissions of the proposed Working Drawings and their anticipated timing during the Construction Phase and shall identify information required from or actions to be undertaken by the Authority or others which are necessary to permit the completion of the design of the Permanent Works and the Working Drawings. Desired Dates for the receipt required by the Contractor.
- (d) of such information or for the completion of such actions shall be included with appropriate justification.

(viii) REPORT ON THE USE OF WORKS AREAS

A report updating the proposals from those contained in the Contractor's Technical Proposals for the use of Works Areas and their reinstatement, detailing the station accesses and accesses facilities.

5.2.5 NOTICES ON DEFINITIVE DESIGN SUBMISSION

The Contractor may make Definitive Design Submissions and seek separate Notices in respect of:

- (a) The temporary works for construction of the Ropeway Towers & station works.
- (b) All works related to the Ropeway Towers,
- (c) All works related to each of the stations.
- (d) Major elements as identified under Clause 2(vi) herein.

The issue of such separate Notices under (a), (b) and (c) above shall be conditional upon the Contractor having demonstrated, to the satisfaction of the Engineer, that the effect of each structure on other structures, utilities, etc., has been fully accommodated in the design.

6. DESIGN SUBMISSIONS - CONSTRUCTION REFERENCE DRAWINGS SUBMISSIONS

- (i) The Construction Reference Drawings shall be derived directly from the Definitive Design and shall detail and illustrate in full the Permanent Works. The Construction Reference Drawings shall form part of the Working Drawings to be used for construction purposes.
- (ii) Prior to any Construction Reference Drawings Submission, the Contractor shall prepare a full list of Construction Reference Drawings in order to demonstrate, to the satisfaction of the Engineer, that such Construction Reference Drawings will be sufficient in extent to cover the construction of the whole of the Permanent Works.
- (iii) Unless otherwise required by the Engineer, the Construction Reference Drawings need not include bar bending schedules, bar reference drawings, fabrication or shop

drawings as well as other schedules or erection drawings which are to be provided by the Contractor during the Construction Phase.

7. DESIGN SUBMISSIONS - CONSTRUCTION PHASE

- (i) On the issue of a Notice in respect of the Construction Reference Drawings the Contractor shall produce the proposed Working Drawings. These shall either be identical to the Construction Reference Drawings or shall be further drawings developed in accordance with the Construction Reference Drawings such as site sketches, bar bending schedules, bar reference drawings, fabrication and shop drawings, construction erection sequences and the like. All such drawings shall comply with the requirements of the Contract.
- (ii) Prior to submission of the proposed Working Drawings, the Contractor shall endorse the appropriate original paper drawings as "Good for Construction". If the Engineer so requires, the endorsed original shall be submitted to the Engineer who shall, if he has no objection to the contents of the submission, further endorse the original by stating that he has no objection to the proposed Working Drawings. On the endorsement by the Engineer, the original will forthwith be returned to the Contractor as the Working Drawings.
- (iii) Only the Working Drawings endorsed as in 7(ii) above or those that the Engineer has expressly stated as not requiring his endorsement shall be issued to the Site. The Construction of the Works shall be strictly in accordance with these Working Drawings.
- (iv) The Contractor shall finalise details of the proposed method of construction and submit such finalised details to the Engineer for review. The proposed method shall have no adverse effects on the partially completed Permanent Works and shall ensure the Works are statically and, if appropriate, aerodynamically stable.
- (v) The Contractor shall undertake and submit a stage-by-stage construction sequence and the effect of any Temporary Works and the Contractor's Equipment on the Permanent Works. This analysis shall be in sufficient detail to demonstrate that the Contractor's proposals are safe and have no adverse effects upon any parts of the Permanent Works.
- (vi) As-Built Drawings, endorsed by the Contractor shall be submitted to the Engineer for agreement in accordance with Clause 5.6 of the GC.

8. DESIGN SUBMISSIONS - REVIEW PROCEDURES

- (i) Submissions of Design Data shall be made and reviewed by the Engineer. The form and details of the review shall be as determined by the Engineer and will not release or remove the contractor's responsibility for the design under the contract.
- (ii) The issue of a Notice shall be without prejudice to the issue of any future Notices.
- (iii) The Contractor shall, prior to the submission of the Design Data, obtain all required and/or statutory approvals that relate to that submission including, where appropriate, the approval of the Concerned Government Authorities and utility undertakings, and demonstrate that all required approvals have been obtained.

- (iv) All submissions shall be accompanied by two original copies of a 'Design Certificate' as set out in Attachment D1 hereto and signed by the Contractor and the Designer.

9. DESIGN SUBMISSION PROGRAMME

- (i) The Contractor shall prepare the Design Submission Programme which is to set out fully the Contractor's anticipated programme for the preparation, submission and review of the Design Packages, the Definitive Design Submission and the Construction Reference Drawings Submissions and for the issue of Notices in relation thereto.
- (ii) The Design Submission Programme shall:
- be consistent with and its principal features integrated into the Works Programme, and show all relevant Key Dates;
 - identify dates and subjects by which the Engineer's decisions should be made;
 - make adequate allowance for periods of time for review by the Engineer and other review bodies;
 - make adequate allowance for the design and development of specialist works;
 - include a schedule identifying, describing, cross-referencing and explaining the Design Packages into which the Contractor intends to divide the Definitive Design and Construction Reference Drawings; and
 - indicate the Design Interface and Co-ordination periods for each Designated Contractor.
- (iii) The Contractor shall submit the Design Submission Programme to the Engineer within thirty (30) days of the date of Notice to Proceed, and thereafter up-dated versions thereof at intervals of not more than one (1) month throughout the Design Phase.

10. PROGRAMME FOR SUBMISSIONS DURING THE CONSTRUCTION PHASE

In accordance with Clause 4 of the Authority's Requirements - General, the Contractor shall identify submissions required during the Construction Phase.

11. CALCULATIONS

- (i) Unless otherwise required by the Engineer, calculations relevant to the Definitive Design and Construction Reference Drawings shall be submitted for review with the respective Design Packages or Submissions. The Engineer may require the submission of applicable software including in house software programmes/ worksheets developed by the Contractor, computer input and programme logic for its review prior to the acceptance of the computer output.
- (ii) The Contractor shall prepare and submit a comprehensive set of calculations for the Definitive Design in a form acceptable to the Engineer. Should the design of the Permanent Works be revised thereafter, and such revision renders the calculations as submitted obsolete or inaccurate, the Contractor shall prepare and submit the revised calculations.

- (iii) Similarly, the Contractor shall submit such further calculations as have been prepared in connection with the Construction Reference Drawings.
- (iv) Calculations to be included as part of the submission herein shall comprise the up-to-date calculations in respect of the Definitive Design, the Construction Reference Drawings and such further calculations which the Contractor has prepared during the production of Working Drawings.
- (v) The Contractor shall submit all calculations necessary to support proposals relating to the construction methods.

12. DOCUMENTS REQUIREMENTS

- (i) Drawings shall be prepared generally to A1 size, but to ISO A0 size where appropriate. Appendix 7 defines the Drawings and CAD Standards required for drawing preparation and submittal.
- (ii) The Contractor shall submit 6 copies of his design and/or drawings for review by the Engineer. After receipt of “No Objection” from the Engineer’s Representative, the Contractor shall submit 6 copies of design and/or drawing for the use of the Engineer.
- (iii) The submission of drawings may be by CAD Media files and Appendix 7 specifies the drawing submission requirements for CAD Media files.
- (iv) The contractor to provide one licensed working software copy being used by its designer to design department maintained for the entire contract period.

ATTACHMENT D 1 DESIGN CERTIFICATE

This Design Certificate refers to design submission no. , which comprises of Definitive Design submission / Construction Reference Drawings submission, working drawing submission scheduled in the attached transmittal, in respect of:
(Description of Permanent Works to which the submission refers)

DESIGNER'S STATEMENT:

We certify that:

- the outline designs, design briefs and performance specifications of those elements of the Permanent works as illustrated and described in the documents scheduled in the attached transmittal, complies with the Outline Design Specifications and other contract provisions.
- an in-house check has been undertaken and completed in accordance to approved Quality Assurance Plan (QAP) to confirm the completeness, adequacy and validity of the design of the Permanent Works as illustrated and described in the documents scheduled in the attached transmittal.
- all necessary and required approval relating to the design of the Permanent Works, as illustrated and described in the documents listed in the attached transmittal, have been obtained.
- all effects of the design comprising the submission on the design of adjacent or other parts of the works have been fully taken into account in the design of those parts.

Signed by Designer's Authorised Representative

Name :

Position :

Date :

CONTRACTOR'S CERTIFICATE:

The Certifies that all design has been performed utilizing the skill and care to be expected of a professionally qualified and competent designer, experienced in work of similar nature and scope. This further certifies that all works relating to the preparation, review, checking and certification of design has been verified by us and the design proposed by the designer has been accepted by us vide clause 5.2 of GC.

Signed by Contractor's authorised representative

Name : Position :

Date :

Note 1

The Contractor shall insert one of the following, as applicable:

- (i) the Contractor's Technical Proposals
- (ii) the Contractor's Technical Proposals and Design Packages Nos for which a Notice of No Objection has been issued.
- (iii) Design Packages Nos for which a Notice of No Objection has been issued if such Design Packages develop and amplify the Contractor's Technical Proposals.
- (iv) The Definitive Design

SAMPLE DRAWING TEMPLATE

(a) 'Design Quality Assurance' by designer & contractor:

DESIGN QUALITY ASSURANCE			
The responsibility of control, check and verification of accuracy, correctness, completeness, integration and full compliance of contract provisions in respect of design analysis and drawings rests with the design consultants and the contractor.			
By Designer			By Contractor
Sig. :	Sig. :	Sig. :	Sig. :
Date. :	Date. :	Date. :	Date. :
Name:	Name:	Name:	Name:
Designed by	Checked by	Approved by	Accepted By

(b) Notice of 'No Objection' from Authority's representatives:

Notice of 'No Objections' from Authority's Representative
Notice of "No Objections" from Authority is being accorded for design Principles. However, the overall responsibility for the detailing and design accuracy lies with Design and Build Contractor.

Signatory	REMARKS	Date	Signature
JE (Design)	Reviewed		
AE/XEN (Design)	Reviewed		
Dy. DGM (Design)	Reviewed		
CE (Design)	Reviewed & comments as marked on drawing		
Engineer (Team Leader)	Reviewed & No objection issued with comments as marked on Drawing		

(c) Contractor to attach copies of necessary and required approvals.

4. CONSTRUCTION

1. CONTRACTOR'S SUPERINTENDENCE

- (1) The Contractor shall submit a Staff Organization Plan in accordance with the GC. This plan shall be updated and resubmitted whenever there are changes to the staff. The plan shall show the management structure and state clearly the duties, responsibilities and authority of each staff member.
- (2) The site agent and his associates/supervisors shall have experience and qualification appropriate to the type and magnitude of the Works. Full details shall be submitted of the qualifications and experience of all proposed staff to the Engineer for his approval.

2. CHECKING OF THE CONTRACTOR'S TEMPORARY WORKS DESIGN

The Contractor shall, prior to commencing the construction of the Temporary Works, submit a certificate to the Engineer signed by him certifying that the Temporary Works have been properly and safely designed and checked and that the Contractor has checked the effect of the Temporary Works on the Permanent Works and has found this to be satisfactory. A third party to be engaged by the contractor for checking to be carried out for all temporary works.

3. THE SITE

- (1) Works Areas are those areas identified in Appendix 2A to these Authority's Requirements and on the Drawings (Appendix – 1).
- (2) **USE OF THE SITE**
The Site or Contractor's Equipment shall not be used by the Contractor for any purpose other than for carrying out the Works in the scope of this contract, except that, with the consent in writing of the Engineer, the Site or Contractor's Equipment such as batching and mixing plants for concrete and bituminous materials may be used for the work in connection with other contracts under the Authority.
- (3) Rock crushing plant shall not be used on the Site.
- (4) The location and size of each stockpile of materials, including excavated materials, within the Site shall be as permitted by the Engineer. Stockpiles shall be maintained at all times in a stable condition.
- (5) Entry to and exit from the Site shall be controlled and shall be only available at the locations for which the Engineer has given his consent.
- (6) **ACCESS TO THE SITE**
The Contractor shall make its own arrangements, subject to the consent of the Engineer, for any further access required to the Site.
- (7) In addition, the Contractor shall ensure that access to every portion of the Site is continually available to the Authority and Engineer.

- (8) Following the handover of the Ropeway Envelope, (as defined in the Authority's Requirements- General), to the Authority, the Authority will control the Ropeway Envelope and will be responsible for all matters relating to security and safety therein. Access to the Ropeway Envelope by the Contractor shall be in accordance with any procedures, requirements and conditions defined in the Authority's Requirements.
- (9) **ACCESS TO OUTSIDE THE SITE**
The Contractor shall be responsible for ensuring that any access or egress through the Site boundaries are controlled such that no disturbance to residents or damage to public or private property occur as a result of the use of such access or egress by its employees and sub-contractors.
- (10) **SURVEY OF THE SITE**
A survey shall be carried out of the Site to establish its precise boundaries and the existing ground levels within it. This survey shall include a photographic survey sufficient to provide a full record of the state of the Site before commencing the work with particular attention paid to those areas where reinstatement will be carried out later on. The survey shall be carried out before the site clearance wherever possible and in any case prior to the commencement of work in any Works Area. The survey shall be carried out by the Contractor and agreed with the Engineer.
- (11) **BARRICADES AND SIGNBOARDS**
The Contractor shall erect barricades and gates around its areas of operations to prevent entry by unauthorized persons to his Works Areas and necessary identity cards /permits should be issued to workers and staff by the contractor. The Contractor shall submit a proposal for barricades of the complete perimeter of all works areas to the Engineer. Painting of the barricades shall be carried out to the design and colours as directed by the Engineer and the Contractor shall carry out re-painting of the entire barricades on a regular basis. No work shall be commenced in any Works Area until the Engineer has been satisfied that the barricades installed by the Contractor are sufficient to prevent, within reason, unauthorized entry. The cost of all this barricade is included in the quoted price, which includes fixing of nailing/ nuts & bolts/ rope lights & blinkers and shifting of barricading boards from one location to another at any number of times. Painting of the barricades shall be carried out to the design and colours as directed by the Engineer and the Contractor shall carry out re- painting of the entire barricades on a regular basis.
- (12) Project signboards shall be erected not more than four (4) weeks, or such other period as the Engineer has given his consent, after the date of commencement of the Works. The types, sizes and locations of project signboards shall be agreed with the Engineer before manufacture and erection. Other advertising signs shall not be erected on the Site.
- (13) The consent of the Engineer shall be obtained before hoardings, fences, gates or signs are removed. Hoardings, fences, gates and signs which are to be left in positions after the completion of the Works shall be repaired and repainted as instructed by the Engineer.
- (14) Hoardings, barricades, gates and signs shall be maintained in clean and good order by

the Contractor until the completion of the Works, whether such hoardings, fences, gates and signs have been installed by the Contractor during the period of the Works. All the fencing, hoardings, gates and signs etc. shall be mopped minimum one in a week and washed monthly.

- (15) All hoardings, barricades, gates and signs installed by the Contractor shall be removed by the Contractor upon the completion of the Works, unless otherwise directed by the Engineer.
- (16) Hoarding/ barricades can be reused after removing from one place to other locations / sites provided they are in good condition and approved by Engineer.
- (17) Damage/worn-out barricades /hoarding shall be replaced by contractor within 24 hours.
Engineer 's decision regarding need for replacement shall be final and binding and if no action is taken by contractor, the Engineer may get it repaired through other agency and the cost of any repairs will be deducted by the Engineer from any payment due to the Contractor.
- (18) **CLEARANCE OF THE SITE**
All Temporary Works which are not to remain on the Site after the completion of the Works shall be removed prior to completion of the Works or at other times instructed by the Engineer. The Site shall be cleared and reinstated to the lines and levels and to the same condition as existed before the Works started except as otherwise stated in the Contract.

4. SURVEY

- (1) The Contractor shall relate the construction of the Works to the Site Grid. To facilitate this, survey reference points have been established and the Engineer will provide benchmarks in the vicinity of the Site.
- (2) Before the Contractor commences the setting out of the Works, the Engineer will provide a drawing showing the position of each survey reference point and benchmark, together with the co-ordinates and/or level assigned to each point. The Contractor shall satisfy itself that there are no conflicts between the data given and shall establish and provide all subsidiary setting out points, monuments, towers and the like which may be necessary for the proper and accurate setting out and checking of the Works.
- (3) The Contractor shall carefully protect all the survey reference points, benchmarks, setting out points, monuments, towers and the like from any damage and shall maintain them and promptly repair or replace any points damaged from any causes whatsoever. The Contractor shall regularly recheck the position of all setting out points, benchmarks and the like to the satisfaction of the Engineer.
- (4) Upon handover to the Contractor, the survey reference points will become the responsibility of the Contractor. The Contractor shall, by annual or more frequent review, ensure that these survey points continue to remain consistent with the benchmarks.

5. SAFETY, HEALTH AND ENVIRONMENTAL REQUIREMENTS

The Contractor shall comply with in the conditions stipulated in the Conditions of contracts on Safety & Health and Environment. To ensure Indian Green Building Council (IGBC) Certification of the stations, the civil contractor shall ensure and provide the data as mentioned in **Appendix-13** of Authority's Requirement (Appendices).

6. OTHER SAFETY MEASURES

Site Safety & Health Plan and Site Environment Plan

- (1) The Contractor shall, within 8 weeks of the date of Notice to Proceed, prepare and submit to the Engineer for review his proposed **Site Safety & Health Plan and Site Environment plan** which shall contain as a minimum those items set out in Conditions of Contract on Safety & Health and Environment Plan.
- (2) **Fire Regulations and Safety**
The Contractor shall provide and maintain all necessary temporary fire protection and firefighting facilities on the Site during the construction of the Works and shall comply with all requirements of the Shimla Fire Services Department. These facilities may include, without limitation, sprinkler systems and fire hose reels in temporary site buildings, raw water storage tanks and portable fire extinguishers suitable for the conditions on the Site and potential hazards.
- (3) The Contractor shall submit details of these facilities to the Engineer for review prior to commencement of work on the Site.
- (4) If, in the Engineer's opinion, the use of naked lights may cause a fire hazard, the Contractor shall take such additional precautions and provide such additional firefighting equipment (including breathing apparatus) as the Engineer considers necessary. The term "naked light" shall be deemed to include electric arcs and oxyacetylene or other flames used in welding or cutting metals.
- (5) Oxyacetylene burning equipment will not be permitted in any confined space. Burning equipment of the Oxy-Propane type shall be used.
Hazard and Risk Assessments: - As per Conditions of Contract on Safety & Health and Environment.
- (6) **Explosives**
Explosives shall not be used without prior written consent of the Engineer. Before consent to blasting is granted, the Contractor shall prepare a Specification as to the size of charge, the method of firing and any other restrictions that may be imposed from time to time.
- (7) Where the Engineer has consented to the use of explosives, the Contractor shall be responsible for obtaining the requisite licenses and permits for complying with all statutory requirements for blasting.
- (8) The storage, transportation and use of explosives shall at all times be governed by the

Explosives Acts and such other statutory regulations which may be applicable and as imposed by the Statutory Authorities.

(9) Standby Equipment

The Contractor shall provide adequate stand-by equipment to ensure the safety of personnel, the Works and the public. These measures shall include as a minimum the following: -

- (a) stand-by pumping and generating equipment for the control of water.
- (b) stand-by equipment and spares for illumination of the Works; and
- (c) Stand-by generating equipment and equipment for the lighting for the works.

(10) Co-operation

The Contractor shall provide full co-operation and assistance in all safety surveillance carried out by the Engineer or the Authority. Any breaches of the Site Safety Plan or the statutory regulations or others disregard for the safety of any persons may be the reason for the Engineer to exercise his authority to require the site agent's removal from the Site.

7. CARE OF THE WORKS

- (1) Unless otherwise permitted by the Engineer all work shall be carried out in dry conditions.
- (2) The Works, including materials for use in the Works, shall be protected from damage due to water. Water on the Site and water entering the Site shall be promptly removed by temporary drainage or pumping systems or by other methods capable of keeping the Works free of water. Silt and debris shall be removed by traps before the water is discharged and shall be disposed of at a location or locations to which the Engineer has given his consent.
- (3) The discharge points of the temporary systems shall be as per the consent of the Engineer. The Contractor shall make all arrangements with and obtain the necessary approval from the relevant authorities for discharging water to drains, watercourses etc. The relevant work shall not be commenced until the approved arrangements for disposal of the water have been implemented.
- (4) The methods used for keeping the Works free of water shall be such that settlement of, or damage to, new and existing structures do not occur.
- (5) Measures shall be taken to prevent flotation of new and existing structures.
- (6) PROTECTION OF THE WORKS FROM WEATHER
Work shall not be carried out in weather conditions that may adversely affect the Works unless proper protection is provided to the satisfaction of the Engineer.
- (7) Permanent Works, including materials for such Works, shall be protected from exposures of weather conditions that may adversely affect such Permanent Works or materials.

- (8) During construction of the Works storm restraint systems shall be provided where appropriate. These systems shall ensure the security of the partially completed and ongoing stages of construction and in all weather conditions. Such storm restraint systems shall be installed as soon as practicable and shall be compatible with the right of way, or other access around or through- out the Site.

- (9) The Contractor shall at all times programme and order progress of the work and make all protective arrangements such that the Works can be made safe in the event of storms.

(10) **PROTECTION OF THE WORK**

The finished works shall be protected from any damage that could arise from any activities on the adjacent site/ works.

8. DAMAGE AND INTERFERENCE

- (1) Work shall be carried out in such a manner that there is no damage to or interference with:

(a) watercourses or drainage systems; (b) utilities; (c) structures (including foundations), roads, including street furniture, or other properties; (d) public or private vehicular or pedestrian access; (e) monuments trees, graves or burial grounds other than to the extent that is necessary for them to be removed or diverted to permit the execution of the Works. Heritage structures shall not be damaged or disfigured on any account. The Contractor shall inform the Engineer as soon as practicable of any items which are not stated in the Contract to be removed or diverted but which the Contractor considers need to be removed or diverted to enable the Works to be carried out. Such items shall not be removed or diverted until the consent of the Engineer to such removal or diversion has been obtained.

- (2) Items which are damaged or interfered with as a result of the Works and items which are removed to enable work to be carried out shall be reinstated to the satisfaction of the Engineer and to at least the same condition as existed before the work started. Any claims by Utility Agencies due to damage of utilities by the Contractor shall be borne by the Contractor.

(3) **UTILITIES**

Please refer Authority's Requirement – Functional

(4) **STRUCTURES, ROADS AND OTHER PROPERTIES**

The Contractor shall immediately inform the Engineer of any damage to structures, roads or other properties.

(5) **ACCESS**

Alternative access shall be provided to all premises if interference with the existing access, public or private, is necessary to enable the Works to be carried out. The arrangements for the alternative access shall be as agreed by the Engineer and the concerned agency. Unless agreed otherwise, the permanent access shall be reinstated as soon as practicable after the work is complete and the alternative access shall be removed immediately as it is no longer required, and the ground surfaces reinstated to the satisfaction of the Engineer. Proper signage and guidance shall be provided for the traffic / users regarding diversions.

(6) **TREES**

The felling of trees in Shimla is governed by the GoHP Act “The Himachal Pradesh Private Forests Act, 1954”. The Contractor is not permitted to cut any trees without the permission of the Authority. The Authority has assessed the number of trees existing within the right-of-way and Stations, and necessary documents w.r.t tree cutting permission including land for compensatory forestation shall be ensured by Authority. The contractor shall facilitate/ liaison with the respective Forest Department for obtaining tree cutting permission. The trees requiring to be felled will be removed from ground level up by the Contractor prior to commencement of the works. The Contractor will not be permitted to cut or remove any further trees. If for the purposes of the works additional trees are required to be cut/trimmed or removed, the Contractor must notify the Engineer of further tree felling requirements. Subject to compliance with the aforementioned act, arrangements for permission from Forest Department for tree felling shall be done by the contractor.

(7) **REMOVAL OF GRAVES AND OTHER OBSTRUCTIONS**

If any graves and other obstructions are required to be removed in order to execute the Works and such removal has not already been arranged for, the Contractor shall draw the Engineer's attention to them in good time to allow all necessary arrangements and authorizations for such removal, and it shall not itself remove them unless the Engineer has given consent.

(8) **PROTECTION OF THE ADJACENT STRUCTURES AND WORKS**

- (a) The Contractor shall take all necessary precautions to protect the structures or works being carried out by others adjacent to and, for the time being, within the Site from the effects of vibrations, undermining and any other earth movements or the diversion of water flow arising from its work.

9. WORK ON ROADS

(1) **Traffic Management Plan**

The Contractor shall develop a detailed Traffic Management Plan for the work under the contract. The purpose is to develop a Traffic Management Plan to cope with the traffic disruption as a result of construction activities by identifying strategies for traffic management on the roads and neighbourhoods impacted by the construction activities. The Contractor shall implement the Traffic Management Plan throughout the whole period of the Contract.

Principles for Traffic Management

The basis for the Plan shall take into consideration four principles:

- to minimize the inconvenience of road users and the interruption to surface traffic through the area impacted by the construction activities;
- to ensure the safety of road users in the impacted area;
- to facilitate access to the construction site, and to maintain reasonable construction progress.
- to ensure traffic safety at each construction site.

Integrated Traffic Management Plan

The Contractor shall prepare an integrated plan showing the arrangements to be made for accommodating road and pedestrian traffic, at individual construction sites and

continuously along the alignment, to smooth traffic operations and for the safety of both construction workers and road users. The Plan shall consider different measures such as:

- proper phasing and timing of traffic signals;
- modifications to intersection geometry;
- changes in lane usage;
- parking prohibitions;
- re-location of bus stops;
- reducing width of footpaths and median;
- right-turn prohibition;
- work site access management;
- minimizing the duration of any road closure;
- reversible lane operations;
- modification of roadway alignment affected by the construction, which shall be in conformance with the requirements and regulations defined by the relevant authorities; and may include widening of roads, Construction of temporarily new road etc.
- other traffic engineering measures as may be applicable.

(2) Mitigation of Traffic Disturbances

The Contractor shall manage the vehicular and pedestrian right of way during the period of construction. The Contractor shall take account of the need to maintain essential traffic requirements, as these may influence the construction process.

The Contractor shall include local traffic diversion routes and assess traffic impacts caused by the construction in the affected areas. Signage layout shall be included to ensure that adequate motorist information will be provided for traffic diversions.

Where it becomes necessary to close a road or intersection, or supplementary lanes are required to satisfy the traffic demands, traffic diversion schemes to adjacent roadways shall be developed with quantitative justifications. The Contractor shall co-ordinate with all relevant authorities.

Other considerations include:

- The minimum lane widths for fast traffic and mixed traffic shall follow the regulations of the different authorities.
- Any roads or intersections that have no alternative access shall not be fully closed for construction.
- Emergency access to all properties shall be maintained at all times.
- Access to business premises and property shall be maintained to the extent that normal activities are not seriously disrupted.
- The footpath shall be separated from vehicle traffic and not necessarily immediately adjacent to vehicle traffic;
- Where existing footbridges and underpasses are demolished or closed, provisions shall be made for pedestrian crossing to minimize the conflicts between a traffic lane.
- Construction traffic shall be separated from other traffic wherever possible;
- Any traffic related facilities (bus stops, parking, etc.) which are affected by the construction works shall be maintained or relocated to appropriate locations;

- Motorists, pedestrians, workmen, plant and equipment shall be protected from accident at all times;
 - Roadway designs, traffic management schemes, and installation of traffic control devices shall be in conformance with the requirements and regulations defined by the relevant authorities; and
 - Where applicable, utility diversions shall be incorporated in the traffic management plan.
- (3) **APPROVAL FOR TEMPORARY TRAFFIC ARRANGEMENTS AND CONTROL**
The Contractor shall make all arrangements with and obtain the necessary approval from the transport authorities and the Police Department for temporary traffic arrangements and control on public roads. In the event that the Contractor, having used its best endeavours, fails to secure the necessary approval from the transport authorities and the Traffic Police Department for temporary traffic arrangements and control on public roads, then the Authority will use its best endeavours to assist the Contractor to secure such approval but without responsibility on the part of the Authority to do so.
- (4) **TEMPORARY TRAFFIC ARRANGEMENTS AND CONTROL**
Temporary traffic diversions and pedestrian routes shall be surfaced and shall be provided where work on roads or footpaths obstruct the existing vehicular or pedestrian access. The relevant work shall not be commenced until the approved temporary traffic arrangements and control have been implemented.
- (5) Temporary traffic arrangements and control for work on public roads and footpaths shall comply with the requirements of the Traffic Police. Copies of documents containing such requirements shall be kept on the Site at all times.
- (6) Temporary traffic signs, including road marking, posts, backing plates and faces, shall comply with the requirements of the Traffic Police and should be in accordance with the requirements of Ministry of Surface Transport. All overhead traffic management signs that are fixed to bridges and gantries shall be illuminated at night. Pedestrian routes shall be illuminated at night to a lighting level of not less than 50 lux.
- (7) Adequate number of traffic marshals shall be deployed for smooth regulation of traffic.
- (8) Temporary traffic arrangements and control shall be inspected and maintained regularly, both by day and night. Lights and signs shall be kept clean and legible. Equipment which are damaged, dirty, incorrectly positioned or not in working order shall be repaired or replaced promptly.
- (9) **PARTICULARS OF TEMPORARY TRAFFIC ARRANGEMENTS AND CONTROL**
The following particulars of the proposed temporary traffic arrangements and control on public roads shall be submitted to the Engineer for consent at least 28 days before the traffic arrangements and control are implemented:
- (a) details of traffic diversions and pedestrian routes;
 - (b) details of lighting, signage, guarding and traffic control arrangements and equipment;

- (c) any conditions or restrictions imposed by Traffic Police or any other relevant authorities, including copies of applications, correspondence and approval.
- (10) Where concrete barriers are used to separate flows of traffic, the barriers shall be in a continuous unbroken line. No gaps shall be left between any section of the barrier.
- (11) Site perimeter fencing and barriers along the roadway, shall have flashing amber lights positioned on the top of them every 50 meters apart and at every abrupt change in location. Directly below the flashing light shall be fixed, in the vertical position, a white, fluorescent light with a waterproof cover.
- (12) **USE OF ROADS AND FOOTPATHS**
Public roads and footpaths on the Site in which the work is not being carried out shall be maintained in a clean and passable condition. Regular brooming, removal of debris collected is the responsibility of contractor.
- (13) Measures shall be taken to prevent the excavated materials, silt or debris from entering gullies on roads and footpaths; entry of water to the gullies shall not be obstructed.
- (14) Surfaced roads on the Site and leading to the Site shall not be used by tracked vehicles unless protection against damage is provided.
- (15) Contractor's Equipment and other vehicles leaving the Site shall be loaded in such a manner that the excavated material, mud or debris will not be deposited on roads. All such loads shall be covered or protected to prevent dust being emitted. The wheels of all vehicles shall be washed, when necessary, before leaving the Site to avoid the deposition of mud and debris on the roads.
- (16) **REINSTATEMENT OF PUBLIC ROADS AND FOOTPATHS**
Temporary diversions, pedestrian access and lighting, signing, guarding and traffic control equipment shall be removed immediately when they are no longer required. Roads, footpaths and other items affected by temporary traffic arrangements and control shall be reinstated to the same condition as existed before the work started or as permitted by the Engineer immediately after the relevant work is complete or at other times permitted by the Engineer.

The Contractor shall submit his design for the reinstatement to the relevant authorities and obtain their prior approval to carrying out the work. Reinstatement works shall include:

- Parking bays
- Footpath and kerbs
- Road Signage
- Street Lighting
- Landscaping
- Traffic Lights and Control Cable
- Road painting

10. SITE ESTABLISHMENT

(1) SITE LABORATORIES

The Contractor shall provide, erect and maintain in a clean, stable and secure condition a laboratory, equipped for the routine testing of concrete, soil and rock samples and for the storage and curing of concrete cubes or cylinders only. This laboratory shall be located at the Contractor's principal work site or at a location agreed to by the Engineer. Detailed requirements for this laboratory are set out in Appendix 11 to these Authority's Requirements.

(2) CONTRACTOR'S SITE ACCOMMODATION

The Contractor shall provide and maintain its own site accommodation at locations consented to by the Engineer. Offices, sheds, stores, mess rooms, garages, workshops, latrines and other accommodation on the Site shall be maintained in a clean, stable and secure condition. Living accommodation shall not be provided on the Site. The Contractor shall comply with the requirements of Appendix 8 to the Authority's Requirements. In addition, the contractor shall provide and maintain field offices for use of Authority and Engineer staffs during the contract period at each station location of area not less than 100 sq.m. with toilet and electricity facility including services for office upkeep, consumable, furniture, security etc.

(3) LATRINES AND WASH PLACES

The Contractor shall provide latrines and wash places for the use of its personnel and all persons who will be on the Site. The size and disposition of latrines and wash places shall accord with the numbers and dispositions of persons entitled to be on the Site, which may necessitate their location on structures and, where necessary there shall be separate facilities for males and females. The capacities and layout shall be subject to approval of the Engineer. The Contractor shall arrange regular disposal of effluent and sludge in a manner that shall be in accordance with local laws/ regulations.

(4) The Contractor shall be responsible for maintaining all latrines and wash places on the Site in a clean and sanitary condition and for ensuring that they do not pose a nuisance or a health threat. The Contractor shall also take such steps and make such provisions as may be necessary or directed by the Engineer to ensure that vermin, mosquito breeding etc. are at all times controlled.

(5) SITE UTILITIES AND ACCESS

(a) The Contractor shall be responsible for providing water, electricity, telephone, sewerage and drainage facilities for contractors site offices, structures and buildings and for all site laboratories in accordance with Appendix 11 to these Authority's Requirements and all such services that are necessary for satisfactory performance of the Works. The Contractor shall make all arrangements with and obtain the necessary approval from the relevant civil and utility authorities for the facilities.

(b) The contractor shall be responsible for provision of power supply for his works including for launching girder and the like. The Authority cannot guaranty provision of adequate, continuous power supply however assistance will be given in obtaining the necessary permissions for site generators and the like.

- (6) Access roads and parking areas shall be provided within the Site as required and shall be maintained in a clean, acceptable and stable condition. For lengths of roadway longer than 100m and where vehicle movements exceed one hundred (100) movements/day and heavy commercial vehicle are to ply the Contractor shall provide paved surfacing of adequate thickness and quality to the satisfaction the Engineer.
 - (7) Any operation of the Works that interferes with the checking of lines and levels shall be temporarily suspended at the request of the Engineer until the checking is complete.
 - (8) **SUBMISSION OF PARTICULARS**
The following particulars shall be submitted to the Engineer for his consent not more than fifty- six (56) days after the date of commencement of the Works:
 - (a) drawings showing the layout within earmarked area for the Contractor's offices, project signboards, principal access and other major facilities required early in the Contract, together with all service utilities;
 - (b) drawings showing the details to be included on the project signboards and diversion boards.
 - (9) Drawings showing location of construction yard, stores, storage areas, concrete batching plants and other major facilities and their access roads/paths shall be submitted to the Engineer for his consent as early as possible but in any case, not less than twenty-eight (28) days prior to when such facilities are intended to be constructed on the Site.
- 11. SECURITY**
- (1) The Contractor shall be responsible for the security of the Site for the full time the Site is in its possession, except for the specific case of the Ropeway Envelope after handover to the Ropeway Operator It shall set up and operate a system whereby only those persons entitled to be on the Site can enter the Site. To this end, the Contractor shall with the consent of Engineer provide the specific points only at which entry through the security fence can be affected and shall provide gates and barriers at such points of entry and whereby maintain a twenty-four (24) hours security guard, and such other security personnel and patrols elsewhere as may be necessary to maintain security.
 - (2) The Contractor shall maintain all site boundary fences in first class condition and shall so arrange site boundary fences at all access drainage points of work areas that it's use of such access points etc., are not restricted by the system or method of achieving the required security measures. Notices shall be displayed at intervals around the Site to warn the public of the dangers of entering the Site.
 - (3) During the progress of the Works the Contractor shall maintain such additional security patrols over the areas of the Works as may be necessary to protect its own and its sub-contractor's work and equipment and shall co-ordinate and plan the security of both the work under this Contract and the work of others having access to and across the Site and the Works.
 - (4) In order to operate such a security system, it will be necessary to institute the issue of

unique passes to personnel and vehicles entitled to be on the Site, and which may need to be separately identifiable according to the shifts being worked on Site. The Contractor shall at the outset determine, together with the Engineer, a system and the design of passes to suit the requirements of the foregoing and to suit the methods of work to be adopted by the Contractor. The Contractor shall at all times ensure that the Engineer has an up-to-date list of all persons entitled to be on the Site at any time. The contractor shall also introduce a system of issue passes to any outsider or person/vehicles belonging to agencies other than Authority/ Engineers who may have to visit the site in connection with work

- (5) The Contractor shall liaise with the Designated Contractors (teams) and the contractors responsible for the adjacent and other interfacing contracts and ensure that coordinated security procedures are operated, in particular in respect of vehicles permitted to pass through the Site and/or the adjacent sites in the latter periods of the Contract.
- (6) Security and checking arrangements as felt necessary shall be provided with advice and help of Police.

12. TESTING GENERAL

- (1) The Contractor shall provide and perform all forms of testing procedures applicable to the Works and various components and the interfacing of the Works with the other Contract works and shall conduct all necessary factory, site and acceptance tests.
- (2) All testing procedures shall be submitted at least thirty (30) days prior to conducting any Test. The Testing procedures shall show unambiguously the extent of testing covered by each submission, the method of testing, the Acceptance Criteria, the relevant drawing (or modification) status and the location.
- (3) The testing Procedures shall be submitted, as required, by the Contractor during the duration of the contract to reflect changes in system design or the identification of additional testing requirements.
- (4) The Engineer shall have the facilities for monitoring all tests and have access to all testing records. Ample time shall be allowed within the testing programmes for necessary alterations to equipment, systems and designs to be undertaken, together with re-testing prior to final commissioning.
- (5) The Contractor is reminded that at some point, the High Voltage Power Supply system will be energized and the additional precautions for the safety of staff and co-ordination of activities after power-on shall be anticipated in its testing and commissioning programmes.
- (6) All costs associated with the Testing shall be borne by the Contractor, unless otherwise specified, including the services of any specialized personnel or independent assessors. The Contractor shall also bear any expenses incurred due to resetting caused by defects or failure of equipment to meet the requirements of the Contract in the first instance.

- (7) Unless agreed in writing by the Engineer, the personnel engaged in testing shall be independent of those directly engaged in the design or installation of the same equipment.
- (8) All testing equipment shall carry an appropriate and valid calibration label.
- (9) **BATCHES, SAMPLES AND SPECIMENS**
A batch of material is a specified quantity of the material that satisfies the specified conditions. If one of the specified conditions is that the material is delivered to the Site at the same time, then material delivered to the Site over a period of a few days may be considered as part of the same batch if in the opinion of the Engineer there is sufficient proof that the other specified conditions applying to the batch apply to all of the material delivered over the period.
- (10) A sample is a specified quantity of material that is taken from a batch for testing, and which consists of a specified amount, or a specified number of pieces or units, of the material.
- (11) A specimen is the portion of a sample that is to be tested.
- (12) **SAMPLES FOR TESTING**
Samples shall be of sufficient size and in accordance with relevant Standards to carry out all specified tests.
- (13) Samples taken on the Site shall be selected by, and taken in the presence of, the Engineer and shall be suitably marked for their identification. An identification marking system should be evolved at the start of works in consultation with the Engineer.
- (14) Samples shall be protected, handled and stored in such a manner that they are not damaged or contaminated and such that the properties of the sample do not change.
- (15) Samples shall be delivered by the Contractor, under the supervision of the Engineer, to the specified place of testing. Samples on which non-destructive tests have been carried out shall be collected from the place of testing after testing and delivered to the Site or other locations instructed by the Engineer.
- (16) Samples which have been tested may be incorporated in the Permanent Works provided that:
 - (a) the sample complies with the specified requirements;
 - (b) the sample is not damaged; and
 - (c) the sample is not required to be retained under any other provision of the Contract.
- (17) Additional samples shall be provided for testing if in the opinion of the Engineer:
 - (a) material previously tested no longer complies with the specified requirements; or
 - (b) material has been handled or stored in such a manner that it may not comply with the specified requirements.

(18) TESTING

The Contractor shall be responsible for all on-site and off-site testing and for all in-situ testing. All appropriate laboratory tests shall be carried out in the Contractor's laboratory, unless otherwise permitted or required by the Engineer. Where the laboratory is not appropriately equipped and/or staffed for some tests, or if agreed to by the Engineer, tests may be carried out in other laboratories provided that:

- (a) they are accredited for the relevant work to a standard acceptable to the Engineer; and
- (b) particulars of the proposed laboratory are submitted to the Engineer for his consent.

(19) In-situ tests shall be done in the presence of the Engineer.

(20) Equipment, apparatus and materials for in-situ tests and laboratory compliance tests carried out by the Contractor shall be provided by the Contractor. The equipment and apparatus shall be maintained by the Contractor and shall be calibrated before the testing starts and at regular intervals as permitted by the Engineer. The equipment, apparatus and materials for in-situ tests shall be removed by the Contractor as soon as practicable after the testing is complete.

(21) The Contractor shall be entitled in all cases to attend the testing carried out in the Authority's or other laboratories, to inspect the calibration certificates of the testing machines and to undertake the testing on counterpart samples. Testing of such samples shall be undertaken in laboratories complying with Clause 12(18)(a) above and particulars of the laboratory proposed shall be submitted to the Engineer for consent prior to the testing.

(22) Attendance on tests, including that by the Engineer, Contractor and Designer, shall be as laid down in the Quality Assurance procedures.

(23) COMPLIANCE OF BATCH

The results of tests on samples or specimens shall be considered to represent the whole batch from which the sample was taken.

(24) A batch shall be considered as complying with the specified requirements for a material if the results of specific tests for of the specified properties comply with the specified requirements for the properties.

(25) If additional tests are permitted or required by the Engineer but separate compliance criteria for the additional tests are not stated in the Contract, the Engineer shall determine if the batch complies with the specified requirements for the material on the basis of the results of all tests, including the additional tests, for every property.

(26) RECORDS OF TESTS

Records of in-situ tests and laboratory compliance tests carried out by the Contractor shall be kept by the Contractor on the Site and a report shall be submitted to the Engineer within seven (7) days, or such other time stated in the Contract or in the Quality Assurance Programme, after completion of each test. In addition to any other requirements, the report shall contain the following details:

- (a) material or part of the Works tested;
 - (b) location of the batch from which the samples were taken or location of the part of the Works;
 - (c) place of testing;
 - (d) date and time of tests;
 - (e) weather conditions in the case of in-situ tests;
 - (f) technical personnel supervising or carrying out the tests;
 - (g) size and description of samples and specimens;
 - (h) method of sampling;
 - (i) properties tested;
 - (j) method of testing;
 - (k) readings and measurements taken during the tests;
 - (l) test results, including any calculations and graphs;
 - (m) specified acceptance criteria; and
 - (n) other details stated in the Contract.
- (27) Reports of tests shall be signed by the site agent or his assistant, or by another representative authorized by the Contractor.
- (28) If requested, records of tests carried out by the Authority's staff or by the Engineer shall be given to the Contractor.
- (29) Sampling, handling & testing of cube specimens for compressive strength are to be carried out as per the guidelines mentioned in Appendix-14 of Authority's Requirement and this guideline should be part of method statement for production and transportation of concrete.

13. RECORDS

(1) DRAWINGS PRODUCED BY THE CONTRACTOR

Drawings produced by the Contractor including drawings of site layouts, Temporary Works, etc. for submission to the Engineer shall generally be to ISO A1 size. They shall display a title block with the information as detailed in Appendix 7 to these Authority's Requirements. The number of copies to be submitted to the Engineer shall be as stated in the Contract, or as required by Engineer.

(2) PROGRESS PHOTOGRAPHS

The Contractor shall provide monthly progress photographs which have been properly recorded to show the progress of the works to the Engineer. The photographs, of not less than 72 in number, shall be taken on the locations agreed with the Engineer to record the exact progress of the Works. Two sets of photographs shall be provided on CD ROM format with two sets of colour prints of 175 mm x 125 mm size. Videography by drone shall also be done at all work places every one month.

- (3) The Contractor shall mount each set of each month's progress photographs in a separate album of a type to which the Engineer has given his consent and shall provide for each photograph two typed self-adhesive labels, one of which shall be mounted immediately below the photograph and one on the back of the photograph. Each label shall record the location, a brief description of the progress recorded and the date on which the photograph was taken.

- (4) All photographs shall be taken by a skilled photographer whose name and experience shall be submitted to the Engineer for consent and approval received. Processing shall be carried out by a competent processing firm to the satisfaction of the Engineer.
- (5) The Contractor shall ensure that no photography is permitted on the Site without the agreement of the Engineer. The contractor should be aware of the local regulations and conditions with regard to Photography in some “RESTRICTED AREA” in Shimla.
- (6) **RECORDS OF WAGE RATES**
The Contractor shall keep monthly records of the average, high and low wage rates for each trade/tradesman employed on the Site and records shall be made available to the Engineer during inspection.

14. MATERIALS

- (1) Materials and goods for inclusion in the Permanent Works shall be new unless the Engineer has consented otherwise. Preference shall be given to local materials where available. Preferred Manufacturers/Suppliers of a few important items have been given in Appendix 9 of this document. These materials shall be procured only for these manufacturers/Suppliers with approval of the Engineer.
- (2) Certificates of tests by manufacturers which are to be submitted to the Engineer shall be current and shall relate to the batch of material delivered to the Site. Certified true copies of certificates may be submitted if the original certificates could not be obtained from the manufacturer.
- (3) Parts of materials which are to be assembled on the Site shall be marked to identify the different parts.
- (4) Materials which are specified by means of trade or proprietary names may be substituted by materials from a different manufacturer which has received the consent of the Engineer provided that the materials are of the same or better quality and comply with the specified requirements.
- (5) Samples of materials submitted to the Engineer for information or consent shall be kept on the Site and shall not be returned to the Contractor or used in the Permanent Works unless permitted by the Engineer. The samples shall be used as a means
- (6) of comparison which the Engineer shall use to determine the quality of the materials subsequently delivered. Materials delivered to the Site for use in the Permanent Works shall be of the same or better quality as the samples which have received consent.

15. PROVISION AND DISPOSAL OF EARTHWORKS MATERIAL

- The contractor shall be responsible for the provision of all classes of earthworks material required for the works, whether sourced from the excavations within the contract or obtained from any other sources, which are located outside the site, for which the Engineer has given consent.
- Requisite dumping site shall be arranged by the contractor at their own cost for dumping and/or disposal of excavated earth and other materials. Necessary

permission/NOC of the concerned authority in this regard shall be arranged by the contractor.

- The disposal of waste material, bentonite fluid, polymer and material contaminated with bentonite/polymer shall be the full responsibility of the contractor and these materials shall be disposed of by the contractor at an appropriate location. Necessary permission of the concerned authority for disposal of waste material, bentonite fluid and material contaminated with bentonite shall be arranged by the contractor.
- Rock deposited as fill material at dumpsite shall be capable of compaction with single pieces no larger than 300mm.

16. RESTORATION OF AREAS DISTURBED BY CONSTRUCTION.

Unless otherwise directed by the Engineer, any areas disturbed by the construction activity, either inside or outside the Project Right of Way, shall be reinstated as follows: All areas affected by the construction work shall be reinstated to their original condition, with new materials of similar specification, including but not necessarily limited to, sidewalks, parking lots, access roads, adjacent roads properties and landscaping. Grass cover shall be provided for any bare earth surface areas, along with proper provisions for surface drainage.

17. SOIL INVESTIGATION

The soil investigation report included in the tender document is for reference purpose only. The contractor may re-validate & utilize this report if desired so. However, if the contractor undertakes additional Geo-Technical Investigation independently, nothing extra shall be payable in this regard. No claim whatsoever on account of any discrepancy between the sub surface conditions that may be actually encountered at the time of execution of the work and those given in these tender documents shall be admissible to the contractor under any circumstances.

5. APPENDIX 1 - DRAWINGS

The Tender Documents contains a set of reference/Tender drawings in the Volume – IV of the bid documents that are applicable to the Contract Works. The contractor shall incorporate into the bid only these drawings from the Voll. – IV, which amplify aspects of the Contractor's Technical Proposals. General information drawings will not be included in the Contract. The dimensions mentioned in the tender drawings are indicative and may vary as per the design of the contractor. Details of the drawings are as under.

S. No.	Description
1.	Plan and profile of ropeway lines
2.	Tower Foundation drawings
3.	Plans, Elevations and 3 D views of the stations

6. APPENDIX 2A - WORK AREAS

The Authority shall not provide the work areas to the Contractor for construction of Construction, Storage, Batching Plant and site office etc. All the work areas (land for Batching Plant & site office) are to be arranged by the Contractor himself including muck disposal sites.

7. APPENDIX 2B - PROJECT COMPLETION SCHEDULE

Project Milestone	Day of occurrence of Milestone from date of commencement of work	Description of works to be done (Minimum)
I	180 th	- Completion of Temporary works and Barricading. - Setting up of Batching Plants and Establishment of offices and construction depots. - Mobilization of the contractor's team and machinery to the site. - Submission of Baseline program. - Completion of Survey verification, Geotechnical Investigation of all three lines. - Obtaining all mandatory clearances from local authorities to carry out work in Shimla City for all three lines i.e. Red, Green and Blue. RTDC will support/facilitate the Contractor in getting the above permissions. Red line - Completion of Design of permanent Civil Works. - Completion of Design of E&M works and other structural works. - Foundation work of stations to be started.
II	365 th	Red line - Completion of foundation work of stations up to ground floor. - Completion of foundation work of 50% towers. - Fabrication and supply 50% of towers. - Completion of framed structure of Taradevi, Chakkar, and ZPTH stations. Green Line - Completion of Design of permanent Civil Works. - Completion of Design of E&M works. - Completion of foundation work of ISBT, Railway Station and Old Bus Stand stations up to ground floor level. - Completion of foundation work of all towers falling between ZPTH and Old Bus Stand Station.
III	545 th	Red line - Completion of foundation work of 100% towers. - Fabrication and supply of 50% towers. - Erection of 50% towers. - Completion of finishing work of Taradevi, Chakkar, and ZPTH stations. - Erection of 100% towers.

Project Milestone	Day of occurrence of Milestone from date of commencement of work	Description of works to be done (Minimum)
		Green Line - Fabrication and supply of towers falling between ZPTH and Old Bus Stand Station. - Completion of framed structure of ISBT, Railway Station and Old Bus Stand stations up to ground floor level. - Erection of towers falling between ZPTH and Old Bus Stand Station. - Completion of foundation work up to Ground Floor level of Lift Point and Secretariat Stations. - Completion of foundation work of towers falling between Lift Point and Secretariat. Blue Line - Completion of Design of permanent Civil Works. - Completion of Design of E&M works. - Completion of Foundation work of 103 Tunnel and Victory Tunnel station. - Completion of foundation work of towers falling between ISBT and Victory Tunnel.
IV	730 th	Red line - Completion of external development of Taradevi, Chakkar, and ZPTH stations including Road, Earth Retaining Structures, Gondola Parking, Vehicular Parking and Access Path to towers etc. - Erection of Wire Rope. - Installation, Testing and Commissioning of E&M Equipments. - Safety Certification. - Submission of O&M manuals, As Built Drawings and Training of O&M Staff etc. - Safety Certification. - Opening for Public. Green Line - Fabrication and supply of towers falling between Lift Point and Secretariat Station. - Completion of finishing work of ISBT, Railway Station and Old Bus Stand stations. - Completion of framed Structure of Lift Point and Secretariat Stations. - Erection of towers falling between Lift Point and Secretariat. - Supply of E&M Equipments. Blue Line

Project Milestone	Day of occurrence of Milestone from date of commencement of work	Description of works to be done (Minimum)
		- Completion of framed Structure work of 103 Tunnel and Victory Tunnel station. - Fabrication and supply of towers falling between ISBT and Victory Tunnel. - Erection of towers falling between ISBT and Victory Tunnel. - Completion of Foundation work upto Ground Floor Level of ICR and IGMC station. - Completion of foundation work of towers falling between Victory Tunnel and IGMC.
V	910 th	Green Line - Completion of finishing work of Lift Point and Secretariate Station. - Completion of external development of ISBT, Railway Station and Old Bus Stand stations and Access Path to towers etc. - Supply of E&M Equipments and wire rope. - Installation of E&M Equipments and Erection of wire rope between ISBT and Old Bus Stand Station. Blue Line - Completion of Finishing work of 103 Tunnel and Victory Tunnel station. - Fabrication and supply of towers falling between Victory Tunnel and IGMC station. - Erection of towers falling between Victory Tunnel and IGMC station. - Completion of framed Structure of ICR and IGMC station. - Completion of foundation work of the Sanjauli and Navbahar Stations upto Ground Floor level. - Completion of Foundation Work of Towers falling between IGMC and Secretariat Station.
VI	1090 th	Green Line - Completion of external development of Lift Point and Secretariate Stations and Access Path to towers etc. - Installation of E&M Equipments and Erection of wire rope between Lift Point and Secretariate Stations Station. - Testing and of Ropeway System of green line. - Submission of O&M manuals, As Built Drawings and Training of O&M Staff etc. - Safety Certification. - Opening for Public.

Project Milestone	Day of occurrence of Milestone from date of commencement of work	Description of works to be done (Minimum)
		Blue Line - Completion of external development work of 103 Tunnel and Victory Tunnel station and Access path to Towers. - Fabrication and supply of towers falling between IGMC and Secretariat Station. - Erection of towers falling between IGMC and Secretariat Station. - Completion of finishing work of ICR and IGMC station. - Completion of framed structure of the Sanjauli and Navbahar Stations upto Ground Floor level.
VII	1270 th	Blue Line - Completion of external development work of ICR and IGMC Station and Access Path to Towers. - Completion of Finishing Work of Sanjauli, Navbahar and Secretariat Stations. - Supply of E&M equipments. - Installation of E&M Equipments and Erection of wire rope between ISBT and Victory Tunnel Station.
VIII	1460 th	Blue Line - Completion of external development work of Sanjauli and Navbahar Stations Station and Access Path to Towers. - Supply of E&M equipments. - Installation of E&M Equipments and Erection of wire rope between Victory Tunnel and Secretariat Station. - Testing of Ropeway System of Green line. - Safety Certification - Opening for public.
Extension of Time		- As per terms and condition of GC&PC. - In case of extension of any or all of the aforesaid Project Milestones or the Scheduled Completion Date, the Project Completion Schedule shall be deemed to have been amended accordingly with approval of Authority in accordance with the provisions of this Agreement.

8. APPENDIX 2C - INTERFACE MANAGEMENT DOCUMENT

The Contractor Shall prepare Interface Management Document in consultation with the Authority and Engineer to ensure proper coordination among the various activities of the project to complete the work as per the completion Schedules. The same shall be submitted to the Engineer for the Approval.

9. APPENDIX 3 - PROJECT CALENDAR

- (1) The Project Weeks shall be commenced on a Monday. A day shall be deemed to commence at 0001 hour on the morning of the day in question. Where reference is made to the completion of an activity or Milestone by a particular week, this shall mean by midnight on the Sunday of that week.
- (2) Requirements for the computation of Completion Schedule Dates are given in Appendix 2B to the Authority's Requirements.
- (3) A 7-day week calendar shall be adopted for various (Work) programme schedules for scheduling purposes.
- (4) For Project purposes, the presentation shall be in 'Week'" units.

For Preparation of the DWP to be compliant on BIM SOFTWARE Platform, follow the Primavera guidelines.

10. APPENDIX 4 - PROGRAMME REQUIREMENTS

1. GENERAL

(1) Purpose of Programme

To provide the Engineer with status reports for managing, monitoring and coordinating the awarded contracts during their execution.

(2) The Contractor shall programme his work at all times to meet the project milestones as stated in Appendix 2B to the Authority's Requirements and the specified interface periods for the design and installation of the Works with those of the Designated Contractors and shall during the progress of the Works constantly monitor his progress against the programme described below.

(3) The Contractor shall include in all programme his work obligations towards shared access, shared Site areas and other coincident or adjacent Works Areas.

(4) The Works Programme, and all more detailed or revised versions, shall be submitted to the Engineer in hard copy as well as soft copy for his consent in accordance with the provisions of the GC/PC.

2. METHODOLOGY

(1) The computerized Critical Path Method (CPM) network using the Precedence Diagramming Method (PDM), has been selected by the Authority as the technique for contract management system and in co-coordinating the multi-contract project. This technique shall also be employed by the Contractor in preparing their Tender submissions and by the Contractor in their Construction Stage submissions.

(2) Unless otherwise agreed by the Engineer, all programmes submitted by the Contractor shall be produced using computerized Critical Path Method (CPM) Networks developed implementing the Precedence Diagramming Method (PDM) with Cost Loaded Charts and Tables.

(3) The Contractor shall implement and use throughout the duration of the Contract, a computerized system to plan, execute, maintain and manage the planning, design, pre-construction, construction, and sub-contracts in executing the CPM scheduling by PDM. The reports, documents and data provided shall be an accurate representation of the current status of the Works and of the work remaining to be accomplished; shall provide a sound basis for identifying problems, deviations from the planned works, and for making decisions; and shall enable timely preparation of the same for presentation to the Engineer.

3. PROGRAMME MANAGEMENT SOFTWARE

(1) CPM programming software used shall be Primavera Project Planning (P6) Program - Ver 17 or later version. Scheduling software and relevant instruction manuals, licensed

for use in connection with the contract, shall be provided by the Contractor according to the Authority's specifications.

- (2) The Contractor may use a system other than Primavera but will be required to demonstrate that full electronic data transfer to Primavera is available and that the various levels of reporting and coding capabilities are at least equivalent to Primavera. Compatibility and comparable performance between Primavera and the Contractor's proposed system shall be demonstrated in his Tender submission. Should compatibility not be demonstrated to the Authority's satisfaction the Contractor shall utilize Primavera for development, statusing, updating and revision of all the Programmes during the duration of the Contract. Upon the Engineer's consent of a system other than Primavera, the Contractor shall supply the Engineer with an original licensed copy, including manuals and approved training of the software and any subsequent versions thereof at no extra cost.

4. POST CONTRACT AWARD

- 4.1 The Contractor shall develop his Tender Programme into the Initial Works Programme including an outline Narrative Statement and submit within 15 days of the date of the Notice to Proceed and its more detailed version within sixty (60) days of receiving the Engineer's consent to the proposed Initial Works Programme.
- 4.2 The first Three Month Rolling Programme shall be submitted within thirty (30) days of the date of Notice to Proceed and all subsequent editions shall accompany the Monthly Progress Report. The Monthly Progress Reports shall also include a Programme Update as described below. These programmes shall subsequently be updated as described below.
- 4.3 Following the Contractor's Initial Works Programme submission but in any case, no later than three (3) months from the date of award of contract, the contractor shall make submissions of the detailed Works Programme suitably amended to take into account the programmes of Designated Contracts. It is the Contractor's responsibility to ensure timely co-ordination with the Designated Contractors to review, revise and finalize his Initial Work Programme so as not to affect the progress of Works/ and or the works of the Designated Contractors. The resubmitted programme when approved by the Engineer shall form the Baseline Programme against which actual progress of the Contract shall be reckoned. As the work progresses, it may be necessary to update/ revise the Baseline programme but such updating shall only be carried out with the prior consent of the Engineer or when directed by them.
- 4.4 For Initial & Detail Work Programme submission, one (1) original and six (6) copies each of the following Programmes and Reports shall be submitted to the Engineer:
 - a) Programme: Baseline CPM Network
 - b) Programme: Baseline Milestone based Cost Activity Schedule
 - c) Baseline Schedule Report
 - d) Narrative Statement
 - e) Baseline Physical Progress 'S' curve
 - f) Baseline Resource Charts

- g) Baseline Financial S-curve
- h) Key plan
- i) BIM SOFTWARE Compliance Checklist
- j) SOQ corresponding to the latest GAD.

- 4.5** The Engineer shall review and comment on the Contractor's programmes and information submitted under this Clause. The Engineer will confirm his consent or otherwise of the submissions within thirty (30) calendar days.
- 4.6** The Engineer shall require the Contractor to re-submit within thirty (30) calendar days if he is of the opinion that the programmes and information submitted by the Contractor is unlikely to meet the Contract key dates.
- 4.7** If in the opinion of the Engineer, any of the Contractor's revised programmes or Baseline Schedule Report is not acceptable, it shall be construed as a failure of the Contractor to meet a Milestone.
- 4.8** Notwithstanding the above, the Engineer may at any time during the course of the Contract require the Contractor to reproduce the computer-generated Baseline Schedule Report described above to reflect actual activity dates and generate schedules based upon "what if" statements. The initial computer-generated report after receiving the Engineer's consent will serve as the base against which the contract progress will be measured. Any changes to the Report reflected in subsequent Baseline Schedule Reports shall also require the Engineer's consent.
- 4.9** Failure to include any element of work required for performance of the Contract shall not relieve the Contractor from completing all works required under the Contract to achieve the original or any extended key completion date.

5. WORKS PROGRAMME

- (1) The Works Programme shall show the Contractor's plan for organizing and carrying out whole of the Works.
- (2) The Works Programme shall be a computerized Critical Path Method (CPM) network developed using the Precedence Diagramming Method (PDM) and shall be present in bar chart and time-scaled network diagram format to a weekly or monthly time scale.
- (3) Tasks in the Works Programme shall be sufficiently detailed to describe activities and events that include, but are not limited to, the following:
 - (a) Completion Schedule Dates,
 - (b) All physical work to be undertaken in the performance of the Contract obligations, including Temporary Works,
 - (c) The requested date for issue of any drawings or information by the Engineer,
 - (d) Incorporation of principal aspects of the Design Submission Programme,
 - (e) Procurement of major materials and the delivery and/or partial delivery date on-Site of principal items of Contractor's Equipment,
 - (f) Any off-site work such as production or pre-fabrication of components,

- (g) Installation of temporary construction facilities,
 - (h) Interface periods with Designated Contractors or utility undertakings,
 - (i) Design, supply and/or construction activities of sub-contractors,
 - (j) Any outside influence which will or may affect the Works.
- (4) The Works Programme shall show achievement of all Key Dates.
- (5) Activity descriptions shall be unique, describing discrete elements of work. Any activity creating an imposed time or other constraint shall be fully defined by the Contractor.
- (6) The Works Programme shall be organized in a logical work-breakdown-structure including work stages and phases, and shall clearly indicate the critical path(s).

Each activity in the Works Programme shall be coded to indicate:

- (a) Activity ID and Activity Code.
 - (b) The Engineer may request additional activity coding to the extent available without restraint to the Contractor's utilization of the programme software. When requested, the Contractor shall add the required additional coding to the Programme. The Contractor shall use additional code fields as requested to comply with the requirements and for the use of the Contractor.
- (7) Activity duration shall not exceed two (2) weeks, unless otherwise consented to by the Engineer (to meet the BIM SOFTWARE requirement), except non-construction activities such as submittals, submittal reviews, procurement and delivery of materials or equipment and concrete curing. The Contractor shall submit a Programme/Project Calendar cross reference clearly indicating the allowance for holidays.
- (8) The Works Programme, in each submission, shall be accompanied by an Activity Report and a Narrative Statement as described below in both electronic (e-mail) and hard copy format (time scale logic diagrams in A1 size, reports in A4 size).
- (9) Activity Report shall list all activities, and events in the Works Programme, sorted by activity identification number.

The Activity Report shall include the following for each activity and event:

- (a) Activity identification number and description,
- (b) Duration expressed in Days,
- (c) early and late start, & early and late finish dates. Planned start and finish dates,
- (d) Calculated total float and free float,
- (e) Predecessor and successor(s), accompanying relationships and lead/lag duration,
- (f) Imposed time or date constraints,
- (g) Calendar.

(10) Narrative Statement

The Narrative shall be a comprehensive statement of the Contractor's plan and approach for the execution of the Works and the achievement of key dates, handover dates, submission dates and any intermediate dates. It shall incorporate outline method statements in respect of major items of work including construction sequences and primary item of plant, Construction Equipment, Temporary Works and the like. It shall fully explain the reasons for the main logic links in the Programme and include particulars of how activity duration are established. This shall include estimated quantities, production rates, hours per shift, work days per week and a listing of the major items of Construction Equipment planned for use on the project. Activities, which may be expedited by use of overtime or additional shifts, shall be identified and explained. A listing of holidays, and other special non-work days being used for the computer reports shall be included.

(11) Baseline Physical Progress 'S' Curve

The Contractor shall also submit a forecast Cumulative Physical Progress 'S' curve based on the time-phased distribution of cost in the CPM Network Logic Diagram, expressed in percentage terms. This 'S' curve shall be generated from the computerised CPM Network Logic Diagram.

(12) Baseline Resource Charts

The Contractor shall also submit a Resource Charts, generated from the Contractor's CPM Network Diagram, showing the anticipated manpower and main Construction Equipment usage during the execution of the Project.

As an additional monitoring facility, indicator resources shall be assigned to relevant activities for the major items of work. Indicator resources shall be directly allocated for excavation (cum.), piling (no.), pile cap (no, pier & pier cap(no), viaduct (RM), parapet wall (RM) concrete (cum) for station etc. Resource indicators may be input as a daily rate, expected required rate, or as an activity total in the relevant units. These are purely indicative quantities and do not form part of contract.

(13) All submissions of proposed Works Programmes subsequently, after approval of the Initial Works Programme, shall include the actual physical progress of work and forecast of the remaining work. Actual progress shall be stated in percent complete, remaining duration, and actual start and finish dates for each activity in the Works Programme.

6. INITIAL WORKS PROGRAMME

- (1) The Initial Works Programme submitted as under Clause 5.1 need not include the full details given under Clause 6 above. It should be a condensed version with combined activities of longer. The outline Narrative Statement shall be in sufficient detail to clearly show the Contractor's intention.
- (2) Within Thirty (30) days of the Engineer's consent to the Initial Works Programme, the Contractor shall submit to the Engineer an expanded and more detailed

version of the Initial Works Programme containing all of the information and detail required under Clause 5 above.

- (3) Such submission shall make use of the Tender Programme submitted earlier but refined to include the best estimates of dates for the work of Designated Contracts which has impact on the Contractor's programme. Such programmes shall be amended subsequently to incorporate the actual dates/ schedule of the affecting contracts. It is the Contractor's responsibility to ensure timely co-ordination with the Designated Contractors to finalize the Initial Programme, without affecting progress of the work.

7. WORKS PROGRAMME REVISIONS

- (1) The Contractor shall immediately notify the Engineer in writing of the need for any changes in the Works Programme, whether due to a change of intention or of circumstances or for any other reason. Where such proposed change affects timely completion of the Works or any other Key Date the Contractor shall within fourteen (14) days of the date of notifying the Engineer submit for the Engineer's consent its proposed revised Works Programme and accompanying Narrative Statement. The proposed revised Works Programme shall show the sequence of operations of any and all works related to the change and the impact of changed work or changed conditions.
- (2) If at any time the Engineer considers the actual or anticipated progress of the work reflects a significant deviation from the Works Programme, he may request the Contractor to submit a proposed revised Programme which together with an accompanying Activity Report and Narrative Statement, shall be submitted by the Contractor within fourteen (14) days after the Engineer's instruction. The proposed revised Works Programme shall show the sequence of operations of any and all work related to the change and the impact of changed work or changed conditions.
- (3) All activities that have negative float must be analyzed by the Contractor to identify the impact on the timely completion of the Works or on the achievement of Key Dates.

8. THREE MONTH ROLLING PROGRAMME

- (1) The Three-Month Rolling Programme shall be an expansion of the current Works Programme, covering sequential periods of three months. The Three-Month Rolling Programme shall provide more detail of the Contractor's plan, organization and execution of the work within these periods. In particular, the Contractor shall expand each activity planned to occur during the next three (3) month period, if necessary to a daily level of detail.
- (2) The Three-Month Rolling Programme shall be developed as a Critical Path Method (CPM) network, and shall be presented in bar chart and time-scaled network diagram format. Bar charts shall be presented on an A4 and time-scaled networks diagrams on an A1 size reproducible media. Tasks in the programme

shall be derivatives of and directly related to tasks in the approved Works Programme.

- (3) The Contractor shall describe the discrete work elements and work element inter- relationships necessary to complete all works and any separable parts thereof including work assigned to sub-contractors.
- (4) Activity duration shall not exceed two (2) weeks unless otherwise consented to by the Engineer (to meet the BIM Software Requirements).
- (5) Each activity in the Three-Month Rolling Programme shall be coded, or described so as clearly to indicate the corresponding activity in the Works Programme

9. THREE MONTH ROLLING PROGRAMME REVISIONS AND UPDATE

- (1) The Three-Month Rolling Programme shall be extended forward each month as described under Clause 5(1) above. Each submission of the Three-Month Rolling Programme shall be accompanied by a Programme Analysis Report, describing actual progress to date, and the forecast for activities occurring over the next three- month period.
- (2) If the Three-Month Rolling Programme is at variance with the Works Programme, the Programme Analysis Report shall be accompanied by a supporting Narrative Statement describing the Contractor's plan for the execution of the activities to be undertaken over the three-month period, including programme assumptions and methods to be employed in achieving timely completion.
- (3) The Contractor shall revise the Three-Month Rolling Programme or propose revisions of the Works Programme, or both, from time to time as may be appropriate to ensure consistency between them.

10. THREE WEEK ROLLING BAR CHART SCHEDULE

Once a week, on a day mutually agreed to by the Engineer and the Contractor, a meeting will be held to assess progress by the Contractor during the previous work week. The Contractor shall submit a construction schedule listing activities completed and in-progress from the previous week and the activities scheduled for the succeeding two weeks based on the detailed Works Programme. Copies of the schedule shall be submitted on A3 sized paper.

11. PROJECT CALENDAR

For the Project, the Contractor shall adopt 7 days a week calendar, identical calendar for the purpose of programming and Execution of Works. Official documents shall be transacted during 5 days week - Monday through Friday, except for National (Govt. of India) Holidays. For Project purposes, a week begins at 0001 hours on a Monday and ends at 2359 hours on a Sunday. The completion of an activity or the achievement of

an event when given a week number shall be taken to mean midnight on the Sunday at the end of the numbered week. An access date or activity start date when given as a week number shall be taken to mean 0001 hours on a Monday of the Numbered week. For preparation of DWP to be compliant on BIM Software Platform, follow the Primavera Guidelines.

12. PROGRAMMING PERSONNEL

The Contractor shall submit, as part of its Staff Organization Plan, the names and required information for the staff to be employed on Works Programming. The principal Works

Programmer shall hold reputable professional qualifications acceptable to the Engineer including at least five (5) years relevant experience in programming civil engineering works. Others in the group shall have at least three (3) years' experience in such work. The programmers shall be employed by the Contractor full time on the Contract until the completion or such earlier time the Engineer may give his consent.

13. PROGRAMME AND REPORT SUBMISSION FORMAT

The Contractor shall submit one (1) original and six (6) copies and one (1) reproducible (for Programmes) of all submissions to the Engineer. All submissions shall be in AO, A1, A3 or A4 size, as appropriate except as may otherwise be agreed by the Engineer. In addition, the computerized programme and report shall be submitted in 3-1/2 inches diskettes (similarly for submissions required under Clause 5.4).

The format for all Programme and Report submissions shall be strictly in accordance with the format as stated herein or as requested by the Engineer.

14. FAILURE TO SUBMIT PROGRAMME

Failure of the Contractor to submit any programme, or any required revisions thereto within the time limits stated for acceptance by the Engineer, shall be sufficient reason for not making the relevant stage on account payment by the Engineer.

To facilitate the integration of BIM software with various Primavera schedules and BIM model. Following guidelines are to be adopted for preparation of Construction Programmes in Primavera and BIM models by various stakeholders viz. DDCs, contractors etc. –

Appendix-A - Guidelines for P6 Schedule preparation.

Appendix-B – File Format.

Appendix-D - Guidelines for revision of primavera Schedule.

Appendix-E - Guidelines for BIM modelling.

The construction programme should be prepared in Primavera P6 version 17.0 or latest version and BIM Models should be prepared in Revit version 2018 or latest

version, for mobile app for mobile phones should be, in case of Android phones versions 5.0 Lollipop (API 21) and higher version and in case of I-Phones version 9.1 and higher version.

11. APPENDIX 5 - MONTHLY PROGRESS REPORTS

1. GENERAL

The Contractor shall submit to the Engineer, a Monthly Progress Report. This Report shall be submitted by fifth day of each calendar month and shall account for all work actually performed from 1st day of previous month and up to and including the last day of the previous month. It shall be submitted in a format to which the Engineer shall have given his consent and shall contain sections/sub- sections.

2. FINANCIAL STATUS

- (1) A narrative review of all significant financial matters, and actions proposed or taken in respect to any outstanding matters.
- (2) A spread sheet summarising each activity, the budget, costs incurred during the period, costs to date, costs to go, cost forecast (total of costs to date and costs to go) and cost variance (difference between cost forecast and budget).
- (3) A spread sheet indicating the status of all payments due and made.
- (4) A report on of the status of any outstanding claims. The report shall in particular provide interim updated accounts of continuing claims.

3. PHYSICAL PROGRESS

- (1) It shall describe the status of work performed, significant accomplishments, including critical items and problem areas, corrective actions taken or planned and other pertinent activities, and shall, in particular, address interface issues, problems and resolutions.
- (2) It shall include a simplified representation of progress measured in percentage terms compared with percentage planned as derived from the Works Programme.

4. PROGRAMME UPDATE (For Entire Project)

Programme updating shall include:

- (a) the monthly Programme Update which shall be prepared by recording actual activity completion dates and percentage of activities completed up to and including last day of the previous month together with estimates of remaining duration and expected activity completion based on current progress. The Programme Update shall be accompanied by an Activity Report and a Narrative Statement. The Narrative Statement shall explain the basis of the Contractor's submittal:
 - (i) Early Work and Baseline Submittals – explains determination of activity duration and describes the Contractor's approach for meeting required Key Dates as specified in the Contract.

- (ii) Updated Detail Programme Submittals – state in narrative the Works actually completed and reflected along Critical Path in terms of days ahead or behind allowable dates. Specific requirements of narrative are:
- If the Updated Detailed Work Programme indicates an actual or potential delay to Contract Completion date or Key Dates, identify causes of delays and provide explanation of Work affected and proposed corrective action to meet Key Dates or mitigate potential delays. Identify deviation from previous month's critical path.
 - Identify by activity number and description, activities in progress and activities scheduled to be completed.
 - Discuss Variation Order Work Items, if any.

(b) the Programme Status which shall:

- (i) show Works Programme status up to and including the current report period, display Cumulative progress to date and a forecast of remaining work.
- (ii) be presented as a bar-chart size A3 or A4 and as a time-related logic network diagram on an A1 media, including activity listings;

(c) the Activity Variance Analysis which shall analyse activities planned to start prior to or during the report period but not started at the end of the report period as well as activities started and/or completed in advance of the Works Programme.

5. COMPLETION SCHEDULE DATES STATUS

A report on the status of all Key dates due to have been achieved during the month and forecasts of achievement of any missed Completion Schedule dates, and those due in the next month.

6. THREE MONTH ROLLING PROGRAMME

The monthly issue of the Three-Month Rolling Programme.

7. PLANNING AND CO-ORDINATION

- (1) A summary of all planning/co-ordination activities during the month and details of outstanding actions.
- (2) A schedule of all submissions and consents/approvals obtained/outstanding.

8. PROCUREMENT REPORT

- (1) A summary of all significant procurement activities during the month, including action taken to overcome problems.

(2) A report listing major items of plant and materials which will be incorporated into the Works. The items shall be segregated by type as listed in the Specifications and the report should show as a minimum the following activities:

- (a) purchase Order Date - Scheduled/Actual,
- (b) manufacturer/Supplier and Origin,
- (c) letter of Credit Issued date,
- (d) manufacturer/Supplier Ship Date - Scheduled/Actual,
- (e) method of Shipment,
- (f) arrival Date in India- Scheduled/Actual.

9. PRODUCTION AND TESTING

Deleted

10. SAFETY

(1) A review of all safety aspects during the month including reports on all accidents and actions proposed to prevent further occurrence.

11. ENVIRONMENTAL

(1) A review of all the environmental issues during the past month to include all monitoring reports, mitigation measures undertaken, and activities to control environmental impacts.

12. **APPENDIX 6 - QUALITY ASSURANCE**

1. **General**

The Contractor shall implement a Project Quality Management Plan in accordance with ISO- 9001 "Quality System - Model for Quality Assurance in Design/Development, Production, Installation and Servicing" to ensure that all materials, workmanship, plant and equipment supplied, and work done under the contract meets the requirements of the contract. This plan shall apply to all activities related to the quality of items, including designing, purchasing, inspecting, handling, assembling, testing, storing, and shipping of materials and equipment and different elements of construction work and installations of system components.

The Quality Plan to be prepared by the Contractor and submitted to the Engineer shall follow the requirements of ISO 9000 and address each element therein.

Registration of the Contractor's organization, or subcontractors or sub-consultants is not required for this Project, but the Project Quality Management Plan as submitted shall meet the intent of the ISO 9000 requirement in that there is a comprehensive and documented approach to achieving the project quality requirements.

2. **Quality Assurance Management Plan**

The Project Quality Management Plan (PQMP) shall as a minimum address the quality system elements as required by ISO 9001, generally noting the applicability to the Contractor's Works Programme for the Project. Procedures or Quality Plans to be prepared by others (Suppliers, Subcontractors, and Sub-consultants) and their incorporation in the overall PQMP shall be identified.

The Contractor shall provide and maintain a Quality Assurance Plan (QA) to regulate methods, procedures, and processes to ensure compliance with the Contract requirements. The QA Plan, including QA written procedures, shall be submitted to the Engineer for his review.

Adequate records shall be maintained in a readily retrievable manner to provide documented evidence of quality monitoring and accountability. These records shall be available to Authority at all times during the term of the Contract and during the Defects Liability Period and for a five-year period thereafter.

The Plan shall identify:

- Design Process: that control, check and verify the accuracy, completeness and integration of the design shall be performed by certified personnel and in accordance with documented procedure that have the written consent of the Engineer.
- Special Processes: that control or verify quality shall be performed by certified personnel and in accordance with documented procedures that have the written consent of the Engineer.
- Inspection and Test: Inspection and testing instructions shall provide for reporting non- conformances or questionable conditions to the Engineer; Inspection shall

occur at appropriate points in the installation sequence to ensure compliance with drawings, test specifications, process specifications, and quality standards. The Engineer shall designate, if necessary, inspection hold points into installation or inspection planning procedures;

- Receiving Inspection: These procedures shall be used to preclude the use of nonconforming materials and to ensure that only correct and accepted items are used and installed;
- Identification and Inspection Status: a system for identifying the progressive inspection status of equipment, materials, components, subassemblies, and assemblies as to their acceptance, rejection, or non-inspection shall be maintained;
- Identification and Control of Items: an item identification and traceability control shall be provided;
- Handling, Storage, and Delivery: provide for adequate work, surveillance and inspection instructions.

The Plan shall ensure that conditions adverse to quality such as failures, malfunctions, deficiencies, deviations, and defects in materials and equipment shall be promptly identified and corrected.

The Plan shall provide for establishing and maintaining an effective and positive system for controlling non-conforming material including procedures for the identification, segregation, and disposal of all non-conforming material. Dispositions for the use or repair of non-conforming materials shall require the Engineers consent.

3. Plan Implementation and Verification

The Plan shall clearly define the QA Organisation. Management responsibility for the QA shall be set forth on the Contractor's policy and organisation chart. The Plan shall define the requirements for QA personnel, their skills and training. Records of personnel certifications shall be maintained and monitored by the QA personnel. These records shall be made available to the Engineer for review, upon request.

The QA operations shall be subject to the Engineers, Authority or Authority's authorised representative's verification at any time, including surveillance of the operations to determine that practices, methods and procedures of the plan are being properly applied; inspection to measure quality of items to be offered for acceptance; and audits to ensure compliance with the Contract documents.

The contractor's Quality Audit Schedule shall be submitted to the Engineer for consent every three months or more frequently as required.

The results of Quality Audits shall be summarised in the Contractor's monthly reports.

Monthly Quality Report (MQR): The contractor shall submit the Monthly Quality Report, on

the lines of sample document of MQR approved by the AUTHORITY, to the Engineer, (Copy of sample document of MQR is available with the Engineer). MQR will contain, apart from the Material Testing Reports, the following major items

- a) Status of Approval of Method Statements:** The Contractor shall submit Method Statements including check lists & ITP (Inspection & Test Plan) for execution of each and every item of work including temporary works at least four weeks before their execution, conforming to the outline construction specifications given in the contract document and sample Method Statements approved by the AUTHORITY, for review and approval by the Engineer. (copies of sample Method Statements are available with the Engineer).
- b) Quality Walk:** Quality Walk of the project site shall be held once in a week by the Authority/Authority's authorized representative.
- c) Weekly Quality Report (WQR):** The contractor shall submit the Weekly Quality Report for review of the quality by the Engineer in weekly progress review meeting. The WQR will be based on the lines of MQR.
- d) Internal Quality Audit (IQA):** The contractor shall conduct an internal audit of the quality of the project by the quality team of their HQ every month and shall submit the report to the Engineer.
- e) External Quality Audit (EQA):** The contractor shall get conducted the External Quality Audit quarterly by the reputed agency accredited by NABCB and approved by the Engineer and shall submit the report to the Engineer.
- f) Calibration of Batching Plant:** The contractor shall get done the calibration of batching plant, immediately after installation of the batching plant and at an interval of six months thereafter, by a reputed external agency accredited by NABCB and approved by the Engineer. However, the contractor shall check the calibration in the presence of Engineer's authorized representative on regular basis at least once in a month.
- g) Laboratory at Site:** The contractor shall get calibrated the Laboratory equipment and their dial gauges from the reputed agency/laboratory accredited by NABL and approved by the Engineer. The calibration certificate including their validity shall be displayed near each and every equipment of the Lab.
- h) External Laboratory for Conducting Tests:** The contractor shall get conducted the tests of materials and elements of the work for which testing facility is not available in the field Lab, from the external laboratories having valid accreditation of NABL approved by the Engineer. In addition to this, the contractor shall get conducted 5% of the tests, for which testing facility is available in field Lab also, in the external Lab, to facilitate independent review.
- i) Water:** The contractor shall get the water tested, from the reputed external laboratory approved by the Engineer, at the start of the work and at an interval of three months thereafter. The contractor shall also conduct the testing of the water at least

once in a month in the field laboratory. Irrespective of the source of water, entire water to be brought to the Casting Yard/ Batching Plant and to be treated through RO plant and only that water to be used for construction and curing. On a daily basis, the treated water to be tested with Water Testing kit for pH, TDS, Chloride and Sulphate and a Daily Record to be maintained.

j) Status of deployment of Machinery and other T&P (Tools & Plants): The contractor shall deploy machinery and other T&P as per the provisions of the contract. Method statements approved by the Engineer and as per the requirement of the site. The contractor shall indicate the schedule of deployment of the machinery and other T&P in the Monthly Quality Report. The fitness of the machinery and other T&P shall be regularly checked by the contractor by external inspection/Audit Team.

k) NCNs (Non-Conformity Notice) of quality issued by

l) & NCR's (Non-Conformity Report) of quality raised by the Contractor: The status of NCNs and NCRs of quality shall be included by the contractor in the Monthly Quality Report. The Contractor shall provide all necessary access, assistance and facilities to enable the Engineer to carry out on-site and off-site surveillance of Quality Assurance Audits to verify that the quality system which has the consent of the Engineer is being implemented fully and properly.

The Contractor shall provide all necessary access, assistance and facilities to enable the Engineer to carry out on-site and off-site surveillance of Quality Assurance Audits to verify that the quality system which has the consent of the Engineer is being implemented fully and properly.

m) Factory Acceptance Tests

Factory Acceptance Tests shall be performed on equipments and plants in compliance with the Conditions of Contract, the Technical Specifications, the applicable Standards and Regulations and the Contractor's Quality Assurance Plan.

The Contractor shall submit detailed FAT programmes, procedure and schedules subjected to approval by or Authority's Engineer.

The following FAT shall be witnessed by the Authority or Authority's Engineer.

- i. Drive Machinery
- ii. Carriers
- iii. Bull wheels, Cabins, sheaves
- iv. Drive assembly (Main and emergency)
- v. Braking system (hydraulic)
- vi. DG sets
- vii. Other mechanical and electronic devices

Note: Towers shall be supplied with FAT test results. Contractor shall get them approved from Authority or Engineer after mobilizing to site prior to erection.

The Contractor shall make all necessary arrangements for upto two representatives of Authority or Engineer to participate in the FAT. It is estimated that each FAT in average will take 7days + travel days.

The Contractor has to arrange International round-trip flight tickets, local transportation, accommodations and food at the place of the FAT and per diem allowances to three representatives during the FAT. The Contractor has to confirm with the Authority about rates of per diem during FAT.

The Contractor shall also make arrangements for Operation and Maintenance Training of upto two engineers of the Authority for a minimum period of two weeks on ropeway operation.

The Contractor shall make available all relevant Standards and regulations at least 15 days prior to visit.

13. APPENDIX 7 - 3D MODELING STANDARDS

Contractor shall implement Building Information Modeling (BIM) for which BIM Implementation Plan will be provided by Authority with the contractor & the contractor shall follow the same; however, broad guidelines are as follows:

1. INTRODUCTION

- i) The purpose of this document is to define the minimum 3D Modeling standard to be achieved by the Contractor for all drawings produced by the Contractor for the purpose of the works.
- ii) By defining a common format for the presentation of drawings and 3D model files, the exchange of information is improved and will enhance the coordination process.
- iii) All submissions shall be made in accordance with the Authority's Requirement and format without objection in accordance with the requirements in :
 - a) The Contract;
 - b) The Document submittal instructions to Consultants and Contractors.
- iv) Paper and drawing sizes shall be "A" series sheets as specified in BS3429.
- v) The following software (latest and updated version) compatible with Intel-Windows based computers shall be used, unless otherwise stated, for the various required electronic submissions.

Document Type	Electronic Document Format
Text Documents	M S Word, Pdf
Spread Sheets	M S Excel
Data Base Files	M S Access
Presentation Files	M S PowerPoint
Programme Ver 2.0a Drawing Graphics Photographic	Primavera for Windows, Sure track Revit (Autodesk AEC collection latest version), CAD drawing extracted from Revit Corel Draw Adobe Photoshop
Desktop Publishing	Page Maker
BIM Models	Autodesk AEC collection (latest version), BIM 360 collaborator pro

- vi) Media for Electronic File Submission- BIM 360 & Email One copy shall be submitted unless otherwise stated in CD-ROM
- vii) Internet File Formats/Standards

The following guidelines shall be followed when the Contractor uses the Internet browser as the communication media to share information with the Authority.

- a) All the data formats or standards must be supported by Microsoft Internet Explorer (latest version) running on windows professional (latest version).
- b) The following list shows the file types and the corresponding data formats to be used on the Internet. The Contractor shall comply with them unless prior consent is obtained for a different Data format from the Authority's Requirement:

File Type	Data Format
Photo Image	Joint Photographic Experts Group (JPEG),JPG
Image other than Photo	GIF or JPEG
BIM Models and Drawings	.rvt, .nfc, .nwc, .nwd, .dwg
Video	Window video (.avi), mp4, wmv
Sound	Wave file (.wav),mp3

- viii) The following states the standards to be used on Internet when connecting to database(s). The Contractor shall comply with them unless prior consent is obtained for a different standard from the Authority's Requirement

Function to be Implemented	Standard to be Complied With
Database connectivity	Open Database Connectivity (ODBC)
Publishing hypertext language on the World Wide Web	Hypertext Markup Language (HTML)

The hard copy of all documents shall be the contractual copy.

2. GENERA REQUIREMTS

General:

- ix) The Contractor shall adopt a title block similar to that used in the Drawings for all drawings prepared under the Contract.
- x) Each drawing shall be uniquely referenced by a drawing number and shall define both the current status and revision of the drawing.
- xi) The current status of each drawing shall be clearly defined by the use of a single letter code as follows:

- P - Preliminary Design Drawing
- D - Definitive Design Drawing
- C - Construction Reference Drawing

- W - Working Drawing
- B - As-Built Drawing
- M - As Manufactured Drawing
- E - Authority's Drawing

Types of drawings:

- i) 'Design drawings' mean all drawings except shop drawings and as-built drawings.
- ii) 'Working drawings' are design drawings of sufficient detail to fully describe the Works and adequate to use for construction or installation.
- iii) 'Site drawings and sketches' are drawings, often in sketch form, prepared on site to describe modifications of the Working drawings, where site conditions warrant changes that do not invalidate the design.
- iv) 'Shop drawings' are special drawings prepared by the manufacturer or fabricator of various items within the Works to facilitate manufacture or fabrication.
- v) 'As-built drawings' show the Works exactly as constructed or installed. They are usually prepared by amending the working drawings to take into account changes necessitated by site conditions and described in Site drawings. These drawings shall be completed on a regular basis as the works progress, and shall not be left until completion of the entire works.

3. COMPUTER AIDED DESIGN & 3D MODELING STANDARDS

3.1. Introduction:

BIM (Building Information Modeling) is a system or technology which defines as a digital representation of physical and functional characteristics of a facility. BIM is a shared knowledge resource for information about a facility forming a reliable base for better planning, decision making and avoiding cost and time overruns during the project life cycle. BIM helps to understand the process and standards to follow throughout the project which enables better coordination amongst stakeholders. BIM is an automated system, which enables a better visualization of the virtual asset, which helps the owner to analyze the model prior to construction at site and minimizing the errors.

BIM helps Authority and all project stakeholders to deliver the project in an optimistic manner through better collaboration and workflow management.

3.2. Objectives

The main objective of implementing BIM in all AUTHORITY projects is to enhance the conventional method in the design, construction and documentation stage and moving towards the collaborative BIM platform for enhanced management.

At the planning and design stage it enables all users to work together to produce the best possible designs and to test them virtually before they are constructed. During construction, it enables AUTHORITY, contractors and suppliers to integrate all components cutting out waste and reducing the risk of errors. In operation, it provides users with real time information about available services and facility managers with accurate assessment of the condition of assets.

In addition, BIM will provide a better control over the versions (Revisions) of the drawings, which will minimize the time as well as the cost of the project. Also, BIM creates opportunities for managing the extensive data of the project and reuse the data for multiple purposes.

3.3. General

AUTHORITY is working in a new collaborative environment to achieve higher standards of quality, real time working and monitoring of the projects. There are significant benefits in the productivity of project team and minimizing the time over runs through application of 3D modeling, Visualization, Multidisciplinary coordination and Clash detection. These processes include:

- i) Automation of drawing and document production processes
- ii) Indexing and searching project material
- iii) Filtering and sorting
- iv) Quality checking and document comparisons

3.3.1. Navisworks (.nwc) Export

Stakeholders shall provide Navisworks (.nwc file) for:

- i) Each Model Breakdown
- ii) Each trade (Discipline)

Stakeholder's models are to provide 3D views categorized as "Navisworks Export" created for each model breakdown, trade and file ID.

These views are to be configured to show only the elements that are to be exported to the federated Navisworks model. All unnecessary settings that diminish the performance such as sun studies and shadows are to be turned off in this view.

3.3.2. Setting Batch Routines

Clashes are to be tracked and clash checked file to be shared with other Design Team members to allow individuals to review issues that pertain to them in a systematic way. This shall be done by using an iterative process:

- i) Clash Detection between various disciplines
- ii) Visual Inspection accordingly.
- iii) Save the viewpoints (in a Folder with date)
- iv) Review issues with the Design Team.
- v) Each discipline resolves issues pertaining to their discipline.

- vi) Repeat the Clash Test.
- vii) Move resolved issue viewpoints to a “Resolved” Folder.
- viii) Create new viewpoints for new issues
- ix) Review previous unresolved issues and new issues.
- x) Resolve issues.
- xi) Repeat the Clash Test.

Multi-Disciplinary Clash Detection shall be executed to develop clash free BIM model. This will enhance the productivity at Construction project stage.

3.3.3. LOD 500 (Levels of Development)

The Level of Development (LOD) 500 framework addresses several issues that arise when a BIM is used as a communication or collaboration tool, i.e., when someone other than the author extracts information from it. The LOD 500 framework allows model authors to clearly state the reliability of given model elements. The LOD 500 Framework provides an industry-developed standard to describe the state of development of various systems within a BIM. This standard enables consistency in communication and execution by facilitating the detailed definition of BIM milestones and deliverables.

3.4. Terminology & Associated Standards /Guidelines

Following terms and definitions are considered for the BIM Implementation Plan:

- (i) 3D: 3D refers to the physical geometry of the building as defined in the model, which consists both properties and the behavior of the geometry. 3D in terms of BIM refers to the building components or elements such as doors, windows, walls, columns, etc. this is mainly for the visualizing the geometry.
- (ii) 4D: 4D refers to the effect of time against the model, specifically relating to the incorporation of the construction program timeline to the model components. This allows construction sequencing simulations, scheduling and on-site production control of the project.
- (iii) Archive: Component of the common data environment (CDE). The archive section of the CDE is for inactive or superseded information. Such information will provide a history of the project information transfers, sharing, change orders and knowledge retention, and can be used for other contractual purposes or “discovery”.
- (iv) As-Built: As-constructed component of the common data platform.
- (v) Asset Information Model (AIM): Maintained information model used to manage, maintain and operate the asset.
- (vi) Authoring Tool: Refers to various BIM software and/or applications used to create, edit and alter objects/elements which make up the BIM model.

- (vii) Autodesk Navisworks: BIM project review software developed by Autodesk. Helps to do navigation, clash detection, quantification and simulation.
- (viii) Autodesk Revit: BIM authoring software developed by Autodesk to create edit and review architectural, structural and systems design and analysis from concept design to construction providing a 3D view which can in Orthographic or perspective view.
- (ix) BIM: Building Information Modeling (BIM) is the generation and management of information about a building during its entire life cycle. BIM is facilitated by a suite of technologies and processes that integrated the building data and defines proper standards to execute the work in a collaborative approach.
- (x) BS1192: Collaborative production of architectural, engineering and construction information. Code of practice.
- (xi) Classification: Systematic arrangement of headings and sub-headings for aspects of construction work including the nature of assets, construction elements, systems and products.
- (xii) Common Data Environment (CDE): Single source of information for any given project, used to collect, manage and disseminate all relevant approved project documents for multi- disciplinary teams in a managed process.
- (xiii) Component: An individual building element that can be reused. Examples include doors, stair cores, furniture or internal room layouts, façade panels, etc. Components are typically inserted and moved/rotated into the required position.
- (xiv) Data: Information stored but not yet interpreted or analyzed
- (xv) Drawing file: it can also be referred as 2D drawings. The format can be in PDF or CAD file.
- (xvi) Drawing rendition: Output from a drawing definition, drawing renditions provide static
- (xvii) DWG: DWG (Drawing) is a binary file format used for storing two- and three-dimensional design data and metadata. AutoCAD is the primary software which refers to this format.
- (xviii) Electronic Document Management System (EDMS): System for storing, retrieving, sharing and otherwise managing electronic documents.
- (xix) IFC: Industry Foundation Class is a neutral and open specification file format. The data model facilitates interoperability between various software involved in project stages.
- (xx) Information Exchange: Structured collection of information at one of a number

of pre- defined stages of a project with defined format and fidelity.

- (xxi) Information Management: Tasks and procedures applied to inputting, processing and generation activities to ensure accuracy and integrity of information.
- (xxii) Information Model: Model comprising properties, its behavior, documentation, information exchange.
- (xxiii) Level of Development (LOD): Collective term used to define the degree to which project team members may rely on the information when using the model
- (xxiv) Model Author / Model Owner: Model Author or Model Owner refers to each individual who contributes to the authoring of model content. The role of a model author includes; Creation and placement of model components; Entering applicable information regarding model components; Coordination of created components; Communication of model creation and coordination issues to the Model Manager.
- (xxv) Coordination Model: A model file containing multiple references of 2D/3D models coordinated using a common geospatial reference system to form a complete model representation of the information.
- (xxvi) Model Extraction: A 2D model file containing elements generated from an external 3D model, usually in the form of sections, elevations and plans. Can contain graphical or non- graphical content.
- (xxvii) Model File: Native CAD file that can be in the form of a 2D or 3D model.
- (xxviii) Model view: The view within CAD files which contains entities or reference files using real- world coordinates
- (xxix) Output file: A generated rendition of graphical or non-graphical information (a plan, section, elevation, schedule, table or other view of a project).
- (xxx) Production drawing: An immutable electronic plot (PDF) produced from a drawing definition, having received all necessary reviews prior to issue
- (xxxi) Project Information Model (PIM): Information Model developed during the design and construction phase of a project.
- (xxxii) Published: Documents and other data outputted from Shared information. Typically, this shall include contract drawings, reports and specifications but can also include information for data exchange between BIM software, such as IFC files. Refer to BS1192.
- (xxxiii) RVT: Standard file format used by all versions of Autodesk Revit.

- (xxxiv) Shared: “SHARED” may be interpreted as being the status of the file rather than being moved across the system. This will prevent multiple copies of files and allow archiving of data with subsequent revisions/versions. Verified design data shared with the project team for collaboration purposes. This will help in providing multi-disciplinary clash check and will develop clash free models.
- (xxxv) WIP: The work in progress (WIP) area of the CDE should be used to hold unapproved information for each organizational role. Non-verified design data used by discipline specific design teams. This section is used where there is a need of fetching data from other disciplines and to modify certain changes and to develop the detailed design.
- (xxxvi) Published Documentation: The PUBLISHED area of the CDE should be used to hold the published information. Information in the PUBLISHED area that is superseded by new information should be moved to the ARCHIVE area. Coordinated and validated design output for project deliverable issue.
- (xxxvii) Archive: The ARCHIVE area of the CDE is for inactive or superseded material and should be used to record all progress through each information exchange and should hold a record of all transactions and change orders and may provide an audit trail in the event of a dispute. It is project history maintained for knowledge and for regulatory and requirements. This will be as a reference document for the Operations and Maintenance Team for facility management.
- (xxxviii) Content Check: This is where the data or the content is checked and internally approved (GAD) so that it can be forwarded to further coordination and develop master model.

3.5. Collaboration Strategy

The BIM coordination process will be collaborative and managed through regular coordination meetings. All discipline integration, coordination and resolution process will take place in a collaborative 3D object orientated Common Data Environment (CDE).

All documents/ models will be managed through strict document management, transfer and record storage protocols.

The contractor will provide an Electronic Data Management System (EDMS) across the entire project consistent with the principles of the sharing of multi-disciplinary object data in a CDE.

Besides Contractor’s EDMS, Authority’s Autodesk BIM360 software will be used to transmit all BIM related communications including but not limited to:

- i) Meeting records/ minutes
- ii) RFI’s
- iii) Clash detection reports

- iv) Coordination zone sketches
 - v) Model revisions reports
- 3.6. Conditions for BIM data Exchange**

The validation and verification of BIM data prior to sharing and coordinating the model shall consider following conditions:

- i) Revit Version: file format and naming Conventions should be standardized with reference to the BIM standards.
- ii) Elements used in the model should correspond to the data classification with respect to the Revit categories; proper coding system and other discipline standards (Structure and Building systems)
- iii) Model file should be synchronized at proper interval to be up-to-date containing all users modifications made in central model (Cloud Model).
- iv) The models should be linked with the central models.
- v) Any associated data which is required for loading the model should be available.
- vi) Model file should be audited, purged and compressed when required.
- vii) The changes from the Markups and issues should be rectified within the due date provided.

3.7. Modeling Guidelines

Whenever several model objects are grouped together or created as a composite object, each individual object should be able to be selected independently. Group of elements within a family is not accepted.

The objects should be free from geometrical errors like open shells. The modeler should check the object library / families to ensure that correct properties are assigned to those families

The model must be split to zones / segments that will meet the construction process. Depending on scope of work, the construction process shall be different and hence the mode of splitting the model to components / elements varies. For example, one should not create a pier directly rising from foundation till deck slab of viaduct. Similarly, one should not create a continuous segment or single deck slab for viaduct as individual segments are erected during construction.

All the elements which do not demand a critical calculation of geometric volume and area may go without a strict accordance with the drawings in three-dimensional detail, but the object name, types, material and module must be in the object properties. For example: In Pier the volume and area is a critical calculation, but in case of CCTV Camera it is not.

General descriptions, Material descriptions of all elements must be present in the model. Naming structure shall be uniform for same type used in the entire project

3.8. Data Transfer Media and Format

Designers will deliver complete 3D discipline models as follows:

- i. The Models shall be developed in a software package compatible with Navisworks Manage.
- ii. The Designers shall provide with 3D models in a format compatible with Revit and in Navisworks Document Format (NWD)
- iii. Exchange of 2D CAD files shall be in AutoCAD file format (.DWG).

The Coordination model shall include, at a minimum: The modeling elements per modelling requirements specified.

- i) All objects must be modeled as 3D solids, not wireframe or lines.
- ii) All Stakeholder Models need to comply with the Files Maintenance Checklist
- iii) All Stakeholder Models are to have a pre-determined Starting View with the minimum following information:
 - a) Project Name
 - b) Service or discipline
 - c) Model Breakdown Zone
 - d) Model Name
 - e) Version Number

3.9. File Naming Structure

This is used to provide proper naming structure for model file. It is the responsibility of the AUTHORITY BIM Managers to develop a model scheme that will provide a stable and manageable model organizational structure for all project teams.

The model size should be limited to 200MB (recommended), but if it is coming out larger than the expected value then the model should be segregated in a logical manner as per the disciplines. It is recommended that the models should be segregated into functional worksets which will help in developing the proper coordinated set of models.

Work sets should be provided in a logical manner which will help to the project teams to work in their specified areas. These all are the responsibility of

AUTHORITY BIM Managers to coordinate and initiate the process for better collaboration of the project teams.

All the BIM models should consist of unique name. The file name should have the following 6 fields: Project – Originator – Discipline – Location – Model Type – Sequence Number_Revision Number EXAMPLE: XXX001 – YYY – ZZ – L1UG01 – CSD – 0001

Project: This is a 6 alphanumeric field that defines the project code.

Originator: This consists of 3 alphabets which defines the name of the contractor or consultant working in the project.

Discipline: Following are the discipline wise codes which will be used in the file naming structure.

ROLE/DISCIPLINE CODE	
Code	Role / Discipline
GE	General
CW	Civil
AR	Architecture
ST	Structure
MW	Mechanical
EW	Electrical
PW	Plumbing
FP	Fire
RP	Ropeway

Figure 1: BIM Standard: Revision

Location: This field should not have more than 6 characters. This defines the geographic area where the project is located. This field is classified into Line no.; Type of facility; facility number. Example: RL; Red line Station.

Facility no.1

Model Type: This element will define the type of model with respect to the discipline. Example: CSD- Common Services Drawings

Sequence Number: A four-digit number to distinguish between different models or drawings. Leading zeros should be used.

Example: 0001

3.10. Work sets

The Revit platform originally implemented Work sets as a mechanism to enable multiple users to collaborate on a single model by taking temporary ownership of user-defined element groups.

Making an entire work sets editable (by checking it out) prevented other users from editing any part of that work sets until control was relinquished upon a Save to Central operation.

Work sets remain extremely valuable for data segregation and managing workflow, because they enable selectively opening and closing portions of a project across all project views. This level of control can represent an advantage overview dependent features such as view filters or visibility/ graphics settings in certain workflows.

While the capability to check out a work sets remains valuable under certain circumstances outlined below, in general the best practice is to use element borrowing rather than checking out entire Work sets.

The Revit platform team recommends that Work sets should be employed most often to segregate conceptual areas of a project, such as:

- i. Separate buildings
- ii. Grid and levels
- iii. Building core
- iv. Building shell
- v. Furniture and equipment spanning multiple categories

3.11. Status Description

- i. Work In progress (WIP)
- ii. Shared
- iii. Published Documentation
- iv. Archive
- v. Content Check

For details of the above Para 3.4-“Terminology & Associated Standards /Guidelines” may be referred.

3.12. Revisions

Models must be revised to a new revision whenever any content from that model is published as a drawing, or the Model itself is issued.

Standard codes for suitability models and documents					
Status	Description	Revision	Graphical Data	Non-Graphical Data	Documents
Work in Progress					
S0	Initial status or WIP Master document index of file identifiers uploaded into the extranet.	P01.01 etc to P0n.0n etc	✓	✓	✓
Shared (Non-contractual)					
S1	Suitable for Co-ordination The file is available to be 'shared' and used by other disciplines as a background for their information.	P01 to P0n	✓	✗	✗
S2	Suitable for Information	P01 to P0n	✗	✓	✓
S3	Suitable for Review & Comment	P01 to P0n	As required	✓	✓
S4	Suitable for Stage Approval	P01 to P0n	✗	✗	✓
Text deleted					
S6	Suitable for PIM Authorization (Information Exchanges 1-3)	P01 to Pnn	✗	✗	✓
S7	Suitable for AIM Authorization (Information Exchange 6)	P01 to Pnn	✗	✗	✓
WIP to Published Unauthorized and (Non-contractual) use at risk.					
D1	Suitable for Costing	P01.01 etc to P0n.0n etc	✓	✓	✓
D2	Suitable for Tender	P01.01 etc to P0n.0n etc	✗	✓	✓
D3	Suitable for Contractor Design	P01.01 etc to P0n.0n etc	✓	✓	✓
D4	Suitable for Manufacture/Procurement	P01.01 etc to P0n.0n etc	✗	✓	✓
Published Documentation (Contractual)					
A1, A2, A3, An etc	Approved and accepted as stage complete (C= Contractual/Complete)	C01 to C0n	✓	✓	✓
B1, B2, B3, Bn etc	Partially signed-off: with minor comments from the Client. All minor comments should be indicated by the insertion of a cloud and a statement of 'in abeyance' until the comment is resolved, then resubmitted for full authorization.	P01.01 etc to P0n.0n etc	✓	✓	✓
Published for AIM Acceptance					
CR	As Construction Record documentation, PDF, Models etc	C01 to C0n	✓	✓	✓

Figure 1: BIM
Standard: Revision

3.13. BIM Quality Check list

BIM quality checklist will be given in BIM Implementation Plan which is to be followed by contractors.

14. APPENDIX 8 - WORKS AREAS & TEMPORARY POWER SUPPLY

1. INTRODUCTION

- (1) The Contractor shall provide within the designated principal Works Areas, at locations agreed with the Engineer, the compounds and facilities for the Engineer and other contractors of the Authority defined under Clause 2 of this Appendix.
- (2) The standard conditions applying to the use of any Works Area by the Contractor for its site facilities are given under Clause 2 of this Appendix.
- (3) The Conditions for supply of electricity by the Contractor to Designated Contractors are given under Clause 3 of this Appendix.

2. STANDARD ENGINEERING CONDITIONS

The following standard engineering conditions apply to all Works Areas:

- (1) Formation
 - (a) The Works Areas shall be formed to the levels that the Engineer has given his consent. No such levels shall be amended without prior consent of the Engineer.
 - (b) The Works Areas shall be surfaced in a manner agreed with the Engineer, compatible with their intended use, and, in particular, footpaths and roadways connecting facilities shall be clearly defined. Measures shall be taken to the satisfaction of the Engineer to ensure all areas are properly drained and kept free of static water.
 - (c) The removal, diversion or reinstatement elsewhere as may be required of any existing works or installation whatsoever within the Works Areas shall be carried out to the satisfaction of the Engineer.
- (2) Roads & Parking
 - (a) Space shall be provided within the Works Areas for parking, loading/unloading and maneuvering of motor vehicles.
 - (b) Any damage done to the adjoining public roads and fixtures and properties (public or private) shall be made good to the satisfaction of the Engineer.
- (3) Drainage & Sewerage
 - (a) All storm or rainwater from the Work Areas including any access roads thereto shall be conveyed to the nearest stream course, catch-pit, channel or storm water drain as required by the Engineer. All temporary and permanent works shall be carried out in such a manner that no damage or nuisance is caused by storm water or rainwater to the adjacent property.

- (b) No drain or watercourse shall be used without the consent of the Engineer.
- (c) Damage or obstructions caused to any watercourse, drain, water- main or other installations within or adjoining the Works Areas shall be made good to the satisfaction of the Engineer.
- (d) Treatment and disposal of sewage and wastewater from the Works Area shall be provided to the satisfaction of the Engineer.
- (4) Buildings
 - (a) No permanent structures other than those required for the Permanent Works shall be Temporary permitted on the Works Areas.
 - (b) Electricity, water, telephone and sewerage should be provided by the Contractor, as required, for all temporary buildings.
 - (c) No potable water from the municipal authority shall be used for heating, cooling and humidification purposes, or vehicle washing without the written consent of the Engineer.
- (5) Pedestrian Access

Every existing pedestrian access throughout the Works Areas shall be maintained in a usable condition at all times to the satisfaction of the Engineer including lighting, signing and guarding.
- (6) Fencing

The Works Areas shall be secured against unauthorized access at all times. In particular fencing or the like shall be maintained, removed and re-erected in the new location wherever and whenever a Works Area is relinquished in stages.

3. Temporary Water & Power Supply

The Contractors, during construction phase, shall provide power & water supply. Facilities provided shall be:

- (a) at the ends of each station, at concourse level, a mains water supply of 25 mm diameter completes with stopcock; and
- (b) at the ends and at the midpoint of each station, at both the concourse and platform levels and at agreed locations along the viaduct (at a maximum distance of 150 m), 415V three phase / 230 V single phase power supply, suitably earthed and each with sockets capable of receiving three (3) electric plugs of the size and type used for hand-held construction equipment.

Such provisions shall be available to the Designated Contractors from the commencement of the first Installation Interfacing and Co-ordination Period until the Permanent water and power supplies are connected and commissioned within the respective stations. The

Designated Contractors shall be responsible for reimbursement to the contractor of the utility charges for consumption of mains water and electricity by the Designated Contractors, supplies shall be individually metred for each Designated contractor. The Contractor shall charge the Designated Contractors for consumption of mains water and electricity at the unit rates as billed to the Contractor by the water and electricity authorities for such utilities.

4. Applicability

- (1) Where the Contractor is required to provide temporary electrical supplies, or to use, extend or expand on temporary supplies installed by others, all such activity shall be executed in accordance with Paragraphs of this Appendix.
- (2) When the Contractor makes use of temporary electrical supplies provided by others he will observe and comply with the requirements of this Appendix.

5. Work on Site

- (1) The Contractor shall nominate a representative whose name and qualifications shall be submitted in writing to the Engineer for review not later than 4 weeks before the appointment and who shall be solely responsible for ensuring the safety of all temporary electrical equipment on Site. The Contractor shall not install or operate any temporary Site electrical systems until this representative is appointed and has commenced duties.
- (2) The name and contact telephone number of the representative having been reviewed without objection by the Engineer shall be displayed at the main distribution board for the temporary electrical supply so that he can be contacted in case of an emergency.
- (3) Schematic diagrams and the details of the equipment for all temporary electrical installations shall be submitted by the Contractor, and these diagrams together with the temporary electrical equipment shall be submitted to the Engineer for his consent.
- (4) All electrical installation work on Site shall be carried out in accordance with the requirements laid down in BS 7375 and the Specification. All work shall be supervised or executed by qualified and suitably categorized electricians, who are registered as such under the Electricity Ordinance 1990/Electricity (Registration) Regulations 1990.

6. Electrical General

Temporary electrical Site installations and distribution systems shall be in accordance with: -

- (1) Indian Electricity Rules
- (2) The Power Companies' Supply Rules;
- (3) Electricity and its subsidiary Regulations;
- (4) IEE Wiring Regulations (16th Edition);
- (5) BS 7375 Distribution of Electricity on Construction and Building Sites;
- (6) BS 4363 Distribution Assemblies for Electricity Supplies for

- (7) Construction and Building Sites; and
- (7) BS 6164 Safety in Tunnelling in the Construction Industry.
- (8) Any other applicable national standards

7. Materials, Appliances and Components

All materials, appliances and components used within the distribution system shall comply with BS 4363 and BS 7375 Appendix A.

8. Design Considerations

- (1) Distribution equipment utilized within the temporary electrical distribution system shall incorporate the following features: -
 - (a) flexibility in application for repeated use;
 - (b) suitability for transport and storage;
 - (c) robust construction to resist moisture and damage; and
 - (d) safety in use.
- (2) All cabling shall be run at high level whenever possible and firmly secured to ensure they do not present a hazard or obstruction to people and equipment.
- (3) The installation on Site shall allow convenient access to authorized and competent operators to work on the apparatus contained within.

9. Mains Voltage

- (1) The Site mains voltage shall be as per the Electricity Authority, 415V/ 3 phase 4 wire system.
 - (a) Single phase voltage shall be as per the Electricity Authority, 230V supply.
 - (b) Reduced voltages shall conform to BS 7375.

(2) Types of Distribution Supply

The following voltages shall be adhered to for typical applications throughout the distribution systems:

- (a) fixed plant - 415V/ 3 phase;
 - (b) movable plant fed by trailing cable - 415V /3 phase;
 - (c) installations in Site buildings - 230V /1 phase;
 - (d) fixed flood lighting - 230V/ 1 phase;
 - (e) portable and hand-held tools - 115V /1 phase;
 - (f) Site lighting (other than flood lighting) - 115V /1 phase; and
 - (g) Portable hand-lamps (general use) - 115V /1 phase.
- (3) When the low voltage supply is energized via the Authority's transformer, any power utilized from that source shall be either 415V 3 phase or / 230V. 1 phase as appropriate. The Contractor shall carry out any conversion that may be necessary to

enable him to use power from that source.

(4) Protection of Circuits

- (a) Protection shall be provided for all main and sub-circuits against excess current, under and over voltage, residual current and earth faults. The protective devices shall be capable of interrupting (without damage to any equipment or the mains or sub- circuits) any short circuit current that may occur.
- (b) Discrimination between circuit breakers, circuit breakers and fuses shall be in accordance with: -
 - (i) BS 88;
 - (ii) BS EN 60898; and
 - (iii) BS 7375;
 - (iv) Any other appropriate Indian Standards.

10. Earthing

- (1) Earthing and bonding shall be provided for all electrical installations and equipment to prevent the possibility of dangerous voltage rises and to ensure that faults are rapidly cleared by installed circuit protection.

Earthing systems shall conform to the following standards: -

- (a) IEE Wiring Regulations (16th Edition);
- (b) BS 7430;
- (c) BS 7375; and
- (d) IEEE Standard 80 Guide for Safety in AC Substation Grounding.

11. Plugs, Socket Outlets and Couplers

Low voltage plugs, sockets and couplers shall be colour coded in accordance with BS 7375, and constructed to conform to BS EN 60309. High voltage couplers and 'T' connections shall be in accordance with BS 3905.

12. Cables

Cables shall be selected after full consideration of the conditions to which they will be exposed and the duties for which they are required. Supply cables up to 3.3KV shall be in accordance with BS 6346.

- (1) For supplies to mobile or transportable equipment where operation of the equipment subjects the cable to flexing, the cable shall conform to one of the following specifications appropriate to the duties imposed on it:
 - (a) BS 6708 flexible cables for use at mines and quarries;
 - (b) BS 6007 rubber insulated cables for electric power and lighting; and
 - (c) BS 6500 insulated flexible cords and cables.
- (2) Where low voltage cables are to be used, reference shall be made to BS 7375. The following specifications shall also be referred to particularly for underground

cables: -

- (a) BS 6346 for armoured PVC insulated cables; and
 - (b) BS 6708 Flexible cables for use at mines and quarries.
- (3) All cables which have a voltage to earth exceeding 65 V (except for supplies from welding transformers to welding electrodes) shall be of a type having a metal sheath and/or armour which shall be continuous and effectively earthed. In the case of flexible or trailing cables, such earthed metal sheath and/or armour shall be in addition to the earth core in the cable and shall not be used as the sole earth conductor.
 - (4) Armoured cables having an oversheath of polyvinyl chloride (PVC) or an oil resisting and flame retardant compound shall be used whenever there is a risk of mechanical damage occurring.
 - (5) For resistance to the effects of sunlight, overall non-metallic covering of cables shall be black in colour.
 - (6) Cables which have applied to them a voltage to earth exceeding 12 V but not normally exceeding 65 V shall be of a type insulated and sheathed with a general purpose or heat resisting elastomer.
 - (7) All cables which are likely to be frequently moved in normal use shall be flexible cables. Flexible cables shall be in accordance with BS 6500 and BS 7375.

13. Lighting Installation

- (1) Where Site inspection of the Works is required during the nights, the Lighting circuits shall be run separate from other sub-circuits and shall be in accordance with BS 7375 and BS 4363.
- (2) Voltage shall not exceed 55 V to earth except when the supply is to a fixed point and where the lighting fixture is fixed in position.
- (3) Luminaries shall have a degree of protection not less than IP 54. In particularly bad environments where the luminaries are exposed to excesses of dust and water, a degree of protection to IP 65 shall be employed.
- (4) The Contractor shall upgrade the lighting level to a minimum of 200 lux by localised lighting in all areas where required by the Engineer.
- (5) Mechanical protection of luminaries against damage by impact shall be provided by use of wire guards or other such devices whenever risk of damage occurs.

14. Electrical Motors

- (1) Totally enclosed fan cooled motors to BS 4999: Part 105 shall be used.
- (2) Motor control and protection circuits shall be as stipulated in BS 6164. Emergency stops for machinery shall be provided.

15. Inspection and Testing

Electrical installations on Site shall be inspected and tested in accordance with the requirements of the IEE Wiring Regulations (16th Edition).

16. Identification

Identification labels of a type reviewed without objection by the Engineer shall be affixed to all electrical switches, circuit breakers and motors to specify their purpose.

17. Maintenance:

- (1) Strict maintenance and regular checks of control apparatus and wiring distribution systems shall be carried out by an electrician (duly qualified to carry out the said checks) to ensure safe and efficient operation of the systems. The Contractor shall submit for review by the Engineer details of his maintenance schedule and maintenance works record.
- (2) All portable electrical appliances shall be permanently numbered (scarf tag labels or similar) and a record kept of the date of issue, date of the last inspection carried out and the recommended inspection period.

18. Metering

The Contractor shall install a separately metered and invoiced supply or supplies of electricity for:-

- (a) Site fabrication facilities;
- (b) Site workshops and work yards; and
- (c) Site offices and stores.

15. APPENDIX 9 - List of Preferred Manufactures/Supplier

S NO	DESCRIPTION OF ITEM/ LOCATION	PROVISION	MAKE
LIST OF PREFERRED MANUFACTURERS (CIVIL WORKS)			
1	CIVIL WORKS		
1.1	Cement	OPC/ PPC/ PSC	ULTRATECH / ACC
1.2	Chemical Admixtures		SIKA / FOSROC
1.3	Internal/ External Walls with brickwork	Fly ash Brickwork in Adhesive/ cement mortar (1:6) & (1:4)	Make to be approved by the Employer
1.4	Reinforcement Steel	Corrosion Resistance Steel	TATA TISCON / SAIL / JSW
2	FINISHING WORKS		
2.1	TILE WORK - FLOORING & DADO		
2.1.1	Toilets	Anti-skid full body vitrified tiles of 600 mm x 600 mm minimum size to be fixed with spacers of 6 mm width and grouted with epoxy of approved shade (150mm thick/as per approved design)	Johnson/ Kajaria/ Somany/ RAK
2.1.2	Ticket Counter, Entrance, Lobby and Porch areas	Granite/Full-body Tiles/ Matt/Gloss Finish as per Approved design	As per approved Design
2.1.3	Ramp at Entry Area	Antiskid heavy-duty Tile/Max Grip Tiles (600 x 600 mm (or as per manufactures design and approved by Engineer)	Johnson/ Kajaria/ Somany/ RAK
2.1.4	Service Electrical/ AHU Rooms	Kota Stone or Equivalent	As per approved Design
2.1.5	Staircase and Lobby area, Common Corridor, Refuge Area - Floor and Wall Façade	Granite	As per approved Design
2.1.6	Floor Area, Toilet Wall, Super Market Area / Retail shops, Cafeteria/ Food Court / Waiting lounge,	Vitrified Tile/Gloss Finish / Full body vitrified tiles of 600 x 600 mm or as per Approved Design by Engineer in- charge	Johnson/ Kajaria/ Somany/ RAK
2.1.7	Toilet Floor, Platform (Open to Sky)	Vitrified Tile/Matt Finish (Anti-Skid) (600 x 600 mm (or as per manufactures design and approved by the Engineer)	Johnson/ Kajaria/ Somany/ RAK
2.2	PAINT, PUTTY AND POP WORK		
2.2.1	Paint	As per architectural design	Asian / Berger/ ICI/Nerolac
2.2.2	External Plastered Surface	Acrylic Exterior Emulsion Paint	Asian/Berger/ /ICI/Nerolac

S NO	DESCRIPTION OF ITEM/ LOCATION	PROVISION	MAKE
2.2.3	Inside Duct	Acrylic Exterior Emulsion Paint	Asian/Berger/ ICI/Nerolac
2.2.4	Putty Punning	Exposed Plastered Surface	Birla/JK
2.2.5	Chemical Paint/Silicon Paint		SIKA/Asian/Berger/ICI/Nerolac
2.3	FALSE CEILING		Armstrong / Ramco Hilux / Aerolite
2.3.1	Common Toilets, Lift lobby area, Entrance Foyer Etc.	Grid False Ceilings - Calcium Silicate reinforced with fiber and natural filler false ceiling with micro look ledge	Approved Brands: Armstrong/Gyproc/USG Boral/Others as approved by EIC
2.4	DOOR & WINDOW FRAMEWORK		
2.4.1	Doors	Un-Plasticized Poly Vinyl Chloride (UPVC) (2150 X 2400)	Fenesta UPVC/Prominence/ Adopen/ Aparna Venstar/ Durofenster
2.4.3	Modular Cubicles for Toilets Doors	Modular Partitions / Cubical (For Toilets) (750 X 2100)	Green ply /Marino/T-line and equivalent
2.4.5	Window	Un-Plasticized Poly Vinyl Chloride (UPVC) (1000 X 1500)	Fenesta UPVC/Prominence/ Adopen/ Aparna Venstar/ Durofenster
2.4.6	Glass Frame Door	Providing & Fixing of Glass Door frame where internal glass partitions are proposed, or the locations as directed by Engineer In-charge.	Modifloat/ Saint Gobain/ Asahi
2.4.7	Ventilators (600 X 600)	Aluminum work for ventilators partitions	Jindal/ Indal
2.4.8	M.S Sheet Door		Jindal or Equivalent
2.4.9	Flush Door		Green ply / Century or Equivalent
2.4.10	Fiber Reinforced Plastic (FRP)		As Approved by Engineer In Charge. Engineer Ply/ Durofenster or Equivalent
2.4.11	UPVC Windows		Fenesta UPVC/Prominence/ Adopen/ Aparna Venstar/ Durofenster
2.4.12	Glass Work	Door / Window / Glazing	Modifloat/ Saint Gobain/ Asahi
2.5	RAILING & MS WORKS		
	Refuge areas & balconies (if any) , Roof top area as per the approved plans		
2.5.1	Refuge areas & balconies (if any) , Roof	12mm Thick. Toughened glass with S.S Top	Saint gobain/ozone

S NO	DESCRIPTION OF ITEM/ LOCATION	PROVISION	MAKE
	top area as per the approved plans		
2.5.2	Common Staircase (Each Floor) , Fire Staircase	M.S Railing: M.S pipes handrail of approved size by welding etc. to steel ladder railing, balcony railing, staircase railing and similar works,	TATA Steel, Jindal Steel or Equivalent
2.5.3	Staircase Railing	AISI 316 L SS Railing	Jindal or Equivalent
2.5.4	Window Openings (if any)	AISI 316 L SS Grill	Jindal or Equivalent
2.6	WATER PROOFING & ANTI - TERMITE	Terrace, sunken slab, toilet, expansion joint, water tank.	SIKA/Pidilite/Dr Fixit/Zydex / Fosroc
2.7	LIFT/ELEVATORS	Passenger Lift/ Service Lift	Schindler/ OTIS/ KONE/JHONSON
2.8	FURNITURE'S WORK		Featherlite / Godrej or Equivalent
3	Outer Development		
3.1	Boom Barrier		Somfy / came / Godrej
3.1	MS Gate		Jindal or Equivalent
3.1	Illuminated Signage	As per graphic design	Chanlong Manufacturing, Adzetera Media, Caterpillar Signs
LIST OF PREFERRED MANUFACTURERS (PH WORKS)			
1	INTERNAL WATER SUPPLY	CPVC Pipes	Supreme/Astral/Ajaya/Ashirvad
1.1	Vitreous China Sanitary Fixtures		Jaquar/ Cera/ Parryware/ Hindware
1.2	Chrome Plated Sanitary Fixtures & Cp Fittings		Jaquar/ Cera/ Parryware/ Hindware
1.3	Geysers		Venus / Racold / AO Smith / Jaquar
1.4	Hand Drier		Utec System / Euronics / Jaquar
1.5	Drinking Water Coolers		Blue Star / Eureka Forbes / AO Smith
1.6	Rainwater Pipe	UPVC Pipe	Oriplast/ Supreme/Ajaya/ Ashirvad
1.7	Pumps & Motors	Horizontal/Vertical Pumps	Kirlosker/ Crompton Greaves
1.8	Porcelain Fittings	a. Wall mounted EWC with concealed cistern & flush plate b. Floor mounted IWC with flushing arrangement for Women's Urinals c. Stall Type Men's Urinal d. Wall mounted wash basin	Hindware (Queo)/Jaquar (Artize)/ Equivalent series in Kohler/ Roca/ Grohe should be of export quality.

S NO	DESCRIPTION OF ITEM/ LOCATION	PROVISION	MAKE
		with half pedestal	
1.9	CP Fittings	Bib Cock/ Stop Cock/ Angle Valve/ Push type Pillar Cock / Flush plate	Hindware (Queo)/Jaquar (Artize)/ Equivalent series in Kohler/ Roca/ Grohe
1.10	CP Accessories	Towel Rail (600 mm)/Soap Tray/Paper Holder/ Robe Hook/ Bottle Trap etc	Hindware (Queo)/Jaquar (Artize)/ Equivalent series in Kohler/ Roca/ Grohe of export quality.
1.11	Overhead Tank	Triple layer polyethylene/FRP	Sintex / Plasto/ Prince / Supreme
1.12	Water supply line valves	Gate Valve/Check Valve/Ball Valve etc	Leader/ Kirti/ Anupama
1.13	Drinking Water Fountain		Oasis/ WTE
1.14	Mirror		Saint Gobain, Pilkington, Asahi, Guardian
2	INTERNAL SEWERAGE	UPVC SWR Pipe	Astral/Supreme/Hind
3	EXTERNAL WATER SUPPLY	CPVC/ UPVC Pipes	Supreme/Astral/Ajaya/Ash ribad/ Hind
3.1	Gi Fittings		KS / Unik / Zoloto
3.2	Gi Pipes		Jindal Hissar / Tata
3.3	Ball Valve		Sant / Zoloto / Audco
3.4	Butterfly Valve		Sant / Zoloto / Audco
3.5	Non-Return Valve		Sant / Zoloto / Audco
3.6	Motorized Butterfly Valve		Zoloto / Sant / Audco / Belimo / AIP
3.7	Insulation		Careflex / Supreme
3.8	Rubber Expansion Joint		Kanwal / Resistoflex
3.9	Suction Strainer		Zoloto / Sant / Audco / Belimo
3.1	Pressure Gauge		Fiebig / H Guru
3.11	DI Pipe & Fittings		Kesoram / Electrosteel / Kartar / Jindal
3.12	Water Supply Pumps		Grundfos / Xylem / CRI
4	EXTERNAL SEWERAGE		Supreme/Hind/Ajay/Astral
4.1	HDPE Pipes & Fittings		Supreme / Prince / SFMC
LIST OF PREFERRED MANUFACTURERS (FIRE WORKS)			
	FIRE FIGHTING SYSTEM		
1	Hydrant valves		BOSCH/ HONEYWELL/ EDWARD
2	Fire alarm		BOSCH/ HONEYWELL/ EDWARD
3	Panel		BOSCH/ HONEYWELL/

S NO	DESCRIPTION OF ITEM/ LOCATION	PROVISION	MAKE
			EDWARD
4	Smoke detector		BOSCH/HONEYWELL/EDWARD
5	MS Pipe/GI Pipe		Jindal Hissar / Jindal Star/ Tata/ Apollo
6	Orifice Plate		Minimax/ Newage/ Safex
7	Ball Valve		Zoloto / Sant/ Leader /Advance
8	Butterfly Valve		Zoloto / Sant/ Leader /Advance
9	Non-Return Valve		Sant / Zoloto /Advance
10	Air Cushion Tank		Site fabricated with MS Pipe
11	Rubber Expansion Joint		Resistoflex/ Easyflex/ Diamond / Dunlop/ Cori
12	Landing Valve		Minimax/ Newage/ Safex
13	CP Hose		Minimax/ Newage/ Safex
14	RRL Hose		Minimax/ Newage/ Safex
15	Branch Pipe		Minimax/ Newage/ Safex
16	Standard Fire Man Axe		Minimax/ Newage/ Safex
17	Fire Brigade 2 Way Inlet		Minimax/ Newage/ Safex
18	Fire Brigade 4 Way Inlet		Minimax/ Newage/ Safex
19	Fire Brigade Suction Hose Coupling		Minimax/ Newage/ Safex
20	Fire Hose Cabinet Internal		Fabricated Required Standard
21	Fire Hose Cabinet External		Fabricated Required Standard
22	Fire Extinguisher		Minimax/ Safex/ Cease Fire / Supremex
23	Pressure Gauge		H. Guru/ Fiebig/ Warree / H.D/ BRC
24	Flow Indicating Switches		Honeywall/ Tyco / System Sensor
25	Pressure Switches		Danfoss / Indfoss / Feibig
26	Sprinklers		Tyco / HD / Viking
27	Gas Flooding System		Minimax/ Newage/ Supremex
28	Fire Sealant		Wruth / Fischer / 3M India
29	Inspection & Testing Assembly		Minimax/ Newage / Sant
30	Flexible Hose Pipe		Minimax/ Safex / Newage / HD
31	Pot Strainer/Y Strainer		Zoloto/ Sant / Leader
32	Suction & Delivery Header		Tata / Jindal Hissar / Apollo

S NO	DESCRIPTION OF ITEM/ LOCATION	PROVISION	MAKE
33	Installation Control Valve Assembly		HD (UL Listed)/ Viking (UL Listed)
34	Fire PUMPS (UL Listed)		Grundfos / Mather & Platt / Xylem /Armstong
35	Motors for Fire Pumps		CGL/ ABB / Wilo
36	Deluge Valve		Safex / Tyco/ HD
37	Anti Vibration Pad		Cori Dunlop / Diamond Pipe Support /Easyflex Flexionics/ Resistoflex
38	Pipe Protection Pypcoat wrapping		IWL / Shalimar
39	Detectors & Devices- Intelligent multi criteria detector, smoke, heat & duct detectors, control & monitor module, fault isolator, hooters etc. Addressable Main Fire Alarm Panel with Digital Voice Evacuation System, all shall comply to UL Listed		Honeywall-Notifier /Edward/Siemens
40	Public Address & Background music system		Honeywall / Bosch / LDA audiotech
41	Forged Fittings		SS / VS / True Forge
42	ERW / butt Welded Fittings		MEC(Jainsons)/ Unik
43	Groove Fittings		Victaulic/ Jainson/ New
44	Air Pressure Valve		Minimax/ Newage / Sant / Leader
45	C.I. Double Flanged Sluice Valves		Zoloto/ Sant / Leader
46	C.I. Double Flanged Non-Return Valves		Zoloto/ Sant / Leader

16. APPENDIX 10 - PLAN AND PROFILE DETAILS

The details with regard to the Plan and Profile of ropeway lines are provided in Volume - IV of the Bid documents.

17. APPENDIX 11 - CONTRACTOR'S SITE LABORATORY

1. SITE LABORATORY

- (1) The Site Laboratory shall be approximately 250 Sq. m. It shall consist of the following accommodation:

1 concrete laboratory	60 Sq. m floor area
1 Soil laboratory	30 Sq. m floor area
1 Sample Room (for keeping approved samples of all the materials till the completion of the works)	15 Sq. m floor area
2 offices	each 15 Sq. m floor area
1 storeroom	10 Sq. m floor area
1 kitchen	10 Sq. m floor area
male toilets, changing room & shower	sufficient for 6 persons

- (2) The remainder of the 250 Sq. shall consist of storage area for concrete cube curing tanks. The laboratory, office etc. shall be in one building; the curing tank storage building may be in a separate building, but if so, it shall be adjacent to the laboratory building & connected to it by a level, weatherproof passageway. In addition, an area of covered hard standing of 50m² for motor vehicles shall be provided adjacent to the laboratory.

2. STANDARD OF CONSTRUCTION

- (3) The laboratory shall be constructed to the best Engineering practice and as approved by the Engineer. Two independent telephone lines with two extensions each shall be provided for the laboratory. Telephones shall be located in areas as agreed with the Engineer.
- (4) A water tank with minimum capacity of 2000 litres shall be installed, as a source of constant water pressure (15 KPa minimum) for each laboratory.
- (5) In the case of sinks used for washing samples, adequate trapping and/or separating devices shall be provided to ensure the proper functioning of the facility.

3. FURNISHINGS AND FIXTURES

The contractor's site laboratory shall be provided with required furnishings and fixtures.

4. LABORATORY EQUIPMENT

- (6) The laboratory equipment, as listed below, shall be approved by the Engineer. The Contractor shall submit for the Engineer's approval within 2 weeks of the order to

commence work the name of the supplier it intends to use for each piece of apparatus together with the relevant catalogue number.

- (7) The layout of the equipment in the testing laboratory shall be instructed by the Engineer. The equipment shall be maintained to an accuracy appropriate to the required testing methods with routine calibration by an accredited organization as recommended by the appropriate Authority. Equipment shall also be calibrated after maintenance or relocation.
- (8) The Contractor's site laboratory shall be equipped with the following material testing equipment as a minimum. The nature and quantity of equipment required for testing may be varied by the Engineer depending on the detail of the Contractor's Design and Construction methods or for any other reason which he deems to be valid and necessary for the proper control of quality:

Determining Liquid Limit (1 complete set)

rice (Casagrande type)	1 set
Grooving tools	1 No.
Evaporating dish	1 No.
Spatula 100mm blade	1 No.
Laboratory balance, capacity 500 gm, (Sensitivity 0.01 Gms.)	1 No.
Wash bottle, capacity 500 ml.	1 No.
Moisture cans, capacity 50 ml.	24 No.

Determining Plastic Limit (1 complete set)

Evaporating dish	1 No.
Spatula 100mm blade	1 No.
Glass plate 250mmx250mmx12mm	2 No.
Moisture cans, capacity 50 ml.	12 No.
Stainless steel rods, 3 mm dia.	2 No.

Determining Moisture Content (1 complete set)

Micro Oven, capacity 35 litres, control temperature up to 200 °c	1 No.
Balance, capacity 200 gm., sensitivity 0.01 gm.	1 set
Lab. Tongs	1 No.
Moisture cans 75ml. with lid	36 No.
Compaction Characteristics (1 complete set)	
Standard compaction mould 100mm dia.	1 No.

Modified compaction mould 150mm dia.	1 No.
Standard compaction Rammer, 2.5 kg.	1 No.
Modified compaction Rammer, 4.5kg.	1 No.
Straight edge 300mm long	1 No.
Sample ejector for 100mm and 150mm mould	1 No.
Sample tray 60 x 60 x 8 cm	3 No.
Wash bottle, 500 ml.	2 No
Moisture cans 250 ml.	24 No.
Density of soil in-place by sand cone method (2 complete set)	
Sand density cone apparatus, 150mm	2 No.
Plate, 300mmx300mm with centre hold 150 mm	2 No.
Glass jug for sand cone 2 No. Chisel 25mmx 150mm	2 No.
Hammer	2 No.
One-gallon field cans	24 No.
Sampling spoon	2 No.
Soft hairbrush	2 No.
Moisture cans 250 ml.	48 No.
Sieve Analysis Sieve shaker (portable)	1 unit
Coarse sieves In Sizes from 100mm to 10mm (1 set Fine Sieves#4, #8, #16, #30, #40, #50, #100, #200 each) Pans & Covers Specific Gravity and Absorption of Coarse Aggregate Wire basket, 200mm dia.	
Heavy duty suspension balance, 20 kg x 1 gm. with accessory for weight in water	
1 set Suitable water container	
1 No Unit Weight of Aggregate Balance, 100 kg. capacity with 10 gm precision	
1 No. Tamping rod 16mm diameter x 600mm long	
1 No. Measuring containers (3,10,15,30 litres)	
1 each Flakiness and Elongation Flakiness gauge, elongation index	
1 set Soundness Test Sodium sulphate 25 kg Soaking tank	
1 No. Balance, Capacity 3 kg., Sensitivity 0.1 gm.	
1 set Sieves: Coarse, 1 set Fine	
1 set Concrete Buckets for concrete sampling	
12 No. Slump cone, 12 No. Tamping rod, 12 No Base plate, 12 No. Mixing pan for concrete, 2 No. Scoop for general purpose	
2 No. Concrete thermometer	
1 No. Concrete cylinder mould, 150 mm * 300 mm; 100 mm * 300 mm 10 each	
Concrete cube mould, 100 mm cube & 150 mm cube 10 each Adjustable spanners for dismantling cube moulds 6 No. Capping set 2 No. Capping compound Concrete curing tank with capacity for 270 cubes, temperature controlled, with circulation system drain and lockable cover 5 No. Schmidt test hammer 1 No. Compression testing machine with printing facility (electrically operated) 1No. Mould oil Temperature chart recorder 1No. Small concrete mixer 1No Miscellaneous Vernier callipers to measure up to 200mm, with elongated jaws 5 No. Steel rule, 300 mm long graduated 2 No. Rubber gloves 10 pr. Cotton working gloves 20 pr. First aid kit 1 set Wire brush 6 No.	

Steel tape, 3m, 5m, 30m	3 No. Each
Ball peen hammer, 1 kg	2 No.
Paint scraper. Approx. 100mm wide	8 No.
Float, steel Approx. 280 x 120 mm	8 No.
Sack barrow	1 No.
Shovel: Square Mouthed	2 No.
Round Mouthed	2 No.
24-wheel trolley, heavy duty, approx. 0.7m x 1.0m long	
pneumatic tyred type	1 No.
Wheelbarrow, rubber tyred	1 No.
Comprehensive tool kit. To include screwdrivers, pliers, claw hammer, multi-grips, spanners (adjustable)	1 No.
Type NR Schmidt Hammer and tester with recording device	1 No.
Testing Anvil for Schmidt Hammer test (SHT)	1 No.
Chart recording paper for SHT	10 pkts
Covermeter for detecting metal objects to depth of 100mm below the surface of non-magnetic objects	3 No.
Noise meter	1 No.
RCPT Testing Machine	1No.
Permeability Testing Machine	1No.

Water Testing Kit (PH, TDS, Chloride & sulphate) As per requirement for daily testing.

18. APPENDIX 12 - INDICATIVE QUANTITIES OF EARTH RETAINING STRUCTURES AT STATIONS

S. No	STATION	QUANTITY					
		EARTHWORK WORK (CUM)		CONCRETE WORK (CUM)		SHUTTERING WORK (SQM)	STEEL WORK (MT)
		EXCAVATION	FILLING	PCC	RCC		
1	TARA DEVI	594.00	280.00	24.00	290.00	2002.90	29.00
2	CHAKKAR	270.75	56.00	4.80	58.00	402.90	5.80
3	ZPTH	178.20	84.00	7.20	87.00	602.90	8.70
4	ISBT	135.00	56.50	6.00	72.50	502.90	7.25
5	RAILWAY STATION	148.50	70.00	6.00	72.50	502.90	7.25
6	OLD BUS STAND	297.00	140.00	12.00	145.00	707.70	14.50
7	LIFT POINT	148.50	70.00	6.00	72.50	502.90	7.25
8	SECRETERIAT	207.90	98.00	8.40	101.50	702.90	10.15
9	103 TUNNEL	148.50	70.00	6.00	72.50	502.90	7.25
10	VICTORY TUNNEL	148.50	70.00	6.00	72.50	502.90	7.25
11	ICR	675.00	379.50	18.00	277.50	1653.70	27.75
12	IGMC	148.50	70.00	6.00	72.50	502.90	7.25
13	SANJAULI	148.50	70.00	6.00	72.50	502.90	7.25
14	NAVBAHAR	148.50	145.55	6.00	72.50	502.90	7.25
TOTAL		3397	1660	122	1539	10096	154

Note: The quantities mentioned here above are indicative. It will be endeavor of the contractor to estimate the actual quantities as per actual site conditions. The Earth Retaining structure shall be provided as per approve design and drawings to the full satisfaction of the Authority/Engineer.

19. APPENDIX 13 - Indian Green Building Council (IGBC) CERTIFICATION

To ensure IGBC Certification of the stations, the contractor shall ensure and provide the data as mentioned in following format, which ever are relevant to the contract.

IGBC Green Mass Rapid System (MRTS)- Documents

Sr. No.	List of Data required
1	Soil test report & if soil is fertile, preserve 20 cm of top soil, Evidence of soil preservation. If soil is not fertile, photographs before the construction.
2	Landscape agreement copy with horticulture contractor and species of landscape plants.
3	1. Tree survey report containing: - a. Number of trees to be felled. b. Name of species required to be felled. c. Number of trees lying in construction site. 2. Permission letter to fell trees as given by Forest Deptt. 3. Copy of letter from Forest Deptt. Regarding number and species of saplings to be planted by them.
4	1. SRI value of the material of non-roof areas such as entry pathway of station & entry/exit structure. 2. Parking area of the station should be shaded with existing tree cover/ newly planted sapling for the next 5 years . Or 3. Shaded parking, Shading should be done with high SRI.
5	Letter from IL&FS for amount of C&D waste diverted from construction site.
6	One page writes up on disposal of sanitary waste.
7	Traffic management plan along with diversion plan if any.
8	1. Station flush out calculation for UG Station. 2. For elevated station door and window should be kept open for one week to ensure proper ventilated rooms should be flush-out with exhaust fan for 24 hours.
9	For material module, material matrix, completely filled in have to be provided to AUTHORITY, It constitutes all the construction material, finishing materials and paints, adhesives & coatings details such as quantity, specifications, per unit cost supplier name & manufacturer. (Please see attachment named as material matrix). Material matrix can be filled contract wise.
10	Letters from manufacturer & Format of letters as given
11	Drawing in auto CAD format as listed
12	Site photograph as listed

IGBC - Formats

MATRIX OF CIVIL MATERIAL
Project: Shimla Ropeway

Sr. No.	Civil Material Description	Supplier	Manufacturer	Specification	Total Quantity	Unit	Rate per Unit	Total Cost of the Material	Distance of anufacturer From site(See Flag C)	% of Recycled content in material (see flag C)
1	Cement			e.g. OPC/PPC /Slag						
2	RCC			M15/M30/ M35						
3	Reinforcement Steel			TMT/FE500						
4	Bricks			Fly ash bricks/ Clay bricks						
5	Structural Steel			TMT/FE500						
6	Other if any									

IGBC Green Mass Rapid System (MRTS) - Formats

MATRIX OF CIVIL MATERIAL
Project: Shimla Ropeway (Interior)

Sr. No.	Civil Material Description	Supplier	Manufacturer	Specification	Total Quantity	Unit	Rate per Unit	Distance of manufacturer From site (See Flag C)	% of Recycled content in material (see flag C)	Total Cost of The Material
1	Aluminium Window and ventilator Frames/Doors									
2	Coarse Sand									
3	Fine Sand									
4	Stone Aggregates									
5	Granite Stone									
6	Commercial Ply Board									
7	White Cement									
8	Glass									
9	Kota Stone									
10	Wood Based Flush doors ply boards used									
11	Anchor Fastener									
12	Poly Carbonate Sheet									
13	Vitrified tiles									
14	Vitrified Poroclien tactile Tile									
15	Ceramic tiles									
16	Calcium silicate board ceiling									
17	Stainless steel Grade 304									
18	Float Glass									
19	Single/Double Leaf Door Shutter									
20	Steel Doors									
21	Door Closer/Floor springs for Normal Doors									
22	Other if any									

IGBC Green Mass Rapid System (MRTS) - Formats

MATRIX OF CIVIL MATERIAL
Project: Shimla Ropeway (Structural)

Sr. No.	Civil Material Description	Supplier	Manufacturer	Total Quantity	VOC Value	Total Cost of the Material
	Sealants					
1	Silicon Sealant					
2	Poly-Sulphide Sealant (flooring)					
	Water Proofing					
3	Into Floor hardtop(flooring)					
4	WC Water Proofing					
5	Liquid polymer membrane					
6	Primer					
7	Red Oxide zinc cremate Primer					
8	Wax Plaster					
	Paints					
9	Paint Acrylic emulsion paint					
10	Synaptic enamel Paints					
11	Epoxy paint					
	Adhesives					
12	Fevicol /Vamicol					
13	Ceramic tile adhesives					
	Agri fiber Product					
14	Commercial Ply Board					
15	Others if any					

IGBC Green Mass Rapid System (MRTS) - Formats

S. No.	List of letters Required from Manufacturer	Letter Attached	
		Yes	No
1	Letter for recycled content in construction material for the following:		
	RCC		
	Stainless Steel		
	Reinforcement Steel		
2	Letter for material which are manufactured within a distance of 400 km from project site for the following materials :		
	Bricks		
	Coarse & Fine Aggregate		
	Kota Stone		
	Granite		
	Concrete		
	Stainless Steel		
	Glass		
	Reinforcement Steel		
3	Letter for low VOC paints, sealants and adhesives, glazing sealants, tile adhesives, interior paints.		
4	Letter stating the flush and flow rates for the water fixtures installed at stations		

IGBC Green Mass Rapid System (MRTS)- Formats

Sr.No.	List of Drawings	Plan Attached	
		Yes	No
1	Site management plan (Ground level plan in which all the envt. & safety measures taken at site are marked.		
2	Tree survey drawing along with marking of tree to be cut and protected.		
3	Landscape Dwg. of Station		
4	Rainwater harvesting auto cad dwg. for drainage plan and piping & dwg. Highlighting pit on ground level plan for stations and viaduct as well. Supporting calculation for the same is also required.		
5	Dwg. for construction waste management plan.		

IGBC Green Mass Rapid System (MRTS)- Formats

S. No.	List of Photographs	Photos	Yes	No
1	Site barricading			
2	Wheel wash Facility / Grating/Manual cleaning			
3	Water sprinkling			
4	Workers wearing PPEs			
5	Stacking of fresh material			
6	Covering of excavated soil with tarpaulin or green net			
7	Tree protection at site			
8	Safety signage's			
9	Diesel storage area with drip tray			
10	Drinking water facility for workers			
11	Sanitary facilities for workers			
12	Rest room for workers			
13	Canteen facility			
14	Air monitoring			
15	Noise monitoring			
16	Waste Segregation (Colored bins)			
17	Electrical equipment covered at site during civil construction and finishing			
18	Covering of HVAC ducts underground station			
19	Fresh material yard			
20	Scrap yard			
21	Work scheduling charts/doc (sample attached)			
22	Good house keeping			
23	Keep Construction pathway free from interruption			

IGBC-Formats

(On the letter head of Manufacturer/Supplier) To whom it may concern

This is state that our product Bricks, which is been supplied to is produced at our manufacturing facility located at..... which is..... km from the project site. And the raw materials required for this product is been extracted from the location which is km from the project site.

Date:

Authorized Name of the Signatory

Designation of the Signatory

(Company Seal)

IGBC – Formats

(On the letter head of Manufacturer/Supplier) To whom it may concern

This is state that our product Coarse sand, which is been supplied to is produced at our manufacturing facility located at which is km from the project site.

Date:

Authorized Signatory Name of the Signatory

Designation of the Signatory

(Company Seal)

IGBC Green Mass Rapid System (MRTS) - Formats

To,

Indian Green Building Council
CII-Sohrabji Godrej Green
Business Centre Survey
No. 64, Kothaguda Post
Near Kothaguda Crossroads Ranga Reddy
Dist. Hyderabad – 500 084

This is to declare that entry and exit structures for Shimla Ropeway stations are finished up with..... material whose SRI values is..... which is less than ----- benchmark values.

Benchmark values are
Minimum SRI value of 78 for Low-sloped
roof (slope <2:12) Minimum SRI value of 29
for Steep -sloped roof (slope >2:12)

Thank you

Name:
Signature:
Designation
Company Stamp and Sea

IGBC – Formats

(On the letter head of Manufacturer) To whom it may concern

This is state that our product Aluminum Frames; supplied to RTDC Shimla Ropeway site is having the following properties:

Pre-consumer
Recycled
Content:

xx% Post-consumer Recycled Content:

xx%

Date:

Authorized Signatory Name of the Signatory
Designation of the Signatory
(Company Seal)

IGBS - Formats

(On the letter head of Manufacturer) To whom it may concern

This is state that our product Glass; supplied to RTDC Shimla Ropeway Project site is having the following properties:

Preconsumer Recycled Content:

xx% Postconsumer Recycled Content:

xx%

Date:

Authorised Signatory

Name of the Signatory

Designation of the Signatory

(Company Seal)

IGBC – Formats

(On the letter head of Manufacturer) To whom it may concern

This is state that our product Aluminum window and frames and doors supplied to RTDC Shimla Ropeway site is having the following properties:

Preconsumer Recycled Content:

xx% Postconsumer Recycled Content:

xx%

Date:

Authorized Signatory Name of the Signatory

Designation of the Signatory

(Company Seal)

IGBC – Formats

(On the letter head of Manufacturer) To whom it may concern

This is state that our product structural steel supplied to RTDC Shimla Ropeway site is having the following properties:

Preconsumer Recycled
Content:

xx% Postconsumer Recycled Content: xx%

Date:

Authorized Signatory Name of the Signatory
Designation of the Signatory

(Company Seal)

IGBC – Formats

(On the letter head of Manufacturer) To whom it may concern

This is state that our product Reinforcement Steel supplied to RTDC Shimla Ropeway site is having the following properties:

Preconsumer Recycled
Content:

xx% Postconsumer Recycled Content: xx%

Date:

Authorized Signatory Name of the Signatory
Designation of the Signatory

(Company Seal)

IGBC – Formats

(On the letter head of Manufacturer) To whom it may concern

This is state that our product RCC supplied to RTDC Shimla Ropeway site is have following recycled content (Percentage of flyash mixed is as follows:

Preconsumer Recycled
Content:

xx% Postconsumer Recycled Content: xx%

Date:

Authorized Signatory Name of the Signatory
Designation of the Signatory

(Company Seal)

IGBC - Formats

(On the letter head of Manufacturer) To whom it may concern

This is state that our product Cement supplied to RTDC Shimla Ropeway site is having the following properties:

Preconsumer Recycled Content:

xx% Postconsumer Recycled Content:

xx%

Date:

Authorized Signatory Name of the Signatory

Designation of the Signatory

(Company Seal)

IGBC – Formats

(On the letter head of Manufacturer) To whom it may concern

This is state that our product Bricks/ACC Blocks supplied to RTDC Shimla Ropeway site is having the following properties:

Preconsumer Recycled
Content:

xx% Postconsumer Recycled Content :

xx%

Date:

Authorized Signatory Name of the Signatory
Designation of the Signatory

(Company Seal)

IGBC – Formats

(On the letter head of Manufacturer/Supplier) To whom it may concern

This is state that our product Reinforced Steel, which is been supplied to is produced at our manufacturing facility located at which is km from the project site. And the raw materials required for this product has been extracted from the location..... which is km from the project site.

Date:

Authorized Signatory Name of the Signatory
Designation of the Signatory

(Company Seal)

IGBC – Formats

(On the letter head of Manufacturer/Supplier) To whom it may concern

This is state that our product Granite Stone, which is been supplied to is produced at our manufacturing facility located at which is km from the project site. And the raw materials required for this product has been extracted from the location..... which is km from the project site.

Date:

Authorized Signatory

Name of the Signatory

Designation of the Signatory

(Company Seal)

IGBC – Formats

(On the letter head of Manufacturer/Supplier) To whom it may concern

This is state that our product Fine Sand, which is been supplied to is produced at our manufacturing facility located at which is.....km from the project site.

Date:

Authorized Signatory Name of the Signatory

Designation of the Signatory

(Company Seal)

20. APPENDIX 14 - Sampling, Handling & Testing of Cube Specimens for compressive strength

1. Sampling of Concrete from Transit Mixer

- (i) Prior to sampling, the grade of concrete and approved design mix should be ensured.
- (ii) The number of samples should be in line with clause 3.24 of Outline Construction Specifications of the contract for checking strength at 7 days or 28 days.
- (iii) Additional samples should be casted in case of checking the strength at desired age for specific requirement.
- (iv) Sampling of concrete should be done at the pouring point.
- (v) Ensure that all the equipment for sampling of concrete is clean and dampen them with a moist but not wet cloth prior to use.
- (vi) Disregard the very first and the very last of the discharge from the Transit
- (vii) mixer (about 10 to 15 percent).
- (viii) The concrete for sampling obtained from Transit mixer shall be mixed thoroughly in non- absorbent container/ wheelbarrow with shovel or by other suitable mixing equipment.
- (ix) Slump and temperature of concrete samples should be checked and recorded at batching plant and pouring point.

2. Preparation of Cube Specimens

- (i) ISI marked cube moulds should be used for preparation of cube specimens.
- (ii) All Nut & Bolts of cube mould should be in place & appropriately tightened, otherwise the cube mould should be discarded.
- (iii) Cube moulds should be assigned unique ID.
- (iv) Calibration of cube moulds should be done internally at monthly interval by calibrated Vernier Caliper or any other measuring equipments and record of the same should be maintained in Register by Contractor which should be reviewed by Authority representative. The acceptance criteria for dimensions of cube moulds should be $150 \text{ mm} \pm 0.2 \text{ mm}$ as per Table 2 of IS: 10086.
- (v) Before filling of concrete ensure that the interior faces of the assembled moulds should be clean and thinly coated with mould/shuttering oil to prevent adhesion of concrete.
- (vi) Place the mould on rigid horizontal surface.
- (vii) Concrete should be remixed before filling in mould.
- (viii) Place the concrete in the mould by means of a scoop in three layers of approximately equal depth of 50mm.
- (ix) While placing each scoopful of concrete, move the scoop around the top edge of the mould as the concrete slides from it, in order to ensure a symmetrical distribution of the concrete within the mould.

- (x) Compact each layer of concrete with not less than 35 stokes per layer using Tamping Rod (600mm long 16 diameter MS rod with round working end). The compaction should be in such a way as to produce full compaction of concrete with neither excessive segregation nor-laitance.
- (xi) After filling the concrete in the mould, the surface should be smoothly finished by straight edge/trowel.
- (xii) Cube specimens should be filled in presence of Authority Representative.

3. Marking on cube specimens after pre-setting

- (i) Cube specimens should be marked with TM IDs and Structure IDs for tracking.
- (ii) Signature of Authority representatives should be done on cube specimens at green stage with nail/binding wire or with permanent marker before transporting to laboratory curing tank facility.
- (iii) The typical marking template should be as below
 - Date of Casting:
 - Structure ID:
 - Grade of Concrete:
 - TM No./Specimen No:
 - Authority Representative's Signature:

4. Transportation and curing of Test Specimens

- (i) Immediately after finishing of cubes, the samples should be covered with damp hessian cloth/plastic sheet to prevent loss of water from samples due to evaporation.
- (ii) Leave the test specimens in moulds for at least 16 hours, but not longer than three days at sampling location.
- (iii) The test specimens should be stored in shaded area ideally at temperature of $27 \pm 3^{\circ}\text{C}$. The sample location should be free from vehicle movement.
- (iv) Designated vehicle should be available at project site for Transportation of cube specimens.
- (v) To prevent any damage to the specimens, test specimens along with moulds should be transported to the Laboratory water curing tank, duly covered with wet hessian cloth. Suitable rubber sheet should be kept below the cube moulds to protect the specimens from shock/vibration.
- (vi) Submerge the test specimens in curing tank in clean & fresh water (water should comply to the requirement of IS: 456) as soon as demoulding is done. Store the test specimens in water at temperature of $27 \pm 2^{\circ}\text{C}$ and temperature of curing tank water should be monitored/recorded regularly.
- (vii) Cleaning of curing tank should be done at regular intervals.
- (viii) Safe and suitable temperature control system should be installed in curing tank to maintain temperature at $27^{\circ} \pm 2^{\circ}$.

- (ix) Cube moulds should be cleaned in laboratory itself and they shall be transported to pouring points before start of concreting.

5. Testing of cube specimens

- (i) Specimens should be tested in 7 days or 28 days or at desired age for conforming the concrete strength.
- (ii) Calibrated Digital Compression Testing Machine (CTM) preferably with printing facility should be installed at Laboratory.
- (iii) Digital CTM should be equipped with storage facility to store and retrieve the data as and when required for tracking of data.
- (iv) Cube IDs along with date and signature should be verified prior to testing.
- (v) Rate of loading 140kg/cm²/min should be ensured prior to testing in digital CTM and maintained throughout the testing.
- (vi) Cube testing records in approved testing format should be maintained in a Register jointly Signed by Contractor's and Authority's representatives.
- (vii) Printout of consolidated summary of testing for the day should be obtained from digital CTM & the same should be jointly signed by Authority and Contractor's representative. The daily consolidated summary should be attached in the Register for verification.
- (viii) The crushed cubes should be stored in a designated area after crushing and should be removed from site only after obtaining permission from Authority.
- (ix) The above SOP is to be followed for making cube samples for flexural strength also.

6. Acceptance Criteria

The Acceptance Criteria of Test Results of cube samples is as per following clause of IS 456:2000 (reaffirmed 2021). In case IS 456 is revised in future, criteria will be as per the latest revision.

7. Test Results of Sample

The test results of the sample shall be the average of the strength of three specimens. The individual variation should not be more than ± 15 percent of the average. If more, the test results of the sample are invalid.

8. Acceptance Criteria

8.1 Compressive Strength

The concrete shall be deemed to comply with the strength requirements when both the following condition are met:

- a) The mean strength determined from any group of four consecutive test results compiles with the appropriate limits in col 2 of Table 11.

- b) Any individual test result complies with the appropriate limits in col 3 of Table 11

9. Flexural Strength

When both the following conditions are met, the concrete complies with the specified flexural strength.

- The mean strength determined from any group of four consecutive test results exceeds the specified characteristic strength by at least 0.3 N/mm^2 .
- The strength determined from any test result is not less than the specified characteristic strength less 0.3 N/mm^2 .

10. Quantity of Concrete Represented by Strength Test Results

The quantity of concrete represented by a group of four consecutive test results shall include the batches from which the first and last samples were taken together with all intervening batches.

For the individual test result requirements given in col 2 of Table 11 or in item (b) of 6.2, only the particular batch from which the sample was taken shall be at risk.

Where the mean rate of sampling is not specified, the maximum quantity of concrete that four consecutive test results represent shall be limited to 40 m^3 .

Table 11 Characteristic Compressive Strength Compliance Requirement
Amendment No.4 to IS 456:2000
(Clauses 16.1 and 16.3)

Specified Grade	Mean of the Group of 4 Non- Overlapped Consecutive Test Result in N/mm^2	Individual Test Results In N/mm^2
(1)	Min (2)	Min (3)
M15 and above	$\geq 2f_{ck} + 0.825 \times \text{established standard deviation}$ (rounded off to nearest 0.5 N/mm^2) or $f_{ck} + 3 \text{ N/mm}^2$ whichever is greater	$\geq 2f_{ck} - 3 \text{ N/mm}^2$

NOTES

- In this absence of established value of standard deviation, the values given in Table 8 may be assumed, and attempt should be made to obtain results of 30 samples as early as possible to establish the value of standard deviation.
2. For concrete of quantity up to 30 m^3 (where the number of samples to be taken is less than four as per the frequency of sampling given in OCS, the mean of test results of

all such samples shall be $f_{ck}+4N/mm^2$, minimum and the requirement of minimum individual test results shall be $f_{ck}-2N/mm^2$, minimum. However, when the number of sample is only one as per OCS, the requirement shall be $f_{ck}+4N/mm^2$, minimum.

Table 8 Assumed Standard Deviation
(Clause 9.2.4.2 and Table11)

Grade of Concrete	Assumed Standard Deviation N/mm^2
M10 M15	3.5
M20 M25	4.0
M30 M35 M40 M45 M50	5.0

NOTE- The above values correspond to the site control having proper storage of cement, weigh batching of all materials, controlled addition of water, regular checking of all materials, aggregate gradings and moisture content, and periodical checking of workability and strength. Where there is deviation from the above the values given in the above, table shall be increased by $1N/mm^2$.

11. Monitoring

- (i) Laboratory should be equipped with CCTV Camera covering footage of digital CTM for monitoring.
- (ii) Access of CCTV Live feed should be provided to Project Manager of the contractor and Authority/Engineer Office.

Appendix – 14 for Testing of cube Specimens should be made part of Method statement (MS) for "Concrete Production & Transportation" and the name of the MS should be "Concrete Production, Transportation and Sampling, Handling & testing of Cube Specimens" and should be implemented at all Project sites for uniformity of the system.

21. APPENDIX 15 - SITE FACILITIES FOR THE AUTHORITY AND THE ENGINEER

1. GENERAL

The Contractor shall provide for the use of the Authority / Engineer office accommodation,

equipment, communication & drawing facilities throughout the course of the work and for such period of time during the defect's liability period as the Authority & Engineer may require, The details of the accommodation & the other facilities are detailed below: All the facilities under this Appendix will continue to be maintained by the Contractor free of cost till the defect liability period is over. Thereafter the Contractor shall dismantle the building and take away all the materials, office furniture, & equipment etc. which will be the property of the Contractor. The Payment for the same shall be covered in quoted rates.

2. SITE OFFICES

Accommodation for the Authority / Engineer shall consist of one site office to be constructed by the Contractor at a place arranged by the Contractor, within Two months from the date of commencement of the works. In case of delay beyond Two months in provision of the accommodation either through construction or hire, penalty @ Rs 10000/- Per week or part thereof will be imposed."

The site office should remain open for 24 hours a day and 7 days a week i.e. round the clock till the defect liability period is over.

Each Site Office will provide for the following rooms:

SITE OFFICE for Engineer/Authority to be constructed by Contractor	Area required (Sq. m)
Director RTDC	30
Chief General Manager RTDC	25
Deputy General Manager	20
Team Leader	20
Key Personnel @ 10 sqmt each (11 nos.)	110
Conference/ Visitor Room	25
Computer/ Drawing Office	12
Pantry & Kitchen area	12
File and Documents & Instruments Storage	15
Toilets – 2 nos. 10 sqm each	20

Note: Suitable car parks with paver blocks for 50% of the number of vehicles shall be constructed and maintained next to site office.

- Materials used for the construction of the offices shall be new and of good quality. Materials shall be chosen such that the buildings, when erected, shall give good ventilation, heat and sound insulation.

- All buildings shall be supplied with continuous (24 hour) running potable cold water to the kitchens and washrooms. The toilets may use raw water for flushing. The Contractor shall also arrange for the constant and hygienic disposal of all effluent, sewage and rubbish from the buildings.
- All buildings shall be supplied with electricity, AC 240 Voltage 50 Hz, that shall be distributed to each room in accordance with the Regulations. Lighting and electrical power points shall be provided in each room. The disposition and location of light and power points will be as directed by the Engineer. 24 hours power supply is to be arranged by contractor to meet full power load. All rooms shall be provided with Air Conditioners of appropriate capacity.
- Fire-fighting equipment shall be provided in accordance with the local recommendations.

3. Scope of Work:

The work consists of construction of temporary site office using precast cement concrete including Ferro-cement components or superior material.

- a) Superstructure of Brick wall panels and roof panels (of I/C section) and R.C.C. columns /Steel Column and joists as per enclosed plans and drawing.
- b) Construction of open foundation using plum concrete as per specifications and drawings (including excavation).
- c) Suitable anchorage between superstructure and foundation, between roof panels and columns/joists.
- d) Provision of PVC water storage tanks one each on ground and overhead on erected supports with suitable pipeline connections, electric motor etc. (as per specifications).
- e) Sanitary installations as per specifications.
- f) Electrical installations as per specifications.
- g) Assembling of various pre-cast components at site in case of pre-cast construction and finishing work including various fixtures as per specifications.
- h) Provision of ferro-cement /FRP septic tanks underground with suitable connection to the building and drainage.
- i) The safe design of structure as whole and its individual components will be solely the responsibility of contractor. Contractor may suitably modify the drawing in case considered necessary with the approval of Engineer
- j) Providing and fixing fixed wire mesh and M.S. grills on windows, ventilators as directed by Engineer

Providing water and electricity to site offices during currency of the contract including defect liability period.

General Requirement for the Temporary Office Building Materials required for the works shall be arranged by the contractor himself including wire mesh /Chicken mesh /Binding wire/G.I. wire and other chemicals required for Ferro-cement work/Brick work as per specifications. All materials arranged by contractor will be tested at contractor's cost, if required by Engineer

4. **Specification for Prefabricated Elements Constituents**

Foundation and Plinth: - Cast-in-situ plum concrete work of Nominal Mix concrete all along the periphery up to 300 mm deep below ground level and 450mm deep at column locations. However, depth may vary depending upon site conditions. Rise from ground level to Plinth shall be provided by two steps of concrete of 1:3:6, mix and properly finished or prefabricated as approved by Engineer

Wall: - This will consist of R.C.C. precast columns/Steel column and Ferro cement panels of size 1500 mm x 300 mm (thickness 25mm)/Brick wall 230 mm thick in 1:6 Cement Mortar with 1:5 CM plaster on both sides. The columns shall be anchored to foundation to hold the structure to foundation resulting in a rigid structure which shall be dust and waterproof when assembled completely.

Roofing: - Precast ferrocement roofing channels /Steel section of I/C Section as per drawing or corrugated galvanized iron sheet over tubular trusses and purein or any better material approved by Engineer in charge as required for the Dead load, live load, wind load and snow load etc.

Flooring: - Precast, hydraulically pressed square or as directed by Engineer-in- charge, tile flooring over a bed of crusher stone dust mixed with nominal cement in the ratio of 1:16 Cement & crusher stone dust.

Finishes: -All interior shall be fine finished with Plaster of Paris and oil bound distemper in two coats of quality and shade as approved by Engineer-in-charge, including priming coat of whiting to give an even shade. The outer face (excluded roof) shall be finished with two coats of cement paint of approved make. The roof should give concrete finish steel sheet coated with 2 coat of synthetic enamel paint over one coat of primer.

Water supply: - One storage tank of 500 lit. capacity, of approved make, shall be erected overhead whereas one storage tank of 2000 lit. capacity, of approved make,

shall be fixed on ground over a platform made of 6 solid concrete blocks on levelled ground. The storage tanks shall conform to provision of IS specifications. Suitable arrangement in the form of an electrical motor of 0.5 Hp with proper electric connection shall be made to lift water from ground tank to overhead tank. Water tank shall be coated inside, with suitable chemical solution (approved by Engineer-in-charge) in order to make storage potable. The location for ground and overhead tanks shall be as given by Engineer at site. Overhead tank shall be erected on a suitable raised support, independent of the main structure and shall be connected to ground tank as well as other sanitary installations of the main structure so as to give adequate water pressure at various aps etc.

Electrical Installation: - All electric wiring shall be with 3/22 copper wire for light/fan points (5 AMP) and 7/22 copper wire for power points (15 AMP). The electrical wiring shall be concealed in covered plastic battens which shall be securely fitted with the main concrete structure. The electric boxes, of approved make, at various locations to be provided duly covered with by hylum sheet of suitable size in which the sockets and switches will be fitted.

Following electrical fittings should be provided at various locations in each unit as below: -

- a) Verandah (1 No) - One tube light and 15 W CFL with holder.
- b) Office (1 No.) - One tube light, one CFL 15 W with holder, one ceiling fan, three pin socket (15 AMP) 1 No. each.
- c) Hall (1 No.) - Two tube Light, 15 W CFL with holder, 5 AMP Socket-2 No., ` 15 AMP Socket – 2 No., Ceiling fans – 2 Nos.
- d) Room (1 No.) - CFL with holder, tube light – 1 No., 15 AMP Socket, Ceiling fan.
- e) Toilets (2 Nos.) - CFL with holder, tube light, 15 AMP Socket exhaust fan (suitable size) 1 No. each in each toilet.
- f) Store (1 No.) - CFL with holder, 5 AMP Socket 1 No. each.

The contractor shall be responsible for internal fittings wirings starting from the main switch board and the main switch board will be provided with suitable MCB as per requirement. Electrical installation shall be of standard make as approved by Engineer-in-charge. Electrical motor of 0.5 hp shall be installed at approved location to lift water from ground tank to overhead tank. This arrangement shall be provided with 15A three pin socket and switch and copper wiring of 7/22. Arrangement shall be made be made by contractor in such a way that main switch board with MCB can be connected to main supply at a later date.

Sanitary Installation: - Following sanitary fittings shall be provided in each unit separately with cistern.

TOILETS (2 Nos.): - White vitreous glazed W.C. pan with cistern of approved brand (western style) and 'S' trap etc. complete. Wash basin (white vitreous) with water pipe etc. complete. Looking glass in PVC frame fixed over wash basin, CP brass bib cock (2 Nos.), CP brass pillar cock (1 No.), single valves (2 Nos.), with suitable connecting pipes to cistern and wash basin complete, floor trap jail of CP brass (2Nos.) and one no. 20 litre geyser for hot water shall also be provided in each toilet with all its accessories.

Pantry: - White vitreous glazed sink of size 60cm x 45cm x 25cm suitably supported on brackets or stainless-steel kitchen sink of approved quality etc. to be provided with PVC water pipe, floor trap jail, CP brass bib cock etc. complete. Sanitary installation as mentioned above shall be provided as complete job and shall be of standard make as approved by Engineer at site. The description of ancillary fittings is not exhaustive, and contractor shall perform all other jobs in this connection as directed by Engineer-in-charge/Engineer at site. All sanitary installations shall be connected to main supply line overhead storage tank, with G.I. pipes (15mm dia) and G.I. fittings and clamps.

Material Specifications

Foundation and plinth: - cast in situ plum concrete of nominal mix 1:3:6 Crusher aggregate shall be used with maximum size of aggregate 20mm.

R.C.C. Columns: - 100mm x 100mm size R.C.C. columns using concrete mix of 1:2:4 with suitable grooves to house wall panels to be used. M.S. channels to be used as shuttering. To be cast with power vibrators or vibrating table. In place of RCC column steel column of suitable section may also be used.

Wall Panels: - Ferrocement wall panels having thickness of 25 mm/Brick wall 230 mm thick, to be cast with power vibrators or vibrating table concrete mix of 1:15:15 (1 part of cement with 1.5 parts of coarse sand 4.75mm nominal size and 1.5 parts of 5mm downsize zeera) to be used with water cement ratio of 0.3 to 0.4 depending upon weather conditions and to be decided by Engineer at site. The coarse sand shall consist of 4mm longitudinal and transverse mild steel wires and 26-gauge wire mesh on both faces (to be placed symmetrically on the two faces). The steel shuttering will have smooth, properly machined surface so as to give smooth finish. In place of Z/C section I channels section may also be used over that CGI sheet of 1 mm thick may also be used for roofing or any better material approved by Engineer in charge.

False Ceiling with 8 mm thick plywood shall be provided with prime coat and 2 coat of

synthetic enamel paint of required colour as directed by Engineer in charge or any better material approved by Engineer in charge.

Horizontal Joists: - Size 100mm x 100mm, it shall be designed with proper joint fastening arrangement with columns and channels as per drawing 8mm dia reinforcement bars at corners shall be fastened with 4mm dia. shear stirrups at 225mm c/c spacing. MS channels shall be used as shuttering.

Z/C-Section Roofing channels: - Masonry moulds shall be used reinforcement details are shown in the drawing. Double layer of 22-gauge wire mesh shall be symmetrically place on both faces 1:2 mix of cement and sand will be used. Suitable water proofing chemicals such as ceco pidlite shall be used as approved by Engineer- in-charge. 28 days compressive strength of a 70 mm cube shall not be less than 25 N/mm².

Joinery: - Door and window frames shall be of precise RCC/ferrocement, conforming to IS 6523-1983 specifications. The doors and windows shall be suitably fixed to the frames with suitable hinges. Doors shutters shall be made up of 22-gauge pressed steel of the approved pattern and design as approved by Engineer Door frames shall be 125 x 75mm in size 1.5 x 0.9m, made of steel with steel shutter and suitable locking arrangement, handle and glass panes, suitable fixed with shutter. Door shutters shall be, provided with two coats of ready mixed red oxide primer and two coats of enamel paint of approved quality and shade as approved by Engineer Curtain rods (metallic) of required length with proper support brackets (wooden/metallic) shall be provided for each door and window in the manner as approved by Engineer

Flooring: - Cement concrete flooring (approx. 25mm thick) shall be provided.

Steps: - Proper steps of suitable size and length to be provided between GL and plinth as approved by Engineer.

Specification for Ferro Cement Work:

- a) Adequate care should be taken to ensure proper clear cover on both faces of ferrocement component any component having exposed chicken mesh will not be allowed to be used.
- b) Power Vibrators / Vibrating Table shall be used to achieve uniform compaction finish and texture.
- c) Special care shall be taken while casting Z/C-Section roofing elements. The male type mould shall be made of brick masonry with clay filling and plastered with cement mortar on the top. Wire mesh shall be cut to a length equal to twice the length of profile of element plus an overlap of 50mm and longitudinal direction shall be about 100mm.
- d) Low alkali cement shall be used.
- e) Constituent material for the mix shall be mixed dry in mortar mixer, water shall then be added in small quantities until the mix attains stiff consistency. Water quantity should be such as it should not lead to segregation of particles as well as it should not lead to shrinkage cracks due to excess water.
- f) Before placing of mix, a thin coating of rich cement slurry shall be applied to reinforced cage with a brush.
- g) Finished elements shall be cured properly by full covering with wet gunny bags.
- h) All members should be mould finished and no repair with cement mortar shall be allowed afterwards.

Note - Any better material approved by Engineer in charge. In case the contractor/s uses any better material than mentioned above, this will be permitted with approval Engineer

5. FURNITURE AND OTHER OFFICE EQUIPMENT

The Contractor shall supply and maintain the following new furniture and equipment to the Engineer's offices within two months of the date of commencement of the works until the defect liability period is over:

Description of Item	Nos.
Conference table (4000mm x 1500mm)	1
Conference chairs	16
Glass-fronted lockable bookcase	4
1500mm x 900mm double pedestal desk	2
1200mm x 900mm single pedestal desks	8
Swivel office chair with armrests	10
Swivel office chair without armrests	3
Typist chair	2

Description of Item	Nos.
Visitors chair	10
4-drawer filing cabinet	4
Plan chest (A 0 size)	1
1500mm x 900mm tables	15
Steel lockable cupboard 6ft high with internal shelves	4
Heavy Duty Paper Shredders	1
Tele-facsimile transmission/reception facility connected to a dedicated line with STD facility	1 set
Telephone switchboard connected to 2 external Lines at each office including the handsets along with the required facilities for the exchange, with STD facility, and with independent Internal communication Facilities with conference facilities.	14 phones lines
First aid kits for up to 36 persons	2 (All kits shall be regularly recouped)
Industrial Safety Helmets along with Cap mounted Earmuffs (with NRR 21 dB), LED Cap Torch and Safety goggles	15 sets (every 12 months)
Gum Boots and Safety Toe shoes	15 sets (every 12 months)
Reflective Safety Jackets (As per IS: 15809) and Safety gloves suitable for Ropewaying operations.	15 sets (every 12 months)
Face mask (NIOS Approved N95)	50 Pieces every 6 months
RO water Purifier	1
2 L kettles	20
Potable water dispenser with hot/cold Taps	1
Cups and plates	20
Fire extinguisher	(As required confirming to the stipulations of Local authorities).
Silent DG set of minimum power of 10 KVA	1

Note: In case of failure to provide the equipment's within Two months, penalty @ Rs 5000/- Per week or part thereof will be imposed.

6. TRANSPORT

General

The Contractor shall provide road transport (for the use of the Authority and the Engineer within one month from the date of commencement of the works) and the Payment for the same shall be covered in quoted rates.

Road Transport

- a) The vehicles shall be new and delivered and maintained by the Contractor in good roadworthy condition including daily cleaning. The vehicle shall be replaced with a new vehicle after a maximum run of 75000 Km or three years whichever is earlier.
- b) The Contractor shall employ and make available competent drivers fully licensed to operate the vehicles as and when required by the Engineer/Authority. The Contractor shall replace drivers at the request of the Engineer/Authority.
- c) The vehicles shall be commercially licensed and insured for use on the public highway and shall have comprehensive insurance cover for any qualified driver authorized by the Engineer together with any authorized passengers and the carriage of goods or samples.
- d) The Contractor shall provide fuel, oil for running of each vehicle for 4000 kms monthly and ensure maintenance in conformity with the vehicle manufacturer's recommendations and all relevant toll and parking charges incurred in connection with the Works. The vehicle shall be provided day and night as required by the Engineer/Authority.
- e) A suitable replacement shall be provided by the contractor for any vehicle out of service for more than 24 hours. If the contractor at any time fails to provide vehicle(s) or substitute vehicle(s) as specified, an amount of Rs.1500 per day for each vehicle (that the Contractor failed to provide) shall be recovered from the Contractor.

Motor Bike

- a) The Motor Bike shall be new and delivered and maintained by the Contractor in

good roadworthy condition. A new helmet shall also be provided along with the bike. The motor bike shall be washed and cleaned once in a month. The bike shall be replaced with a new Motor Bike after a maximum run of 90000 Kms or three years whichever is earlier.

- b) The Motor Bike shall be registered and insured for use on the public roads and shall have comprehensive insurance cover for any rider having valid driving license and authorized by the Engineer.
- c) The Contractor shall provide fuel, lubricants and other oils for running of the Motor Bike for 2500 Kms monthly and ensure maintenance in conformity with the vehicle manufacturer's recommendations and all relevant toll and parking charges incurred in connection with the works shall be borne by the Contractor. The motor bike shall be provided day and night as required by the Engineer/Authority.
- d) A suitable replacement shall be provided by the contractor for any motor bike out of service for more than 24 hours. If the contractor at any time fails to provide motor bike as specified, an amount of Rs.400 per day for each motor bike (that the Contractor failed to provide) shall be recovered from the Contractor.

Number of Vehicles

The Contractor shall provide the following type of vehicles as per requirement indicated by the Project Director within one month of the date of commencement.

Type	Numbers
INOVA, MAHINDRA XUV500 or similar	3 (Three)
BOLERO/SCORPIO/ERTIGA/MARAZZO or Similar	8 (Eight)
Motor Bike 150CC or more, Bajaj Pulsar/ Honda CB Hornet 160R/ Hero Xtreme Sorts/ Suzuki Gixxer or Similar	5 (Five)

The vehicle requirement given above is the maximum requirement of the vehicles at a time. However, requirement in a particular period will be intimated by the Authority/Engineer to the contractor on programme basis at least 7 days before the actual date of requirement. The Contractor shall withdraw particular vehicle(s) if the same is not further required by the Engineer/Authority if so, directed by the Authority/Engineer. In such cases the instructions shall be given in writing 7 days in advance. The requirement during the Defect Liability Period will be quite less than the

maximum requirement mentioned above.

Duration of Transport Requirements

Transport for the Engineer / Authority shall be provided so as to cover the entire completion period(s) and defect liability period(s). The transport so provided, shall continue to be the property of the Contractor.

7. OFFICE MAINTENANCE

The contractor is required to maintain the offices throughout the contract period and provide the following, but not limited to:

- i. Pay all electricity charges.
- ii. Reimburse telephone bills for the use of telephone, up to Rs 3000/- per month for each external landline connection
- iii. Pay all water charges.
- iv. Carry out necessary repairs to office and equipment as and when required.
- v. Day - to - Day cleaning and maintenance and watch & ward etc.

8. EQUIPMENT FOR USE OF THE ENGINEER.

The Contractor shall provide new equipment and software as listed below and maintain them for the exclusive use of the Authority and the Engineer. The Contractor shall provide and maintain the following equipment for the use of the Engineer and the Authority within two months from the date of commencement of the works until the defect liability period is over. No payment for the same shall be made separately and it is included in quoted rates. On completion of defect liability period, the equipment shall be property of the Contractor.

A.	Desktop Computer Eight nos.	With minimum specification of Intel Core i5, 9TH generation, upto 4.1 GHz, 9 MB Cache, 8GB DDR4 2666MHz RAM, 1 TB 7200 RPM Hard disk drive, DVD writer, 22-inch color TFT monitor, 10/100 LAN Card, Modem Card. Operating System - Windows 10 or higher preloaded with media and documentation and certificate of authenticity and Microsoft Security Essentials preloaded antivirus software.
B.	Laptop rugged – Four Nos.	With minimum specification of Intel Core i5, 10th generation, upto 4.2 GHz, 6 MB Cache, 8GB DDR4

		2666MHz RAM, 2gb Graphics Card, 1 TB 5400 RPM Hard disk drive, DVD writer, 14-inch color display, 2xUSB-3.0 Weight - not more than 2.5 kg, Battery backup - minimum 4 hrs Operating System - Windows 10 or higher preloaded with media and documentation and certificate of authenticity and Microsoft Security Essentials preloaded antivirus software. A laptop bag and Adapter/Battery charger shall also be provided with the laptop.
C.	Printers – 2 nos. (A4 size – 1 No. and A3 size – 1 No.)	The A4 size printer shall be all in one officejet having features of Fax, Scanner and Printer, A3 size printer shall be Colour Officejet with a print speed of up to 8 pages at 800 dpi or more.
D.	Large Format Plotter - One No.	36-inch color plotter: Model -HP T830 Designjet Multifunction plotter or similar/ better
E.	Application software* (on all desktop and laptop with one-year license)	(i) Microsoft office latest release. (ii) AUTOCAD 3D latest release. (iii) M S Project/Primavera latest release. (iv) PDF Converter/Professional
F.	Colour scanner- 1 no.	A3 size
G.	Xerox Machine- 1 No. for colored prints capable of reduction and copying A3 & A4 size paper with automatic document feeder capability and sorter. (Canon IR Advance C3500i III series or similar/ better)	
H.	UPS system with sufficient power backup (with minimum backup time of 30 minute) to meet the sufficient power load in case of power disruption.	
I.	Surge Protection Devices (one for each computer and printer as given above)	
J.	Power supply for the systems is to be AC 240 volts, 50 Hz from normal building wiring circuit mains, power regulator, stabilizer or transformer should be supplied by the Contractor for the computer systems such that the systems can function efficiently.	
K.	50 MBPS internet connection with wifi facility so that multiple devices can be connected.	
L.	50 MBPS wifi HotSpot/USB Dongle with 2 GB daily data connection and minimum monthly download limit of 50 GB for use with laptops – Four nos	

Note: In case of failure to provide the equipment including original software & internet connectivity within two-month, penalty @ Rs 5000/- Per week or part thereof will be

imposed.

9. DOCUMENTATION

A complete set of documentation will be supplied with each System. The documentation should be self-tutorial in nature and be readily understood by non-computer personnel. The following manuals will be supplied with the system:

- (a) Manual on how to operate the equipment; and
- (b) Manual on how to use the facilities and software provided by the supplier (including languages and utilities).

22. APPENDIX 16 – GENERAL ROPEWAY SYSTEM REQUIREMENTS

1. General Ropeway System Requirements

The Contractor shall be required to Design, Construct and Commission CEN Standard Ropeway System as per the as described in Volume III (Part 3): Electromechanical Works including Outline Construction Specifications.

23. APPENDIX 17 - PAYMENT MILESTONES AND WEIGHTAGES

1.1 Procedure of estimating the value of work done.

CIVIL COMPONENTS COST: Weightage Price = 29 %

S. No.	Name of Station	Weightage w.r.t. Civil Cost		Description of Items	Weightage w.r.t. station Cost
1	Tara Devi	6.30%	1	Civil Cost	
			1.1	Survey, Geotechnical Investigation, and preparation of working drawings.	1.50%
			1.1.1	Survey of site and submission Survey report	0.15%
			1.1.2	Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.15%
			1.1.3	Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				Total	1.50%
			1.2	Foundation and Sub structure	57.22%
			1.2.1	Piling, PCC and Earth Work etc, complete Foundation work up to Ground Floor level.	14.31%
			1.2.2	Framed Structures	
			1.2.2.1	Up to Ground Floor (including staff floor)	19.07%
			1.2.2.2	Completion of Open Restaurant Area (including ropeway platform)	19.07%
			1.2.2.3	Completion of Office Floor, Service Floor area and Gondola Parking	19.07%
				Total	57.21%
			1.3	Finishing	6.12%
			1.3.1	Up to Ground Floor (including staff floor)	2.04%
			1.3.2	Completion of Open Restaurant Area (including ropeway platform)	2.04%
			1.3.3	Completion of Office Floor, Service Floor area and Gondola Parking	2.04%

S. No.	Name of Station	Weightage w.r.t. Civil Cost		Description of Items	Weightage w.r.t. station Cost
				Total	6.12%
			1.4	Providing Amenities	29.52%
			1.4.1	Up to Ground Floor (including staff floor)	9.84%
			1.4.2	Completion of Open Restaurant Area (including ropeway platform)	9.84%
			1.4.3	Completion of Office Floor, Service Floor area and Gondola Parking	9.84%
				Total	29.52%
			1.5	Outer Development Signage, Approach Road, STP, Retaining Wall, Water Supply etc.	5.63%
			1.5.1	Signage	0.56%
			1.5.2	Approach Road	1.69%
			1.5.3	STP	0.00%
			1.5.4	Retaining Wall	1.69%
			1.5.5	Water Supply	0.84%
			1.5.6	Anything leftover	0.84%
					5.63%
2	Chakkar	5.87%	2	Civil Cost	
			2.1	Survey, Geotechnical Investigation, and preparation of working drawings.	1.50%
			2.1.1	Survey of site and submission Survey report	0.15%
			2.1.2	Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.15%
			2.1.3	Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				Total	1.50%
			2.2	Foundation and Sub Structure	56.30%
			2.2.1	Piling, PCC and Earth Work, Columns, etc, complete work including foundation work up to Station entry level.	16.89%
			2.2.2	Framed Structures	0.00%

S. No.	Name of Station	Weightage w.r.t. Civil Cost		Description of Items	Weightage w.r.t. station Cost
			1.2.2.1	Up to Platform entry level	14.07%
			1.2.2.2	Up to Commercial/ Utility level	14.07%
			1.2.2.3	Completion of roof including roof slab casting	11.26%
				Total	56.30%
			2.3	Finishing	7.76%
			2.3.1	Upto Platform entry level	3.11%
			2.3.2	Upto Commercial/ Utility level	3.11%
			2.3.3	Completion of roof including roof slab casting	1.55%
				Total	7.76%
			2.4	Providing Amenities	32.23%
			2.4.1	Upto Platform entry level	12.89%
			2.4.2	Upto Commercial/ Utility level	12.89%
			2.4.3	Completion of roof including roof slab casting	6.45%
				Total	32.23%
			2.5	Outer Development Signage, Approach Road, STP, Retaining Wall, Water Supply etc.	2.26%
			2.5.1	Signage	0.23%
			2.5.2	Approach Road	0.68%
			2.5.3	STP	0.00%
			2.5.4	Retaining Wall	0.68%
			2.5.5	Water Supply	0.34%
			2.5.6	Anything leftover	0.34%
				Total	2.26%
3	ZPTH	7.58%	3	Civil Cost	
			3.1	Survey, Geotechnical Investigation, and preparation of working drawings.	1.50%
			3.1.1	Survey of site and submission Survey report	0.15%
			3.1.2	Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.15%

S. No.	Name of Station	Weightage w.r.t. Civil Cost		Description of Items	Weightage w.r.t. station Cost
			3.1.3	Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				Total	1.50%
			3.2	Foundation and Sub Structure	56.60%
			3.2.1	Piling, PCC and Earth Work, Columns, etc, complete work including foundation work and framed structure upto road (Ground floor) level.	19.24%
			3.2.2	Framed Structures	
			3.2.2.1	Upto Commercial Level	12.45%
			3.2.2.2	Upto platform Level	12.45%
			3.2.2.3	Completion of Gondola Parking	12.45%
				Total	56.60%
			3.3	Finishing	6.50%
			3.3.1	Upto Commercial Level	2.60%
			3.3.2	Upto platform Level	2.60%
			3.3.3	Completion of Gondola Parking	1.30%
				Total	6.50%
			3.4	Providing Amenities	33.13%
			3.4.1	Upto Commercial Level	14.91%
			3.4.2	Upto platform Level	14.91%
			3.4.3	Completion of Gondola Parking	3.31%
				Total	33.13%
			3.5	Outer Development Signage, Approach Road, STP, Retaining Wall, Water Supply etc.	2.26%
			3.5.1	Signage	0.23%
			3.5.2	Approach Road	0.68%
			3.5.3	STP	0.00%
			3.5.4	Retaining Wall	0.68%
			3.5.5	Water Supply	0.34%
			3.5.6	Anything leftover	0.34%
					2.26%
4	ISBT	7.43%	4	Civil Cost	

S. No.	Name of Station	Weightage w.r.t. Civil Cost		Description of Items	Weightage w.r.t. station Cost
			4.1	Survey, Geotechnical Investigation, and preparation of working drawings.	1.50%
			4.1.1	Survey of site and submission Survey report	0.15%
			4.1.2	Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.15%
			4.1.3	Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				Total	1.50%
			4.2	Foundation and Sub Structure	53.28%
			4.2.1	Piling, PCC and Earth Work, Columns, etc, complete work including foundation work and framed structure upto Ground floor (Commercial) level.	15.98%
			4.2.2	Framed Structures	0.00%
			4.2.2.1	Completion of Commercial Floor Level with public utility	10.66%
			4.2.2.2	Completion of Ropeway Entry Level Green line	13.32%
			4.2.2.3	Completion of Ropeway Entry Level Blue line including roof	13.32%
				Total	53.28%
			4.3	Finishing	9.93%
			4.3.1	Completion of Commercial Floor Level with public utility	1.99%
			4.3.2	Completion of Ropeway Entry Level Green line	3.97%
			4.3.3	Completion of Ropeway Entry Level Blue line including roof	3.97%
				Total	9.93%
			4.4	Providing Amenities	33.12%
			4.4.1	Completion of Commercial Floor Level with public utility	14.90%
			4.4.2	Completion of Ropeway Entry Level Green line	14.90%

S. No.	Name of Station	Weightage w.r.t. Civil Cost		Description of Items	Weightage w.r.t. station Cost
			4.4.3	Completion of Ropeway Entry Level Blue line including roof	3.31%
				Total	33.12%
			4.5	Outer Development Signage, Approach Road, STP, Retaining Wall, Water Supply etc.	2.18%
			4.5.1	Signage	0.22%
			4.5.2	Approach Road	0.65%
			4.5.3	STP	0.00%
			4.5.4	Retaining Wall	0.65%
			4.5.5	Water Supply	0.33%
			4.5.6	Anything leftover	0.33%
				Total	2.18%
5	Railway Station	5.81%	5	Civil Cost	
			5.1	Survey, Geotechnical Investigation, and preparation of working drawings.	1.50%
			5.1.1	Survey of site and submission Survey report	0.15%
			5.1.2	Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.15%
			5.1.3	Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				Total	1.50%
			5.2	Foundation and Sub Structure	50.29%
			5.2.1	Piling, PCC and Earth Work, Columns, etc, complete work including foundation work and framed structure upto station entry level.	20.12%
			5.2.2	Framed Structures	
			5.2.2.1	Upto commercial and entry Level	15.09%
			5.2.2.2	Completion of Platform Entry level including roof	15.09%
				Total	50.29%

S. No.	Name of Station	Weightage w.r.t. Civil Cost		Description of Items	Weightage w.r.t. station Cost
			5.3	Finishing	3.52%
			5.3.1	Upto commercial and entry Level	1.41%
			5.3.2	Completion of Platform Entry level including roof	2.11%
				Total	3.52%
			5.4	Providing Amenities	34.18%
			5.5.1	Upto commercial and entry Level	13.67%
			5.5.2	Completion of Platform Entry level including roof	20.51%
				Total	34.18%
			5.5	Outer Development Signage, Approach Road, STP, Retaining Wall, Water Supply etc.	10.46%
			5.5.1	Signage	1.05%
			5.5.2	Approach Road	3.14%
			5.5.3	STP	0.00%
			5.5.4	Retaining Wall	3.14%
			5.5.5	Water Supply	1.57%
			5.5.6	Anything leftover	1.57%
				Total	10.46%
6	Old Bus Station	5.94%	6	Civil Cost	
			6.1	Survey, Geotechnical Investigation, and preparation of working drawings.	1.50%
			6.1.1	Survey of site and submission Survey report	0.15%
			6.1.2	Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.15%
			6.1.3	Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				Total	1.50%
			6.2	Foundation and Sub Structure	59.45%
			6.2.1	Piling, PCC and Earth Work, Columns, etc, complete work including foundation work upto	17.83%

S. No.	Name of Station	Weightage w.r.t. Civil Cost		Description of Items	Weightage w.r.t. station Cost
				Railway Parking level.	
			6.2.2	Frame Structure	
			6.2.2.1	Upto Railway Parking Level at stilt level	8.92%
			6.2.2.2	Upto Parking Level	8.92%
			6.2.2.3	Upto commercial floor level	8.92%
			6.2.2.4	Completion of Platform entry level including roof	14.86%
				Total	59.45%
			6.3	Finishing	7.24%
			6.3.1	Upto Railway Parking Level at stilt level	0.36%
			6.3.2	Upto Parking Level	0.36%
			6.3.3	Upto commercial floor level	0.72%
			6.3.4	Completion of Platform entry level including roof	5.79%
				Total	7.24%
			6.4	Providing Amenities	30.45%
			6.4.1	Upto Railway Parking Level at stilt level	1.52%
			6.4.2	Upto Parking Level	1.52%
			6.4.3	Upto commercial floor level	3.05%
			6.4.4	Completion of Platform entry level including roof	24.36%
				Total	30.45%
			6.5	Outer Development Signage, Approach Road, STP, Retaining Wall, Water Supply etc.	1.36%
			6.6.1	Signage	0.14%
			6.6.2	Approach Road	0.41%
			6.6.3	STP	0.00%
			6.6.4	Retaining Wall	0.41%
			6.6.5	Water Supply	0.20%
			6.6.6	Anything leftover	0.20%
				Total	1.36%
7	Lift Point	3.40%	7	Civil Cost	

S. No.	Name of Station	Weightage w.r.t. Civil Cost		Description of Items	Weightage w.r.t. station Cost
			7.1	Survey, Geotechnical Investigation, and preparation of working drawings.	1.50%
			7.1.1	Survey of site and submission Survey report	0.15%
			7.1.2	Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.15%
			7.1.3	Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				Total	1.50%
			7.2	Foundation and Sub Structure	58.72%
			7.2.1	Piling, PCC and Earth Work, Columns, etc, complete work including foundation work upto road level floor.	11.74%
			7.2.2	Frame Structure	
			7.2.2.1	Upto Entry and Utility Level	11.74%
			7.2.2.2	Upto Level 1	5.87%
			7.2.2.3	Upto Level 2	5.87%
			7.2.2.4	Upto Level 3	5.87%
			7.2.2.5	Upto Transfer/utility level	5.87%
			7.2.2.6	Completion of Platform entry level including roof	11.74%
				Total	58.72%
			7.3	Finishing	4.45%
			7.3.1	Road level floor proposed level 1	1.33%
			7.3.2	Transfer/utility level to Platform entry level	1.33%
			7.3.3	Platform entry level to roof level	1.78%
				Total	4.45%
			7.4	Providing Amenities	31.47%
			7.4.1	Road level floor proposed level 1	9.44%
			7.4.5	Transfer/utility level to Platform entry level	9.44%
			7.4.6	Platform entry level to roof level	12.59%
				Total	31.47%

S. No.	Name of Station	Weightage w.r.t. Civil Cost		Description of Items	Weightage w.r.t. station Cost
			7.5	Outer Development Signage, Approach Road, STP, Retaining Wall, Water Supply etc.	3.86%
			7.7.1	Signage	0.39%
			7.7.2	Approach Road	1.16%
			7.7.3	STP	0.00%
			7.7.4	Retaining Wall	1.16%
			7.7.5	Water Supply	0.58%
			7.7.6	Anything leftover	0.58%
				Total	3.86%
8	Secreteri at	6.86%	8	Civil Cost	
			8.1	Survey, Geotechnical Investigation, and preparation of working drawings.	1.50%
			8.1.1	Survey of site and submission Survey report	0.16%
			8.1.2	Geotechnical Investigation and submission of Geotechnical Interpretive Report(GIR)	0.15%
			8.1.3	Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				Total	1.52%
			8.2	Foundation and Sub Structure	55.18%
			8.2.1	Piling, PCC and Earth Work, Columns, etc, complete work including foundation work upto entry parking level.	16.56%
			8.2.2	Frame Structure	
			8.2.2.1	Completion of Entry parking and Utility level	11.03%
			8.2.2.2	Completion of Gondola Parking Level	5.53%
			8.2.2.3	Completion of Green line Platform level	11.03%
			8.2.2.4	Completion of Blueline Platform level including roof	11.03%
				Total	55.18%

S. No.	Name of Station	Weightage w.r.t. Civil Cost		Description of Items	Weightage w.r.t. station Cost
			8.3	Finishing	7.35%
			8.3.1	Completion of Entry parking and Utility level	0.73%
			8.3.2	Completion of Gondola Parking Level	0.73%
			8.3.3	Completion of Green line Platform level	2.94%
			8.3.4	Completion of Blueline Platform level including roof	2.94%
				Total	7.35%
			8.4	Providing Amenities	34.02%
			8.4.1	Completion of Entry parking and Utility level	1.70%
			8.4.5	Completion of Gondola Parking Level	1.70%
			8.4.6	Completion of Green line Platform level	15.31%
			8.4.7	Completion of Blueline Platform level including roof	15.31%
				Total	34.02%
			8.5	Outer Development Signage, Approach Road, STP, Retaining Wall, Water Supply etc.	1.99%
			8.8.1	Signage	0.20%
			8.8.2	Approach Road	0.60%
			8.8.3	STP	0.00%
			8.8.4	Retaining Wall	0.60%
			8.8.5	Water Supply	0.30%
			8.8.6	Anything leftover	0.30%
				Total	1.99%
9	103 Tunnel	8.07%	9	Civil Cost	
			9.1	Survey, Geotechnical Investigation, and preparation of working drawings.	1.50%
			9.1.1	Survey of site and submission Survey report	0.15%
			9.1.2	Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.15%

S. No.	Name of Station	Weightage w.r.t. Civil Cost		Description of Items	Weightage w.r.t. station Cost
			9.1.3	Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				Total	1.50%
			9.2	Foundation and Sub Structure	70.03%
			9.2.1	Piling, PCC and Earth Work, Columns, etc, complete work including foundation work upto entry parking level.	17.50%
			9.2.2	Frame Structure	
			9.2.2.1	Completion of Parking/Entry level	6.99%
			9.2.2.2	Completion of level 1	6.99%
			9.2.2.3	Completion of level 2	6.99%
			9.2.2.4	Completion of level 3	6.99%
			9.2.2.5	Completion of restaurant level	6.99%
			9.2.2.6	Completion of commercial/utility level	6.99%
			9.2.2.7	Completion of Platform entry level including roof	10.51%
				Total	69.94%
			9.3	Finishing	3.85%
			9.3.1	Parking entry level to proposed level 1	0.38%
			9.3.2	Utility level to Platform level	1.54%
			9.3.3	Platform level to roof level including roof level	1.92%
				Total	3.85%
			9.4	Providing Amenities	22.76%
			9.4.1	Parking entry level to proposed level 1	2.28%
			9.4.5	Utility level to Platform level	9.10%
			9.4.6	Platform level to roof level including roof level	11.38%
				Total	22.76%
			9.5	Outer Development Signage, Approach Road, STP, Retaining Wall, Water Supply etc.	1.90%
			9.5.1	Signage	0.19%

S. No.	Name of Station	Weightage w.r.t. Civil Cost		Description of Items	Weightage w.r.t. station Cost
			9.5.2	Approach Road	0.57%
			9.5.3	STP	0.00%
			9.5.4	Retaining Wall	0.57%
			9.5.5	Water Supply	0.29%
			9.5.6	Anything leftover	0.29%
				Total	1.90%
10	Victory Tunnel	3.21%	10	Civil Cost	
			10.1	Survey, Geotechnical Investigation, and preparation of working drawings.	1.50%
			10.1.1	Survey of site and submission Survey report	0.15%
			10.1.2	Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.15%
			10.1.3	Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				Total	1.50%
			10.2	Foundation and Sub Structure	71.12%
			10.2.1	Piling, PCC and Earth Work, Columns, etc, complete work including foundation work upto entry and parking level.	17.78%
			10.2.2	Frame Structure	
			10.2.2.1	Completion of Parking and entry level	4.98%
			10.2.2.2	Completion of level 1	4.98%
			10.2.2.3	Completion of level 2	4.98%
			10.2.2.4	Completion of level 3	4.98%
			10.2.2.5	Completion of level 4	4.98%
			10.2.2.6	Completion of level 5	4.98%

S. No.	Name of Station	Weightage w.r.t. Civil Cost		Description of Items	Weightage w.r.t. station Cost
			10.2.2.7	Completion of level 6	4.98%
			10.2.2.8	Completion of level 7	4.98%
			10.2.2.9	Completion of level 8	4.98%
			10.2.2.10	Completion of Ropeway Platform level including roof	8.53%
				Total	71.12%
			10.3	Finishing	1.91%
			10.3.1	Parking entry level to proposed level 1	0.19%
			10.3.2	Platform level to roof level	1.72%
				Total	1.91%
			10.4	Providing Amenities	23.05%
			10.4.1	Parking entry level to proposed level 1	2.30%
			10.4.5	Platform level to roof level	20.74%
				Total	23.05%
			10.5	Outer Development Signage, Approach Road, STP, Retaining Wall, Water Supply etc.	2.43%
			10.5.1	Signage	0.24%
			10.5.2	Approach Road	0.73%
			10.5.3	STP	0.00%
			10.5.4	Retaining Wall	0.73%
			10.5.5	Water Supply	0.36%
			10.5.6	Anything leftover	0.36%
				Total	2.43%
11	ICR	5.11%	11	Civil Cost	
			11.1	Survey, Geotechnical Investigation, and preparation of working drawings.	1.50%
			11.1.1	Survey of site and submission Survey report	0.15%
			11.1.2	Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.15%

S. No.	Name of Station	Weightage w.r.t. Civil Cost		Description of Items	Weightage w.r.t. station Cost
			11.1.3	Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				Total	1.50%
			11.2	Foundation and Sub Structure	52.34%
			11.2.1	Piling, PCC and Earth Work, Columns, etc, complete work including foundation work up to parking level.	15.70%
			11.2.2	Frame Structure	
			11.2.2.1	Completion of Parking Area level	10.47%
			11.2.2.2	Completion of Commercial/Utility level	10.47%
			11.2.2.3	Completion of Platform entry level upto roof	15.70%
				Total	52.34%
			11.3	Finishing	2.83%
			11.3.1	Completion of Parking Area level	0.28%
			11.3.2	Completion of Commercial/Utility level	1.13%
			11.3.3	Completion of Platform entry level upto roof	1.41%
				Total	2.83%
			11.4	Providing Amenities	32.85%
			11.4.1	Completion of Parking Area level	3.28%
			11.4.2	Completion of Commercial/Utility level	13.14%
			11.4.3	Completion of Platform entry level upto roof	16.42%
				Total	32.85%
			11.5	Outer Development Signage, Approach Road, STP, Retaining Wall, Water Supply etc.	10.54%
			11.5.1	Signage	1.05%
			11.5.2	Approach Road	3.16%
			11.5.3	STP	0.00%
			11.5.4	Retaining Wall	3.16%

S. No.	Name of Station	Weightage w.r.t. Civil Cost		Description of Items	Weightage w.r.t. station Cost
			11.5.5	Water Supply	1.58%
			11.5.6	Anything leftover	1.58%
				Total	10.54%
12	IGMC	9.92%	12	Civil Cost	
			12.1	Survey, Geotechnical Investigation, and preparation of working drawings.	1.50%
			12.1.1	Survey of site and submission Survey report	0.15%
			12.1.2	Geotechnical Investigation and submission of Geotechnical Interpretive Report(GIR)	0.15%
			12.1.3	Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				Total	1.50%
			12.2	Foundation and Sub Structure	58.65%
			12.2.1	Piling, PCC and Earth Work, Columns, etc, complete work including foundation work up to 1ts. Gondola Parking level.	17.59%
			12.2.2	Frame Structure	
			12.2.2.1	Completion of 1st. Gondola Parking level including Entrance Lobby	11.73%
			12.2.2.2	Completion of Ropeway Platform Level	17.59%
			12.2.2.3	Completion of 2nd Gondola Parking level upto roof	11.73%
				Total	58.65%
			12.3	Finishing	11.10%
			12.3.1	Completion of 1st. Gondola Parking level including Entrance Lobby	2.22%
			12.3.2	Completion of Ropeway Platform Level	6.66%
			12.3.3	Completion of 2nd Gondola Parking level upto roof	2.22%
				Total	11.10%
			12.4	Providing Amenities	27.85%

S. No.	Name of Station	Weightage w.r.t. Civil Cost		Description of Items	Weightage w.r.t. station Cost
			12.4.1	Completion of 1st. Gondola Parking level including Entrance Lobby	5.57%
			12.4.2	Completion of Ropeway Platform Level	16.71%
			12.4.3	Completion of 2nd Gondola Parking level upto roof	5.57%
				Total	27.85%
			12.5	Outer Development Signage, Approach Road, STP, Retaining Wall, Water Supply etc.	0.87%
			12.5.1	Signage	0.09%
			12.5.2	Approach Road	0.26%
			12.5.3	STP	0.00%
			12.5.4	Retaining Wall	0.26%
			12.5.5	Water Supply	0.13%
			12.5.6	Anything leftover	0.13%
				Total	0.87%
13	Sanjauli	5.97%	13	Civil Cost	
			13.1	Survey, Geotechnical Investigation, and preparation of working drawings.	1.50%
			13.1.1	Survey of site and submission Survey report	0.15%
			13.1.2	Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.15%
			13.1.3	Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				Total	1.50%
			13.2	Foundation and Sub Structure	72.29%
			13.2.1	Piling, PCC and Earth Work, Columns, etc, complete work including foundation work upto Parking level.	14.46%
			13.2.2	Frame Structure	
			13.2.2.1	Upto Parking level including approach bridge	7.23%
			1		

S. No.	Name of Station	Weightage w.r.t. Civil Cost		Description of Items	Weightage w.r.t. station Cost
			13.2.2.2	Upto Utility/commercial level	7.23%
			13.2.2.3	Upto Level 1	7.23%
			13.2.2.4	Upto Level 2	7.23%
			13.2.2.5	Upto Level 3	7.23%
			13.2.2.6	Upto Level 4	7.23%
			13.2.2.7	Upto Level 5	7.23%
			13.2.2.8	Completion of Ropeway Platform Level including roof	7.23%
				Total	72.29%
			13.3	Finishing	1.50%
			13.3.1	Parking level to utility/commercial level	0.60%
			13.3.2	PF level to 2nd Gondola Parking level	0.90%
				Total	1.50%
			13.4	Providing Amenities	22.85%
			13.4.1	Parking level to utility/commercial level	9.14%
			13.4.2	PF level to 2nd Gondola Parking level	13.71%
				Total	22.85%
			13.5	Outer Development Signage, Approach Road, STP, Retaining Wall, Water Supply etc.	1.91%
			13.5.1	Signage	0.19%
			13.5.2	Approach Road	0.57%
			13.5.3	STP	0.00%
			13.5.4	Retaining Wall	0.57%
			13.5.5	Water Supply	0.29%
			13.5.6	Anything leftover	0.29%
				Total	1.91%
14	Navbahar	5.39%	13	Civil Cost	
			13.1	Survey, Geotechnical Investigation, and preparation of working	1.50%

S. No.	Name of Station	Weightage w.r.t. Civil Cost		Description of Items	Weightage w.r.t. station Cost
				drawings.	
			13.1.1	Survey of site and submission Survey report	0.15%
			13.1.2	Geotechnical Investigation and submission of Geotechnical Interpretive Report(GIR)	0.15%
			13.1.3	Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				Total	1.50%
			13.2	Foundation and Sub Structure	61.65%
			13.2.1	Piling, PCC and Earth Work, Columns, etc, complete work including foundation work upto Parking level.	21.58%
			13.2.2	Frame Structure	
			13.2.2.1	Completion of Parking level	9.25%
			13.2.2.2	Completion of Commercial and entry level	9.25%
			13.2.2.3	Completion of Utility area	9.25%
			13.2.2.4	Completion of Ropeway Platform including roof	12.33%
				Total	61.65%
			13.3	Finishing	3.52%
			13.3.1	Completion of Parking level	0.09%
			13.3.2	Completion of Commercial and entry level	0.09%
			13.3.3	Completion of Utility area	1.23%
			13.3.4	Completion of Ropeway Platform including roof	2.11%
				Total	3.52%
			13.4	Providing Amenities	30.95%
			13.4.1	Completion of Parking level	0.77%
			13.4.2	Completion of Commercial and entry level	0.77%

S. No.	Name of Station	Weightage w.r.t. Civil Cost		Description of Items	Weightage w.r.t. station Cost
			13.4.3	Completion of Utility area	10.83%
			13.4.4	Completion of Ropeway Platform including roof	18.57%
				Total	30.95%
			13.5	Outer Development Signage, Approach Road, STP, Retaining Wall, Water Supply etc.	2.32%
			13.5.1	Signage	0.23%
			13.5.2	Approach Road	0.70%
			13.5.3	STP	0.00%
			13.5.4	Retaining Wall	0.70%
			13.5.5	Water Supply	0.35%
			13.5.6	Anything leftover	0.35%
				Total	2.32%

Tower accesses

S. No	Description	Weightage w.r.t. Civil Cost	Description of Items	Weightage w.r.t. Tower Access Cost
15	Tower accesses	1.17%	15 Civil Cost	
			15.1 Survey, Preparation of Plan & Profile, Pavement design and approval of working drawings.	10.00%
			15.2 Completion of the work	90.00%
Note: Payment for 2m wide tower access shall be made for each completed m.				

Tower Foundations

S. No.	Line	Weightage w.r.t. Civil Cost	Section	Description of Items	Weightage w.r.t. Foundation Cost
16	Red line	0.41%	R1	16.1 Civil Cost	23.00%
				16.1.1 Survey, Geotechnical Investigation, and	2.0%

S. No.	Line	Weightage w.r.t. Civil Cost	Section	Description of Items	Weightage w.r.t. Foundation Cost
				preparation of working drawings.	
				16.1.1.1 Survey of site and submission Survey report	0.40%
				16.1.1.2 Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.40%
				16.1.1.3 Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				16.1.2 Earthwork	10%
				16.1.2.1 Site clearance, earthwork in all type of soils including rock, PCC and refilling after casting of the foundation.	10%
				16.1.3 RCC work	78%
				16.1.3.1 Casting of the foundations as per design and drawing including centring shuttering, foundation anchors complete in all aspects.	78%
				16.1.4 Fencing	10%
				16.1.4.1 Providing and fixing of GI Chain linked fabric Fencing as per specifications.	10%
			R2	16.2 Civil Cost	77.00%
				16.1.1 Survey, Geotechnical Investigation, and preparation of working drawings.	2.0%
				16.1.1.1 Survey of site and submission Survey report	0.40%
				16.1.1.2 Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.40%
				16.1.1.3 Preparation of working drawings and submission of	1.20%

S. No.	Line	Weightage w.r.t. Civil Cost	Section	Description of Items	Weightage w.r.t. Foundation Cost
				the working drawings proof checked by IIT.	
				16.1.2 Earthwork	10%
				16.1.2.1 Site clearance, earthwork in all type of soils including rock, PCC and refilling after casting of the foundation.	10%
				16.1.3 RCC work	78%
				16.1.3.1 Casting of the foundations as per design and drawing including centring shuttering, foundation anchors complete in all aspects.	78%
				16.1.4 Fencing	10%
				16.1.4.1 Providing and fixing of GI Chain linked fabric Fencing as per specifications.	10%
16	Green line	1.42%	G1	16.1 Civil Cost	4.90%
				16.1.1 Survey, Geotechnical Investigation, and preparation of working drawings.	2.0%
				16.1.1.1 Survey of site and submission Survey report	0.40%
				16.1.1.2 Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.40%
				16.1.1.3 Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				16.1.2 Earthwork	10%
				16.1.2.1 Site clearance, earthwork in all type of soils including rock, PCC and refilling after casting of the foundation.	10%
				16.1.3 RCC work	78%
				16.1.3.1 Casting of the foundations as	78%

S. No.	Line	Weightage w.r.t. Civil Cost	Section	Description of Items	Weightage w.r.t. Foundation Cost
				per design and drawing including centring shuttering, foundation anchors complete in all aspects.	
				16.1.4 Fencing	10%
				16.1.4.1 Providing and fixing of GI Chain linked fabric Fencing as per specifications.	10%
			G2	16.1 Civil Cost	22.75%
				16.1.1 Survey, Geotechnical Investigation, and preparation of working drawings.	2.0%
				16.1.1.1 Survey of site and submission Survey report	0.40%
				16.1.1.2 Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.40%
				16.1.1.3 Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				16.1.2 Earthwork	10%
				16.1.2.1 Site clearance, earthwork in all type of soils including rock, PCC and refilling after casting of the foundation.	10%
				16.1.3 RCC work	78%
				16.1.3.1 Casting of the foundations as per design and drawing including centring shuttering, foundation anchors complete in all aspects.	78%
				16.1.4 Fencing	10%
				16.1.4.1 Providing and fixing of GI Chain linked fabric Fencing as per specifications.	10%
			G3	16.1 Civil Cost	4.12%
				16.1.1 Survey, Geotechnical	2.0%

S. No.	Line	Weightage w.r.t. Civil Cost	Section	Description of Items	Weightage w.r.t. Foundation Cost
				Investigation, and preparation of working drawings.	
				16.1.1.1 Survey of site and submission Survey report	0.40%
				16.1.1.2 Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.40%
				16.1.1.3 Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				16.1.2 Earthwork	10%
				16.1.2.1 Site clearance, earthwork in all type of soils including rock, PCC and refilling after casting of the foundation.	10%
				16.1.3 RCC work	78%
				16.1.3.1 Casting of the foundations as per design and drawing including centring shuttering, foundation anchors complete in all aspects.	78%
				16.1.4 Fencing	10%
				16.1.4.1 Providing and fixing of GI Chain linked fabric Fencing as per specifications.	10%
			G4	16.1 Civil Cost	29.41%
				16.1.1 Survey, Geotechnical Investigation, and preparation of working drawings.	2.0%
				16.1.1.1 Survey of site and submission Survey report	0.40%
				16.1.1.2 Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.40%
				16.1.1.3 Preparation of working	1.20%

S. No.	Line	Weightage w.r.t. Civil Cost	Section	Description of Items	Weightage w.r.t. Foundation Cost
				drawings and submission of the working drawings proof checked by IIT.	
			16.1.2	Earthwork	10%
			16.1.2.1	Site clearance, earthwork in all type of soils including rock, PCC and refilling after casting of the foundation.	10%
			16.1.3	RCC work	78%
			16.1.3.1	Casting of the foundations as per design and drawing including centring shuttering, foundation anchors complete in all aspects.	78%
			16.1.4	Fencing	10%
			16.1.4.1	Providing and fixing of GI Chain linked fabric Fencing as per specifications.	10%
			G5	16.1 Civil Cost	38.82%
			16.1.1	Survey, Geotechnical Investigation, and preparation of working drawings.	2.0%
			16.1.1.1	Survey of site and submission Survey report	0.40%
			16.1.1.2	Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.40%
			16.1.1.3	Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
			16.1.2	Earthwork	10%
			16.1.2.1	Site clearance, earthwork in all type of soils including rock, PCC and refilling after casting of the foundation.	10%
			16.1.3	RCC work	78%
			16.1.3.1	Casting of the foundations as	78%

S. No.	Line	Weightage w.r.t. Civil Cost	Section	Description of Items		Weightage w.r.t. Foundation Cost
					per design and drawing including centring shuttering, foundation anchors complete in all aspects.	
				16.1.4	Fencing	10%
				16.1.4.1	Providing and fixing of GI Chain linked fabric Fencing as per specifications.	10%
	Blue line	2.22%	B1	16.1	Civil Cost	13.55%
				16.1.1	Survey, Geotechnical Investigation, and preparation of working drawings.	2.0%
				16.1.1.1	Survey of site and submission Survey report	0.40%
				16.1.1.2	Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.40%
				16.1.1.3	Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				16.1.2	Earthwork	10%
				16.1.2.1	Site clearance, earthwork in all type of soils including rock, PCC and refilling after casting of the foundation.	10%
				16.1.3	RCC work	78%
				16.1.3.1	Casting of the foundations as per design and drawing including centring shuttering, foundation anchors complete in all aspects.	78%
				16.1.4	Fencing	10%
				16.1.4.1	Providing and fixing of GI Chain linked fabric Fencing as per specifications.	10%
			B2	16.1	Civil Cost	4.27%

S. No.	Line	Weightage w.r.t. Civil Cost	Section	Description of Items	Weightage w.r.t. Foundation Cost
				16.1.1 Survey, Geotechnical Investigation, and preparation of working drawings.	2.0%
				16.1.1.1 Survey of site and submission Survey report	0.40%
				16.1.1.2 Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.40%
				16.1.1.3 Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				16.1.2 Earthwork	10%
				16.1.2.1 Site clearance, earthwork in all type of soils including rock, PCC and refilling after casting of the foundation.	10%
				16.1.3 RCC work	78%
				16.1.3.1 Casting of the foundations as per design and drawing including centring shuttering, foundation anchors complete in all aspects.	78%
				16.1.4 Fencing	10%
				16.1.4.1 Providing and fixing of GI Chain linked fabric Fencing as per specifications.	10%
			B3	16.1 Civil Cost	15.68%
				16.1.1 Survey, Geotechnical Investigation, and preparation of working drawings.	2.0%
				16.1.1.1 Survey of site and submission Survey report	0.40%
				16.1.1.2 Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.40%

S. No.	Line	Weightage w.r.t. Civil Cost	Section	Description of Items	Weightage w.r.t. Foundation Cost
				16.1.1.3 Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				16.1.2 Earthwork	10%
				16.1.2.1 Site clearance, earthwork in all type of soils including rock, PCC and refilling after casting of the foundation.	10%
				16.1.3 RCC work	78%
				16.1.3.1 Casting of the foundations as per design and drawing including centring shuttering, foundation anchors complete in all aspects.	78%
				16.1.4 Fencing	10%
				16.1.4.1 Providing and fixing of GI Chain linked fabric Fencing as per specifications.	10%
			B4	16.1 Civil Cost	4.64%
				16.1.1 Survey, Geotechnical Investigation, and preparation of working drawings.	2.0%
				16.1.1.1 Survey of site and submission Survey report	0.40%
				16.1.1.2 Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.40%
				16.1.1.3 Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				16.1.2 Earthwork	10%
				16.1.2.1 Site clearance, earthwork in all type of soils including rock, PCC and refilling after casting of the foundation.	10%
				16.1.3 RCC work	78%

S. No.	Line	Weightage w.r.t. Civil Cost	Section	Description of Items	Weightage w.r.t. Foundation Cost
				16.1.3.1 Casting of the foundations as per design and drawing including centring shuttering, foundation anchors complete in all aspects.	78%
				16.1.4 Fencing	10%
				16.1.4.1 Providing and fixing of GI Chain linked fabric Fencing as per specifications.	10%
			B5	16.1 Civil Cost	20.20%
				16.1.1 Survey, Geotechnical Investigation, and preparation of working drawings.	2.0%
				16.1.1.1 Survey of site and submission Survey report	0.40%
				16.1.1.2 Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.40%
				16.1.1.3 Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				16.1.2 Earthwork	10%
				16.1.2.1 Site clearance, earthwork in all type of soils including rock, PCC and refilling after casting of the foundation.	10%
				16.1.3 RCC work	78%
				16.1.3.1 Casting of the foundations as per design and drawing including centring shuttering, foundation anchors complete in all aspects.	78%
				16.1.4 Fencing	10%
				16.1.4.1 Providing and fixing of GI Chain linked fabric Fencing as per specifications.	10%
			B6	16.1 Civil Cost	29.99%

S. No.	Line	Weightage w.r.t. Civil Cost	Section	Description of Items	Weightage w.r.t. Foundation Cost
				16.1.1 Survey, Geotechnical Investigation, and preparation of working drawings.	2.0%
				16.1.1.1 Survey of site and submission Survey report	0.40%
				16.1.1.2 Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.40%
				16.1.1.3 Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				16.1.2 Earthwork	10%
				16.1.2.1 Site clearance, earthwork in all type of soils including rock, PCC and refilling after casting of the foundation.	10%
				16.1.3 RCC work	78%
				16.1.3.1 Casting of the foundations as per design and drawing including centring shuttering, foundation anchors complete in all aspects.	78%
				16.1.4 Fencing	10%
				16.1.4.1 Providing and fixing of GI Chain linked fabric Fencing as per specifications.	10%
			B7	16.1 Civil Cost	11.67%
				16.1.1 Survey, Geotechnical Investigation, and preparation of working drawings.	2.0%
				16.1.1.1 Survey of site and submission Survey report	0.40%
				16.1.1.2 Geotechnical Investigation and submission of Geotechnical Interpretive Report (GIR)	0.40%

S. No.	Line	Weightage w.r.t. Civil Cost	Section	Description of Items	Weightage w.r.t. Foundation Cost
				16.1.1.3 Preparation of working drawings and submission of the working drawings proof checked by IIT.	1.20%
				16.1.2 Earthwork	10%
				16.1.2.1 Site clearance, earthwork in all type of soils including rock, PCC and refilling after casting of the foundation.	10%
				16.1.3 RCC work	78%
				16.1.3.1 Casting of the foundations as per design and drawing including centring shuttering, foundation anchors complete in all aspects.	78%
				16.1.4 Fencing	10%
				16.1.4.1 Providing and fixing of GI Chain linked fabric Fencing as per specifications.	10%

ELECTROMECHANICAL COMPONENTS COST: Weightage Price = 71%

S. No	line	Section	Weight age w.r.t. E&M Cost	Description of Items	Weightag e w.r.t. E&M Cost
17	Red line	RL1 (Taradevi - ZPTH)	14.31%	E&M cost	100.00%
				17.1 Design	10.07%
				17.1.1 Design, preparation of working drawings and submission of the working drawings proof checked by Cen certified firm.	10.07%
				17.2 Mechanical facilities	74.05%
				17.2.1 Station - Taradevi	13.28%
				17.2.2 Station Chakkar	13.55%
				17.2.3 Station ZPTH	9.07%

S. No	line	Section	Weight age w.r.t. E&M Cost		Description of Items	Weightage w.r.t. E&M Cost
				17.2.4	Line equipment	18.00%
				17.2.5	Carriers	5.55%
				17.2.6	Evacuation facilities	2.33%
				17.2.7	Equipments, tools, spare parts package mech.	1.12%
				17.2.8	Execution of the assembly work	11.15%
				17.3	Electrotechnical equipment	12.44%
				17.3.1	Drive system	1.77%
				17.3.2	Low voltage supply	0.72%
				17.3.3	Control and Station facilities	2.01%
				17.3.4	Electrical devices	1.74%
				17.3.5	Line facility	3.50%
				17.3.6	Equipments, tools, spare parts package elect	2.69%
				17.3	Haul rope	3.43%
				17.3.1	Haul rope	3.43%
18	Green line	GL1 (ZPTH - Old Bus Stand)	35.78%	18	E&M cost	52.96%
				18.1	Design	10.07%
				18.1.1	Design, preparation of working drawings and submission of the working drawings proof checked by Cen certified firm.	10.07%
				18.2	Mechanical facilities	76.63%
				18.2.1	Station - ZPTH	11.76%
				18.2.2	Station ISBT	12.17%
				18.2.3	Station Railway station	10.19%
				18.2.4	Station - Old Bus Stand	6.85%
				18.2.5	Line equipment	17.81%
				18.2.6	Carriers	4.51%
				18.2.7	Evacuation facilities	1.87%

S. No	line	Section	Weight age w.r.t. E&M Cost		Description of Items	Weightage w.r.t. E&M Cost
				18.2.8	Equipments, tools, spare parts package mech.	0.85%
				18.2.9	Execution of the assembly work	10.61%
				18.3	Electrotechnical equipment	10.28%
				18.3.1	Drive system	1.91%
				18.3.2	Low voltage supply	0.53%
				18.3.3	Control and Station facilities	1.97%
				18.3.4	Speech memory 6 languages	1.69%
				18.3.5	Line facility	2.21%
				18.3.6	Equipment, tools, spare parts package elect	1.97%
				18.4	Haul rope	3.01%
				18.4.1	Haul rope	3.01%
19	Green line	GL2 (Old Bus Stand - Secretariat)	35.82%	19	E&M cost	46.70%
				19.1	Design	10.06%
				19.1.1	Design, preparation of working drawings and submission of the working drawings proof checked by Cen certified firm.	10.06%
				19.2	Mechanical facilities	76.52%
				19.2.1	Station - Old Bus Stand	7.76%
				19.2.2	Station Lift Point 2	12.89%
				19.2.3	Station - Secretariat	15.66%
				19.2.4	Line equipment	21.83%
				19.2.5	Carriers	5.19%
				19.2.6	Evacuation facilities	2.24%
				19.2.7	Equipments, tools, spare parts package mech.	0.96%
				19.2.8	Execution of the assembly work	9.99%
				19.3	Electrotechnical	9.63%

S. No	line	Section	Weight age w.r.t. E&M Cost		Description of Items	Weightage w.r.t. E&M Cost
					equipment	
				19.3.1	Low voltage supply	0.97%
				19.3.2	Control and Station facilities	1.72%
				19.3.3	Electrical devices	1.49%
				19.3.4	Line facility	2.70%
				19.3.5	Equipment, tools, spare parts package elect	2.74%
				19.4	Haul rope	3.79%
				19.4.1	Haul rope	3.79%
20	Blue line	BL1 (ISBT - ICR)	49.54%	20	E&M cost	40.30%
				20.1	Design	10.06%
				20.1.1	Design, preparation of working drawings and submission of the working drawings proof checked by Cen certified firm.	10.06%
				20.2	Mechanical facilities	73.95%
				20.2.1	Station ISBT	13.35%
				20.2.2	Station 103 Tunnel	9.07%
				20.2.3	Station Victory Tunnel	7.52%
				20.2.4	Station ICR	6.12%
				20.2.5	Line equipment	22.36%
				20.2.6	Support/Compressing sheave ass. D = appr 400 mm	1.36%
				20.2.7	Carriers	4.73%
				20.2.8	Evacuation facilities	1.91%
				20.2.9	Equipment's, tools, spare parts package mech.	0.83%
				20.2.10	Execution of the assembly work	6.71%
				20.3	Electrotechnical equipment	12.66%
				20.3.1	Drive system	2.41%

S. No	line	Section	Weight age w.r.t. E&M Cost		Description of Items	Weightage w.r.t. E&M Cost
				20.3.2	Low voltage supply	1.10%
				20.3.3	Control and Station facilities	1.87%
				20.3.4	Electrical devices	1.61%
				20.3.5	Line facility	3.43%
				20.3.6	Equipment's, tools, spare parts package elect	2.24%
				20.4	Haul rope	3.32%
				20.4.1	Haul rope	3.32%
21	Blue line	BL2 (ICR - Sanjauli)	49.57%	21	E&M cost	29.02%
				21.1	Design	10.06%
				21.1.1	Design, preparation of working drawings and submission of the working drawings proof checked by Cen certified firm.	10.06%
				21.2	Mechanical facilities	75.35%
				21.2.1	Station - ICR	6.03%
				21.2.2	Station IGMC	16.48%
				21.2.3	Station Sanjauli	13.90%
				21.2.4	Line equipments	23.58%
				21.2.5	Carriers	4.14%
				21.2.6	Evacuation facilities	2.05%
				21.2.7	Equipment's, tools, spare parts package mech.	1.12%
				21.2.8	Execution of the assembly work	8.05%
				21.3	Electrotechnical equipment	11.91%
				21.3.1	Drive system	2.38%
				21.3.2	Low voltage supply	1.13%
				21.3.3	Control and Station facilities	2.00%
				21.3.4	Electrical devices	1.73%
				21.3.5	Line facility	2.87%

S. No	line	Section	Weight age w.r.t. E&M Cost		Description of Items	Weightage w.r.t. E&M Cost
				21.3.6	Electrical equipment cabins	0.00%
				21.3.7	Equipment's, tools, spare parts package elect	1.79%
				21.4	Haul rope	2.68%
				21.4.1	Haul rope	2.68%
21	Blue line	BL3 (Sanjauli - Secretariate)	49.57%	21	E&M cost	30.28%
				21.1	Design	10.06%
				21.1.1	Design, preparation of working drawings and submission of the working drawings proof checked by Cen certified firm.	10.06%
				21.2	Mechanical facilities	73.68%
				21.2.1	Station - Sanjauli	4.81%
				21.2.2	Station Navbahar	12.06%
				21.2.3	Station Secretariat	12.94%
				21.2.4	Line equipment	27.76%
				21.2.5	Carriers	4.63%
				21.2.6	Evacuation facilities	2.15%
				21.2.7	Equipment's, tools, spare parts package mech.	1.07%
				21.2.8	Execution of the assembly work	8.26%
				21.3	Electrotechnical equipment	13.00%
				21.3.1	Drive system	2.52%
				21.3.2	Low voltage supply	1.09%
				21.3.3	Control and Station facilities	1.92%
				21.3.4	Electrical devices	1.66%
				21.3.5	Line facility	3.33%
				21.3.6	Electrical equipment cabins	0.00%
				21.3.7	Equipment, tools, spare parts package elect	2.48%

S. No	line	Section	Weight age w.r.t. E&M Cost		Description of Items	Weightage w.r.t. E&M Cost
				21.4	Haul rope	3.25%
				21.4.1	Haul rope	3.25%

1.2 The Cost of Each Item for a Specific station shall be calculated as under:

For example:

Cost of Each Item for a Specific station in CIVIL PART

= {Weightage of Civil Component Cost} * {Cost Weightage for each station; for ex: Red Line (1.1 Taradevi)} * {Cost weightage of each item for ex: 1.1.3}
= 29% * 6.3% * 1.2% * Project Cost.

a) Cost of Each Item for Specific Line in E&M PART

= {Weightage of Electrical Component Cost} * {Cost Weightage for each line as defined; for ex: 17 Red Line – RL1 Taradevi –Tutikandi Parking (ZPTH) * {Cost weightage of each item for ex: 17.1.1}
= 71% * 14.31% * 10.07% * Project Cost = VALUE.

Payment for E&M part shall be further paid as below percentages:

- (i) For Delivery = 20% * VALUE,
- (ii) For Installation = 40%*VALUE,
- (iii) For Commissioning = 40%* VALUE.

Annexure - I

Finishings at Stations

1	Electrical Work- Internal
1.1	Internal Electric Installation
1.2	Power Wiring & Plugs
1.3	Lightning Conductors
1.4	Telephone Conduits
2	Electrical Work- External
2.1	External service connections and local body approval charges shall be as hereunder or as per estimates given by the local body whichever is higher.:
2.2	Civil External Service Connection
2.3	Supplying, installation, testing and commissioning of 33 kV/0.433 kV or 11 kV/0.433 kV substation equipment comprising HT panel, dry type. Oil type transformers, HT cable, bus trunking from transformer to LT panel, LT panels, automatic power factor correction panel, active harmonic filters, TVSS (transient voltage suppression system), SPD (surge protection system), essential panel, earthing, required inter-connections, substation safety equipment's including LT cabling from substation to the buildings fed by the substation.: Electrical Substation Equipment (@9000 per KVA)
2.4	Supplying, installation, testing and commissioning of DG sets, AMF panel, bus ducting/ cables from DG sets to essential panel, DG set enclosure room sound insulation/ ventilation/ smoke exhaust as required, earthing of DG set system, control cabling, fuel tank/piping, DG set exhaust piping/ exhaust chimney as per CPCB norms, civil works connected with DG sets including foundation as required and Extra for synchronizing panels wherever required.:
3	PHE Work- Internal
3.1	Internal Water Supply & Sanitary Installations.
3.2	Underground sump-Water Supply
3.3	Underground sump-Fire Fighting
3.4	Underground sump-Treated Water
4	Baggage Scanners
4.1	Baggage scanner big: computer based multi energy X- Ray baggage inspection system capable of passing through bags/parcels of dimension 940mm (W) x 640mm (H) with Belt Height- 750mm-850mm with 22/24" LCD Monitor, input/ Output rollers with frames etc. as required.:
5	IBMS (Integrated Building Management System)
5.1	Supplying, installation, testing and commissioning of integrated building management system for digital/electronic display and monitoring of all E&M systems like substation, DG sets, UPS, solar power, lifts, AC plants, ventilation systems, tire protection systems, pumps etc. to include cabling, monitors, recording, display system, hardware, software support (up to 10,000 sqm) (Rate applicable on total plinth area).: Integrated Building Management System.
6	Door Frame Metal Detector
6.1	20 zone or above door frame metal detector nominal size: 760 mm (W) x 2050 mm (H) x 700

	mm (D) loaded with necessary software.: Door Frame Metal Detector
7	Access Control System
7.1	Supplying, installation, testing and commissioning of access control system for building security comprising of controller, E&M locks, reader, smart cards, cabling, recording, display system, hardware and software support as required (Rate applicable only on plinth area of high security area in the building).:
8	IP Based EPABX System
8.1	Supplying, installation, testing and commissioning of IP based EPABX system comprising of core switches & L2 switches with 10 G, 10 giga SFP modules, industry standard appliance server, cloud-based, enterprise-grade UC solution, MID/ENTRY level IP/SIP phone with, dual 1 gig ports, racks, CAT 6A cable, patch panels, OFC etc. (Rate applicable on plinth area excluding service/common areas).:
9	Fire Fighting & Alarm System
9.1	Automatic Fire Alarm System
9.2	Fire Fighting with Wet Riser & Sprinkler System.:
10	Boom Barrier
10.1	Electromechanical boom barrier with all accessories.
11	Other Building Services
11.1	CCTV SYSTEM - 80% of Total B.U.A
11.2	Supplying, installation, testing and commissioning of IP based CCTV system for building security comprising of PTZ / fixed camera, cabling, digital recording , HD display system with minimum display of 5" x 8" per camera and hard ware software support -for indoors only {Rate applicable on total plinth area but CCTV coverage shall be limited to 15% of the total plinth area as per requirement}.: CCTV SYSTEM - EXETRNAL SUVEILLANCE on total plot area
11.3	LIFTS with power operated center opening doors and AC variable voltage & variable frequency controls Passenger Lift
12	Solar

Annexure - II

Amenities at Stations

1	Site Development
1.1	Levelling
1.2	Internal Road with WMM and Bituminous Top
1.3	Storm water drains
1.4	Supplying, installation, testing and commissioning of LED street/ compound/ high mast/ pathway/ landscape lighting for the entire campus (Rate applicable on total plot area).: Street Lighting with LED.
1.5	Illuminated Signage
1.6	Horticulture operations including 300mm earth filling, grassing, tree plantations/shrubs and potted Plants etc.
1.7	Foot path with PCC Base, 60mm thick paver blocks and kerb stone edging.
1.8	External Water Supply
1.9	Rainwater Harvesting

Annexure - III: Monocable gondola Section Taradevi - ZPTH	
1.	Mechanical facilities
1.1	Station - Taradevi
1.1.1	Tensioning device
1.1.2	Bridge drive adjustable
1.1.3	Deceleration, acceleration device
1.1.4	Entry and exit facility, cabin guide
1.1.5	Lifting and lowering platform access area
1.1.6	Steel construction station
1.1.7	Steel construction drive station
1.1.8	Safety net
1.2	Station Chakkar
1.2.1	Rope guide, rope deflection
1.2.2	Deceleration, acceleration device
1.2.3	Connection section 1 - 2
1.2.4	Entry and exit facility, cabin guide
1.2.5	Steel structure connection section 1
1.2.6	Fixtures including M & P
1.2.7	Safety net
1.3	Station ZPTH
1.3.1	Return Unit, adjustable
1.3.2	Deceleration and acceleration
1.3.3	Connection section 1 - 2
1.3.4	Entry and exit facility, cabin guide
1.3.5	Steel structure connection section 1
1.3.6	Fixtures including M & P
1.4	Line equipment
1.4.1	Surcharge Sunshades prop shaft
1.4.2	sheave assembly
1.4.3	Sheave assembly 8/8 rolls
1.4.4	Surcharge Sunshades prop shaft
1.4.5	sheave assembly
1.4.6	sheave assembly
1.4.7	sheave assembly
1.4.8	Sheave assembly 8/8 rolls
1.4.9	Electronic rope position monitoring mechanical part
1.4.10	Towers galvanized, including crossmember, lifting jack, platforms, ladders
1.4.11	Rodent protection electric cables

Annexure - III: Monocable gondola Section Taradevi - ZPTH	
1.5	Carriers
1.5.1	Grips and Cabins (initial expansion)
1.5.2	Grips and hangers
1.5.3	Ropeway cabin 10 Pers
1.6	Evacuation facilities
1.6.1	Integrated recovery concept
1.6.2	Vertical evacuation equipment
1.7	Equipment, tools, spare parts package mech.
1.7.1	Inspection vehicle, maintenance hangers
1.7.2	Tools
1.7.3	Signage
1.7.4	Spare parts package ropeway technology
1.8	Execution of the assembly work
1.8.1	Assembly station 1
1.8.2	Assembly station 2
1.8.3	Assembly station 3
1.8.4	Assembly of Carriers
1.8.5	Assembly of Towers and roller Sheave assemblys
1.8.6	Haul rope pulling + splicing
1.8.7	Assembly station 1
1.8.8	Assembly station 2
1.8.9	Assembly garage station 2
1.8.10	Assembly station 3
1.8.11	Assembly garage station 3
1.8.12	Assembly of Towers and roller Sheave assemblys
1.8.13	Haul rope pulling
1.8.14	Transport of towers from bottom station to site
2.	Electrotechnical equipment
2.1	Drive system
2.1.1	Main drive motor
2.1.2	Frequency converter
2.2	Low voltage supply
2.2.1	Low voltage distribution station 1
2.2.2	Low voltage distribution station 2
2.2.3	Low voltage distribution station 3
2.2.4	Standby DG Set 200KVA (valley station-2, hill station-1)
2.2.5	Standby DG Set 840KVA (Valley station ropeway)
2.2.6	Standby DG Set 30KVA (Hill station ropeway)
2.3	Control and Station facilities

Annexure - III: Monocable gondola Section Taradevi - ZPTH	
2.3.1	Control devices
2.3.2	Other Station facilities
2.3.4	Remote control stations
2.3.5	Earting and other material
2.3.6	Speech memory 6 languages
2.4	Electrical devices
2.4.1	Station panels
2.4.2	Station wiring
2.4.3	Batteries and charging equipment
2.4.4	Telephone and signalling system
2.5	Line facility
2.5.1	Station and tower connection
2.5.2	Line cable
2.5.3	Electronic rope position monitoring Electrical part
2.5.4	Control cable or fibre optic cable ropeway
2.5.5	Earthing cable
2.5.6	Power supply track lighting, LED-lights on towers
2.5.7	Incoming Electrical Panel with Cable
2.6	Electrical equipment cabins
2.6.1	Energy supply cabin
2.6.2	Communication device cabin
2.6.3	Interior lighting cabin
2.7	Equipment, tools, spare parts package elect
2.7.1	Spare parts package electrical engineering
2.7.2	Documentation, engineering services
2.7.3	Freight and packaging
2.7.4	Assembly of electrical equipment
3.	Haul rope
3.1	Haul rope
3.1.1	Haul rope compacted
3.1.2	Surcharge Haul rope "PERFORMA"

Annexure - IV: GL1 ZPTH - Old Bus Stand 10 MGD	
	Monocable gondola Section ZPTH - Old Bus Stand
1.	Mechanical facilities

Annexure - IV: GL1 ZPTH - Old Bus Stand 10 MGD	
1.1	Station - ZPTH
1.1.1	Tensioning device
1.1.2	Drive unit
1.1.3	Bridge drive adjustable
1.1.4	Surcharge Bridge drive direct drive Mechanical or comparable noise insulation measure
1.1.5	Steel construction
1.1.6	Station facilities
1.1.7	Deceleration, acceleration device
1.1.8	Entry and exit facility, cabin guide
1.1.9	Station cladding
1.1.10	Lifting and lowering platform access area
1.1.11	Garage
1.1.12	Steel construction station
1.1.13	Steel construction drive station
1.1.14	Safety net
1.2	Station ISBT
1.2.1	Rope guide, rope deflection
1.2.2	Steel construction
1.2.3	Steel structure intermediate station
1.2.4	Safety net
1.2.5	Station facilities
1.2.6	Deceleration, acceleration device
1.2.7	Connection section 1 - 2
1.2.8	Entry and exit facility
1.2.9	Station cladding
1.2.10	Lifting and lowering platform access area
1.2.11	Garage
1.2.12	Steel structure connection section 1
1.2.13	Fixtures including M & P
1.2.14	Safety net
1.2.15	Garage Station 2
1.3	Station Railway station
1.3.1	Rope guide, rope deflection
1.3.2	Steel construction
1.3.3	Steel structure intermediate station
1.3.4	Safety net
1.3.5	Station facilities
1.3.6	Deceleration, acceleration device

Annexure - IV: GL1 ZPTH - Old Bus Stand 10 MGD	
1.3.7	Connection section 1 - 2
1.3.8	Entry and exit facility
1.3.9	Station cladding
1.3.10	Lifting and lowering platform access area
1.3.11	Steel structure connection section 1
1.3.12	Fixtures including M & P
1.3.13	Safety net
1.4	Station - Old Bus Stand
1.4.1	Return Unit
1.4.1.1	Return Unit, adjustable
1.4.2	Steel construction
1.4.3	Station facilities
1.4.3.1	Deceleration and acceleration
1.4.3.2	Connection section 1 - 2
1.4.3.3	Entry and exit facility, cabin guide
1.4.3.4	Station cladding
1.4.3.5	Steel structure connection section 1
1.4.3.6	Fixtures including M & P
1.4.3.7	Safety net
1.5	Line equipment
1.5.1	Section 1 ZPTH - ISBT
1.5.1.1	Towers galvanized
1.5.1.2	Surcharge Sunshades prop shaft
1.5.1.3	Sheave assemblies (sheave assemblies)
1.5.1.4	Support sheave assemblies D = appr 500 mm
1.5.1.5	Compression sheave assemblies D = appr 400 mm
1.5.1.6	Support/Compressing sheave ass. D = appr 400 mm
1.5.1.7	Support sheave assemblies D = appr 550 mm
1.5.1.8	Support/Compressing sheaves D = appr 550 mm
1.5.1.9	Electronic rope position monitoring mechanical part
1.5.2	Section 2 ISBT - Railway Station
1.5.2.1	Towers galvanized
1.5.2.2	Surcharge Sunshades prop shaft
1.5.2.3	Sheave assemblies (sheave assemblies)
1.5.2.4	Support sheave assemblies D = appr 500 mm
1.5.2.5	Compression sheave assemblies D = appr 400 mm
1.5.2.6	Support/Compressing sheave ass. D = appr 400 mm
1.5.2.7	Support sheave assemblies D = appr 550 mm
1.5.2.8	Support/Compressing sheaves D = appr 550 mm

Annexure - IV: GL1 ZPTH - Old Bus Stand 10 MGD	
1.5.2.9	Electronic rope position monitoring mechanical part
1.5.3	Section 3 Railway Station - Old Bus Stand
1.5.3.1	Towers galvanized including crossmember, lifting jack, platforms, ladders
1.5.3.2	Surcharge Sunshades prop shaft
1.5.3.3	Sheave assemblies (sheave assemblies)
1.5.3.4	Support sheave assemblies D = appr 500 mm
1.5.3.5	Compression sheave assemblies D = appr 400 mm
1.5.3.6	Support/Compressing sheave ass. D = appr 400 mm
1.5.3.7	Support sheave assemblies D = appr 550 mm
1.5.3.8	Support/Compressing sheaves D = appr 550 mm
1.5.3.9	Electronic rope position monitoring mechanical part
1.5.3.10	Surcharge Rodent protection electric cables
1.6	Carriers
1.6.1	Grips and Cabins (initial expansion)
1.6.2	Grips and hangers
1.6.3	Ropeway cabin 10 Pers
1.6.4	Surcharge wooden Seat
1.6.5	Surcharge Top-hung window on mast side
1.6.6	Surcharge Front top-hung window
1.6.7	Surcharge Heat-insulating screen filming
1.7	Evacuation facilities
1.7.1	Integrated recovery concept
1.7.2	Vertical evacuation equipment
1.8	Equipments, tools, spare parts package mech.
1.8.1	Inspection vehicle, maintenance hangers
1.8.2	Tools
1.8.3	Spare parts package ropeway technology
1.8.4	Signage
1.9	Execution of the assembly work
1.9.1	Assembly station 1
1.9.2	Assembly garage station 1
1.9.3	Assembly station 2
1.9.4	Assembly garage station 2
1.9.5	Assembly station 3
1.9.6	Assembly station 4
1.9.7	Assembly of Carriers
1.9.8	Assembly of Towers and roller Sheave assembly
1.9.9	Haul rope pulling + splicing
1.9.10	Assembly station 1

Annexure - IV: GL1 ZPTH - Old Bus Stand 10 MGD	
1.9.11	Assembly garage station 1
1.9.12	Assembly station 2
1.9.13	Assembly garage station 2
1.9.14	Assembly station 3
1.9.15	Assembly garage station 3
1.9.16	Assembly station 4
1.9.17	Assembly of Towers and roller Sheave assembly
1.9.18	Haul rope pulling
1.9.19	Transport of towers from bottom station to site
1.9.20	Transport of top station from bottom station to site
2.	Electrotechnical equipment
2.1	Drive system
2.1.1	Main drive motor
2.1.2	Frequency converter
2.1.3	Surcharge Direct drive electrotechnical part or comparable noise insulation measure
2.2	Low voltage supply
2.2.1	Low voltage distribution station 1
2.2.2	Low voltage distribution station 2
2.2.3	Low voltage distribution station 3
2.2.4	Standby DG Set 200KVA (valley station-2, hill station-1)
2.2.5	Standby DG Set 1200KVA (Valley station ropeway)
2.2.6	Standby DG Set 30KVA (Hill station ropeway)
2.3	Control and Station facilities
2.3.1	Control devices
2.3.2	Other Station facilities
2.3.3	Remote control stations
2.3.4	Earting and other material
2.3.5	Speech memory 6 languages
2.4	Electrical devices
2.4.1	Station panels
2.4.2	Station wiring
2.4.3	Batteries and charging equipment
2.4.4	Telephone and signaling system
2.5	Line facility
2.5.1	Station and tower connection
2.5.2	Line cable
2.5.3	Electronic rope position monitoring Electrical part
2.5.4	Control cable or fiber optic cable ropeway
2.5.5	Earthing cable

Annexure - IV: GL1 ZPTH - Old Bus Stand 10 MGD	
2.5.6	Power supply track lighting, LED-lights on towers
2.5.7	Incoming Electrical Panel with Cable
2.6	Electrical equipment cabins
2.6.1	Energy supply cabin
2.6.2	Communication device cabin
2.6.3	Interior lighting cabin
2.7	Equipment, tools, spare parts package elect
2.7.1	Spare parts package electrical engineering
2.7.2	Documentation, engineering services
2.7.3	Freight and packaging
2.7.4	Assembly of electrical equipment
3.	Haul rope
3.1	Haul rope
3.1.1	Haul rope compacted
3.1.2	Surcharge Haul rope "PERFORMA"

Annexure – V: Monocable gondola Section Old Bus Stand - Secretariat	
1.	Mechanical facilities
1.1	Station - Old Bus Stand
1.1.1	Return Unit

Annexure – V: Monocable gondola Section Old Bus Stand - Secretariat	
1.1.2	Return Unit, adjustable
1.1.3	Steel construction
1.1.4	Station facilities
1.1.5	Deceleration and acceleration
1.1.6	Connection section 1 - 2
1.1.7	Entry and exit facility, cabin guide
1.1.8	Station cladding
1.1.9	Steel structure connection
1.1.10	Fixtures including M & P
1.1.11	Safety net
1.2	Station Lift Point 2
1.2.1	Rope guide, rope deflection
1.2.2	Steel construction
1.2.3	Steel structure intermediate station
1.2.4	Safety net
1.2.5	Station facilities
1.2.6	Deceleration, acceleration device
1.2.7	Connection section 1 - 2
1.2.8	Entry and exit facility
1.2.9	Station cladding
1.2.10	Lifting and lowering platform access area
1.2.11	Steel structure connection
1.2.12	Fixtures including M & P
1.2.13	Safety net
1.3	Station - Secretariat
1.3.1	Tensioning device
1.3.2	Drive unit
1.3.3	Bridge drive adjustable
1.3.4	Surcharge Bridge drive direct drive Mechanical or comparable noise insulation measure
1.3.5	Steel construction
1.3.6	Station facilities
1.3.7	Deceleration, acceleration device
1.3.8	Entry and exit facility, cabin guide
1.3.9	Station cladding
1.3.10	Lifting and lowering platform access area
1.3.11	Garage
1.3.12	Steel construction station
1.3.13	Steel construction drive station

Annexure – V: Monocable gondola Section Old Bus Stand - Secretariat	
1.3.14	Safety net
1.3.15	Garage Station 1 Sektion 1
1.4	Line equipment
1.4.1	Section 1 Old Bus Stand - Lift Point 2
1.4.1.1	Towers galvanized
1.4.1.2	Surcharge Sunshades prop shaft
1.4.1.3	Sheave assemblies (sheave assemblies)
1.4.1.4	Support sheave assemblies D = appr 500 mm
1.4.1.5	Compression sheave assemblies D = appr 400 mm
1.4.1.6	Support/Compressing sheave ass. D = appr 400 mm
1.4.1.7	Support sheave assemblies D = appr 550 mm
1.4.1.8	Support/Compressing sheaves D = appr 550 mm
1.4.1.9	Electronic rope position monitoring mechanical part
1.4.2	Section 2 Lift Point 2 - Secretariat
1.4.2.1	Towers galvanized
1.4.2.2	Surcharge Sunshades prop shaft
1.4.2.3	Sheave assemblies (sheave assemblies)
1.4.2.4	Support sheave assemblies D = appr 500 mm
1.4.2.5	Compression sheave assemblies D = appr 400 mm
1.4.2.6	Support/Compressing sheave ass. D = appr 400 mm
1.4.2.7	Support sheave assemblies D = appr 550 mm
1.4.2.8	Support/Compressing sheaves D = appr 550 mm
1.4.2.9	Electronic rope position monitoring mechanical part
1.4.2.10	Towers galvanized, including crossmember, lifting jack, platforms, ladders
1.4.2.11	Surcharge Rodent protection electric cables
1.5	Carriers
1.5.1	Grips and Cabins
1.5.2	Grips and hangers
1.5.3	Ropeway cabin (10 Person)
1.5.4	Surcharge wooden Seat
1.5.5	Surcharge Top-hung window on mast side
1.5.6	Surcharge Front top-hung window
1.5.7	Surcharge Heat-insulating screen filming
1.6	Evacuation facilities
1.6.1	Integrated recovery concept
1.6.2	Vertical evacuation equipment
1.7	Equipments, tools, spare parts package mech.
1.7.1	Inspection vehicle, maintenance hangers
1.7.2	Tools

Annexure – V: Monocable gondola Section Old Bus Stand - Secretariat	
1.7.3	Spare parts package ropeway technology
1.7.4	Signage
1.8	Execution of the assembly work
1.8.1	Assembly station 1
1.8.2	Assembly garage station 1
1.8.3	Assembly station 2
1.8.5	Assembly station 3
1.8.4	Assembly garage station 3
1.8.6	Assembly of Carriers
1.8.7	Assembly of Towers and roller Sheave assembly
1.8.8	Haul rope pulling + splicing
1.8.9	Assembly station 1
1.8.10	Assembly garage station 1
1.8.11	Assembly station 2
1.8.12	Assembly garage station 2
1.8.13	Assembly station 3
1.8.14	Assembly garage station 3
1.8.15	Assembly of Towers and roller Sheave assembly
1.8.16	Haul rope pulling
1.8.17	Transport of towers from bottom station to site
1.8.18	Transport of top station from bottom station to site
2.	Electrotechnical equipment
2.1	Drive system
2.1.1	Main drive motor
2.1.2	Frequency converter
2.1.3	Surcharge Direct drive electrotechnical part or comparable noise insulation measure
2.2	Low voltage supply
2.2.1	Low voltage distribution station 1
2.2.2	Low voltage distribution station 2
2.2.3	Low voltage distribution station 3
2.2.4	Standby DG Set 200KVA (valley station-2, hill station-1)
2.2.5	Standby DG Set 840KVA (Valley station ropeway)
2.2.6	Standby DG Set 30KVA (Hill station ropeway)
2.3	Control and Station facilities
2.3.1	Control devices
2.3.2	Other Station facilities

Annexure – V: Monocable gondola Section Old Bus Stand - Secretariat	
2.3.3	Remote control stations
2.3.4	Earting and other material
2.3.5	Speech memory 6 languages
2.4	Electrical devices
2.4.1	Station panels
2.4.2	Station wiring
2.4.3	Batteries and charging equipment
2.4.4	Telephone and signaling system
2.2.4	Standby DG Set 200KVA (valley station-2, hill station-1)
2.2.5	Standby DG Set 840KVA (Valley station ropeway)
2.2.6	Standby DG Set 30KVA (Hill station ropeway)
2.5	Line facility
2.5.1	Station and tower connection
2.5.2	Line cable
2.5.3	Electronic rope position monitoring Electrical part
2.5.4	Control cable or fibre optic cable ropeway
2.5.5	Earthing cable
2.5.6	Power supply track lighting, LED-lights on towers
2.5.7	Incoming Electrical Panel with Cable
2.6	Electrical equipment cabins
2.6.1	Energy supply cabin
2.6.2	Communication device cabin
2.6.3	Interior lighting cabin
2.7	Equipment, tools, spare parts package elect
2.7.1	Spare parts package electrical engineering
2.7.2	Documentation, engineering services
2.7.3	Freight and packaging
2.7.4	Assembly of electrical equipment
3.	Haul rope
3.1	Haul rope
3.1.1	Haul rope compacted
3.1.2	Surcharge Haul rope "PERFORMA"

Annexure - VI: BL1 ISBT - ICR 10 MGD	
A	Monocable gondola Section ISBT - ICR
1.	Mechanical facilities
1.1	Station ISBT

Annexure - VI: BL1 ISBT - ICR 10 MGD	
1.1.1	Tensioning device
1.1.2	Drive unit
1.1.3	Bridge drive adjustable
1.1.4	Surcharge Bridge drive direct drive Mechanical or comparable noise insulation measure
1.1.5	Steel construction
1.1.6	Station facilities
1.1.7	Deceleration, acceleration device
1.1.8	Entry and exit facility, cabin guide
1.1.9	Station cladding
1.1.10	Steel construction station
1.1.11	Steel construction drive station
1.1.12	Safety net
1.2	Station 103 Tunnel
1.2.1	Rope guide, rope deflection
1.2.2	Steel construction
1.2.3	Steel structure intermediate station
1.2.4	Safety net
1.2.5	Station facilities
1.2.6	Deceleration, acceleration device
1.2.7	Connection section 1 - 2
1.2.8	Entry and exit facility, cabin guide
1.2.9	Station cladding
1.2.10	Steel structure connection section 1
1.2.11	Fixtures including M & P
1.2.12	Safety net
1.3	Station Victory Tunnel
1.3.1	Rope guide, rope deflection
1.3.2	Steel construction
1.3.3	Steel structure intermediate station
1.3.4	Safety net
1.3.5	Station facilities
1.3.6	Deceleration, acceleration device
1.3.7	Connection section 1 - 2
1.3.8	Entry and exit facility, cabin guide
1.3.9	Station cladding
1.3.10	Steel structure connection section 1
1.3.11	Fixtures including M & P
1.3.12	Safety net

Annexure - VI: BL1 ISBT - ICR 10 MGD	
1.4	Station ICR
1.4.1	Return Unit
1.4.2	Return Unit, adjustable
1.4.3	Steel construction
1.4.4	Station facilities
1.4.5	Deceleration and acceleration
1.4.6	Connection section 1 - 2
1.4.7	Entry and exit facility, cabin guide
1.4.8	Station cladding
1.4.9	Steel structure connection section 1
1.4.10	Fixtures including M & P
1.4.11	Safety net
1.5	Line equipment
1.5.1	Section 1 ISBT - 103 Tunnel
1.5.1.1	Towers galvanized
1.5.1.2	Surcharge Sunshades prop shaft
1.5.1.3	Sheave assemblies (sheave assemblies)
1.5.1.4	Support sheave assemblies D = appr 500 mm
1.5.1.5	Compression sheave assemblies D = appr 400 mm
1.5.1.6	Support/Compressing sheave ass. D = appr 400 mm
1.5.1.7	Support sheave assemblies D = appr 550 mm
1.5.1.8	Support/Compressing sheaves D = appr 550 mm
1.5.1.9	Electronic rope position monitoring mechanical part
1.5.2	Section 2 103 Tunnel - Victory Tunnel
1.5.2.1	Towers galvanized
1.5.2.2	Surcharge Sunshades prop shaft
1.5.2.3	Sheave assemblies (sheave assemblies)
1.5.2.4	Support sheave assemblies D = appr 500 mm
1.5.2.5	Compression sheave assemblies D = appr 400 mm
1.5.2.6	Support/Compressing sheave ass. D = appr 400 mm
1.5.2.7	Support sheave assemblies D = appr 550 mm
1.5.2.8	Support/Compressing sheaves D = appr 550 mm
1.5.2.9	Electronic rope position monitoring mechanical part
1.5.3	Section 3 Victory Tunnel - ICR
1.5.3.1	Towers galvanized
1.5.3.2	Surcharge Sunshades prop shaft
1.5.3.3	Sheave assemblies (sheave assemblies)
1.5.3.4	Support sheave assemblies D = appr 500 mm
1.5.3.5	Compression sheave assemblies D = appr 400 mm

Annexure - VI: BL1 ISBT - ICR 10 MGD	
1.5.3.6	Towers galvanized, including crossmember, lifting jack, platforms, ladders
1.5.3.7	Surcharge Rodent protection electric cables
1.6	Support/Compressing sheave ass. D = appr 400 mm
1.6.1	Support sheave assemblies D = appr 550 mm
1.6.2	Support/Compressing sheaves D = appr 550 mm
1.6.3	Electronic rope position monitoring mechanical part
1.7	Carriers
1.7.1	Grips and Cabins
1.7.2	Grips and hangers
1.7.3	Ropeway cabin 10 Pers
1.7.4	Surcharge wooden Seat
1.7.5	Surcharge Top-hung window on mast side
1.7.6	Surcharge Front top-hung window
1.7.7	Surcharge Heat-insulating screen filming
1.8	Evacuation facilities
1.8.1	Integrated recovery concept
1.8.2	Vertical evacuation equipment
1.9	Equipment's, tools, spare parts package mech.
1.9.1.	Inspection vehicle, maintenance hangers
1.9.2	Tools
1.9.3	Spare parts package ropeway technology
1.9.4	Signage
1.10	Execution of the assembly work
1.10.1	Assembly station 1
1.10.2	Assembly garage station 1
1.10.3	Assembly station 2
1.10.4	Assembly garage station 2
1.10.5	Assembly station 3
1.10.6	Assembly of Carriers
1.10.7	Assembly of Towers and roller Sheave assembly
1.10.8	Haul rope pulling + splicing
1.10.9	Assembly station 1
1.10.10	Assembly garage station 1
1.10.11	Assembly station 2
1.10.12	Assembly garage station 2
1.10.13	Assembly station 3
1.10.14	Assembly garage station 3
1.10.15	Assembly of Towers and roller Sheave assembly
1.10.16	Haul rope pulling

Annexure - VI: BL1 ISBT - ICR 10 MGD	
1.10.17	Transport of towers from bottom station to site
1.10.18	Transport of top station from bottom station to site
2	Electrotechnical equipment
2.1	Drive system
2.1.1	Main drive motor
2.1.2	Frequency converter
2.1.3	Surcharge Direct drive electrotechnical part or comparable noise insulation measure
2.2	Low voltage supply
2.2.1	Low voltage distribution station 1
2.2.2	Low voltage distribution station 2
2.2.3	Low voltage distribution station 3
2.2.4	Low voltage distribution station 4
2.2.5	Standby DG Set 1200KVA (station 1 - Drive station ropeway)
2.2.4	Standby DG Set 30KVA (station-2)
2.2.6	Standby DG Set 30KVA (station-3)
2.3	Control and Station facilities
2.3.1	Control devices
2.3.2	Other Station facilities
2.3.3	Remote control stations
2.3.4	Earting and other material
2.3.5	Speech memory 6 languages
2.4	Electrical devices
2.4.1	Station panels
2.4.2	Station wiring
2.4.3	Batteries and charging equipment
2.4.4	Telephone and signalling system
2.5	Line facility
2.5.1	Station and tower connection
2.5.2	Line cable
2.5.3	Electronic rope position monitoring Electrical part
2.5.4	Control cable or fiber optic cable ropeway
2.5.5	Earthing cable
2.5.6	Power supply track lighting, LED-lights on towers
2.5.7	Incoming Electrical Panel with Cable
2.6	Electrical equipment cabins
2.6.1	Energy supply cabin
2.6.2	Communication device cabin
2.6.3	Interior lighting cabin
2.7	Equipments, tools, spare parts package elect

Annexure - VI: BL1 ISBT - ICR 10 MGD	
2.7.1	Spare parts package electrical engineering
2.7.2	Documentation, engineering services
2.7.3	Freight and packaging
2.7.4	Assembly of electrical equipment
3.	Haul rope
3.1	Haul rope
3.1.1	Haul rope compacted
3.1.2	Surcharge Haul rope "PERFORMA"

Annexure - VII: BL2 ICR - Sanjauli 10 MGD	
A	Monocable gondola Section ICR - Sanjauli
1.	Mechanical facilities
1.1	Station - ICR
1.1.1	Return Unit
1.1.2	Return Unit, adjustable
1.1.3	Steel construction
1.1.4	Station facilities
1.1.5	Deceleration and acceleration
1.1.6	Connection section 1 - 2
1.1.7	Entry and exit facility, cabin guide
1.1.8	Station cladding
1.1.9	Steel construction station
1.1.10	Fixtures including M & P
1.1.11	Safety net
1.2	Station IGMC
1.2.1	Rope guide, rope deflection
1.2.2	Steel construction
1.2.3	Steel structure intermediate station
1.2.4	Safety net
1.2.5	Station facilities
1.2.6	Deceleration and acceleration
1.2.7	Connection section 1 - 2
1.2.8	Entry and exit facility, cabin guide
1.2.9	Station cladding
1.2.10	Lifting and lowering platform access area
1.2.11	Garage
1.2.12	Steel structure connection section 1
1.2.13	Fixtures including M & P
1.2.14	Safety net
1.2.15	Garage Station 1 Sektion 1
1.3	Station Sanjauli
1.3.1	Tensioning device
1.3.2	Drive unit
1.3.3	Bridge drive adjustable
1.3.4	Surcharge Bridge drive direct drive Mechanical or comparable noise insulation measure
1.3.5	Steel construction
1.3.6	Station facilities
1.3.7	Deceleration, acceleration device

Annexure - VII: BL2 ICR - Sanjauli 10 MGD	
1.3.8	Entry and exit facility, cabin guide
1.3.9	Station cladding
1.3.10	Steel construction station
1.3.11	Steel construction drive station
1.3.12	Safety net
1.4	Line equipment
1.4.1	Section 1 ICR - IGMC
1.4.1.1	Towers galvanized
1.4.1.2	Surcharge Sunshades prop shaft
1.4.1.3	Sheave assemblies (sheave assemblies)
1.4.1.4	Support sheave assemblies D = appr 500 mm
1.4.1.5	Compression sheave assemblies D = appr 400 mm
1.4.1.6	Support/Compressing sheave ass. D = appr 400 mm
1.4.1.7	Support sheave assemblies D = appr 550 mm
1.4.1.8	Support/Compressing sheaves D = appr 550 mm
1.4.1.9	Electronic rope position monitoring mechanical part
1.4.2	Section 2 IGMC - Sanjauli
1.4.2.1	Towers galvanized
1.4.2.2	Surcharge Sunshades prop shaft
1.4.2.3	Sheave assemblies (sheave assemblies)
1.4.2.4	Support sheave assemblies D = appr 500 mm
1.4.2.5	Compression sheave assemblies D = appr 400 mm
1.4.2.6	Support/Compressing sheave ass. D = appr 400 mm
1.4.2.7	Support sheave assemblies D = appr 550 mm
1.4.2.8	Support/Compressing sheaves D = appr 550 mm
1.4.2.9	Electronic rope position monitoring mechanical part
1.4.2.10	Towers galvanized, including crossmember, lifting jack, platforms, ladders
1.4.2.11	Surcharge Rodent protection electric cables
1.5	Carriers (final expansion 3000 PPHD)
1.5.1	Grips and Cabins (initial expansion)
1.5.2	Grips and hangers
1.5.3	Ropeway cabin 10 Pers
1.5.4	Surcharge wooden Seat
1.5.5	Surcharge Top-hung window on mast side
1.5.6	Surcharge Front top-hung window
1.5.7	Surcharge Heat-insulating screen filming
1.6	Evacuation facilities
1.6.1	Integrated recovery concept
1.6.2	Vertical evacuation equipment

Annexure - VII: BL2 ICR - Sanjauli 10 MGD	
1.7	Equipments, tools, spare parts package mech.
1.7.1	Inspection vehicle, maintenance hangers
1.7.2	Tools
1.7.3	Spare parts package ropeway technology
1.7.4	Signage
1.8	Execution of the assembly work
1.8.1	Assembly station 1
1.8.2	Assembly garage station 1
1.8.3	Assembly station 2
1.8.4	Assembly garage station 2
1.8.5	Assembly station 3
1.8.6	Assembly of Carriers
1.8.7	Assembly of Towers and roller Sheave assembly
1.8.8	Haul rope pulling + splicing
1.8.9	Assembly station 1
1.8.10	Assembly garage station 1
1.8.11	Assembly station 2
1.8.12	Assembly garage station 2
1.8.13	Assembly station 3
1.8.14	Assembly garage station 3
1.8.15	Assembly of Towers and roller Sheave assembly
1.8.16	Haul rope pulling
1.8.17	Transport of towers from bottom station to site
1.8.18	Transport of top station from bottom station to site
2.	Electrotechnical equipment
2.1	Drive system
2.1.1	Main drive motor
2.1.2	Frequency converter
2.1.3	Surcharge Direct drive electrotechnical part or comparable noise insulation measure
2.2	Low voltage supply
2.2.1	Low voltage distribution station 1
2.2.2	Low voltage distribution station 2
2.2.3	Low voltage distribution station 3
2.2.4	Standby DG Set 30KVA (valley station-2, hill station-1)
2.2.5	Standby DG Set 840KVA (Valley station ropeway)
2.2.6	Standby DG Set 30KVA (Hill station ropeway)
2.3	Control and Station facilities
2.3.1	Control devices

Annexure - VII: BL2 ICR - Sanjauli 10 MGD	
2.3.2	Other Station facilities
2.3.3	Remote control stations
2.3.4	Earthing and other material
2.3.5	Speech memory 6 languages
2.4	Electrical devices
2.4.1	Station panels
2.4.2	Station wiring
2.4.3	Batteries and charging equipment
2.4.4	Telephone and signaling system
2.5	Line facility
2.5.1	Station and tower connection
2.5.2	Line cable
2.5.3	Electronic rope position monitoring Electrical part
2.5.4	Control cable or fiber optic cable ropeway
2.5.5	Earthing cable
2.5.6	Power supply track lighting, LED-lights on towers
2.5.7	Incoming Electrical Panel with Cable
2.6	Electrical equipment cabins
2.6.1	Energy supply cabin
2.6.2	Communication device cabin
2.6.3	Interior lighting cabin
2.7	Equipment, tools, spare parts package elect
2.7.1	Spare parts package electrical engineering
2.7.2	Documentation, engineering services
2.7.3	Freight and packaging
2.7.4	Assembly of electrical equipment
3.	Haul rope
3.1	Haul rope
3.1.1	Haul rope compacted
3.1.2	Surcharge Haul rope "PERFORMA"

Annexure - VIII: BL3 Sanjauli- Secretariat 10 MGD	
Monocable gondola Section Sanjauli - Secretariat	
1.	Mechanical facilities
1.1	Station - Sanjauli
1.1.1	Return Unit
1.1.2	Return Unit, adjustable
1.1.3	Steel construction
1.1.4	Station facilities
1.1.5	Deceleration and acceleration
1.1.6	Connection section 1 - 2
1.1.7	Entry and exit facility, cabin guide
1.1.8	Station cladding
1.1.9	Steel construction station
1.1.10	Safety net
1.2	Station Navbahar
1.2.1	Rope guide, rope deflection
1.2.2	Steel construction
1.2.3	Steel structure intermediate station
1.2.4	Safety net
1.2.5	Station facilities
1.2.6	Deceleration, acceleration device
1.2.7	Connection section 1 - 2
1.2.8	Entry and exit facility
1.2.9	Station cladding
1.2.10	Lifting and lowering platform access area
1.2.11	Steel structure connection
1.2.12	Fixtures including M & P
1.2.13	Safety net
1.3	Station Secretariat
1.3.1	Tensioning device
1.3.2	Drive unit
1.3.3	Bridge drive adjustable
1.3.4	Surcharge Bridge drive direct drive Mechanical or comparable noise insulation measure
1.3.5	Steel construction
1.3.6	Station facilities
1.3.7	Deceleration, acceleration device
1.3.8	Connection section 1 - 2
1.3.9	Entry and exit facility, cabin guide
1.3.10	Station cladding
1.3.11	Lifting and lowering platform access area

Annexure - VIII: BL3 Sanjauli- Secretariat 10 MGD	
1.3.12	Steel structure connection
1.3.13	Fixtures including M & P
1.3.14	Safety net
1.4	Line equipment
1.4.1	Section 1 Sanjauli - Navbahar
1.4.1.1	Towers galvanized
1.4.1.2	Surcharge Sunshades prop shaft
1.4.1.3	Sheave assemblies (sheave assemblies)
1.4.1.4	Support sheave assemblies D = appr 500 mm
1.4.1.5	Compression sheave assemblies D = appr 400 mm
1.4.1.6	Support/Compressing sheave ass. D = appr 400 mm
1.4.1.7	Support sheave assemblies D = appr 550 mm
1.4.1.8	Support/Compressing sheaves D = appr 550 mm
1.4.1.9	Electronic rope position monitoring mechanical part
1.4.2	Section 2 Navbahar - Secretariat
1.4.2.1	Towers galvanized
1.4.2.2	Surcharge Sunshades prop shaft
1.4.2.3	Sheave assemblies (sheave assemblies)
1.4.2.4	Support sheave assemblies D = appr 500 mm
1.4.2.5	Compression sheave assemblies D = appr 400 mm
1.4.2.6	Support/Compressing sheave ass. D = appr 400 mm
1.4.2.7	Support sheave assemblies D = appr 550 mm
1.4.2.8	Support/Compressing sheaves D = appr 550 mm
1.4.2.9	Electronic rope position monitoring mechanical part
1.4.2.10	Towers galvanized, including crossmember, lifting jack, platforms, ladders
1.4.2.11	Surcharge Rodent protection electric cables
1.5	Carriers (final expansion 3000 PPHD)
1.5.1	Grips and Cabins (initial expansion)
1.5.2	Grips and hangers
1.5.3	Ropeway cabin 10 Pers
1.5.4	Surcharge wooden Seat
1.5.5	Surcharge Top-hung window on mast side
1.5.6	Surcharge Front top-hung window
1.5.7	Surcharge Heat-insulating screen filming
1.6	Evacuation facilities
1.6.1	Integrated recovery concept
1.6.2	Vertical evacuation equipment
1.7	Equipment's, tools, spare parts package mech.
1.7.1	Inspection vehicle, maintenance hangers

Annexure - VIII: BL3 Sanjauli- Secretariat 10 MGD	
1.7.2	Tools
1.7.3	Spare parts package ropeway technology
1.7.4	Signage
1.8	Execution of the assembly work
1.8.1	Assembly station 1
1.8.2	Assembly garage station 1
1.8.3	Assembly station 2
1.8.4	Assembly garage station 2
1.8.5	Assembly station 3
1.8.6	Assembly of Carriers
1.8.7	Assembly of Towers and roller Sheave assembly
1.8.8	Haul rope pulling + splicing
1.8.9	Assembly station 1
1.8.10	Assembly garage station 1
1.8.11	Assembly station 2
1.8.12	Assembly garage station 2
1.8.13	Assembly station 3
1.8.14	Assembly garage station 3
1.8.15	Assembly of Towers and roller Sheave assembly
1.8.16	Haul rope pulling
1.8.17	Transport of towers from bottom station to site
1.8.18	Transport of top station from bottom station to site
2.	Electrotechnical equipment
2.1	Drive system
2.1.1	Main drive motor
2.1.2	Frequency converter
2.1.3	Surcharge Direct drive electrotechnical part or comparable noise insulation measure
2.2	Low voltage supply
2.2.1	Low voltage distribution station 1
2.2.2	Low voltage distribution station 2
2.2.3	Low voltage distribution station 3
2.2.4	Standby DG Set 30KVA (valley station-2, hill station-1)
2.2.5	Standby DG Set 840KVA (Valley station ropeway)
2.2.6	Standby DG Set 30KVA (Hill station ropeway)
2.3	Control and Station facilities
2.3.1	Control devices

Annexure - VIII: BL3 Sanjauli- Secretariat 10 MGD	
2.3.2	Other Station facilities
2.3.3	Remote control stations
2.3.4	Earthing and other material
2.3.5	Speech memory 6 languages
2.4	Electrical devices
2.4.1	Station panels
2.4.2	Station wiring
2.4.3	Batteries and charging equipment
2.4.4	Telephone and signaling system
2.5	Line facility
2.5.1	Station and tower connection
2.5.2	Line cable
2.5.3	Electronic rope position monitoring Electrical part
2.5.4	Control cable or fiber optic cable ropeway
2.5.5	Earthing cable
2.5.6	Power supply track lighting, LED-lights on towers
2.5.7	Incoming Electrical Panel with Cable
2.6	Electrical equipment cabins
2.6.1	Energy supply cabin
2.6.2	Communication device cabin
2.6.3	Interior lighting cabin
2.7	Equipment, tools, spare parts package elect
2.7.1	Spare parts package electrical engineering
2.7.2	Documentation, engineering services
2.7.3	Freight and packaging
2.7.4	Assembly of electrical equipment
3.	Haul rope
3.1	Haul rope
3.1.1	Haul rope compacted
3.1.2	Surcharge Haul rope "PERFORMA"

24. **APPEXDIX 18 - TESTS ON COMPLETION - ROPEWAY PROJECT**

1. **Schedule for Tests:**

- i. The Contractor shall, at least 30 (thirty) days before the anticipated completion of construction, notify the Engineer (GC) and the Authority regarding the intention to subject the Ropeway Project to Tests. Detailed inventory and particulars of all works and equipment forming part of the project shall be furnished to the GC and the Authority no later than 10 (ten) days before the actual Test date.
- ii. The Contractor shall notify the GC of readiness to conduct Tests on the Ropeway Project no sooner than 10 (ten) days after such notice. The GC, in consultation with the Contractor, shall determine the date and time for each Test and inform the Authority, who may designate its representative to witness the Tests. The GC shall then conduct the Tests or arrange for their conduct in accordance with Article 12 and this APPENDIX 18.

2. **Tests:**

- i. Before the Ropeway is commissioned, it shall be submitted to installation tests to check that it meets the requirements of the approved plans and specifications.
- ii. Full Load Tests for continuous 24 hours in which each cabin is ballasted with equivalent weight of seating capacity with weight of each passenger to be considered as 80kg as per relevant IS Code.
- iii. Full-down empty up and Full-up empty down for 2 hours of time and will calculate that the ropeway can be stopped using service or emergency brakes in stipulated manner.
- iv. The installation, routine and periodic tests shall be carried out in line with the BIS standards and specifications. In case of absence of BIS standards, suitable/applicable international standards for Ropeway and other relevant standards for other project components shall be followed. The Ropeway system shall be accepted by the RTDC only after obtaining a completion certificate from the designated authority.

3. **Agency for Conducting Tests:**

All Tests set forth in this Schedule-K shall be conducted by the Independent Engineer or any other designated agency or individual as specified by the GC in consultation with the Authority.

4. **Tests for Safety Certification**

The Tests to determine the conformity of the project with the Safety Requirements shall be conducted in accordance with Good Industry Practice and in conformity with Applicable Laws.

5. Completion Certificate:

Upon successful completion of Tests, the Engineer shall Take Over the work as the provisions of **GC Clause 10**.

6. Testing by Authority:

Sr. No.	Key Metrics of Asset	Equipment
1	Surface Defects on Ropeway	Visual Inspection
2	Rope Wear and Tear	Rope Inspection Kit
3	Ropeway Tension	Tension Meter
4	Grip Performance	Grip Force Tester
5	Cabin Doors and Seals	Visual Inspection
6	Safety Braking Systems	Operational Testing
7	Emergency Evacuation Systems	Drill and Simulation Exercises
8	Structural Integrity of Towers and Supports	Visual Inspection
9	Electrical Systems	Electrical Testing Equipment
10	Weather Monitoring Equipment	Anemometer, Thermometer, etc.
11	Communication Systems	Communication Testing Equipment
12	Emergency Power Supply	Backup Generator
13	Passenger Comfort	Survey and Feedback from Passengers
14	Environmental Impact	Environmental Audit
15	Safety Audit	Safety Inspection and Audit

These tests cover various aspects of the Ropeway Project, ensuring its safe and efficient operation while complying with regulatory standards and ensuring passenger comfort and safety.

25. APPENDIX 18 - FORMAT OF COMPLETION CERTIFICATE

1. We, PINI INDIA PVT. LTD. , acting as the Engineer(GC) under the Agreement dated March 26, 2024 (the “Agreement”), for the Construction of Ropeway Red Line Between Taradevi – Chakkar – Tutikandi parking 2.10 KM, Green Line Tutikandi Parking (ZPTH) – ISBT – Railway Station – Old Bus Stand – Lift Point – Secretariat 5.14 KM and Blue Line ISBT – 103 Tunnel – victory Tunnel – ICR- IGMC- Sanjauli – Navbahar – Secretariat 6.55 KM – Total Length of 13.79 KM District Shimla in State of Himachal Pradesh On Engineering, Procurement and Construction (EPC) basis through [Name of Contractor], hereby certify that the Tests in accordance with Article 12 of the Agreement have been successfully undertaken to determine compliance of the Ropeway Project with the provisions of the Agreement. I am satisfied that the Ropeway Project is ready and safe for operation.
2. It is certified that, in terms of the aforesaid Agreement, all works forming part of the Ropeway Project have been completed, and the Ropeway Project is hereby declared fit for entry into operation on this [insert day] of [insert month] 20[insert year], the scheduled completion date for which was the [insert scheduled completion date].

SIGNED, SEALED AND DELIVERED

For and on behalf of the GC by:

(Signature)

(Name)

(Designation)

(Address)

26. APPENDIX 19 - SELECTION OF ENGINEER

The Authority has already appointed “M/s PINI INDIA PVT. LTD.” as Engineer (GC) for this project. GC will be working as Contract Administrator on behalf of RTDC and will act as Engineer of the Project.

The “Deputy General Manager, RTDC, Shimla, H.P” of the Authority is responsible for the overall supervision and monitoring of the execution of project as the representative of the owner of the project.

GC (i.e., M/s PINI INDIA PVT.LTD) is appointed to assist the Authority for carrying out the functions as detailed under GC/PC Sub Clause 1.1.35. As such, an officer of the Authority is vested with all such powers and responsibilities as are enjoined upon the GC and is fully competent to issue any instructions for proper monitoring and supervision of the project, either by himself or through the GC. Instructions issued by the concerned officer of the Authority shall have the same effect as that of the GC in terms of this Agreement. Wherever such concerned officer issues any instructions or notice to the Contractor, he shall endorse a copy thereof to the GC.

As such, an officer of the Authority is vested with all such powers and responsibilities as are enjoined upon the GC and is fully competent to issue any instructions for proper monitoring and supervision of the project, either by himself or through the GC. Instructions issued by the concerned officer of the Authority shall have the same effect as that of the GC in terms of this Agreement. Wherever such concerned officer issues any instructions or notice to the Contractor, he shall endorse a copy thereof to the GC.

27. APPENDIX 20 – ENVIRONMENTAL & SOCIAL MANAGEMENT ACTION PLAN

Based on the environmental assessment of the project activities, an Environmental and Social Management Plan (ESMP) has been developed for the project to mitigate any adverse environmental impacts. The EMP discusses anticipated impacts, mitigation measures, monitoring requirements and responsible authorities to implement the ESMP with respect to the different project stages. Detailed, site-specific mitigation measures (Environment Management Action Plan) and monitoring plans have been developed to be implemented during the project construction/implementation phase.

Tentative Environment and Social Management Action Plan (ESMP) for the project is provided in Appendix which identifies feasible and cost-effective measures to be taken to reduce potential significant, adverse, impacts to acceptable levels. Here, proper mitigation measures are proposed for each potential environmental activity/impact, including details on responsible parties for implementation of mitigation measures and supervision.

The monitoring of the Environmental aspects of the project shall be done at site by the Environmental Safeguard Specialists of RTDC/GC. Activities to be monitored include: all planning, coordination and management activities related to the implementation of safeguard issues; the identification of corrective and preventive actions; records of health and safety matters and training activities; worker and community near misses, minor, fatal accidents during construction; consultations with project affected people (as and when needed, particularly during the implementation); feedback, trouble shooting and project related grievances; preparation of progress and monitoring reports as required by the Employer (RTDC); and verifying the projects overall compliance with safeguard measures. Other environmental good practices include sanitary waste management, noise abatement, maintaining hygienic conditions, maintenance of fire and safety equipment. Environmental Safeguard Specialist of RTDC/PMSC will ensure that Contractor adhere and comply with all measures and procedures as identified in the ESMP

Environmental Parameters to be monitored; To ensure that the project will not generate negative impacts to the overall environment quality, monitoring of environmental parameter has to be performed by Contractor as per contract provisions. Monitoring of the quality of water, soil, air and noise during the pre-construction (to establish baseline) and construction stage is the responsibility of the Contractor by the Central Pollution Control Board approved agency. The measurement of environmental parameters and its periodicity for the project is summarized in ESMP.

The contractor will have the provision of a Senior Health, Safety and Environmental Expert to implement the environmental requirements of the project.

ESMP during Construction

Activities/ Concerns	Potential impacts	Assessed Risk level	Mitigation measures	Monitoring Indicators	Institutional Responsibilities	
					Implemen tation	Supervision
Submission of C-ESMP	-		-	-	Contractor	Safeguard Team, of construction phase of RTDC LTD /GC
Labour management risk	Delayed and Unpaid wages to workers and suppliers Contractor's inability to provide adequate facilities for workers at worksite and work camp.	Medium	- Include requirements for contractors in the bidding documents This will include - labour management obligations with effective non-compliance remedies which will be applied where there is a breach; and - E&S guarantee which can be applied against contractor in case of non-compliance with the labor management requirements	Feedback from workers and other Parties about receipt of their wages and payment in a timely manner as per the requirements of relevant labour laws. Employee registers (attendance, wages, overtime) maintained on site. Basic facilities (Gender segregated toilets, canteen, crèche facilities, etc.)	Contractor	RTDC /Engineer

Activities/ Concerns	Potential impacts	Assessed Risk level	Mitigation measures	Monitoring Indicators	Institutional Responsibilities	
					Implemen tation	Supervision
				established at worksite as per relevant labour laws.		
Safety hazards due to increased traffic	Accident and incident risk	Medium	Traffic Management Plan (TMP) addressing general access Safety and security actions and procedures to protect the local community	Ensure the TMP is prepared and available at the project site	Contractor	Supervision Consultant
Work place injury and hazard	Increased risk of workforce injury. Failure of contractor to abide by labour standard requirements pertaining to community & labour health and safety,	Medium	- Include requirement for ESMP and Occupation, Health and Safety Plan in specifications - Provide trainings on health, safety and labour welfare requirements to the employees as per existing laws and regulations.	- Acceptable ESMP and Occupation, Health and Safety Plan included in specifications - Labour awareness level, labour welfare rights including occupational health and safety requirements	Contractor	Safeguard team of construction phase of Authority Engineer.

Activities/ Concerns	Potential impacts	Assessed Risk level	Mitigation measures	Monitoring Indicators	Institutional Responsibilities	
					Implemen tation	Supervision
	including labour welfare					
Risks related to community health and safety including SEA / SH	Community safety issues. Risks related to labour influx Local community complaints and inconvenience from project activities. Local community to push for hiring residents instead of outsiders. Risks of transmission of communicable diseases including	Low	- Contractor to Comply with safety guidelines and ensure compliance of Code of Conduct by all workers. - Undertake community and stakeholders' consultation. - Disseminate information on Grievance Redressal Mechanism - Provision of toll-free project helpline no. to register and redress grievances in a timely manner. - A clause to be included in the contract to mandate the hiring of locals than outsider.	- Monitor contractor performance related to safety and health issues - Number of grievances received and redressed by multiple intake channels including GRC at the community and project level. - Number of local workers hired by the contractor during the construction period - Number of trainings and awareness camps on COVID-19,	Contractor PMU	Engineer

Activities/ Concerns	Potential impacts	Assessed Risk level	Mitigation measures	Monitoring Indicators	Institutional Responsibilities	
					Implemen tation	Supervision
	COVID-19, HIV/AIDS, etc.		Contractor to ensure compliance of guidelines on management of COVID-19 pandemic	HIV/AIDS, GRM organised on site and with host community.		
	SEA/SH risks	Low	- Contractor to setup an Internal Complaints Committee (ICC) and provide trainings as per the requirements of the Sexual Harassment at the Workplace (Prevention, Prohibition and Redressal) Act, 2013 - Mandatory training and dissemination of information related to SEA/SH risks, lawful conduct of workers	ICC setup by the contractor Number of complaints redressed by the ICC Number of trainings and awareness camps on SEA/SH organised on sites. Number of trainings and awareness camps on Worker's Code of Conduct organized on site.	Contractor	Engineer

Activities/ Concerns	Potential impacts	Assessed Risk level	Mitigation measures	Monitoring Indicators	Institutional Responsibilities	
					Implemen tation	Supervision
			and consequences for failure to comply with law. - Contractor to ensure that each contractor's personnel is provided with a copy of the Code of Conduct and obtain that person's - Signature on receipt.			
Accidental leakage of oil, failure of unit	Risk to labours nearby residents	High	Contractor to ensure the up gradation of all equipment's and machinery	Record of frequency of accidents, strict monitoring	Contractor	Engineer
Chance find	Loss of cultural, historical items	Medium	Strictly follow the cultural and heritage management rule	Strict monitoring reporting to PMU and construction activities	Contractor	Engineer
Water logging	-	Low		Monitoring at site	Contractor	Engineer
Excavated		Medium	After utilization for same	Monitoring at site	Contractor	Engineer

Activities/ Concerns	Potential impacts	Assessed Risk level	Mitigation measures	Monitoring Indicators	Institutional Responsibilities	
					Implemen tation	Supervision
debris, soil disposal and management	-		during construction phase, balance materials, debris, discarded boxes, containers, drums etc; will be removed from the site. Solid waste, C&D waste will be segregated and disposed as per at designated sites in consultation with local authorities.			
Topsoil conservation		High		Monitoring at site	Contractor	Engineer
C&D waste	Impacts at working place and neighbouring people	Medium	- Disposal should be as per C&D waste as per C&D Rule 2016 - Segregation of C&D waste and deposit at collection centre or handover it to the authorized processing facilities. - To ensure that there is no littering or	Monitoring at site	Contractor	Engineer

Activities/ Concerns	Potential impacts	Assessed Risk level	Mitigation measures	Monitoring Indicators	Institutional Responsibilities	
					Implemen tation	Supervision
			deposition so as to prevent obstruction to the traffic or the public or drains. Removal of all C&D waste in consultation with concerned local authority on their own or through any agency			
Air Quality	Air pollution, fugitive dust emission due to dust, vehicle exhaust	High	- Keep the Air Quality within the acceptable limits - At feeding points stone crusher air mist spray shall be carried out - The contractor will be responsible for maintaining properly functioning construction equipment to minimize exhaust. - Construction equipment and	Monitoring of air quality	Contractor	Engineer

Activities/ Concerns	Potential impacts	Assessed Risk level	Mitigation measures	Monitoring Indicators	Institutional Responsibilities	
					Implemen tation	Supervision
			vehicles will be turned off when not used for extended periods of time. • Unnecessary idling of construction vehicles to be prohibited. • Effective traffic management to be undertaken to avoid significant delays in and around the project area. • Plantation of local species			
	Impact on biodiversity due to change in air quality	Medium	• Implementation of conservation measures	Monitoring of air quality	Contractor	Engineer
Noise and vibration	Noise pollution	Low to medium	• Vehicles to be equipped with mufflers recommended by the vehicle manufacturer. • The construction activities shall be	Monitoring of Noise levels	Contractor	Engineer

Activities/ Concerns	Potential impacts	Assessed Risk level	Mitigation measures	Monitoring Indicators	Institutional Responsibilities	
					Implemen tation	Supervision
			limited to day time. Suitable barriers shall be provided around construction sites. - Staging of construction equipment and unnecessary idling of equipment within noise sensitive areas to be avoided whenever possible. - Notification will be given to residents within 100m.			
Water quality	Water pollution	Low	- Keep the water quality within the acceptable limits - Provision of storm water and waste water management system - Provision of clean drinking & domestic water facility at labour camps and	Monitoring of water quality	Contractor	Engineer

Activities/ Concerns	Potential impacts	Assessed Risk level	Mitigation measures	Monitoring Indicators	Institutional Responsibilities	
					Implemen tation	Supervision
			construction site • Provision of Mobile Toilets			
Ecology	Impact on flora and fauna	Medium	• Implementation of conservation measures	Monitoring of flora, fauna in the vicinity of construction sites	Contractor	Engineer
Solid waste	Water and Air pollution	High	• Provision of solid waste management in construction phase • Collection, segregation and proper disposal of municipal waste, hazardous waste (used oil) and dredged soil	Monitoring in the construction camps	Contractor	Engineer

28. **APPENDIX 21 - TRAINING AND CAPACITY BUILDING** (Domestic and overseas)

1. CONSTRUCTION PHASE

- Project Scheduling and BIMS (Building Information Management System)
 - Introduction to Project Scheduling
 - Importance of BIMS in Project Implementation
 - Hands-on Training with BIMS Tools
 - Integration of BIMS with Project Scheduling
- Quality Control Management of Civil Works
 - Principles of Quality Control in Construction Projects
 - Techniques for Ensuring Quality in Civil Works
 - Case Studies and Best Practices
 - Quality Assurance vs. Quality Control
- Quality Control Management of E&M Works (Electrical & Mechanical).
 - Overview of E&M Works in Ropeway Projects
 - Challenges and Solutions in Quality Control for E&M Works
 - Standards and Regulations
 - Inspection and Testing Protocols
- **Training of Project Information Management Software**
 - Compatibility and Integration of Tools and Software
 - Automation and Efficiency Gains
 - Case Studies of Successful Integration
 - Future Trends in Project Management Technology
- Ropeway principles – general overview and understanding of ropeway design and operations.
- Ropeway regulation basics – general understanding of regulatory requirements and standards (EU regulations and CEN standards)
- FIDIC Claims and Disputes Resolution Course.
- FIDIC Contract Management and Administration Course.
- Theoretical Training on Ropeway Systems
 - Training on Operation – Safety in passenger transport, Operating modes, operating concept, Operation with the main drive, deactivation concept, Filling the carriers onto the line and carrier parking, Special operating modes, Opening

and closing, equipment for carriers, Behaviour in case of, unusual events (storm, lightning stroke, etc.)

- Training on Safety Devices – Aim and purpose of the safety devices, Switches, actuation of grip gauges, causes and interpretation of the shutdown, Simulation of general shutdowns – interpretation.
- Training on General checks and Inspections – Aim and purpose, Periodic inspections in accordance with the operation and maintenance manual, Functional checks.
- Training on Operation & maintenance Manual usage instructions – How to use the operation and maintenance manual, Daily operations log, documentation, inspection.
- and repair report, Operating instructions, Electrotechnical description.
- Training on Aim & Purpose of Load Test.
- Training on Maintenance requirements - Information on risks and hazards related to maintenance, Visual rope inspection, Simple maintenance procedures, Replacement criteria.
- Management Software (Maintain X)
- Visit to CEN Certified Manufacture facility and training on Ropeway Installation Procedures - Demonstration of and exercises with the functioning of all the components of Ropeway systems.
- Hands-on trainings courses at the manufacturer's facility on trouble-shooting and preventive maintenance.

Note: The Contractor shall intimate the Schedule/Period of each training, so the trainees are fully trained (familiar and through knowledge of the training subject).



Ropeways and Rapid Transport System Development Corporation HP Ltd.

प्रदूषण मुक्त यातायात के लिए हिमाचल की पहल



“Design, Supply, Construction, Installation, Testing, Commissioning and Operation & Maintenance for 5 (five) years of Seamless Innovative Urban Transportation (Ropeways, Lifts & Escalators Etc.) Network in Shimla City (Himachal Pradesh) on Engineering Procurement and Construction (EPC) Mode.”

**AUTHORITY’S REQUIREMENTS
FOR
OUTLINE CONSTRUCTION SPECIFICATIONS FOR CIVIL WORKS
Volume III (Part – 2)
October - 2024
Externally Aided Project
(Under Consideration for funding by New Development Bank)**

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SECTION – S.01

GENERAL

1.1 GENERAL:

- 1.1.1** These Specifications contained herein shall be read in conjunction with other parts of bid document.
- 1.1.2** The Work shall be carried out in accordance with the "Good for Construction" drawings and designs as would be issued to the Contractor by the Engineer duly signed and stamped by him. The Contractor shall not take cognizance of any drawings, designs, specifications, etc. not bearing the Engineer's signature and stamp. Similarly, the Contractor shall not take cognizance of instructions given by any other Authority except the instructions given by the Engineer in writing.
- 1.1.3** The work shall be executed and measured as per metric units given in the Schedule of Quantities, drawings etc. (FPS units where indicated are for guidance only).
- 1.1.4** The absence of terms such as providing, supplying, laying, installing, fixing etc. in the descriptions does not even remotely suggest that the Contractor is absolved of such providing, supplying etc. unless an explicit stipulation is made in this contract. The Owner shall bear no costs of materials, labour, equipment, duties, taxes, royalties etc.
- 1.1.5** The specifications may have been divided into different sections / sub-heads for convenience only. They do not restrict any cross-references. The Contractor shall take into account inter-relations between various parts of works/trades. No claim shall be entertained on the basis of compartmental interpretations.
- 1.1.6** The classification of various items of works for purposes of measurements and payments shall be as per bills of quantities (BOQ). Except where distinguished by BOQ, the rates apply to all heights, depths, sizes, shapes and locations. They also cater for all cuts and wastes. No floor-wise separation shall be made for the rates. Likewise, all heights of centering, shuttering, staging, formwork and scaffolding, launching trusses and other launching methods are covered by the rates including multistage propping for heights greater than one floor as per drawings.
- 1.1.7** Reference to the Standard Codes of Practice:
- The contractor shall make available on the site all relevant Codes of practice as applicable.

Legends	Definition
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers

AASTHO	American Association of State Highway and Transportation Officials
ASTM	American Section of the International Association for Testing and Materials
BS	British Standard
ISO	International Organization for Standardization
EN	European Standard
CPWD	Central Public Works Department
DIN	Deutsches Institut für Normung e.V.
IRC	Indian Road Congress
IRS	Indian Railway Standards
IS	Indian Standards
JIS	Japanese Industrial Standard
MORTH	Ministry of Road Transport and Highways
RDSO	Research Designs and Standards Organisation

2. Other Publications.

American Petroleum Industry (API) Standard 1104	
Indian Standard Handbook on steel sections Part-I	
Indian Railway Manual on Design and Construction of well and pile foundations	
UIC/772-R	The International Union of Railways Publication
CIRIA Report 80	A review of instruments for gas and dust monitoring underground
CIRIA Report 81	Tunnel Water proofing
CIRIA Report 44	model code of practice for work in compressed air
CIRIA Report C660	Early age thermal crack control in concrete
CIRIA Report 91	Early age thermal crack control in concrete
Swedish standard 05 59 00	
PCI STD-112-84	
CRRI and IOC, New Delhi Bituminous Road Construction Handbook	

1.1.8 Alternative or additional codes and standards proposed by the contractor shall be

internationally recognized codes and shall be equivalent to or better than, Indian Standards issued by the Bureau of Indian Standards or any other Indian professional body or organization, subject to being, in the opinion of the Authority's Representative, suitable for incorporation or reference into the specifications

1.1.9 Contractor to Provide:

The Contractor shall provide and maintain at site throughout the period of works the following at his own cost and without extra charge, Except for the items specified in the Bill of Quantities

the cost being held to be included in the Contract Rates:

- a) General works such as setting out, site clearance before setting out and on completion of works. All weather approach roads to the site office should also be constructed and maintained in good condition.
- b) All labour, materials, plant, equipment and temporary works, Overhead charges as well as general liabilities, obligations, insurance and risks arising out of GC, required to complete and maintain the works to the satisfaction of the Engineer.
- c) Adequate lighting for night work, and also whenever and wherever required by the Engineer.
- d) Temporary fences, barricades, guards, lights and protective work necessary for protection of workmen, supervisors, engineers, General public and any other persons permitted access to the site. The contractor shall provide proper signages as directed.
- e) All fences and barricade shall be painted with colour shades as specified by the Engineer. The barricading should be of adequate height to ensure visual obstruction of work from public view.

All equipment, instruments, labour and materials required by the Engineer for checking alignment, levels, slopes and evenness of surfaces measurements and quality etc.

- f) Design mixes and testing them as per relevant clauses of specifications giving proportion of ingredients, sources of aggregates and binder along with accompanying trial mixes. Test results to be submitted to the Engineer for his approval before adoption on works.
- g) Cost of Preparation and compliance with provision of a quality assurance control program.
- h) Cost of safeguarding the environment.

-
- i) A testing laboratory as specified by the Engineer equipped with the following minimum apparatus, materials and competent trained staff required for carrying out tests, as specified in the relevant sections of the specifications: -
- i. Set of standard sieves for testing grading of sand with mechanical sieve shaker.
 - ii. Sieves with openings respectively of 4.75mm, 10mm, 20mm, 25mm, 30mm for testing and grading of aggregates.
 - iii. Weighing Balance of capacity up to 10 Kg. reading up to 5 gm.
 - iv. Electric Thermostat controlled oven and pans for drying of sand and aggregates.
 - v. Glass measuring flasks of 1/2, 1 liter & 2 liter capacity.
 - vi. Flask for determining moisture content of sand.
 - vii. Slump cone with rod and V B Apparatus, flow table to measure slump or DIN Specifications.
 - viii. Apparatus to measure permeability of concrete as per Appendix 1700/II of MOST Specifications.
 - ix. Minimum 24 Nos. steel moulds for 150mm x 150mm x 150mm concrete test cubes. It may be necessary to provide more steel cube moulds depending upon concreting program.
 - x. 25mm dia vibrator for compaction of concrete in test cubes and also vibrating table.
 - xi. Concrete cube testing machine of 200 tonnes capacity with 3 dial gauges electrically operated.
 - xii. Work benches, shelves, desks, sinks and any other furniture and lighting as required by the Engineer.
 - xiii. Abrasion Flakiness & Impact testing Equipment for testing coarse aggregate.
 - xiv. Silt Testing Equipment.
 - xv. Any other equipment specified by Engineer.

1.1.10 Quality Assurance & Quality Control:

- a) The work shall conform to high standards of design and workmanship, shall be structurally sound and aesthetically pleasing. The Contractor shall conform to the Quality standards prescribed, which shall form the backbone for the Quality Assurance and Quality Control system.
- 1. At the site, the Contractor shall arrange the materials, their stacking/storage in appropriate manner to ensure the quality. The Contractor shall provide all the necessary equipment and qualified manpower to test the quality of materials, assemblies etc., as directed by the Engineer. The tests shall be conducted at specified intervals and the results of tests properly documented. In addition, the Contractor shall keep appropriate tools and equipment for checking alignments, levels, slopes and evenness of the surfaces.
 - b) The Engineer shall be free to carry out such tests as may be decided by him at his sole discretion, from time to time, in addition to those specified in this document. The Contractor may provide the samples and labour for collecting the samples. Nothing extra shall be payable to the Contractor for samples or for the collection of the samples.
 - i) The test shall be conducted at the Site laboratory that may be established by the Contractor or at any other Standard Laboratory selected by the Engineer.
 - ii) The Contractor shall transport the samples to the laboratory for which nothing extra shall be payable. In the event of the Contractor failing to arrange transportation of the samples in proper time the Engineer shall have them transported and recover two times the actual cost from the Contractor's bills.
 - iii) All testing shall be performed in the presence of Engineer. Testing may be witnessed by the Contractor or his authorized representative if permitted by the Test House. Whether witnessed by the Contractor or not, the test results shall be binding on the Contractor.
 - c) The Engineer shall have the right at all times to inspect all operations including the sources of materials, procurement, layout and storage of materials, all equipment including the concrete batching and mixing equipment, and the quality control system. Such an inspection shall be arranged, and the Engineer's approval obtained prior to starting of the particular item of work. This shall, however, not relieve the Contractor of his responsibilities. All materials which do not conform to these specifications shall be rejected and shall be removed from the site immediately. The Engineer shall have the powers to cause the Contractors to purchase and use materials from any particular source, as May in the Engineer's opinion be necessary for the proper execution of work.

1.1.11Dimensions:

- a) Figured dimensions on drawings shall only be followed and drawings to a large scale shall take precedence over those to a smaller scale. Special dimensions or directions

in the specifications shall supersede all others. All dimensions shall be checked on site prior to execution.

- b) The dimensions where stated do not allow for waste, laps, joints, etc. but the Contractor shall provide at his own cost sufficient labour and materials to cover such waste, laps, joints, etc.
- c) The levels, measurements and other information concerning the existing site as shown on the drawings are believed to be correct, but the Contractor should verify them for himself and also examine the nature of the ground as no claim or allowance whatsoever will be entertained on account of any errors or omissions in the levels or the description of the ground levels or strata turning out different from what was expected or shown on the drawings.

1.1.12 Setting out of Works:

The Contractor shall set out the Works indicated in the Conditions of Contract. The Contractor shall provide suitable stones with flat tops and build the same in concrete for temporary benchmarks. All the pegs for setting out the Works and fixing the levels required for the execution thereof shall, if desired by the Engineer, likewise be built in masonry at such places and in such a manner as the Engineer may direct. The Contractor shall carefully protect and preserve all benchmarks and other marks used in setting out the works. The contractor will make overall layout of complete work and get it checked from engineer. The cost of all operations of setting out including construction of benchmarks is deemed to be included in the quoted rates.

- a) All the survey work except leveling work shall be carried out using total stations with one second accuracy. The leveling work shall be carried out using Auto level.
- b) The triangulations point given by concerned organization before start of work shall be maintained during execution and handed over back to concerned organization after completion of work.

1.1.13 Materials:

a) Source of Materials:

It shall be the responsibility of the contractor to procure all the materials required for construction and completion of the contract. The contractor shall indicate in writing the source of materials well in advance to the Engineer, after the award of the work and before commencing the work. If the material from any source is found to be unacceptable at any time, it shall be rejected by the Engineer and the contractor shall forthwith remove the material immediately from the site as directed by the Engineer.

b) Quality:

All materials used in the works shall be of the best quality of their respective kinds as

specified herein, obtained from sources and suppliers approved by the Engineer and shall comply strictly with the tests prescribed hereafter, or where tests are not laid down in the specifications, with the requirements of the latest issues of the relevant Indian Standards.

c) Sampling and Testing:

All materials used in the works shall be subjected to inspection and test in addition to test certificates. Samples of all materials proposed to be employed in the permanent works shall be submitted to the Engineer at least **45 days in advance** for approval before they are brought to the site.

Samples provided to the Engineer for their retention are to be labeled in boxes suitable for storage. Materials or workmanship not corresponding in character and quality with approved samples will be rejected by the Engineer.

Samples required for approval and testing must be supplied sufficiently in advance if required quality and number to allow for testing and approval, due allowance being made for the fact that if the first samples are rejected further samples may be required. Delay to the works arising from the late submission of samples will not be acceptable as a reason for delay in completion of the works.

Materials shall be tested before leaving the manufacturer's premises, quarry or resource, wherever possible. Materials shall also be tested on the site, and they may be rejected if not found suitable or in accordance with the specification, notwithstanding the results of the tests at the manufacturer's works or elsewhere or test certificates or any approval given earlier.

The contractor will bear all expenses for sampling and testing, whether at the manufacturer's premises at source, at site or at any testing laboratory or institution as directed by the Engineer. No extra payment shall be made on this account.

d) Dispatch of materials:

Materials shall not be dispatched from the manufacturer's works to the site without written authority from the Engineer.

e) Test certificates:

All manufacturer's certificates of test, proof sheets, etc. showing that the materials have been tested in accordance with the requirement of this specification and of the appropriate Indian Standard are to be supplied free of charge on request to the Engineer.

f) Rejection:

Any materials that have not been found to conform to the specifications will be

rejected forthwith and shall be removed from the site by the Contractor at his own cost within two weeks or as instructed by the Engineer.

The Engineer shall have power to cause the Contractors to purchase and use such materials from any particular source, as may in his opinion be necessary for the proper execution of the work.

1.1.14 Storing of Materials at site:

All materials used in the works shall be stored on racks, supports, in bins, under cover etc as appropriate to prevent deterioration or damage from any cause whatsoever to the entire satisfaction of the Engineer.

The storage of materials shall be in accordance with **IS 4082 “Recommendation on stacking and storage of construction materials on site”** and as per **IS 7969 “Safety code for handling and storage of building materials”**.

The materials shall be stored in a proper manner at places at site approved by the Engineer. Should the place where material is stored by the Contractor be required by the Authority for any other purpose, the Contractor shall forthwith remove the material from that place at his own cost and clear the place for the use of the Authority.

1.1.15 Water:

a) Water from approved source:

Potable water only shall be used for the works. Contractor shall have his own source of water duly approved by Engineer. The water shall be free from any deleterious matter in solution or in suspension and be obtained from an approved source. The quality of water shall conform to IS 456.

b) Storage:

The Contractor shall make his own arrangements for storing water, if necessary, in drums or tanks or cisterns, to the approval of the Engineer. Care shall be exercised to see that water is not contaminated in any way.

c) Testing:

Before starting any concreting work and wherever the source of water changes, the water shall be tested for its chemical and other impurities to ascertain its suitability for use in concrete for approval of the Engineer. No water shall be used until tested and found satisfactory. Cost of all such Tests shall be borne by the contractor.

1.1.16 Workmanship:

- a) All works shall be true to level, plumb and square and the corners, edges and arises in

all cases shall be unbroken and neat.

- b) Any work not to the satisfaction of the Engineer or his representative will be rejected and the same shall be rectified or removed and replaced with work of the required standard of workmanship at no extra cost.

1.1.17 Load Testing on Completed Structures

- 1.1.1.1 During the period of construction or within the defect liability period the Engineer may at his discretion order the load testing of any completed structure or any part thereof if he has reasonable doubts about the adequacy of the strength of such structure for any of the following reasons:
- a. Results of compressive strength on concrete test cubes falling below the specified strength.
 - b. Premature removal of formwork.
 - c. Inadequate curing of concrete.
 - d. Overloading during the construction of the structure or part thereof.
 - e. Carrying out concreting of any portion without prior approval of the Engineer.
 - f. Honey combed or damaged concrete which in the opinion of the Engineer is particularly weak and will affect the stability of the structure to carry the design load, more so in important or critical areas of the structure.
 - g. Any other circumstances attributable to alleged negligence of the contractor which in the opinion of the Engineer may result in the structure or any part thereof being of less than the expected strength.
- 1.1.1.2 All the loading tests shall be carried out by the contractor strictly in accordance with the instructions of the Engineer, as per IRS: CBC and IRC: SP-51, as indicated hereunder. Such tests shall be carried out only after expiry of minimum 28 days or such longer period as directed by the Engineer.
- 1.1.1.3 The structure shall be subjected to the load as approved for SLS condition in the design. This load shall be maintained for a period of 24 hours before removal. During the test, struts strong enough to take the whole load shall be placed in position leaving a gap under the members as directed. The deflection due to the superimposed load shall be recorded by sufficient number of approved deflectometers capable of reading up to 1/500 of a cm and located suitably under the structure as directed by the Engineer.

In case the recovery of the structure is not as per codal provisions, the structure shall be considered to have failed to pass the test and shall be deemed to be unacceptable.

1.1.1.4 In such cases the portion of the work concerned shall be taken down or cut out and reconstructed to comply with the specifications. Other remedial measures may be taken to make the structure secure at the discretion of the Engineer. However, such remedial measures shall be carried out to the complete satisfaction of the Engineer.

1.1.1.5 All costs involved in carrying out the tests and other incidental expenses thereto shall be borne by the contractor regardless of the result of the tests. The contractor shall take down or cut out and reconstruct the defective work or shall make the remedial measures instructed at his own cost.

If the load testing is instructed on any ground other than mentioned in (a) to (g) of 1.1.17.1, then the cost of the same shall be reimbursed if the result of the test are found to be satisfactory.

1.1.1.6 In addition to the above load tests, non-destructive test methods such as core test and ultrasonic pulse velocity test shall be carried out by the contractor at his own expense if so desired by the Engineer. Such tests shall be carried out by an agency approved by the Engineer and shall be done using only recommended testing equipment. The acceptance criteria for these tests shall be as per provisions in the relevant Indian/International standards and as approved by the Engineer.

1.2 STRUCTURAL WORK:

1.2.1 Unless specified, only controlled concrete with design mix and weigh batching is to be used for the work.

1.2.2 Minimum cement content specified in CPWD specification is purely from durability point of view. Larger content of cement shall have to be provided if demanded by mix design.

1.2.3 Provision of cement slurry to create bond between plain / reinforced concrete surface and subsequent applied finishes shall not be paid extra.

1.2.4 Mix design using smaller aggregates of 10mm down shall also be done in advance for the use in the junction having congested reinforcement.

1.2.5 The procedure of mixing the admixtures shall be strictly as per the manufacturer's recommendations if not otherwise directed by the Engineer.

1.2.6 All the water tanks and other liquid retaining concrete structures shall undergo hydro-testing.

1.2.7 Special benches shall be provided at site for stacking reinforcement bars of different sizes.

1.2.8 Formwork for beams of RCC areas shall be designed in such a way that the formwork of the adjacent slabs can be removed without disturbing the props / supports of the beams.

1.2.9 Wherever there are tension / suspended concrete members which are suspended from upper-level structural members, the shuttering / scaffolding of such members at lower level shall have to be kept in place till the time the upper level supporting members gain minimum required strength. The cost of such a larger duration of keeping in place the shuttering/scaffolding shall be deemed to be included in the price quoted for respective structural members.

1.2.10 Formwork is required for full height at all locations. Special precautions for such tall formwork shall be taken to ensure its safety. Extra costs for such formwork shall be deemed to have been included in the price quoted.

1.2.11 In the mobilization period, the contractor shall carry out expeditiously and without delay the following works:

- i) Material testing and mix designs of concrete as contemplated in the specifications.
- ii) Setting up of full-fledged site laboratory as per the requirements of these specifications.
- iii) Any other pre-requisite items required for final execution.
- iv) Site office for the use of the Engineer staff.
- v) Construction yard with full facilities.

1.2.12 Construction Yard to have following minimum facilities:

- a. Casting beds as required.
- b. All handling facilities for precast elements.
- c. Curing arrangements as required.
- d. Stacking arrangements for precast elements.
- e. Storing of materials.
- f. Proper drainage and approach roads.

1.3 SUPPLY OF PROGRESS PHOTOGRAPHS AND ALBUMS (DIGITAL):

The work covers the supply of digital photographs to serve as a permanent record of various stages/facets of work needed for authentic documentation as approved by the Engineer.

The photographs shall be of acceptable quality, and they shall be taken by a

professionally competent photographer with a camera having the facility to record the date of the photographs taken in a soft copy. Each photograph in the album shall be suitably captioned and dated.

The photographs and materials shall form a part of the records of concerned organization and same cannot be supplied to anybody else or published without the written permission of concerned organization.

1.4 SUPPLY OF VIDEO CDS:

The work consists of taking video films of important activities of the works as directed by the Engineer during the currency of the Project and editing them to a video film of playing time not less than 60 minutes. It shall contain narration of the activities in English by a competent narrator. The edition of the film and script of the narration shall be approved by the Engineer.

Robotic Inspection

Remotely Operated vehicles (ROV's) data collection technology provides safe and relatively accurate inspection and monitoring of structures. Camera, sensors, lights and other devices are commonly included on the platform of the robot to increase its usability and accuracy while inspection. It can even be set up to be operated by remote control.

There are numerous applications of ROV's such as drones for inspection and monitoring of structures. Infrared technologies can also be added to these devices. ROV shall also be used monitoring of physical progress of works. The record of progress (photographs and videos) shall be submitted to the engineer on monthly basis or as directed by engineer.

1.5 SURVEY WORK:

The said work involves at the very start of work taking-over of reference point from the Engineer, establishment of control points, triangulation points, bench marks, grid layout for all the piers and other structures maintaining horizontal and vertical control within the permissible limits, incorporating changes (if any), submission of full data in the tabulation form and survey drawings including setting and layout of various works during the progress of work and matching of the station areas with the ropeway alignment at station ends and incorporating the changes (if any).

1.6 BARRICADING

The work covers barricading for the work done along the median and areas affecting road traffic. Barricading for the other areas like casting yard, batching plant, storage and other working area shall be done at own cost by the contractor. The detailed scope of work is as follows:

- i) Providing and installing the barricade of the approved design and type, fixing the same firmly with the ground and maintaining it during the progress of

work.

- ii) Dismantling of barricading and other temporary installations from the site and cleaning the site as per direction of Engineer upon completion and acceptance of work.
- iii) Providing earthing of Barricades.
- iv) Providing Lighting on the periphery of Barricades for Direction illumination.
- v) Arrangement of CCTV for dust control.
- vi) Providing adequate road safety devices. A tentative list given hereunder identifies minimum items, which may be required. However, actual numbers required will be as per approved plan by the Engineer and clearance from the traffic department, Shimla. The contractor shall not be paid extra for any addition to this list if required during the execution of works.

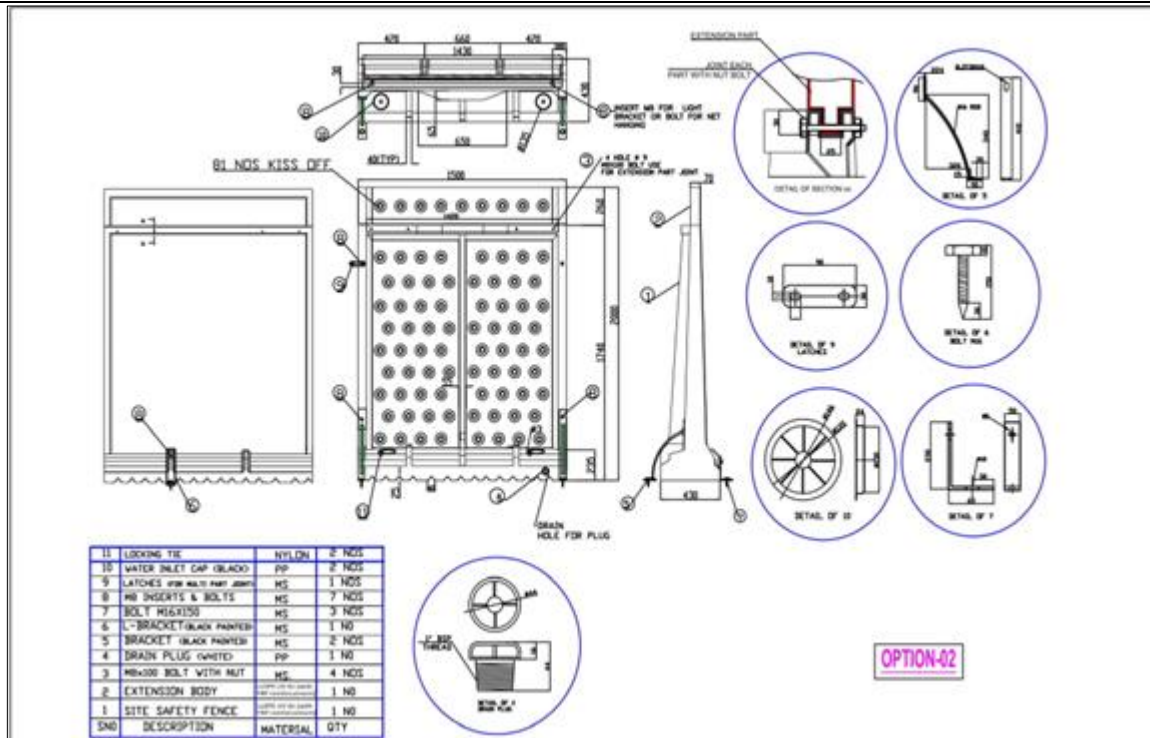
Tentative Road Safety Devices

S. No.	Brief Description
1.	Supply of Red portable heavy duty traffic cones of 750 mm height with white reflective tape bands on min. 100 mm width all around
2.	Hazard warning light flasher with rechargeable. Maintenance free battery & Charging system
3.	Safety light island post with 11 nos. parallel reflector
4.	Red reflective arrow fitted on enameled mild steel board of 360 x 220 mm size
5.	Traffic Triangular Tripod made of fluorescent cloth fitted on steel frame
6.	Retro-reflective tape (I) 50 mm width
7.	Fluorescent Jackets with reflective tape all around
8.	Yellow reflective cat eyes of size 115 x 11 x 22 mm made of ABS material having 19 glass beads on each side.
9.	Metal Tubular Delineator of 610 mm height with reflective tapes
10.	Retro-reflective arrows diversion board 450 x 900 mm with crystal clear protective transparent coat to avoid damage on 14-gauge Mild Steel sheet with and without pole
11.	Retro-reflective "Men at work" triangular board of size 900 mm with crystal protective transparent coat to avoid damage on 14-gauge Mild steel board with and without poles
12.	Retro-reflective board for "Go Slow Work in progress" of size 1200 x 750 mm with crystal clear protective transparent coat to avoid damages to the Mild Steel sheets with and without pole.
13.	Retro-reflective advance direction sign cum Diversion Boards of size 1200 x 900 mm with crystal clear protective transparent coat to avoid damage to the 14-gauge Mild Steel sheet with and without pole.
14.	Retro-reflective speed limit circular sign Boards of 600 mm Diameter with crystal clear protective transparent coat to avoid damage to the 14-gauge sheet (without pole).
15.	"SORRY FOR INCONVENIENCE" Retro-reflective Boards of size 900 x 300 mm size with crystal clear protective transparent coat to avoid damage to the 14-gauge Mild Steel Sheet (without pole).

S. No.	Brief Description
16.	HAZARD MARKERS (Yellow & Black) must be put all over the construction sites. This Retro- reflective board is of size 300 x 900 mm with crystal clear protective transport coat to avoid damage and the 14-gauge Mild Steel Sheet with or without pole
17.	“CAUTION” tape which is normally yellow tape of special Polythene Material having 75 mm width “CAUTION” is written all over with Black colour in rolls of 300 metre.

18. Heavy Duty Glass Reinforced Plastic Temporary Barricade

Providing **Heavy** Duty Glass Reinforced Plastic Temporary Barricade of 2.0m m high, 1.5m length with base width of 430 mm as a provision to accept water ballasting of 101 liters approx. and arrangement for traffic diversion such as traffic signals during construction at site, for day and night as per requirement. The raw material shall be UV stabilized Linear Low Density Polyethylene and should meet the requirements stipulated in standard IS:10146-1982, IS:10141-1982 and should also comply to FDA:CFR Title 21.177.1520. Olefin Polymers, with specific FRP Grade 300-104 reinforced during moulding process to the permissible extent for improved impact strength, Qualification Criteria: For qualifying the sample, few tests shall be performed at Government Lab OR NABL Accredited Lab on site safety Fence sample, failure or Deviation in test results of sample shall be disqualified. The tests and qualifying results are as under, (a) tensile strength at yield by ASTM D 638=20.93 Mpa, (b) Elongation at break ASTM D 638= 121.66 Mpa (c) Flexural Modulus ASTM D 790 = 633.76 Mpa (d) Izad Impact Strength (Notched) ASTM D 256= 4.41 Kg/Sqm (e) Izad Impact strength(Un-Notched) ASTM D 256 = 67.04Kg/Sqm (f) Drop Impact Strength 25 Kg Load from 1m, 2m & 5m height the weight of empty single Rotomoulded Plastic Barricade Without to fix two brackets at both end in corner for anchoring purpose each rear bracket is constructed through rod of Dia 60 mm with curvature welded with MS strip of 3mm thick, 50mm width and 90mm length at its top and base, effective bracket shall be 410mm approx.. the anchoring hole in each Bracket shall be 18mm dia. For routine the MS bolt of 16mm thickness and 15mm length with sharp pointed edge at one end. The upper part of each bracket shall have a slot size of 30mm x 10mm for connecting it with barricade model through bolts. Similarly front bracket for site safety fence is 3mm thick, 50mm width, effective height after single bend is 230 mm and anchoring in each bracket shall be dia 18mm unique safety feature for firm gripping to prevent from displacement and falling when interconnected even without water filling. There shall be 7 no's premoulded inserts on site safety Fence for following application: 2no's for safety latches interconnectivity, 2 numbers for fixing rear brackets for anchoring. One no. at front side for fixing the front bracket for higher stability, and 2 numbers on Extension top for holding light bracket/Rod for cloth holding. The plastic barricades have a strong vertical rib of 1740 mm length at the rear center & 72 No's of kiss offs spread on entire rear surface, the water container (bottom) Site Safety Fence (2.00 mtrs(H)) (Efficient Substitution to sheet Metal Barricade), Empty Weight: 1700 Kg/Rgm Full: 70.00 Kg/Rgm approx. (After Water/Sand Filling)



1.7 TRANSPLANTATION OF TREES

The item shall be carried out as per the approved plan by the Engineer after the identification of the trees to be transplanted. The actual number of trees shall be finalized after the necessary clearances by the concerned departments. The item is complete and including all expenditures for carrying out all operations i.e. excavation, watering, feeding of chemicals, back filling, lifting of trees by crane and transporting to the designated site where it is to be transplanted and all necessary care to be taken for the specified initial period till the tree gets settled at new site and up to the full satisfaction of the Engineer.

1.8 FINISHING WORK:

1.8.1 The Contractor shall incorporate seismic considerations of anchoring and isolation in the design and detailing of the finishes as directed by the Engineer. The element to be anchored shall have its motion suitably restrained whilst at the same time it shall be suitably isolated so as not to be affected by the deformations/ vibrations of the building during Construction.

1.8.2 Sub-Contractor:

Works as listed below and those dealing with proprietary materials/ products may be carried out by the Contractor through the Sub-Contractors as may be approved by the Engineer in writing. The Sub-Contractors must be firms of repute and long standing,

having adequate experience and complete facilities to carry out all items of work required for completion as per Specifications and expected quality to the satisfaction of the Engineer. The Sub-Contractor must also have personnel experienced in preparing shop drawings. All such works shall be carried out under the direct supervision of the manufacturers of the proprietary materials/ products or their trained and accredited licensee.

- a. Waterproofing
- b. Caulking & Sealants
- c. Seismic Joints
- d. Expansion joints
- e. Application of Silicone water repellent solution where specified, etc.

1.8.3 Guarantees and Building Maintenance for Finishes:

The Contractor shall guarantee and undertake to maintain and rectify the various components of the Civil Works for their successful performance for the periods as specified below. The Contractor shall indemnify the Engineer for a similar period against any damage to property and injury to persons on account of any defective work or maintenance carried out by the Contractor. The format and text of the Guarantee and the Indemnity Bond shall be as followed in CPWD or as approved by the Engineer.

- i) Waterproofing for underground structures (which include raft, retaining walls, and expansion/separation joints in retaining walls) and roofs shall be guaranteed for 10 years. The waterproofing shall include all allied works on the roof such as concrete screed and the China Mosaic roof finish/ stone cladding on the parapet between which the waterproofing treatment shall be sandwiched.
- ii) Waterproofing for the other areas such as toilets, kitchens, chhajjas etc. shall also be guaranteed for 10 years. The waterproofing shall include all allied works on the slab etc. such as concrete/ mortar screeding, if any, floor finish between which the waterproofing treatment shall be sandwiched.

Contractor shall submit Performance Bank Guarantee for water proofing works (for 10% of the cost of water proofing item only) which shall be valid for the entire guarantee period.

1.8.4 Responsibility for Shop drawings, Samples and Mock-ups:

Approval of shop drawings, samples and mock-ups for the various components shall not absolve the Contractor of his responsibility of completing the work to the specifications, standards, tests for performance and guarantees given in these documents and to a quality of finish as desired by the Engineer.

1.8.5 Cleaning:

Surfaces on which finishes are to be provided shall be cleaned with water jets or oil

free compressed air or power tools with wire brushes and detergents all as approved by the Engineer.

1.8.6 Expansion bolts/ fasteners:

- a) Unless specified otherwise all expansion bolts/ fasteners shall be fabricated from austenitic stainless-steel sheet, strip or plate conforming to ASTM A 240 Gr 304 or bar to ASTM A 479 Gr 304 of approved make and design. The material of the bolt shall not cause any bimetallic corrosion with the reinforcing bars of the RCC/ brickwork or with any other fixings or doors or windows or skylights etc.
 - i) For steel backings the fasteners shall be prevented from contact with other metals, which would lead to bimetallic corrosion.
 - ii) For brick masonry backing the sleeves of the expansion bolts shall be fixed in wedge shaped pockets having an area of 75mm x 75mm at the surface and 100mm x 100mm at the inner surface and shall be 125mm deep. The wedge could also be a truncated cone of 75mm dia/ 100mm dia. The dimensions shall be reviewed by the Engineer during execution of the work. The wedge shall be filled with PCC 1:1:2 (1 Cement, 1 Sand and 2 Coarse Aggregate) mixed with non-Shrink Compound in the proportion as recommended by the manufacturer.
 - iii) The holes drilled for the expansion fasteners shall be cleaned of all ground material, dust, etc. before inserting the expansion sleeves.
 - iv) All expansion bolts fixed into soffits shall be bonded to the backing with epoxy/ polyester resin of approved make.
 - v) All expansion bolt fixings shall be tightened in accordance with the recommended torque figures by the manufacturer. Where such values are not available the Contractor shall test at least 6 samples to determine the safe torque values. All bolts shall be tightened using torque spanner/ wrenches. All bolts shall be checked 24 hours (minimum) after installation and retightened if necessary.

1.8.7 No walls and terraces shall be cut for making any opening after water proofing has been done without written approval of the Engineer. Cutting of waterproofing when authorized by the Engineer in writing shall be done very carefully so that no other portion of the waterproofing is damaged. On completion of the work at such places, the water proofing membrane shall be made good and ensured that the opening / cutting is made fully waterproof as per specifications and details of water proofing approved by the Engineer at no extra cost. No structural member shall be cut or chased without the written permission of the Engineer.

1.8.8 Provision of grooves in plaster, drip courses etc., if directed, at junction of walls-

ceilings, columns- walls, frames-plaster and such other generally typical locations shall not be paid extra, including grooves in concrete, masonry, stonework.

1.8.9 Applicable Codes, Standards & Publications for Structural & Architectural Work:

The more important Codes, Standards and Publications to Contract are listed here under:

Any other code/publication, if found necessary by the engineer, may be referred to for such works. The latest revision along with all corrections slip & amendments shall only be followed

A	General
IS: 875	Code of practice for design loads (other than earthquake) for buildings and structures
IS: 1200 (Part 4)	Methods of measurement of building and Civil engineering works- Stone masonry
IS: 1237	Specification for cement concrete flooring tiles
IS: 1322	Bitumen felts for water proofing and damp-proofing
IS: 1893	Criteria for earthquake resistant design of structures
IS: 2185 (Part 1)	Concrete masonry units: Hollow and solid concrete Blocks
IS: 2185 (Part 2)	Concrete masonry units: Hollow and solid light weight concrete blocks
IS: 2185 (Part 3)	Concrete masonry units: Autoclaved cellular aerated concrete blocks
IS: 2572	Code of Practice for construction of hollow concrete block Masonry
IS: 3414	Code of practice for design and installation of joints in Buildings
IS: 3462	Specification for unbacked flexible PVC flooring
IS: 5318	Code of practice for laying of flexible PVC sheet and tile Flooring
IS: 6408 (Parts 1,2)	Recommendations for modular co-ordination in building industry – tolerances
IS: 8183	Bonded mineral wool
IS:10958	General check list of functions of joints in building
IS:11817	Classification of joints in buildings for accommodation of dimensional deviations during construction
IS:11818	Method of test for laboratory determination of air permeability of joints in buildings
IS:12440	Precast concrete stone masonry blocks
CPWD	Specifications with up-to-date correction slips
BS:476 (Part 7)	Method for classification of the surface spread of flame of Products
BS:476 (Part 20)	Method of determination of the fire resistance of elements of construction (general principles)
BS:476 (Part 22)	Methods for determination of the fire resistance of non- load bearing elements of construction
BS: 1245	Specification for metal door frames (steel)
BS: 3261	Specification for unbacked flexible PVC flooring
BS:3261:Part 1	Homogeneous flooring

BS:5215	Specification for one-part gun grade polysulphide based Sealants
BS:5606	Guide to accuracy in building
BS:5725 (Part 1)	Specification for panic bolts and panic latches mechanically operated by a horizontal push-bar
BS:6093	Code of practice for the design of joints and jointing in building construction
BS:8200	Code of practice for the design of non-load bearing external vertical enclosure of building
ASTM C 332	Specification for light weight aggregate for insulating Concrete
ASTM C 635	Specification for the manufacture, performance and testing of metal suspension systems for acoustical tile and lay-in panel ceilings
SP 7	Natinal Building Code of India
SP 23 (S&T)	Handbook on Concrete Mixes
B	Bitumen
IS:702	Industrial Bitumen
IS:3384	Specification for bitumen primer for use in waterproofing and damp-proofing
C	Building Construction Practices
IS: 1838 Parts I and II.	Specifications for preformed fillers for expansion joint in concrete pavements and structures.
IS: 1946	Code of Practice for use of fixing devices in walls, ceilings, and floors of solid construction.
IS: 3414	Code of Practice for design and installation of joints in buildings.
IS: 6509	Code of Practice for installation of joints in concrete pavements.
IS: 11134	Code of Practice for setting out of buildings
IS: 11433	Parts I and II. Specifications for one part Gun grade polysulphide based joint sealant
IS: 12200	Code of Practice for provision of water stops at transverse contraction joints in masonry and concrete dams
D	Cement
IS: 269	33 grade ordinary
IS: 455	Portland cement Portland Slag Cement
IS: 650	Specification for standard sand for testing cement.
IS: 1489 (Part 1)	Portland pozzolana cement: Fly ash based
IS: 1489 (Part 2)	Portland pozzolana cement: Calcined clay based
IS: 3535	Method of Sampling Hydraulic Cements
IS: 4031	(Parts 1 to 13) Methods of physical tests for hydraulic cement.
IS: 4032	Method of chemical analysis of hydraulic cement.
IS: 6925	Methods of test for determination of water soluble chlorides in concrete admixtures.
IS: 8042	White Portland Cement
IS: 8112	Specification for 43 grade ordinary Portland cement.
IS: 12269	Specification for 53 grade ordinary Portland cement.
IS: 12330	Specification for sulphate resistant Portland cement.

IRS: T 40	Indian Railways standard specifications for special grade cement for use in concrete sleepers
E	Concrete
IS:456	Code of practice for plain and reinforced concrete.
IS:457	Code of practice for general construction of plain and reinforced concrete for dams and other massive structures.
IS:460 (Part I to III)	Specification for Test Sieves
IS:516	Methods of test for strength of concrete.
IS:1199	Methods of sampling & analysis of concrete.
IS:1200	Method of measurement of building and civil engineering
IS:1343	Code of practice for prestressed concrete
IS:1607	Method of Test Sieving
IS:2386	Parts I-VIII. Methods of tests for aggregates for concrete.
IS:2430	Methods of Sampling of Aggregates of Concrete
IS:2438	Specification for roller pan mixer
IS:2514	Specification for concrete vibrating tables
IS:2571	Code of practice for laying in-situ cement concrete Flooring
IS:2645	Specifications for integral cement water proofing Compounds
IS:2722	Specifications for portable swing batchers for concrete (double bucket type)
IS:2770	Methods of testing bond in reinforced concrete part I pull out test
IS:3025	Methods of sampling and test (physical and chemical) for water & wastewater
IS:3370	Code of practice for concrete structures for storage of Liquids
IS:3935.	Code of practice for composite construction
IS:4326	Code of practice for earthquake resistant construction of Building
IS:6925.	Methods of test for determination of water-soluble chlorides in concrete Admixtures
IS:7242	Specifications for concrete spreaders
IS:7251	Specifications for concrete finishers
IS:7861	Parts I & II. Code of practice for extreme weather concreting.
IS:7969	Safety code for handling and storage of building materials
IS:8989	Safety code for erection of concrete framed structures
IS:8142	Methods of test for determining setting time of concrete by penetration resistance
IS:9103	Specifications for admixtures for concrete
IS:9013	Method of making, curing and determining compressive strengths of accelerated cured concrete test specimens
IS:9284	Method of test for abrasion resistance of concrete
IS:10262	Recommended guidelines for concrete mix design.
IS:4926	Code of Practice ready mixed concrete needs to be included in list
MORTH	Specifications for Road and Bridge Works, Ministry of Road Transport and Highways (Roads Wing)

SP 34	Handbook on Concrete Reinforcement and Detailing
IRS	Concrete Bridge Code
IRC 112	Code of Practice for Concrete Road Bridges
IRC 83 (Part 4)	Standard Specifications and code of practice for road bridges Section IX Bearings (Spherical & Cylindrical)
ASTM -C -94	Ready Mix Concrete
F	Construction Plant and Machinery.
IS:1791	Specification for batch type concrete mixers.
IS:2505	General requirements for concrete vibrators: Immersion type.
IS:2506	General requirements for screed board concrete vibrators.
IS:3366	Specification for pan vibrators.
IS:3558	Code of Practice for use of immersion vibrators for consolidating concrete.
IS:4656	Specifications for form vibrators for concrete.
IS:4925	Specification for concrete batching and mixing plant.
IS:11993	Code of Practice for use of screed board concrete vibrators.
G	Formwork
IS:4990	Specifications for plywood for concrete shuttering work.
IRC:87	Guidelines for the design and erection of false work for road bridges.
IS:806	Code of practice for use of steel tubes in general building construction.
IS:1161	Specification of steel tubes for structural purposes.
IS:1239	Specification for mild steel tubes, tubular and other wrought steel fittings
H	Gypsum and Gypsum Board
IS:2095	Gypsum plaster boards
IS:2542(Part 1/Sec to 12)	Methods of test for gypsum plaster, concrete and products: plaster and concrete
IS:2542 (Part2/Sec 1 to 8)	Methods of test for gypsum plaster, concrete and products: Gypsum products
IS:2547 (Part 1)	Gypsum building plaster: Excluding premixed lightweight plaster
IS:2547 (Part 2)	Gypsum building plaster: Premixed lightweight plaster
I	Handle and Storage
IS:4082	Recommendation of Stacking and Storage of construction materials
IS:8348	Code of practice for stacking and packing of stone slabs for transportation
IS:8759	Code of practice for maintenance and preservation of stones in building
J	Instruments For Testing Cement and Concrete
IS:5513	Specification for vicat apparatus.
IS:5514	Specification for apparatus used in Le-Chatelier test.
IS:5515	Specification for compaction factor apparatus.
IS:7320	Specification for concrete slump test apparatus.
IS:7325	Specification for apparatus to determine constituents of fresh concrete.
IS:10080	Specification for vibration machine.
IS:10086	Specification for moulds for use in tests of cement and concrete.
IS:10510	Specification for vee-bee consistometer.

K	Joint Fillers
IS:1838 (Part 1)	Preformed fillers for expansion joint in concrete pavements and structures (non extruding and resilient type): Bitumen impregnated fibre
L	Paints and Coatings
IS:102	Ready mixed paint, brushing, red lead, non-setting, priming
IS:109	Ready mixed paint, brushing, priming, plaster, to Indian Standard Colour No. 361 and 631 white and off white.
IS:218	Creosote and anthracene oil for use as wood preservatives
IS:347	Varnish, shellac, for general purpose.
IS:348	French Polish
IS:2074	Ready mixed paint, air drying, red oxide-zinc chrome, priming
IS:4833	Methods of field testing of preservatives in wood
IS:10013 (Parts 1 to 3)	Water soluble type wood preservatives
IS:10013 (Parts 1 to 3)	(Part-1) Acid-copper-chrome preservative
IS:10013 (Parts 1 to 3)	(Part-2) Copper-chrome-arsenic wood preservative
IS:10013 (Parts 1 to 3)	(Part-3) Copper-chrome-boron wood preservative
BS:6496	Specification for powder organic coatings for application and stoving to aluminum alloy extrusions, sheet and preformed sections for external architectural purposes, and for the finish on aluminum alloy extrusions, sheet and preformed sections coated with powder organic coatings
BS: EN:10152	Specification for electrolytically zinc coated cold rolled steel flat products. Technical delivery conditions
ASTM A 164-71	Specification for electrodeposited coatings of zinc on steel
M	Pigment for Cement
BS:1014	Specification for pigments for Portland cement and Portland cement products
N	Reinforcement & Structural Steel
IS:206	Code of Practice for use of Steel Tubes in General Building Construction
IS:210	Grey Iron Castings
IS:280	Mild steel wire for general engineering purposes
IS:432	Part I. Mild steel and medium tensile steel bars. Part II Hard drawn steel wire.
IS:451	Technical Supply conditions for Wood Screws
IS:806	Code of practice for use of steel tubes in general building construction
IS:815	Classification coding of covered electrodes for metal arc welding of structural steels
IS:1239	Specification for mild steel tubes, tubulars and other wrought steel fittings
IS 1343	Code of Practice for Prestressed Concrete
IS:1363	Black hexagon bolts, nuts and lock nuts and black hexagon screws.

IS:1365	Slotted countersunk screws.
IS:1566	(Part I) Specifications for hard-drawn steel wire fabric for concrete reinforcement.
IS:1786	Specification for high strength deformed steel bars and wires for concrete reinforcement.
IS:2502	Code of Practice for bending and fixing of bars for concrete reinforcement.
IS:2629	Recommended practice for hot-dip galvanising of iron and steel.
IS:2751	Code of Practice for welding of mild steel plain and deformed bars for reinforced concrete construction.
IS 4000	Code of practice for high strength bolts in steel structures
IS:4759	Hot-dip zinc coating on structural steel and other allied products.
IS:5525	Recommendations for detailing of reinforcement in reinforced concrete works
IS:9417	Recommendations for welding cold-worked steel bars for reinforced concrete construction.
IS:14268	Uncoated stress relieved low relaxation steel class 2 for Prestressed concrete
IS:226	Structural steel (Standard Quality)
IS:800	Code of practice for use of structural steel in general building construction.
IS:813	Scheme of symbols for welding.
IS:814	Covered electrodes for metal arc welding of structural steel. (Part I & Part II)
IS:816	Code of practice for use of metal arc welding for general construction in mild steel.
IS:822	Code of practice for inspection of welds.
IS:961	Structural steel (High Tensile)
IS:1024	Code of practice for use of welding in bridges and structures subject to dynamic loading.
IS:1030	Carbon steel casting for General Engineering Purposes
IS:1120	Coach Screws
IS:1367	Technical Supply Conditions for Threaded Fasteners
IS:1161	Steel tubes for structural purposes.
IS:1182	Recommended practice for radiographic examination of fusion welded butt joints in steel plates.
IS:1915	Code of Practice for Steel Bridges
IS:2016	Plain Washers
IS:2062	Structural steel (Fusion welding quality)
IS:3063	Single Coil Rectangular Section Sprint Washers for Nuts, Bolts and Screws
IS:3443	Crane Rail Sections
IS:3757	Specification for high tensile friction grip bolts.
IS:5624	Specification for foundation bolts.

IS:3600	Code of practice for testing of fusion welded (Part I) joints and weld metal in steel.
IS:4923	Hollow steel sections for structural use.
IS:6227	Code of practice for use of metal arc welding in tubular structure.
IS:801	Code of practice for use of cold formed light gauge steel structural members in general building construction.
IS:811	Specifications for cold formed light gauge structural steel sections.
IS:8500	Structural steel Micro alloyed (Medium and high strength qualities)
IS:8910	General requirements of supply of weldable structural steel
IS:9595	Recommendations for metal arc welding of carbon & carbon- manganese steels.
IS 16172	Reinforced Couplers for Mechanical Splices of Bars in Concrete
O	Sand
IS:383	Coarse and fine aggregates from natural sources for concrete.
P	Scaffolding
IS:2750	Specification for steel scaffoldings
IS:3696 (Part 1)	Safety Code of scaffolds and ladders: Scaffold
IS:3696 (Part 2)	Safety Code of scaffolds and ladders: Ladders
IS:4014 (Part 1)	Code of practice for steel tubular scaffolding: Definition and materials
IS:4014 (Part 2)	Code of practice for steel tubular scaffolding: Safety regulations for scaffolding
IRC:87	Guidelines for the design and erection of falsework for Road bridge
Q	Sealants
IS:10959	Glossary of terms for sealants for building purposes
IS:11433 (Part 1)	One part grade polysulphide base joint sealant: General requirements
IS:11433 (Part 2)	One part grade polysulphide base joint sealant: Methods of test
IS:13055	Methods of sampling and test for anaerobic adhesives and sealants
BS:5889	Specification for one part gun grade silicone-based sealants.
R	Wood
IS:303	Plywood for General Purposes
IS:848	Synthetic resin adhesives for plywood (phenolic and aminoplastic)
IS:1141	Seasoning of Timber – Code of Practice
IS:1328	Veneered decorative plywood
IS:1659	Block Boards
IS:2046	Decorative thermosetting synthetic resin bonded laminated sheets
IS:2202 (Part 1)	Wooden flush door shutters (solid core type): Plywood face panels
IS:2202 (Part 2)	Wooden flush door shutters (solid core (type): Particle face panels and hardboard face panels
S	Bearing
IRC:83Part-II	Standard specifications and code of practice for road bridges Elastomeric Bearings
IRC:83 Part-III EN 1337gh	Standard specifications and code of practice for road bridges Pot Bearings

T	PILING
IS:2911(All Parts)	Bored Cast in-situ Concrete Piles
IRC:78	Standard specifications and code of practice for road bridges Foundation and Substructure
U	All Indian Railway & RDSO Standards, any other code or publication as approved by engineer in-charge
V	Metal
IS:276	Austenitic manganese steel castings
IS:733	Wrought aluminium and aluminium alloy bars, rods and sections for general engineering purpose.
IS:737	Specifications for wrought aluminium and aluminium alloy sheet and strip for general engineering purpose.
IS:3614 (Part 1)	Specification for fire check doors: Plate metal covered and rolling type
IS:3614 (Part 2)	Specification for metallic and non-metallic fire check doors: Resistance test and performance criteria
IS:7196	Specification for Hold Fast
ASME Sect 2 Part A	Ferrous Material Specifications
ASTM B 221	Specification for aluminum-alloy extruded bars, rods, wires, shapes, and tubes
BS: 4873	Specification for Aluminum alloy windows
BS: 7352	Specification for strength and durability performance of metal hinges for side hanging applications and dimensional requirements for template drilled hinges
BS EN:10143	Specification for continuously hot-dip metal coated steel sheet and strip. Tolerances on dimensions and shape
W	Glazing
BS:952 (Part 1)	Glass for glazing: classification
BS:952 (Part 2)	Glass for glazing: Terminology for work on glass
BS:4315 (Part 2)	Methods of Test for Resistance to Air and water penetration: Permeable walling constructions (water penetration)
BS:5368 (Part 1)	Method of testing Windows: Air permeability test
BS:5368 (Part 2)	Method of testing Windows: Water tightness test under static pressure
BS:5368 (Part 3)	Method of testing Windows: Wind resistance tests
BS:5368 (Part 4)	Method of testing Windows: Form of test report
BS:5713	Specification for Hermetically sealed flat double glazing units
BS:6262	Code of practice for glazing for buildings
BS:6262 (Part 4)	Glazing for buildings: Code of practice for safety, Human impact
BS: 6375 (Parts 1)	Performance of windows: Classification for weather tightness (including guidance on selection and Specification)
BS:6375 (Parts 2)	Performance of windows: Specification for operation and strength characteristics
DIN:1249 (Part 12)	Glass for use in building construction; toughened glass; dimensions, working and requirements

JIS:R 3203	Float and Polished Plate Glasses
ASTM E 283	Test method for determining the rate of air leakage through exterior windows, curtain walls, and doors underspecified pressure differences across the specimen
ASTM E 330	Test method for structural performance of exterior windows, curtain walls, and doors by uniform static air pressure difference
ASTM E 331	Test method for water penetration of exterior windows, curtain walls, and doors by uniform static air pressure difference
X	Stone and Facings/ Linings
IS:1121-(Parts 1 to 4)	Methods of test for determination of strength properties of natural building stones
IS:1121-(Parts 1 to 4)	(Part-1 Compressive strength)
IS:1121-(Parts 1 to 4)	(Part-2 Transverse strength)
IS:1121-(Parts 1 to 4)	(Part-3 Tensile strength)
IS:1121-(Parts 1 to 4)	(Part-4 Shear strength)
IS:1122	Method of test for determination of true specific gravity of natural building stones.
IS:1123	Method of identification of natural building stones.
IS:1124	Method of test for determination of water absorption, apparent specific gravity and porosity of natural building stones.
IS:1125	Method of test for determination of weathering of natural building stones.
IS:1126	Method of test for determination of durability of natural building stones.
IS:1127	Recommendations for dimensions and workmanship of natural building stones for masonry work.
IS:1128	Specification for Limestone (Slabs and Tiles)
IS:1129	Recommendation for dressing of natural building stones.
IS:1130	Specification for marble (blocks, slabs and tiles).
IS:1597 (Part 2)	Code of practice for construction of stone masonry: Ashlar masonry
IS:1706	Method for determination of resistance to wear by abrasion of natural building stones
IS:1805	Glossary of terms relating to stones, quarrying and dressing
IS:3620	Specification for laterite stone block for masonry
IS:3622	Specification for Sandstone (slab & tiles)
IS:4101 (Part 1)	Code of practice for external facing and veneers: stone Facing
IS:4101 (Part 2)	Code of practice for external facing and veneers: Cement concrete facing
IS:4101 (Part 3)	Code of practice for external facing and veneers: Wall tiling and mosaics

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IS:4121	Method of test for determination of water transmission rate by capillary action through natural building stones
IS:4122	Method of test for surface softening of natural building stones by exposure to acidic atmospheres
IS:4348	Method of test for determination of permeability of natural building stones
IS:5218	Method of test for toughness of natural building stones
IS:8381	Recommended practice for quarrying stones for construction purposes
IS:14223 (Part 1)	Polished building stones: Granite
BS: 8298	Code of practice for design and installation of natural stone cladding and lining

SECTION – S.02

EARTH WORK

2.1 EXCAVATION

2.1.1 *Site Clearance*

The Contractor shall clear the Site as required by removing vegetation and demolishing any structure, debris, trees along with their roots, buildings etc. and the like to approved locations the site as agreed by the Authority's Representative.

Stumps and major roots shall be grubbed up and disposed of off the site as directed. The Contractor shall take precautions to prevent the spread of fire to adjacent areas.

2.1.2 Topsoil Stripping

Topsoil shall be removed as required, deposited in separate heaps at locations approved by Authority's Representative.

2.1.3 Removal of Unsuitable Material

The Contractor shall remove unsuitable material as ordered or agreed to by the Authority's Representative and shall dispose of it on or off the site as directed in the required manner. Boulders, stones and other materials of value or usable again on the works shall be neatly stacked and graded as directed by Authority's Representative.

2.1.4 Excavation – General- (soil and rock)

- a) Excavation shall be carried out to the lines, levels and profiles shown on the Drawings. The work shall be carried out by the Contractor in such a way as to avoid soil erosion, ground water pollution, accidents in habitational or frequented places, disturbance to the surrounding ground or structures, accident to workmen and any other untoward incident. Particular care shall be taken to maintain stability when excavating in close proximity to existing works. Fencing, caution signages with red lights and other safety measures shall be employed to avoid accidents. Where necessary, signal men shall be employed to guide the movement of people, vehicles and equipment.
- b) The work shall be carried out in a careful manner to ensure that the exposed surfaces are as sound as the nature of the material permits and that no point shall protrude inside the lines shown on the Drawings except as otherwise specified or agreed by the Authority's Representative. In soft soil excavation, which is to remain open permanently, exposed faces shall be formed accurately

to the required slopes and profiles and properly protected by turfing or pitching as required by the Authority's Representative.

- c) The Contractor shall dispose of all material arising from excavations either off the site or to approved tips on the site, as required.
- d) The Contractor shall be responsible for keeping all excavations free from water from whatever cause arising and shall provide such pumping capacity and other measures as may be necessary for this purpose.
- e) The Contractor shall properly support the sides of excavations and shall be responsible for their safety. In case of any slips or blows in the excavation, the same shall be cleared by the Contractor at his own cost.
- f) The Contractor shall notify the Authority's Representative without delay of any permeable strata, joints, faults, fissures or unusual ground conditions encountered during excavation.
- g)
- h) The contractor shall ensure that no air pollution takes place during excavation, storage and transportation of earth by providing suitable measures like cover etc.
- i)
- j) The Contractor shall provide the Authority's Representative full details of the proposed rock excavation methods for his approval. Excavation should be carried out by such manual/mechanical means or methods, so as to eliminate noise and dust up to the prescribed limits and without using any blasting and/ or any expansive chemicals. Similarly, the Contractor shall submit his plans for methods for monitoring vibration adjacent to residential area.
- k)
- l) The Contractor shall carry out rock stabilization measures with minimum delay after the excavation of each round. In order to facilitate this, the Contractor shall request that the Authority's Representative always accompanies him when inspecting the existing structures and excavated rock surfaces revealed after excavation operations.

2.1.5 Excavation beyond True Lines and Levels

If from any cause whatsoever excavations are carried out beyond their true line and level other than as per existing approved drawings then the Contractor shall make good at his own cost to the required line and level with the appropriate grade of filling to be contained in the true excavation, or with concrete or other approved material in such a manner as the Authority's Representative shall require.

2.1.6 Approval of Excavation

When excavations have been taken out accurately to the profiles or dimensions

required for the work, the Contractor shall inform the Authority's Representative so that he may carry out an inspection. If Dead man is used, it should be offered for inspection to the Authority's representative.

If, after his inspection, the Authority's Representative requires additional excavation to be carried out, the Contractor shall do so to such new profiles or dimensions as the Authority's Representative may direct.

2.1.7 Excavations for Structures

- a) Open excavation to lay a foundation for a structure shall be carried out to the lines and dimensions necessary to permit the proper construction of the structure.
- b) Where a structure is to be founded on soft ground, the excavation shall be taken down until the required suitable soil formation is exposed and prepared to the satisfaction of the Authority's Representative.
- c) If required, before any concrete for a foundation is placed, the bottom of the excavation shall be re-compacted to achieve a dense smooth and level surface both longitudinally and transversely or stepped. Subject to the satisfaction of the Authority's Representative, sand layers not exceeding 150 mm thick shall be placed and compacted to minimum 95% of the maximum dry density over the same.
- d) In the event of excavation having been made deeper than that shown on the drawings or as ordered by the Authority's Representative, the extra depth shall be made up with concrete of the foundation grade at the cost of the contractor. Ordinary filling shall not be used for the purpose of bringing the base of foundation to required level.
- e) Surfaces of excavations or filling which are to receive reinforced concrete work shall, where indicated, be prepared with a blinding layer of concrete as shown on the Drawings or in such other manner as will provide a suitable surface at the correct lines and levels to the satisfaction of the Authority's Representative.

2.1.8 Trench Excavation

- a) Trench excavation shall be performed by the use of suitable hand tools or mechanical equipment, in such a manner as to minimize disturbance of the sides and bottom of the excavation.
- b) Trenches for pipes shall be excavated to a sufficient depth and width to enable the pipe and the specified joint, bedding, haunching and surrounding to be accommodated.

2.1.9 Trenches

- a) The Contractor shall carry out excavation in a safe manner such that the sides

of the trench are adequately supported and stable till the completion of work.

- b) The Contractor shall leave a clear adequate space between the edge of the excavation and the inner toes of the spoil banks.
- c) Trenches shall be excavated to the lines and levels shown on the Drawings.
- d) Trenches shall not be excavated too far in advance of pipe laying and shall be sufficiently wide to allow proper and efficient jointing to be carried out in clean and dry conditions. Due allowance shall be made for bedding and surrounds where these are specified.
- e) The bottoms of all trenches shall be trimmed to grade and level and compacted before any bedding is placed or pipes are laid.
- f) The widths of trenches crossing roads or at other locations as directed shall be as narrow as is practicably possible. The maximum width measured between undisturbed soil in the trench sides shall not exceed the outside diameter of the pipe being laid plus 550 mm for pipes up to and including 800 mm in diameter and plus 750 mm for pipes over 800 mm in diameter. The depth of excavation shall be such as to provide adequate cover / cushion to the pipe.
- g) Trenches for pipes carrying water under pressure shall, except where otherwise described in the Contract, be excavated to a sufficient depth to ensure a minimum cover of 900mm to the top of the pipes.

2.1.10 Road Crossings

The Contractor shall close-sheet and adequately support all trenches across existing roads. Great care shall be taken by the Contractor to ensure that existing roads and services are not damaged by road crossing operations. The trenches on roads shall be back filled and roads repaired on utmost priority taking all safety precautions.

2.1.11 Channels

- a) Channels shall be excavated by methods which do not endanger the stability of the side slopes.
- b) Existing channels, which are to be reshaped, cleared and trimmed, shall be cleared of all weeds and growth and the beds graded to the required levels. The sides of channels shall be trimmed to the required safe limits of slope and width.
- c) Side banks of channels shall be trimmed to a neat appearance and even surfaces.
- d) Any channels, streams, drains or pipes taking water to or from cultivated land shall be diverted so as to maintain their flow before being moved or broken into. All diversions and their subsequent reinstatement shall be carried out to the satisfaction of the Authority's Representative.
- e) The Contractor shall control the rates of filling and draw-down of water in

channels so as not to endanger the stability of earthworks.

2.1.12 Approval of Excavations prior to Backfilling

The Contractor shall obtain approval of excavations prior to placing pavement layers, fill or concrete. The Contractor shall maintain open excavations in an approved condition and shall rectify the effects of deterioration due to weather.

2.2 FILL

2.2.1 Fill - General

Prior to commencement of filling, the Contractor shall submit in writing to the Authority's Representative for **'Notice of No Objection'** his proposals for carrying out the work such that the optimum use may be made of excavated material. The proposals shall include details of the compaction plant and methods for adjusting the moisture content of the

material. Filling shall not commence until the **'Notice of No Objection'** proposals and the material intended to be used are put up for review by the Authority's Representative and finally his observations are carried out.

2.2.2 Fill Material

Fill material, other than for roadworks, shall be evenly graded granular material. Material with more than 20% passing a 75-micron sieve or more than 10% in excess of 75 mm size is unlikely to be suitable for use. Clods or hard lumps of earth over 75 mm in greatest dimension shall be broken up before compacting the material in embankment.

Following types of material are considered unsuitable and shall not be used for fill or embankment:

- Materials brought from swamps, marshes or bogs;
- Peat, loam, fine silt, log, stump or organic or perishable materials;
- Material susceptible to spontaneous combustion;
- Clay of liquid limit exceeding 80 and plasticity index exceeding 55;
- Materials containing salts prone to inducing leaching in the embankment.

The Contractor shall carry out the following initial tests on the proposed material

- 1) Wet sieve analysis
- 2) Dry density/moisture content relationship

Thereafter, one set of tests shall be carried out for each 2000 cum of fill, supplied

to Site or as required by Authority's Representative.

Fill material shall be obtained only from the approved source.

2.2.3 Backfill - General

Except around structures, excavations shall be backfilled with approved material compacted in layers of 300 mm maximum thickness to achieve a density of at least 95% of the maximum dry density.

2.2.4 Backfill to Structures

The Contractor shall not backfill around structures until the structural elements have attained adequate strength and the consent of the Authority's Representative to proceed for type of fill material has been obtained. Unless otherwise directed, the backfill material shall be sand, thoroughly compacted in layers not exceeding 200 mm deep to achieve a density of at least 95% of the maximum dry density.

2.2.5 Preparation of Base/ Foundation for Embankment

- (a) Prior to placing any embankment upon any area all clearing and grubbing operations shall have been completed in accordance with Clauses 2.1.1 to 2.1.3 and got approved by the Engineer's Representative for starting of filling operations. Where the height of filling is 1 meter or less all sod, grass and vegetable matter shall be removed from the ground surface and the top 15 cm shall be processed as necessary and compacted to 95% of the maximum dry density.
- (b) Where filling is to be done on slopes, the existing slopes shall be loosened by scarifying or ploughing to a depth of not less than 10 cm, to ensure a good bond between the slope and filling, or where this is impracticable, steps in vertical and horizontal face shall be cut in the existing slope and the filling of successive layers. Material which has been loosened shall be recompact simultaneously with the first level of embankment material placed.
- (c) Where filling is to be done against sloping ground, having slopes steeper than 4 horizontals to 1 vertical, continuous horizontal bench, each at least 300 mm wide, shall be cut in to the old slope for ensuring adequate bond with fresh embankment being added.
- (d) Where existing embankments are to be widened or included in new embankment, the slopes of the exiting embankment shall be ploughed or scarified to a depth of not less than 10cm or, where this is impracticable, steps in horizontal and vertical faces shall be cut in existing slopes and the embankment built up in successive layers to the level of the old road, before its height is increased.

Unless otherwise shown on the Drawings, where existing unpaved roads are to be covered with less than 30 cm of fill, excluding pavement, the top of the old roadbed shall be scarified and recompacted with the next layer of the new embankment. The total depth of the scarified and added material shall not exceed the permissible depth of layer.

- (e) Embankments in swamps or water shall be constructed by sand embankment. The Contractor shall excavate or displace swamp ground and backfill with suitable material. Backfill will be in accordance with the same provisions as for embankment.
- (f) Fill material shall not be placed against any abutment or wing wall unless permission has been granted by the Authority's Representative.

2.2.6 Placing Embankment

Embankment shall be placed in accordance with the following requirements:

(a) **General:**

Except as otherwise required all embankments shall be constructed in layers approximately parallel to the finished grade of the track/ roadbed. During construction of embankment, a smooth grade having an adequate crown or super elevation shall be maintained to provide drainage. Embankments shall be constructed to the required grade, and completed embankments shall correspond to the shape of the typical sections as shown on the Drawings.

During construction of the embankment, it should be ensured that any work, which is to be done during the course of laying the fill material shall not be left out.

(b) **Earth Embankment:**

Earth embankments shall be defined as those principally of material other than rock and shall be constructed of approved material brought from designated or other approved sources.

Except as specified for embankment in swamps, earth embankments shall be constructed in successive layers, for the full width of the cross section and in such lengths as are suited to the compaction and watering methods used.

(c) **Placing over swamp ground:**

Embankment in or over swamps or in water shall be placed by dumping sand in a uniformly distributed layer of a thickness not greater than that necessary to support the equipment while placing subsequent layers, after which the remainder of the embankment should be constructed in layers and compacted as

specified.

(d) **Preparation of subgrade:**

The surface of the finished subgrade shall be neat and workmanlike and shall have the required form, super elevation, levels, grades, and cross section. The surface shall be constructed to sufficient accuracy to permit the construction of subsequent layers of material to the thickness, surface tolerance, and compaction specified.

2.2.7 Compaction of Embankments

- (a) When necessary, each layer, before being compacted, shall be processed as required to bring the moisture content sufficiently close to optimum to make possible its compaction to the required density. The material shall be worked as to have uniform moisture content through the entire layer.
- (b) Each layer of material shall be compacted uniformly by use of adequate and appropriate compaction equipment. The compaction shall be done in a longitudinal direction along the embankment and shall generally being at the outer edges and progress towards the centre in such a manner that each section receives equal compaction effort.

Hauling equipment shall be operated over the full width of each layer in so far as practicable. There should be a minimum overlap of 150 mm between each run of the rollers.

- (c) Filling compaction shall be carried out in one of the following two ways: -

Either the top 15 cm of the finished embankment shall be compacted to a dry density equal to at least 95% of the maximum dry density. Other embankment layers more than 15cm below finished surface or the underside of the lowest layer of base sub-base and shoulder shall be compacted to a dry density equal to at least 95% of the maximum dry density.

OR the embankment shall be compacted to a dry density equal to at least 95% of the maximum dry density. In the case of embankment exceeding 70 cm in height, layers more than 50 cm below finished surface, or the underside of the lowest layer of base sub-base and shoulder shall be compacted to a dry density equal to at least 95% of the maximum dry density. The method to be adopted shall be directed by the Authority's Representative.

2.2.8 Inverted Filter

An inverted filter consisting of stone boulders and coarse aggregates to accepted grading shall be constructed behind the earth retaining structures up to the height as shown in the drawings.

It shall be constructed simultaneously with the filling work. Care shall be taken during laying of filter media that it does not cause damage to structural members or application of excessive pressure against the structure.

2.3 TESTS

2.3.1 Testing of Fill – General

Classification tests as per relevant Standards to which the Engineer's Representative has given his consent shall be carried out to ensure that true comparisons can be made between in-situ densities, laboratory compaction densities and field trial densities i.e. that variations in properties of materials being used in the tests are not affecting the results.

Tests shall be carried out on fill to determine the degree of compaction achieved, at the rate of one test for either each 1,200 cum or each layer whichever is more frequent. Compacted layers shall not be covered without approval.

The density of individual compacted layers shall be determined by a method acceptable to the Engineer's Representative.

The in-situ dry density of fill shall average 95% of the maximum reached in trials. No single result shall be less than 92% and no more than 25% of the results on any one layer shall fall between 92% and 95%. The average shall be computed from the total number of tests on any one layer where the extent of the layer is defined by the Contractor in submitting same for inspection.

2.3.2 Materials for Top Layer of Fill

In addition to the general requirements for fill material, the material in the top layer shall not exceed the following test values:

Plasticity Index : 6
Liquid Limit : 35
Total fine shall not exceed 15%,
Uniformity Coefficient (Cu) shall not be less than 4.

The laboratory California Bearing Ratio (CBR) value, at 95% of the maximum dry density achieved after soaking for 96 hours, shall not be less than 30%.

2.3.3 Testing of Top Layer

Tests shall be carried out on the top layer of fill as follows:

Test	Frequency of test (not less than one test per...)

A. Laboratory tests to monitor the consistency of the approved material during construction:	
Maximum dry density	1500 sqm
Optimum moisture content	1500 sqm
Grading	1500 sqm
Plasticity index	1500 sqm
Linear shrinkage	1500 sqm
CBR Value	3500 sqm
B. In situ tests to confirm that the required degree of compaction is being achieved during construction:	
Dry density	500 sqm
CBR Value	2500 sqm

Tests shall be carried out as required by the accepted test procedure.

SECTION – S.03

CONCRETE: PLAIN & REINFORCED

These specifications shall be read in conjunction with the latest version of CPWD specifications with up-to-date correction slips, MOST/MORTH Specifications and other relevant specifications described in these Specifications.

3.1 MATERIALS

Before bringing it to the site, all materials for concrete shall be approved by the Engineer. All approved samples shall be deposited in the office of the Engineer before placing orders for the materials with suppliers. The materials brought on to the works shall conform in every respect to their approved samples.

Fresh samples shall be deposited with the Engineer whenever type or source of any material changes. The contractor shall check fresh consignment of materials as it is brought on to the works to ensure that they conform to the specifications and/or approved samples.

The Engineer shall have the option to have any of the materials tested to find whether they are in accordance with specifications at the contractor's expense. All bills vouchers and test certificates, which in the opinion of the Engineer are necessary to convince him as to the quality of materials or their suitability, shall be produced for his inspection when required.

If fly ash is used in concrete, the contractor shall demonstrate the quality control procedure including source of fly ash, its properties, handling as per the relevant IS & international codes etc. and shall use in slabs and walls only after “no objection” to the same has been obtained from the Engineer.

Any materials which have not been found to conform to the specifications and not approved by the Engineer shall be rejected forthwith and shall be removed from the site by the contractor at his own cost within the time stipulated by the Engineer. The Engineer shall have the powers to cause the contractors to purchase and use materials from any particular source, as may in his opinion be necessary for the proper execution of work.

Contractor shall also ensure that all constituents of exposed concrete shall be taken from same sources to achieve a uniform colour and texture.

3.1.1 Cement

3.1.1.1 The cement used shall be of the following types:

- a) 53 grade Ordinary Portland Cement conforming to IS:12269.
- b) Portland Slag Cement (PSC) conforming to IS: 455.
- c) IRST-40 Indian Railway standard specifications for special grade cement for use in concrete sleepers

3.1.1.2 Whenever possible all cements of each type shall be obtained from one constant source throughout the contract, cement of different types shall not be mixed together. Different brands of cement, or the same brand of cement from different sources, shall not be used without prior approval of the Engineer- in-Charge.

3.1.1.3 Packaged cement shall be delivered to the site in original sealed bags or bulker which shall be labeled with the weight, name of manufacturer, brand and type. Cement received in torn bags shall not be used. Cement shall be used in the order in which it is received. Cement in bags in storage for more than 3 months shall be retested before use. A sample taken once for every 1000 bags shall be tested. The sampling from bulker shall be increased as decided by the Engineer.

The Contractor may obtain cement in bulk through bags or bulker and store it in suitable silos of adequate capacity. Each type of cement shall be stored in a separate silo, and it shall be ensured that cement of different quality are not mixed up.

3.1.1.4 All cement shall be fresh when delivered and at ambient atmospheric temperature.

3.1.1.5 In fair faced elements, the cement used in the concrete for any complete element shall be from a single consignment. All cement for exposed concrete shall be from the same approved source and uniform in colour.

3.1.1.6 With each and every delivery of cement the contractor shall provide manufacturers certificate that the cement conforms to the relevant Indian standard. The contractor shall provide complete facilities at site for carrying out the following tests:

- a) Setting time by vicat's apparatus as per IS:5513 and IS:4031.
- b) Compressive strength on cement as per IS: 4031, IS:650, IS:10080.

3.1.1.7 Total chloride content in cement shall in no case exceed 0.05 percent by mass of

cement. Also, total sulphur content calculated as sulphuric anhydride (SO_3), shall in no case exceed 2.5 percent and 3.0 percent when tri-calcium aluminate per cent by mass is upto 5 or greater than 5 respectively.

3.1.2 Aggregate

Aggregates from natural sources shall be in accordance with IS:383. The contractor shall submit to the Engineer certificates of grading and compliance for all consignments of aggregate. In addition, at site from time to time, the contractor shall allow for carrying out such tests and for supplying test records to the Engineer. The aggregates shall be procured from approved sources only as directed by the Engineer from time to time.

For fair faced concrete, the contractor shall ensure that aggregates are free from iron pyrites and impurities, which may cause discoloration. Aggregates shall be stored on paved areas in different compartments according to their nominal size.

3.1.2.1 Fine Aggregate

The contractor shall provide complete facilities at site for determining grading of aggregates by sieves as per IS: 383, IS: 460, IS: 1607, and IS: 2386. The fine aggregate shall be river sand pit sand, stone dust or other approved sand. It shall be free from clay, loam, earth or vegetable matter, salt or other harmful chemical impurities. It shall be clean, sharp, strong, angular and composed of hard siliceous material. If considered by the Engineer as necessary, the sand shall be washed in screw type mechanical washers in potable water to remove silt, clay and chlorides. This shall be done at least one day before using it in concrete. The washed sand shall be stored on a sloping concrete platform and in such a manner as to avoid contamination. Such sand washing, storing, etc. shall be at the Contractor's cost. The grading of fine aggregate when determined as described in IS: 2386 (part I), shall be within the grading zones I, II, III. Water absorption shall be less than 3% by weight (ASTM C 117)

The contractor shall provide complete facilities at site for carrying out the following tests:

- A) Proportion of clay, silt and fine dust by sedimentation method as per IS:2386 part II.
- B) Moisture content in fine aggregate as per IS: 2386 Part III.
- C) Bulk density/ Bulkage.

3.1.2.2 Coarse Aggregate

The coarse aggregate shall be crushed stone, crushed gravel, natural gravel or a suitable combination thereof. Coarse aggregate obtained from crushed or broken stone shall be angular, hard, strong, dense, durable, clean and free from soft, friable, thin

plate, elongated or flaky pieces and any deleterious material.

River gravel or pit gravel shall be sound, hard, clean, non-porous, suitably graded in size with or without broken fragments and free from flat particles of shale, clay, silt, loam, and other impurities.

Except where it can be shown to the satisfaction of the Engineer that a supply of properly graded aggregate of uniform quality can be maintained over the said period of the works, the grading of aggregate shall be controlled by obtaining the coarse aggregate in different sizes and blending them in correct proportions as and when required. Aggregate shall be stored in such a way as to prevent segregation of sizes and avoid contamination with fines.

All coarse aggregate shall conform to IS: 383 and tests for conformity shall be carried out as per IS: 2386, Parts I to VIII.

The maximum size of coarse aggregate shall be such that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corners of formwork. The grading of coarse aggregate shall be such that not more than 5% shall be larger than the maximum size and not more than 10% shall be smaller than the smallest size. Between these sizes the coarse aggregate shall be well graded. Unless otherwise permitted by the Engineer the nominal maximum size shall not exceed 20 mm. Water absorption shall be less than 3% by weight (ASTM C 117)

3.1.2.3 Chloride Content

The chloride content of aggregates shall be within the recommended limits stated in IS: 383 or BS 882 and the chloride content of the concrete mix shall be within the recommended limit of IS: 456 or BS 8110. Chloride levels shall be determined daily in accordance with the methods described in BS 812.

3.1.2.4 Alkali-Silica Reactivity

If aggregates contain any materials which are reactive with alkalis in any of the constituents of the concrete, or in water which will be in contact with the finished work, then the Contractor shall take samples of these materials every week. The Contractor shall ensure that the concrete mix complies with the requirements of this Specification regarding "Minimising risk of alkali-silica reaction in concrete", Vide sub section 3.3.1. The results of the Contractor's weekly monitoring tests shall be submitted in writing to the Engineer-in-charge.

3.1.2.5 Sulphate Content

The total acid soluble sulphate content of the concrete mix, expressed as SO₃, shall not

exceed the recommended limit in IS: 456 or BS 8110.

3.1.2.6 Water

Water used in the works shall be potable water and free from deleterious materials. Water used for mixing concrete as well as for cooling and/or washing aggregate shall be fresh and clean free from injurious amounts of oil, salts, acids, alkali, sugar other chemicals and organic matter.

Water shall be from the source approved by the Engineer and shall be in accordance with clause 5.4 of IS: 456 and/or BS 3148. However, chloride content in water for R.C.C. shall not exceed 500 mg/litre.

Before starting any concrete work and wherever the source of water changes, the water shall be tested in accordance with IS: 3025 for its chemical and other impurities to ascertain its suitability for use in concrete for approval of the Engineer. No water shall be used until tested and found satisfactory. Cost of all such Tests shall be borne by the contractor.

3.2 BLENDING OF AGGREGATES:

In order to obtain optimum workability, individual aggregates of nominal size 20mm, 10mm, 4.75mm and 2.36mm will be blended in such a way that the grading curve for all aggregates will be a smooth curve from size 0.15mm to 25mm falling within the established envelop grading curve. Contractor shall establish envelop grading curve for each grade of concrete for given maximum size of aggregates and get it approved by Engineer-in-Charge before finalizing the mix design.

3.3 ADMIXTURES:

- a) Chemical admixtures are not to be used until permitted by the Engineer. In case their use is permitted, the type, amount and method of use of any admixtures proposed by the Contractor shall be submitted to the Engineer-in-charge for approval. The minimum cement content specified shall not be reduced on account of the use of Admixtures.
- b) The contractor shall further provide the following information concerning each admixture to the Engineer
 - i. Normal dosage and detrimental effects if any of under dosage and over dosage.
 - ii. The chemical names of the main ingredients in the admixtures.
 - iii. The chloride content, if any, is expressed as a percentage by weight of admixture.

- iv. Whether or not the admixture leads to the entrainment of air when used in the manufacturer's recommended dosage.
- v. Where two or more admixtures are proposed to be used in any one mix, the manufacturer's written confirmation of their compatibility.
- c) In reinforced concrete, the chloride content of any admixture used shall not exceed 2 percent by weight of the admixture as determined in accordance with IS:6925 and the total chloride and sulphate contents in concrete mix shall not exceed 0.15 and 4.0 percent respectively by weight of cement.
- d) The admixtures when used shall conform to IS: 9103 or BS 5075 and BS 1014. The suitability of all admixtures shall be verified by trial mixes.
- e) The addition of calcium chloride to concrete containing embedded metal will not be permitted under any circumstances.
- f) Retarding admixtures when used shall be based on ligno-sulphonates with due consideration to clause 5.2 and 5.3 of IS: 7861.
- g) Fibre reinforcement will be Propex (Fibermesh 300-e3 / Fibermesh 150-e3) or equivalent make polypropylene fibres, shall be added to ready-mixed concrete wherever the material is to be used for parapet, box girder. Bar reinforcement is still considered primary reinforcement. Under normal conditions, add to the ready-mix at the plant in the quantity recommended by the manufacturer subjected to the approval of Engineer-in-Charge. If job conditions warrant, fibre reinforcement may be added at the jobsite provided that fibers are evenly distributed in the mix.
- h) Micro silica (Silica fume) when used as mineral admixture in to concrete shall be conforming to ASTM C 1240 latest standards to establish specified strengths, durability and to meet special design objectives.

3.3.1 Minimizing the Risk of Alkali-Silica Reaction (ASR) in Concrete

- a) Precautions against ASR in Concrete
Concrete mixes for use in the Permanent Works shall comply with one of the Subsections (b), (c) or (d). The Contractor shall notify the Engineer of his proposals for complying with this requirement.
- b) The cementitious material shall have a reactive alkali content not exceeding a maximum

value of 0.6% by mass when defined and tested in accordance with Subsections 3.3.1 (e) to (k) inclusive).

To combat the ASR, Microsilica shall be used in minimum 5% cement and shall not exceed 10% by the wt of cement in order to bind free alkalis early in plastic concrete and to reduce the permeability of concrete to prevent the moisture and external alkalis penetration.

OR

- c) The total mass of reactive alkali in the concrete mix shall not exceed 3.0 kg/m^3 of concrete when defined, tested and calculated in accordance with Subsections 3.3.1 (e) to (k) inclusive) and 3.3.1 (l) to (o) inclusive).

OR

- d) The aggregate shall be classed as non-reactive in accordance with the definition in Subsection (n).
- e) Cementitious Material (Hydraulic and Latent Hydraulic Binders):
- f) The term alkali refers to the alkali metals sodium and potassium expressed as their oxides. The reactive alkali content of Portland cements shall be defined as the percentage by mass of equivalent sodium oxide (Na_2O) calculated from: -

$$\% \text{ equivalent Na}_2\text{O} = \% \text{ acid soluble Na}_2\text{O} + 0.658 \times (\% \text{ acid soluble K}_2\text{O})$$
- g) The method used in determining the acid soluble alkali content of the materials shall be in accordance with BS 4550: Part 2: Subsection 16.2.
- h) The Contractor shall make available the certified average acid soluble alkali content of Portland cement on a weekly basis.
- i) The Contractor shall give immediate notice of any change which may increase the certified average acid soluble alkali content above the level used in the mix design for the concrete. A revised mix design for any concrete which would be affected by the increased alkali content shall be submitted for consent with notification of the change.
- j) Minimizing the Risk by Using Cementitious material Containing less than 0.6% Reactive Alkali

The requirements of Subsection (b) will be met by Subsection (k) provided that the contribution of alkalis from other sources does not exceed 0.2 kg/m^3 (see Subsections

(n) and (u). Where alkalis exceed 0.2 kg/m³ the requirements of Subsections (l) to (o) shall apply.

- k) The cementitious material shall be Portland cement complying with Indian Standard and shall have additionally a certified maximum acid soluble alkali content not exceeding 0.6%.

The Contractor shall provide on request weekly certificates which name the source of the cement and confirm compliance with the Specification.

- l) Minimizing the Risk by Limiting the Reactive Alkali content of the concrete to 3.0 kg/m³. The requirements of Subsection (c) will be met provided that Subsections (m) and (n) are satisfied.

- m) The reactive alkali content of the concrete contributed by the Portland cement to the concrete shall be calculated from:

Portland cement

$$A = \frac{C \times a}{100}$$

Where,

A = reactive alkali content of the concrete to the nearest 0.1 (kg/m³) C = target mean Portland cement content of the concrete (kg/m³)

a = certified average acid soluble alkali content of the Portland cement (%).

- n) Where reactive alkalis in excess of 0.2kg/m³ are contributed to the concrete from sources other than the cementitious material the limit of 3.0 kg/m³ from the cementitious material shall be reduced by the total amount so contributed. The reactive alkali contributed by sodium chloride contamination of aggregates shall be calculated from:

$$H = 0.76 \times \frac{\{(NF \times MF) + (NC \times MC)\}}{100} \text{ (kg/m}^3\text{)}$$

Where H = equivalent alkali contribution made to the concrete by the sodium chloride

NF = chloride ion content of the fine aggregate as a percentage by mass of dry aggregates and measured according to BS 812: Part 4

MF = fine aggregate content (kg/m³)

NC = chloride ion content of the coarse aggregate as a percentage by mass of dry aggregate and measured according to BS 812: Part 4: 1976 (now in draft as Part 117)

MC = coarse aggregate content (kg/m³).

The factor 0.76 is obtained from a consideration of the composition of sea water.

The chloride ion content of aggregate sources containing 0.01% of chloride ion by mass or more shall be determined weekly in accordance with BS 812 or another approved method. When the chloride ion level is less than 0.01% it shall be regarded as nil.

- o) The Contractor shall provide certificates on request confirming compliance with the Specification and stating:
 - i. The target means cementitious material content of the concrete.
 - ii. The names of the works manufacturing cement.
 - iii. A weekly report of the cement alkali determinations in accordance with Subsection (f).
 - iv. The certified average acid soluble alkali content of the Portland cement.
- p) **Minimizing the Risk by Using Selected Aggregates**
Fine and coarse aggregate material shall comply with the requirements of IS:383 (and/or AASHTO Standard Specifications M6 and M80 respectively) to be taken out to conform to 512(2).
- q) **Water**
Water for use in the manufacture of concrete shall be obtained from a public utility undertaking supply or from a source approved by Engineer and shall be of potable quality, and comply with the requirement of IS:456 and or BS 3148
- r) Where a potable mains supply is not available the Contractor shall obtain confirmation of the quality and reliability of the proposed source from the appropriate water authority and shall thereafter seek consent from the Engineer to use the proposed source.
- s) Water other than from a public utility undertaking supply shall be sampled at a frequency to be determined by the Engineer and tested in accordance with the relevant provisions of IS:3025 or BS 3148. The sodium oxide and potassium oxide content shall be declared and expressed as equivalent Na₂O and shall be taken into account when calculating the total reactive alkali content of the concrete mix.
- t) **Admixtures and Pigments**
Admixtures and pigments shall comply with the requirements of IS 9103 and IS:6925 or BS 5075 and BS 1014. The manufacturer's declared equivalent acid soluble alkali content and the dosage rate of any admixture or pigment to be incorporated shall be included with details of all concrete mixes submitted for consent.

- u) The alkali content of admixtures shall be taken into account when determining the total equivalent alkali content of the concrete mix.
- v) Micro silica (silica fume) shall be used in 5% by the weight of cement and shall not exceed 15% by the weight of cement.

3.4 BATCHING PLANTS, MIXERS AND VIBRATORS:

- a) Unless specified in the schedule of items, for all structural concreting work the Contractor shall provide automatic weigh-batching plant of suitable capacity. The plant used shall conform to IS: 4925.
- b) The Contractor shall provide Concrete mixers (IS: 1791 – Batch type concrete mixers, IS: 2438 – Roller Pan Mixer) and Vibrators (IS: 2505 – Concrete Vibrators Immersion Type, IS: 2506 – Screed board concrete vibrators, IS: 4656
- Form Vibrators for Concrete) supplied by recognised manufacturers.

3.5 GRADE OF CONCRETE:

The concrete is designated as follows:

- a) Concrete M25/20
- b) The letter M refers to the mix
- c) The number 25 represents the characteristic compressive strength of 15cm cubes at 28days in MPa (Mega Pascal: 1 MPa: 10 kg/cm² approximately). M25 concrete thus has a characteristic strength of 250 kg/cm². Other mix design will also be denoted in same way.
- d) The number 20 represents the nominal size of the aggregate in mm.

3.6 MIX DESIGN:

It is the complete responsibility of the Contractor to design the concrete mixes by approved standard methods and to produce the required concrete conforming to the specifications and the strength, workability requirements approved by the Engineer.

Mix Design Once approved must not be altered without prior approval of the Engineer. However, should the contractor anticipate any change in quality of future supply of materials than that used for preliminary mix design, he should inform the Engineer quite in advance and bring fresh samples sufficiently in advance, to carry out fresh trial mixes. Design mix will indicate by means of graphs and curves etc., the extent of variation in the grading of aggregates which can be allowed.

3.6.1 Limits of Water and Cement Contents

Maximum water/cement ratio

a)	For RCC members including piles	-	0.40
b)	For PSC members	-	0.40

3.6.2 Cement Content

Minimum Cementitious content in concrete shall be as per IRS CBC. In the case of piling work minimum cementitious content shall be as specified under Pile Foundations. However, this shall be limited to 500 kg/ cum of concrete. Ordinary Portland cement (OPC) conforming to IS: 12269 shall be used. For pre-stressed concrete, cement conforming to codal specifications for OPC 53 grade cement shall be used. For structures exposed to sulphate sulphate attack, Table 4 of IS:456 shall be referred. However, for nominal mixes, CPWD specification and DSR will be followed.

As regards trial mixes, acceptance criteria, acceptance specification, lot size, sampling and testing and sampling size for piling work, PSC girders (cast-in-situ and precast post-tensioned) and general work, the requirement of the relevant codes, standards and directions of the Engineer shall be followed.

3.7 ADDITIONAL TESTS FOR CONCRETE:

As frequently as the Engineer may require, additional testing shall be carried out for concreting in addition to mandatory test specified in CPWD specifications 1996/2002 / relevant IS Code / MOST/MORTH Specifications.

3.7.1 Non-Destructive tests for concrete

1. Ultra sonic pulse velocity test

2. Rebound hammer test

In order to determine the following properties of concrete, non-destructive tests for concrete (ultra sonic pulse velocity test and rebound hammer test) in accordance with IS 13311(Part 1 and Part 2) shall be carried out.

- i. the homogeneity of concrete
- ii. the presence of cracks, voids and other imperfections
- iii. changes in the structure of the concrete which may occur with time
- iv. the quality of the concrete in relation to the standard requirements
- v. the quality of one element of concrete in relation to the another, and
- vi. the values of dynamic elastic modulus of the concrete

In view of the limitations of each method of the non-destructive testing of the concrete, it is essential that the results of tests obtained by one method should be complemented by other tests and each method should be adopted very carefully.

3.7.2 Permeability test for Concrete:

The concrete will be verified for permeability by the following procedure and shall confirm to IS: 3085-1965 – „Permeability of Cement Mortar & Concrete”, **Section 1717. 7..5 of MOST Specification** and **DIN 1048**.

- a) The Engineer shall select random batches of concrete for examination at his discretion and sampling will generally be done at the point of discharge from the mixer and at placing point.
- b) From the batches thus selected two concrete cylinders shall be made in accordance DIN 1048.
- c) All cylinders shall be made, cured, stored, transported and tested in accordance with clause 1717. 7..5 of MOST Specifications. The tests shall be carried out in a laboratory approved by the Engineer.
- d) At least two cylinders shall be made on each day's concreting until 60 cylinders have been made for each grade of concrete. The cylinders will be tested as per the procedure given in Clause (e) next.
- e) Test Procedure:
The permeability of concrete will be verified by the following procedure:
 - i. Prepare a cylindrical test specimen 150 mm dia and 160mm high.
 - ii. After 28 days of curing, the test specimen will be fitted in a machine such that the specimen can be placed in water under pressure up to 7 bars. The typical machine shall be similar to the one shown in Appendix 1700/II of MOST.
 - iii. At first a pressure of one bar is applied for 48 hours, followed by 3 bars for 24 hours and 7 bars for the next 24 hours.
 - iv. After the passage of the above period, the specimen is taken out and split in the middle by compression applied on two round bars on opposite sides above and below.
 - v. The water penetration in the broken core is measured with scale and the depth of

penetration assessed in mm (max permissible limit 25 mm).

vi. Acceptability Criteria:

The concrete shall pass the permeability test if it is properly compacted and is not considered permeable when tested as per DIN, and the water penetration in the broken core is less than 25mm.

No extra payment shall be made for this test and cost of the same will be included in his rate for concrete work.

3.7.3 Chlorides in Concrete

The levels of equivalent acid-soluble chlorides as NaCl ($\text{Cl} \times 1.65 = \text{NaCl}$) in the constituents of concrete as stated elsewhere are indicative and are subject to the overriding limits for the mixes. The total estimated content as a percentage by weight of the cement in the mix shall not exceed the following limits: -

- (a) For reinforced concrete
 - 0.5% if made with Ordinary Portland Cement (OPC)
 - 0.1% if made with Sulphate Resistant Portland Cement (SRPC)
- (b) For mass concrete
 - 1.0% if made with OPC
 - 0.2% if made with SRPC

The Contractor shall test the constituents of the concrete to establish these contents as provided for elsewhere in this Specification.

In addition, regular tests to BS 1881: Part 6 for chloride content shall be made on the hardened concrete. The following values are acceptable: -

- (i) For reinforced concrete made with OPC
 - 95% of the test results less than 0.40% NaCl by weight of cement and no result greater than 0.50% NaCl by weight of cement.
- (ii) For reinforced concrete made with SRPC
 - 95% of the test results less than 0.1% NaCl by weight of cement and no result greater than 0.14% NaCl by weight of cement.
- (iii) For mass concrete made with OPC

95% of the test results less than 1.0% NaCl by weight of cement, and no result greater than 1.30% NaCl by weight of cement.

(iv) For mass concrete made with SRPC

95% of the test results less than 0.2% NaCl by weight of cement and no result greater than 0.25% NaCl by weight of cement.

In the event that the SRPC used contains a proportion by weight of tri-calcium aluminate which approaches 4 - 8%, then consent may be sought for an appropriate adjustment of the relevant chloride content limits.

Sulphates in Concrete

The level of acid-soluble sulphates (SO₃) in the mix shall be no greater than:

Coarse aggregate	0.4% by weight
Fine aggregate	0.4% by weight
Water	500 mg/l

The total estimated sulphate content (SO₃) of the mix including that present in the cement shall not exceed 3.7% by weight of cement in the mix.

In addition, regular tests to BS 1881: Part 6 shall be made on the hardened concrete to determine the total sulphate content, which shall not exceed 4% by weight of cement in the mix.

Permissible Level of Chloride and Sulphates

The permissible level of chlorides and sulphates quoted in the above Subsections shall not be considered as mean values for the whole of the Works but shall apply to any concrete.

Concrete for water-retaining structures shall in addition be as per IS: 3370.

3.8 BATCHING OF CONCRETE INGREDIENTS:

Unless permitted by the Engineer, all concreting shall be either produced in automatic weigh batching plant installed at site or Ready-Mix Concrete manufactured in automatic weigh batching plant.

3.9 PLACING TEMPERATURES:

During extreme hot or cold weather, the concreting shall be done as per procedures set out in IS: 7861, Parts I & II.

In hot weather with temperature exceeding 40 degree C, the stockpiles of fine and

coarse aggregates for concreting shall be kept shaded from direct rays of sun and the concrete aggregates sprinkled with water for a sufficient time before concreting in order to ensure that the temperature of these ingredients is as low as possible prior to batching. The mixer and batching equipment shall be also shaded and if necessary painted white in order to keep their temperatures as low as possible. The placing temperature of concrete shall be as low as possible in warm weather and care shall be taken to protect freshly placed concrete from overheating by sunlight in the first few hours of its laying. The time of day selected for concreting shall also be chosen so as to minimise placing temperatures. In case of concreting in exceptionally hot weather the Engineer may in his discretion specify the use of ice either flaked and used directly in the mix or blocks used for chilling the mixing water. In either case, the Contractor shall not be paid extra for cost of ice, additional labour involved in weighing and mixing etc. All salt and saw dust shall be removed from ice before use. Quality of water used for making ice shall conform to IS: 456.

3.10 TRANSPORTING, PLACING, COMPACTING AND CURING:

Transporting, placing, compacting and curing of concrete shall be in accordance with IS: 456.

3.10.1 Transporting:

The mix after discharging from the mixer shall be transported by transit mixers, buckets, pumps etc. or as approved by the engineer without causing segregation and loss of cement slurry and without altering its desired properties with regard to water cement ratio, slump, air content, cohesion and homogeneity. It should be ensured that the concrete is moved to its final destination before it attains an initial set.

The transportation is to be done by agitating transit mixers, pumps or other approved methods.

3.10.2 Placing:

a) Placing General

Concrete shall be placed in the position and sequence indicated on the Drawings, or as directed. Placing shall not be commenced until the fixing and condition of reinforcement and items to be embedded, and the condition of the containing surfaces or formwork has been approved. 24-hour written notification shall be given of the intention to place concrete.

Concrete shall be transported by means which prevent contamination (by dust, rain etc.) segregation or loss of ingredients, and shall be transported and placed without delay. Concrete shall be placed directly in its final position without segregation or

displacement of the reinforcement, embedded items and formwork. Concrete shall not be placed in water, except as specified. Concrete shall not be dropped through a height greater than 1.5m.

b) **Extent of Pours**

The limit of individual pours and the height of lifts shall be as approved. For walls, the length of panel placed at one time shall not exceed 6m; adjacent panels shall not be placed within 2 days but shall be placed as soon as practicable thereafter. Subsequent vertical lifts shall not be poured within 2 days.

For piers and pier heads, portal columns the concreting is to be carried out in single stage i.e. in first stage concreting will be from kicker to just below pier head bottom and second stage of concreting will be pier head including shear key and cross girder (in station zone stages as given in drawings for all heights by using tremie/ pumps at the rate not more than 1.5m / hr or as approved by the Engineer.

Floors, roofs and ground slabs shall be placed in a sequence of pours to the approval of the Designer and the consent of the Engineer.

If the use of slip-forms or paving trains is permitted, these limits may be revised. The sequence of pours shall be arranged to minimise thermal and shrinkage strains.

c) **Placing Equipment**

Concrete shall generally be placed without segregation by pumping or bottom-opening skips. If chutes are used their slopes shall not cause segregation and spouts or baffles shall be provided.

d) **Time for Placing**

Concrete and mortar must be placed and compacted within 30 minutes of water being added to the mix or otherwise included via damp aggregates, unless admixtures are in use. Partially set concrete shall not be used in the Works.

e) **Continuity of Placing**

Placing in each section of work shall be continuous between construction joints. The Contractor shall make provision for standby equipment. If the placing of concrete is delayed due to breakdown, then the Contractor shall erect vertical stop-ends and form a construction joint or remove the concrete already placed and restart after repair of the breakdown, as directed.

f) **Placing in Inclement Weather**

Placing shall not take place in the open during storms or heavy rains. If such conditions are likely to occur the Contractor shall provide protection for the materials, plant and formwork so that work may proceed. If strong winds are prevalent protection from driving rain and dust shall be provided.

g) **Placing in High Temperature and Low Temperature**

The temperature of concrete shall not exceed 32° nor below 5°C or the temperature stated in the table of Mixes whichever is the lower at the time of placing concrete. Also, the maximum concrete temperature after placing shall not exceed temperature 50°C or 30°C above the concrete temperature at the time of placing whichever is the lower.

"Concrete in hot countries" published by FIP congress at New Delhi 1986 shall be complied with. The procedures the Contractor wishes to employ shall be subject to the Engineer consent

The Contractor shall supply suitable maximum/minimum thermometers and record the shade and sun temperatures at locations where concrete is being placed. Recommendations for cold weather concrete can be had from IS: 7861 (Part 2).

h) **Placing at Night**

If consent has been given for placing at night or in dark interiors, adequate lighting shall be provided where mixing, transportation and placing are in progress.

i) **Placing Under Water**

Underwater concrete shall be placed with minimum disturbance of the water. Running water and wave wash shall be controlled. The specified concrete grade shall be used and the mix design shall provide for good flowing ability.

Tremie pipes, bottom-dump skips, or other approved placing equipment shall be used. Segregation shall be avoided.

Placing shall be commenced in approved sections and continued to completion.

The tremie pipe shall be buried in the concrete for at least 1.5m and the pipe must not be emptied until the pour is complete. If a bottom-dump skip is used, the contents shall be covered by canvas or similar before lowering into the water. The doors shall be opened when the skip is resting on the bottom with no tension in the support cable, and the skip shall be lifted gradually so that the concrete flows out steadily.

j) **Preparation Before Placing**

Before placing concrete for reinforced work on the ground, the formation shall be compacted as specified and a screed of blinding concrete shall be applied to form a surface for construction.

Before placing concrete on or against rock, masonry, brickwork or old concrete, loose material shall be removed, and the surface washed down; water seepage shall be stopped or channeled away from the work.

For mass concrete placed against masonry or brickwork the following shall apply: -

- The mortar joints in the facework shall have fully hardened.
- The water-cement ratio of the concrete shall be increased to compensate for the absorption of moisture by the existing work.
- The surface shall be soaked prior to placing.
- The concrete shall be worked around ties and bond stones and into open joints.

3.10.3 Compaction:

Internal (needle) and surface (screed board) vibrators of approved make shall be used for compaction of concrete.

Internal vibrators shall be used for compaction of concrete in foundations, columns, buttresses arch section, slabs etc, and if required surface vibrators shall also be used. Depending on the thickness of layer to be compacted, 25 mm, 40 mm, 60 mm and 75 mm dia internal vibrators will be used. The concrete shall be compacted by use of appropriate diameter vibrator by holding the vibrator in position until:

- a) Air bubbles cease to come to surface.
- b) Resumption of steady frequency of vibrator after the initial short period of drop in the frequency, when the vibrator is first inserted.
- c) The tone of the vibrated concrete becomes uniform.
- d) Flattened, glistening surface, with coarse aggregates particles blended into it appears on the surface.
- e) Use of curing compounds may be permitted with specific approval of the Engineer.

After the compaction is completed, the vibrator should be withdrawn slowly from the concrete so that concrete can flow into the space previously occupied by the vibrator.

To avoid segregation during vibration the vibrator shall not be dragged through the concrete nor used to spread the concrete. The vibrator shall be made to penetrate, into the layer of fresh concrete below if any for a depth of about 150mm. The vibrator shall be made to operate at a regular pattern of spacing. The effective radii of action will overlap approximately half a radius to ensure complete compaction.

- f) To secure even and dense surfaces free from aggregate pockets, vibration shall be supplemented by tamping or rodding by hand in the corners of forms and along the form surfaces while the concrete is plastic.
- g) A sufficient number of spare vibrators shall be kept readily accessible to the place of deposition of concrete to assure adequate vibration in case of breakdown of those in use.
- h) Form vibrators whenever used shall be clamped to the sides of formwork and shall not be fixed more than 450 mm above the base of the new formwork and concrete shall be filled not higher than 230mm above the vibrator. The formwork must be made especially strong and watertight where this type of vibrator is used.

Care must be taken to guard against over vibration especially where the workability of the concrete mix is high since this will encourage segregation of the concrete.

- i) Plain concrete in foundations shall be placed in direct contact with the bottom of the excavation, the concrete being deposited in such a manner as not to be mixed with the earth. Plain concrete also shall be vibrated to achieve full compaction.

3.10.4 Concrete placed below the ground shall be protected from falling earth during and after placing. Concrete placed in ground containing deleterious substances shall be kept free from contact with such ground and with water draining there from during placing and for a period of seven days or as otherwise instructed thereafter. Approved means shall be taken to protect immature concrete from damage by debris, excessive loading, abrasion, vibrations, deleterious ground water, mixing with earth or other materials, and other influences that may impair the strength and durability of the concrete.

3.10.5 Curing:

- a) The curing compound material should be clear, water based, non-toxic, non-film forming, reactive silicate treatment for 12 months (1 year) shelf life suitable as a complete replacement to any water curing procedures such as water soak, ponding, blankets and plastic sheets for all horizontal and vertical surfaces. After completion of

curing process, there should not be any requirement of removal or special preparation for surface applied adhesives, flooring, coatings, patching, concrete stains, etc. Material test result should be in compliance with ASTM C 309 and ASTM 1315. No curing compound is allowed for segmental box superstructure, U-Girder & precast I girder.

- b) Method of curing and their duration shall be such that the concrete will have satisfactory durability and strength and members will suffer a minimum distortion, be free from excessive efflorescence and will not cause undue cracking in the works by shrinkage.
- c) Steam curing with approved methodology can be adopted if required, for precast components subject to the approval of Engineer-in-Charge. No extra payment will be made for adopting steam curing. Before concrete products are subjected to any accelerated method of curing, the cement to be used shall be tested in accordance with accepted standards (relevant IS codes) especially for soundness, setting time and suitability for steam curing. In the case of elements manufactured by accelerated curing methods, concrete admixtures to reduce the water content may be allowed to be as permitted by applicable codes of practice subject to the approval of the Engineer-in-Charge. The normal aeration agents used to increase the workability of concrete shall not be allowed. The steam curing of concrete products shall take place under hoods, under chambers or in tunnels. Use of insulated tarpaulin may be permitted. The steam shall have a uniform quality throughout the length of the member. The precast elements shall be stacked with sufficient clearance between each other and the bounding enclosure, so as to allow proper circulation of steam. The surrounding walls, the top cover and the floor of steam curing chamber or tunnel or hood shall be so designed as not to allow more than 1 kcal/m²/h/ deg C. The inside face of the steam curing chamber, tunnel or hood shall have a damp-proof layer to maintain the humidity of steam. Moreover, proper slope shall be given to the floor and the roof to allow the condensed water to be easily drained away. At first, when steam is let into the curing chambers, the air inside shall be allowed to go out through openings provided in the hoods or side walls which shall be closed soon after moist steam is seen jetting out. Preferably, steam should be let in at the top of the chamber through perforated pipelines to allow uniform entry of steam throughout the chamber. In no case shall steam impinge directly on concrete products. The fresh concrete in the moulds shall be allowed to get the initial set before allowing the concrete to come into contact with steam. The regular heating up of fresh concrete product from 20 °C to 35 °C shall start only after a waiting period ranging from 2 to 5 hours depending on the setting time of cement used. The second stage in steam curing process shall be to heat up the concrete elements, moulds and the surroundings in the chamber. The air-space around the member shall be heated up to a temperature maximum to 70°C at a gradual rate, not faster than 10° per hour. This

process shall continue 1 1/2 to 2 1/2 hours depending upon the outside temperature. The third stage of steam curing shall be to maintain the uniform temperature and pressure for a duration depending upon thickness of the section. This may vary from 3 to 5 1/2 hours. The fourth stage of steam curing shall be the gradual cooling down of concrete products and surroundings in the chamber and normalization of the pressure to bring it at par with the outside air. The maximum cooling rate, which is dependent on the thickness of the member, shall not exceed 30° per hour. In all these cases, the difference between the temperature of the concrete product and the outside temperature shall not be more than 60°C for concrete up to M 30 and 75°C for concrete greater than M 45. In the case of light weight concrete, the difference in temperature shall not be more than 60°C for concrete less than M 25. For concrete greater than M 50, the temperature differences may go up to 75°C. After the steam curing is completed, the elements shall be further water cured for about 3 to 7 days.

- d) In order to ascertain that the curing compound is applied properly and in desired quantity uniformly, the curing compound shall be applied with colour pigment and should be applied in two layers with each layer of having different colour and to use low pressure spray guns or roller while applying curing compound. The consumption of the curing compound shall be monitored by engineer-in-charge.
- e) The warranty should be given by supplier/manufacturer for satisfactory performance of the product including its application and supervision.

3.11 JOINTS:

a) Construction Joints

Construction joints shall be located and the sequence of placing arranged as approved, to minimize shrinkage and thermal strains in the concrete.

Concrete placing shall not be interrupted except where joints occur and shall continue after normal hours if necessary to achieve this. Joints shall be formed square to the work with keyways included.

Before placing is resumed at a joint the set surface shall be roughened to remove laitance and expose the aggregate; the aggregate shall not be damaged. If damaging materials have come into contact with the surface of the joint the concrete shall be cut back and the roughened surface cleaned by compressed air or water jets and brushed and watered immediately before placing. If required, the surface shall be coated with a layer of stiff cement-grout prior to placing the new concrete.

Chemical surface-retarders shall not be used. Construction joints shall be sealed with

an approved sealant at external and liquid-contact faces. Construction joints in water-retaining structures shall incorporate an approved water stop.

b) Expansion, Contraction and Movement Joints

Expansion, contraction and other movement joints shall be incorporated in the works as shown on the Drawings.

Where shown on the Drawings approved, expansion joint fillers shall be supplied and installed. Filler material shall be stored flat on a dry surface adequately protected from rain or moisture in such a way that the material does not deteriorate. Filler material which has been damaged or has started to deteriorate shall not be incorporated in the works.

Movement joints shall be sealed with an approved sealant applied in strict accordance with the manufacturer's instructions to the dimensions shown on the Drawings. The surface of the concrete to which the sealant is to adhere shall be straight and cleaned of all filler material, dirt, oil, grease and other matter. The sealant shall be applied by methods recommended by the manufacturer so that the sealant is brought flush to the surface of structure and a smooth surface is achieved. Excess material and spillage shall be properly cleaned off and removed.

Dowel bars shall be installed and cast in across the movement joint were shown on the Drawings. The bars shall be straight with clean cut ends of the diameters and lengths as shown on the Drawings or in the Schedules. Cutting and cleaning of the dowel bars shall comply with the requirements of this Specification.

The bars shall be firmly supported in the positions shown on the Drawings so that they remain accurately parallel and are not displaced during the casting of the concrete in the first part of the structure. After the concrete has hardened and the formwork removed, the projecting ends shall be cleaned of all concrete spillage and painted with two coats of an approved bituminous paint and caps shall be fitted to the free ends of the bars. Dowel bar end caps shall be of cardboard or other material, of correct diameter for the dowel bar and of sufficient length to allow the specified movement of the two adjacent concrete structures. They shall be manufactured expressly for this purpose by an approved manufacturer.

The Contractor shall take care to protect the projecting ends of dowel bars from bending or other damage prior to concreting the succeeding bay. The bituminous paint shall be applied as soon as practicable, but end caps shall not be fitted until immediately prior to the succeeding concreting operations.

c) Water-stops

The layout and installation of the water-stops shall be in accordance with the manufacturer's recommendation and shall be subject to the approval of Designer and consent of Engineer-in-Charge.

d) Bolts, Inserts and Openings

All fixing blocks, brackets, built in bolts, holes, chases, etc., shall be accurately set out and formed and carefully sealed prior to the concrete being placed. No cutting away of concrete for any of these items shall be done without the permission of the Engineer-in-Charge.

Bolts and other inserts to be cast into the concrete shall be securely fixed to the formwork in such a way that they are not displaced during the concreting operations, and that there is no loss of materials from the wet concrete through holes in the formwork.

Unless shown otherwise on the Drawings or the Engineer has given consent, reinforcement shall be locally moved so that the minimum specified cover is maintained at the locations of inserts, holes, chases, etc.

Temporary plugs shall be removed and the threads of cast in bolts shall be proved to be free and shall be greased before handing over any part of the Works. Construction joints in all concrete work shall be made as directed by the Engineer. Where vertical joints are required, these shall be shuttered as directed and not allowed to take the natural slope of the concrete.

3.12 CRACKS:

If cracks, which in the opinion of the Engineer may be detrimental to the strength of the construction, develop in concrete construction, the Contractor at his own expense shall test the structure as specified in "Loading Tests" of these Specifications.

If under such test loads the cracks develop further, the Contractor shall dismantle the construction, carry away the debris, replace the construction and carry out all consequential work thereto.

If any cracks develop in the concrete construction, which in the opinion of the Engineer-in-Charge, are not detrimental to the stability of the construction, the Contractor at his own expense shall grout the cracks with neat cement grout or with other composition as directed by Engineer-in-Charge and also at his own expense and risk shall make good to the satisfaction of the Engineer all other works such as plaster, moulding, surface finish,

which in the opinion of the Engineer have suffered damage either in appearance or stability owing to such cracks. The Engineer's decision as to the extent of the liability of the Contractor in the above matter shall be final and binding.

External crack width shall be as per IRS: CBC with latest addendums.

3.13 DEFECTIVE CONCRETE:

Should any concrete be found honeycombed or in any way defective, such concrete shall be cut out partially or wholly by the Contractor and made good at his own expense. If Engineer feels that repaired structure will not be having same strength or shape or uniformity with other exposed surface as original desired structure / original structure, the same shall be rejected by Engineer and required to be dismantled and disposed by contractor at his own cost as instructed by Engineer-in-Charge. Decision of the Engineer shall be final and binding in this regard.

3.14 EXPOSED FACES, HOLES AND FIXTURES:

On no account shall concrete surfaces be patched or covered up or damaged concrete rectified or replaced until the Engineer or his representative has inspected the works and issued written instructions for rectification. Failure to observe this procedure will render that portion of the works liable to rejection.

Holes for foundation or other bolts or for any other purposes shall be moulded, and steel angles, holdfasts or other fixtures shall be embedded, according to the drawing or as instructed by the Engineer.

3.15 FINISHES:

Unless otherwise instructed the face of exposed concrete placed against formwork shall be rubbed down immediately on removal of the formwork to remove irregularities. The face of concrete for which formwork is not provided other than slabs shall be smoothed with a float to give a finish equal to that of the rubbed down face, where formwork is provided. The top face of a slab which is not intended to be covered with other materials shall be levelled and floated to a smooth finish at the levels or falls shown on the drawings or as directed. The floating shall be done so as not to bring an excess of mortar to the surface of the concrete. The top face of a slab intended to be surfaced with other material shall be left with a spaded finish. Faces of concrete intended to be plastered shall be roughened by approved means to form key.

3.16 CONCRETE FOR FLOORING ON GRADE:

Concrete for flooring on grade shall be placed in alternate bays not exceedingly more than 4m x 6m or as specified in the drawings including forming the joints or adjacent bays. The stiff mix shall be thoroughly vibrated and finished to receive the floor finish.

3.17 GROUTING OF BASE PLATES & BOLT HOLES:

a) **Mixing:**

Dry grout should be mixed in a mechanical mixer: the conventional 200/400-litre capacity concrete mixer can be used to mix four bags of dry grout; alternatively, paddle type mortar mixers can be used. The quantity of grout to be mixed at one time should not exceed that amount which can be placed in approximately 10 to 15 minutes.

b) **Batching:**

Batching of grout by fraction of a bag is not allowed. The quantity of mixing water should be the minimum commensurate with workability, compaction, and filling of the grout in all corners and crevices. Mixing should be done for a minimum of three minutes to obtain a fluid grout of uniform consistency.

c) **Cleaning and preparation of the surface:**

The base concrete should be clean and strong, and its surface should be properly hacked; all dust should be removed suction or compressed air. The surface should be thoroughly wetted with water for several hours. Before the grout is poured, all free water should be removed, and the flat surfaces coated with a thin cement slurry.

d) **Restraint:**

Heavy back-up blocks of timber or concrete should be fixed on all sides of the base plate to prevent escape of the grout, when poured through the openings provided in the base plate. Adequate restraint must be ensured on all the sides for a period of 7 days to obtain effective expansion and shrinkage compensation.

e) **Curing:**

The grout should not dry out where external restraint is provided in the form of form-work, the top opening and all stray openings should be covered with wet sack for at least 7 days.

f) **Placing and Compaction:**

The grout should be placed quickly and continuously either through the holes in the base plates or from one side only to ensure complete filling without entrapment of air. Grout should be properly spread and compacted by rodding. Excessive vibration should be avoided.

Below the bed plates the grout should be compacted using long pieces of doubled-over flexible steel strapping or chains. The forward and backward movement of the strap or chain will assist in the flow of the grout into place. Steps must be taken to keep the grout

in full contact with the underside of the bedplate until the grout sets, maintaining a small head of fresh grout in the forms.

g) Shrinkage Compensated Grout:

Shrinkage compensated grout or non-shrinkable grout of Associated Cement Companies Limited or any other approved manufacturer (Fosroc, Roff, Sikka, or equivalent) should be used. The batching shall be as per the manufacturer's specifications, other procedures being as above.

3.18 PRECAST CONCRETE:

3.18.1 Manufacture off the Site

- i. Casting of members shall not begin until consent to the shop drawings, required computation, prestressing system (if required) and method of manufacture has been given and is approved by Engineer.
- ii. When the drawings and method of manufacture have been approved, no changes shall be made without the approval of designer and consent of the Engineer.
- iii. The Contractor shall inform the Engineer in advance of the date of commencement of manufacture and casting of each type of member Concrete reinforcement and workmanship shall be as per IS:456.
- iv. A copy of all cube test results to the work shall be sent to the Engineer as soon as they become available.
- v. Where the Engineer requires tests to be carried out, no members to which the tests relate shall be dispatched to the Site until the tests have been satisfactorily completed and accepted.
- vi. All members shall be indelibly marked to show the Member Mark as described in the Contract, the production line on which they were manufactured, the date on which the concrete was cast and, if they are of symmetrical section, the face that will be uppermost when the member is in its correct position in the works. The markings shall be so located that they are not exposed to view when the member is in its permanent position.

3.18.2 Forms

- i. The design and engineering of the forms and falsework as well as their construction shall be the responsibility of the Contractor. Design of the falsework for all concrete shall be done under the direction of a registered engineer. All exposed surfaces of each element of the structure shall be formed with similar material to produce similar

concrete surface textures, colour, and appearance. Forms shall be inspected and approved by the Engineer prior to authorizing casting operations. Details shown on the Drawings shall be built into the forms. Worn, damaged, or otherwise unacceptable forms shall be repaired before casting of any member will be authorized.

- ii. The forms may be made either of steel or plywood. If the Contractor elects to use plywood forms, it shall be a high-quality plywood, 19mm minimum thickness, marine grade and it shall be subject to the consent of the Engineer.
- iii. Forms shall be structurally adequate to support the members within permissible tolerances. The form design shall incorporate the method and the necessary hardware to adjust and maintain grade and alignment. Details of the hardware and adjustment procedure shall be included in the required plans.
- iv. Forms shall be coated with form release agent prior to use. Form release agent shall be a commercial quality form oil or other equivalent coating which will permit the ready release of forms and will not discolour the concrete. Excess form release agent shall not be allowed to stand in puddles in the forms nor shall coating be allowed to come in contact with reinforcing steel or hardened concrete.
- v. Anchor devices may be cast into the concrete for later use in supporting forms, provided the arrangement is approved by the designer and consented by Engineer. The use of driven or drilled types of anchorages for fastening forms or form supports to concrete will not be permitted.

3.18.3 Storage

When members are stored, they shall be firmly supported only at the points specified by the Designer. The accumulation of trapped water and deleterious matter in the units shall be prevented. Care shall be taken to avoid rust staining and efflorescence.

3.18.4 Handling and Transport

- i. Members shall be lifted or supported only at points specified by the Designer or otherwise agreed by the Engineer and shall be handled and placed without impact.
- ii. The method of lifting, the type of equipment and transport to be used, and the minimum age of the members to be handled shall be subject to the Designer's requirements.

3.18.5 Assembly and Erection

The method of assembly and erection described in the Contract shall be as practicable

and be strictly adhered to on site. Immediately after a unit is in position, and before the lifting equipment is removed, temporary supports or connections between members, as necessary, shall be provided. The final structural connections shall be completed as soon as possible.

3.18.6 Forming Structural Connections

- i. No structural connections shall be made until the Engineer's consent has been given.
- ii. Unless otherwise agreed by the Engineer, the composition and water/cement ratio of the in-situ concrete or mortar used in any connection and the packing of joints shall be in accordance with the assembly instructions.
- iii. Levelling devices shall only be released or removed with the consent of the Engineer.

3.18.7 Epoxy Grout for Structural Connections (if required)

i. Description

Epoxy shall be furnished as 2 components which shall be mixed together at the Site.

ii. Sampling and Testing

All tests will be conducted in accordance with the latest test methods of the American Society for Testing and Materials, Federal Test Method Standard No. 141 or equivalent British Standard.

iii. Packaging, Labelling and Storing

Each component shall be packaged in steel containers not larger than 20 litres in volume. When the components are to be mixed at a ratio of 2 parts A to one part B, by volume, the container containing component B shall be one half the volume of the container containing component A. The containers shall have lug type crimp lids with ring seals, shall be new, not less than 0.6 mm nominal thickness, and shall be of such character as to resist any action by the components. Each container shall be clearly labelled with the designation (Component A or B), type (Standard or Rapid) if applicable, manufacturer's name, date of manufacture, batch number (a batch shall consist of a single charge of all components in a mixing chamber), lot number, all directions for use specified elsewhere and the following warning

"CAUTION"

"This material will cause severe dermatitis if it is allowed to come in contact with the skin or eyes. Use gloves and protective creams on the hands. Should this material contact the skin, wash thoroughly with soap and water. Do not attempt to remove this

material from the skin with solvents. If any gets in the eyes, flush for 10 minutes with water and secure immediate medical attention."

Attention is directed to the characteristic of some epoxy components to crystallize or thicken excessively prior to use when stored at temperatures below 2°C. Any material which shows evidence of crystallization or a permanent increase in viscosity or settling of pigments which cannot be readily redispersed with a paddle shall not be used.

iv. **Directions for Use**

At the time of mixing, components A and B shall be at a temperature between 16°C and 29°C, unless otherwise specified. Any heating of the adhesive components shall be done by application of indirect heat. Immediately prior to mixing, each component shall be thoroughly mixed with a paddle. Separate paddles shall be used to stir each component. Immediately prior to use, the 2 components shall be thoroughly mixed together in the specified ratios. When mixed, all adhesives shall have a uniform gray colour without black or white streaks. No solvent shall be added to any epoxy.

After mixing, all epoxies shall be placed in the work and any overlaying or inserted be cleaned and it shall have moisture content of not more than 0.50% when tested. The maximum size of the aggregate shall not exceed that of material which is to be bonded to the work by the epoxy. It shall also be placed before thickening of the epoxy has begun. Surfaces upon which epoxy is to be placed shall be free of rust, paint, grease, asphalt, moisture and loose and deleterious material. When epoxy is used as a binder to make epoxy concrete or grout, the 2 components of epoxy shall be thoroughly mixed together before the aggregate is added and, unless otherwise specified, the mix proportions shall consist of one part of binder to approximately 4 parts of aggregate, by volume. Aggregate for use in epoxy concrete and grout shall one-fourth of the thickness of the joint to be grouted. All surfaces against which epoxy concrete, and grout are to be placed shall be primed with a coat of the epoxy used just prior to placing the grout.

Not more material shall be mixed than can be used within 20 minutes from the time mixing operations are started. The pot life of the epoxy mixture shall be 45 minutes.

v. **Epoxy Grout Strength Requirements**

The compressive strength of 38 mm cubes of epoxy grout tested in accordance with ASTM C39 after 10 hours of curing at 20°C shall be not less than the design strength of the precast number.

Temporary Supports and Connections:

Temporary supports provided during erection should take into account all construction

loads likely to be encountered during the completion of joints between any combination of precast and in-situ concrete structural elements. The supports should be arranged in a manner that will permit the proper finishing and curing of any in-situ concreting and grouting associated with the precast member being supported when the gaps of joints have to be filled with concrete or mortar. They should first be cleaned and the faces of the joints should be wetted. The mixing, placing and compacting of cement and mortar should be done with special care. Mortar of a dry consistency should be in the proportion of 1:1½ (1 part of cement to 1½ parts of sand) and should be placed in stages and packed hard from both sides of the joint.

Tolerances:

The following tolerances apply to finished precast products at the time of placement in the structure. The forms must be constructed to give a casting well within these limits:

- 1 Overall dimensions of members should not vary more than $\pm 6\text{mm}$ per 3m length with a maximum variation of $\pm 20\text{mm}$.
- 2 Cross-sectional dimensions should not vary more than the following:
 - + 3mm for sections less than 150mm thick
 - + 4mm for sections over 150mm & less than 450mm
 - + 6mm for sections over 450mm to 1000mm
 - + 10mm for sections over 1000mm
- 3 Deviation from straight line in long sections should not be more than $\pm 6\text{mm}$ up to 3m, $\pm 10\text{mm}$ for 3m to 6m, $\pm 12\text{mm}$ for 6m to 12m.
 - For tolerances on precast components, standard documents shall be followed
 - Structural steel inserts/bolts for connecting precast concrete elements (Parapet to Box Girder)

Connection of precast concrete parapet with segmental box girder:

Square rods with internal threading and base plate/stiffener, shall be firmly fixed in the mould to the true line, level and alignment as shown in drawings. If required by engineer MS template may use for above purpose. The threaded hole/pipe shall be properly protected so as to prevent ingress of mortar etc (by providing dummy bolts, PVC cover, cotton waste etc).

For connection of parapet with segmental box girder bolts of required length having threads at both ends shall be provided as shown in drawings. The grade of steel will be in accordance with the values specified in the drawing. Welding bolts is not permitted. Grade of nuts will be same as grade of respective bolts. It is imperative to verify that that bolts can be threaded smoothly at all times. Dummy bolts shall be used in the stacking yard as a protection measure to keep the threads clean free of dust / rust. Threading, bolts materials, tests etc shall be as per IS: 1367 part 1 to 16, IS: 1821-1987, IS: 4206.

Levelling bolts as shown in tender drawings are for facilitating alignment of the precast parapet.

3.19 READY MIX CONCRETE AND PUMPING:

- i. Ready-mixed concrete may be manufactured in a central automatic weigh Batching plant and transported to the place of work in agitating transit mixers.

The maximum size of coarse aggregate shall be limited to one-third of the smallest inside diameter of the hose or pipe used for pumping. Provision shall be made for elimination of over-sized particles by screening or by careful selection of aggregates. To obtain proper gradation it may be necessary to combine and blend certain fractional sizes of aggregates. Uniformity of gradation throughout the entire job shall be maintained.

The quantity of coarse aggregate shall be such that the concrete can be pumped, compacted and finished without difficulty.

- ii. **Fine aggregates:**

The gradation of fine aggregate shall be such that 15 to 30 percent should pass the 0.30 mm screen and 5 to 10 percent should pass 0.15 mm screen so as to obtain pumpable concrete. Sands, which are deficient in either of these two sizes, should be blended with selected finer sands to produce these desired percentages. With this gradation, sands having a fineness modulus between 2.4 and 2.8 are generally satisfactory. However, for uniformity, the fineness modulus of the sand should not vary more than 0.2 from the average value used in proportioning.

- iii. **Water, Admixtures and Slump:**

The amount of water required for proper concrete consistency shall take into account the rate of mixing, length of haul, time of unloading, and ambient temperature conditions.

Additions of water to compensate for slump loss should not be resorted to nor should the design maximum water-cement ratio be exceeded. Additional dose of retarder be

used to compensate the loss of slump at contractor's cost, when permitted by Engineer. Retempering water shall not be allowed to be added to mixed batches to obtain desired slump.

iv. **Transportation:**

The method of transportation used should efficiently deliver the concrete to the point of placement without significantly altering its desired properties with regard to water-cement ratio, slump, and homogeneity.

The revolving-drum truck bodies of approved make shall be used for transporting the concrete. The numbers of revolutions at mixing speed, during transportation, and prior to discharge shall be specified and agreed upon. Reliable counters shall be used on revolving-drum truck units. Standard mixer uniformity tests, conforming to ASTM standards C 94-69 "Standard Specifications for Ready Mix Concrete", shall be carried out to determine whether mixing is being accomplished satisfactorily.

vi. **Pumping of concrete:**

Only approved pumping equipment, in good working condition, shall be used for pumping of concrete. Concrete shall be pumped through a combination of rigid pipe and heavy-duty flexible hose of approved size and make. The couplings used to connect both rigid and flexible pipe sections shall be adequate in strength to withstand handling loads during erection of pipe system, misalignment, and poor support along the lines. They should be nominally rated for at least 3.5 MPa pressure and greater for rising runs over 30 m. Couplings should be designed to allow replacement of any section without moving other pipe sections and should provide full cross section with no construction or crevices to disrupt the smooth flow of concrete.

All necessary accessories such as curved sections of rigid pipe, swivel joints and rotary distributors, pin and gate valves to prevent backflow in the pipe line, switch valves to direct the flow into another pipe line, connection devices to fill forms from the bottom up, extra strong couplings for vertical runs, transitions for connecting different sizes of pipe, air vents for downhill pumping, clean-out equipment etc, shall be provided as and where required. Suitable power-controlled booms or specialized cranes shall be used for supporting the pipeline.

vii. **Field control:**

Sampling at both truck discharge and point of final placement shall be employed to determine if any changes in the slump and other significant mix characteristics occur. However, for determining strength of concrete, cubes shall be taken from the placement end of line.

viii. **Planning:**

Proper planning of concrete supply, pump locations, line layout, placing sequence, and the entire pumping operation shall be made and got approved. The pump should be as near the placing area as practicable, and the entire surrounding area shall have adequate bearing strength to support concrete delivery pipes. Lines from pump to the placing area should be laid out with a minimum of bends. For large placing areas, alternate lines should be installed for rapid connection when required. Standby power and pumping equipment should be provided to replace the initial equipment, should breakdown occur. The placing rate should be estimated so that concrete can be ordered at an appropriate delivery rate.

As a final check, the pump should be started and operated without concrete to be certain that all moving parts are operating properly. A grout mortar should be pumped into the lines to provide lubrication for the concrete, but this mortar shall not be used in the placement. When the form is nearly full, and there is enough concrete in the line to complete the placement the pump shall be stopped, and a go-devil inserted and shall be forced through the line by water under pressure to clean it out. The go-devil should be stopped at a safe distance from the end of the line so that the water in the line will not spill into the placement area. At the end of placing operation, the line shall be cleaned in the reverse direction.

3.20 ADDITIONAL SPECIFICATIONS FOR CONCRETE (M50 & Above)

- a) Mineral admixture in the form of micro silica or condensed silica fume shall be permitted in the design mix. It shall comply with ASTM C 1240 "Specifications for Silica Fume for use in Hydraulic Cement Concrete and Mortar". It shall be obtained from a proven and reliable manufacturer/supplier to the satisfaction of the Engineer.
- b) Adequate and complete dispersal of the micro silica during the concrete mixing shall be ensured.
- c) When micro silica is used in powder form the contractor shall take all precautions against potential health hazards during handling of the material.
- d) Chilled water and/ or ice shall be used in the concrete mix depending on the ambient temperature, dimensions of the concrete element, rate of pouring and design mix constituents.
- e) Special profuse curing arrangements shall be made for dissipation of the heat of hydration. The water curing shall be continued for a period of 21 days.

- f) The concrete design mix and arrangement for mixing, transportation, and curing of concrete shall be subject to the approval of the Engineer.

3.21 SPECIFICATION FOR CRYSTALLINE DURABILITY ADMIXTURE

Apart from the regular workability admixtures, Integral Crystalline Durability admixtures shall be added in the Concrete to enhance the Concrete Durability. It shall be used for structural concrete for all Underground structures (including shotcrete inside tunnel but excluding foundations of elevated structures such as pile, pile cap, etc). The Crystalline Admixture shall be added either at the time of batching at the batching plant or in the drum of the transit mixer, when the concrete arrives the point of pouring.

The crystalline durability admixture must confirm to the Annexure-A of S.12. Wherever the use of crystalline durability admixture (as per Annexure-A of S.12) is provided to reduce the carbonation/corrosion in the structure, the waterproofing over the same structure (if any) is achieved by providing crystalline slurry (as per Annexure-B of S.12) in addition to the already added crystalline durability admixture (as per Annexure-A of S.12).

3.22 TESTING CONCRETE STRUCTURES FOR WATER TIGHTNESS & ACCEPTANCE CRITERIA

a) Underground Structures, Pump Rooms and Sumps

In the case of structures whose external faces are submerged and are not accessible for inspection, such as underground structures, the structures shall be filled with water and after the expiry of seven days after the filling, the level of the surface of the water shall be recorded. The level of water shall be recorded again at subsequent intervals of 24 hours over a period of seven days. Backfilling shall be withheld till the tanks are tested. The total drop in surface level over a period for seven days shall be taken as an indication of the water tightness of the structure.

A structure shall be deemed to be watertight if the total drop in the surface level over a period of seven days does not exceed 40 mm.

b) Roofs

The roofs of liquid-retaining structures shall be water-tight and shall be tested on completion by flooding the roof with water to a minimum depth of 25 mm for 24 hrs. Where it is impracticable, because of roof falls or otherwise, to contain a 25 mm depth of water, the roof shall have water applied by a continuous hose of sprinkler system to provide a sheet flow of water over the entire area of the roof for not less than 6 hrs. In

either case the roof shall be considered satisfactory if no leaks or damp patches show on the soffit. Should the structure not satisfy either of these tests, then after completion of the remedial work it should be re- tested in accordance with this clause. The roof insulation and covering should be completed as soon as possible after satisfactory testing. Contractor shall give warranty for leak tightness of joints for 10 years.

3.23 CONCRETE CUBE TESTS:

The quality of hardened concrete will be verified by the following procedure:

- a) The Engineer shall select random batches of concrete for examination without warning the Contractor and sampling will generally be done at the point of discharge from the mixer.
- b) From the batches thus selected 6 concrete cubes shall be made in accordance with Indian Standards. However not more than 2 cubes may be made from any single batch. Of these 6 cubes thus made 3 cubes (each cube representing concrete of different batches) shall be tested at 7 days and the remaining 3 cubes shall be tested at 28 days.
- c) All cubes shall be made, cured, stored, transported and tested in accordance with Indian Standards. The tests shall be carried out in a laboratory approved by the Engineer.
- d) At least 6 cubes shall be made on each day's concreting until 60 cubes have been made for each grade of concrete. This is the initial period.
- e) After the initial period, subject to the acceptance of the Engineer, the frequency at which the cubes shall be made may be reduced as follows:

(1 set = 6 cubes, each pair of cubes representing concrete from a different batch.)

At least 1 set for each day's concreting consisting of:

- i. 1 set for every 10m³ or part thereof of concrete for critical structural elements like columns, parapet, segments, larger cantilever, plus.
- ii. 1 set for every 40m³ or part thereof for all other elements.

If concrete is batched at more than one point simultaneously the above frequency of making cubes shall be followed at each point of batching. 3 of the cubes of each set shall be tested at 7 days and the remaining 3 cubes shall be tested at 28 days from the

day of the casting the cubes.

3.24 FAILURE TO MEET SPECIFIED REQUIREMENTS:

- a) If from the cube test results it appears that some portion of the Works has not attained the required strength, the Engineer may order that portion of the structure be subjected to further testing of any kind whatsoever as desired by the Engineer, including, if so desired by him, full load testing of the suspected as well as adjacent portions; of the structure as specified in the Conditions of Contract. Such testing shall be at the Contractor's cost. The Engineer may also reject the work and order its demolition and reconstruction at the Contractor's cost.

If the strength of concrete in any portion of the structure is lower than the required strength but is considered nevertheless adequate by the Engineer so that demolition is not necessary, the Contractor shall be paid a lower rate for such lower strength concrete as determined by the Engineer.

3.25 PROTECTIVE COATING ON CONCRETE STRUCTURES OF STATIONS:

- a) Water based, UV resistant, dust pick up resistant, algae and fungus proof anti carbonation protective paint on Concrete surface/porous exposed surfaces which penetrate into the surface to make the surface water repellent and provides anti carbonation barrier (CO₂ & SO₂ diffusion) and allow surface to breathe.
- b) After cleaning and preparation of the surface application of one coat of penetrative clear primer followed by two coats of pigmented Anti-carbonation coating in approved colour and shade applied by brush/roller or spray gun, as per manufacturer's specification with the direction of Engineer-in-Charge.
- c) Protective coating shall be applied on elevated structures (excluding pile foundations, open foundations, etc.) as directed by engineer in charge (if indicated in the Scope of Work).

SECTION – S.04

FORM WORK

- 4.1 These specifications shall be read in conjunction with the latest version of the CPWD specifications with up-to-date correction slips, MOST/MORTH Specifications and other relevant specifications described in section 1.1 of these specifications.

4.2 MATERIALS:

Formwork shall be of timber, plywood (including marine plywood), steel or any other suitable material capable of resisting damage to the contact faces under normal conditions of erecting forms, fixing steel and placing concrete. The selection of materials suitable for formwork shall be made by the Contractor based on the quality consistent with the specified finishes and safety. For designated areas prominently in public view like piers, piers caps, portals, viaduct (cast-in-situ or pre-cast), parapet etc., only steel shuttering shall be used. Steel material shall be in good condition. It should not be corroded. Condition of material shall be decided by engineer and If find not as per Indian standards or not as per requirement it shall be replaced. Number of uses for steel shuttering shall be between 50 and 100. Uses shall be decided by engineer as per the condition of steel shuttering. Special finishes like grooves, logos, floral designs, engraving in inset and outset shall be provided by fixing monolithic rubber forms fixed on entire surface of the formwork. The minimum shore hardness of rubber shall be A-55 to ensure strength, flexibility & elasticity. The contours, design and edges of rubber form should be smooth to ensure minimal deposition of grime or dust. The material shall be approved by the Engineer before erected at site. However, the entire responsibility of planning, designing, erection, dismantling, shifting and safety of false work lies with the contractor.

All formwork and formwork support (centering, props, scaffolds etc.) shall only be in structural steel and preferably of pipes conforming to IS:806, IS:1161, IS:1239, IS:2750. Wooden ballies shall not be permitted as props/formwork supports. All props shall be properly braced using x & k bracings.

Timber:

Timber used for formwork shall be easily workable with nails without splitting. It shall be stable and not liable to warp when exposed to sun and rain or wetted during concreting.

Plywood:

Plywood used for formwork shall be minimum 12 mm thick. Shuttering quality plywood complying with IS: 4990 and of make approved by the Engineer. Suitable stiffeners and walers shall be provided depending on the shuttering design.

Steel:

Steel formwork shall be made of minimum 4 mm thick black sheets stiffened with angle iron frame made out of M.S. angles 40mmx 40 mm x 6 mm minimum supported at suitable spacing.

4.3 DESIGN & DRAWINGS:

All temporary works such as formwork, false work, staging, launching girder, cantilever form traveler scheme etc. shall be designed by the Contractor. The permissible stresses in materials of formwork, false work, staging, launching girder & cantilever form traveler shall be limited as same as for permanent structure. All calculations and drawings of the same including construction sequence shall be checked and verified by an independent agency appointed by the contractor. Only after the checking of the same, the calculations and drawings (along with soft copy in CD ROM) shall be submitted to Engineer for no objection certificate (NOC) well in advance of work. All temporary work shall be also inspected by the independent agency and an independent report shall be submitted to Engineer. All temporary works shall be constructed so that the concrete can be properly placed and thoroughly compacted to obtain the required shape, position and level subject to specified tolerances. It is the responsibility of the Contractor to obtain the results required by the Engineer, whether or not some of the work is sub-contracted. NOC of the temporary works by the Engineer shall not diminish the Contractor's responsibility for the satisfactory performance of the same, nor for the safety and co- ordination of all operations.

For pier formwork, it shall be ensured that total deflection (taking account of combined deflection of plate, stiffeners, walers or any other supporting arrangement) shall not be more than 3mm. All the formwork, launching truss and cantilever form traveler and other selected temporary works shall be tested for the load including factor of safety for which the truss/formwork is designed before use in works.

The design of false work should be such as to facilitate easy and safe access to all parts for proper inspection.

Methodology for removal of form should be planned as a part of total form work design. In case of pre-stressing concrete, careful consideration shall be given to re-distribution of loads due to pre-stressing.

4.4 FORMWORK FOR EXPOSED CONCRETE SURFACES:

The facing formwork, unless indicated otherwise on drawings, or specifically approved by the Engineer in writing, shall generally be made with materials not less than the thickness mentioned below for different elements of the structure:

- a) Plain slab soffit and sides of beams, girders, joists and ribs and side of walls, fins,

parapets, pardis, sun-breakers, etc shall be made with:

- i. Steel plates not less than 4mm thick of specified sizes stiffened with a suitable structural framework, fabricated true to plane.
 - ii. Timber planks of 20mm actual thickness and of specified surface finish, width and reasonable length,
 - iii. Plywood not less than 12mm thick (IS:4990 - Specification for Plywood for Concrete Shuttering Work) or 3mm thick plywood with a 20mm timber plank backing, of specified sizes stiffened with a suitable timber framework. At joints 6mm/10mm sponge to be provided.
- b) Bottoms of beams, girders and ribs, sides of columns shall be made with:
- i. Steel plates not less than 5mm thick of specified sizes stiffened with a suitable structural framework, fabricated true to plane
 - ii. Timber planks of 35mm actual thickness and of specified surface finish, width and reasonable length,
 - iii. Plywood plates not less than 12mm thick, of specified sizes stiffened with a suitable timber framework.
- c) For Precast segments, piers, pier caps, cross-arms, pier heads, portals etc. suitable steel form work is to be used unless as specified by Engineer.

4.5 FORMWORK FOR SLOPED SURFACES:

- a) Forms for sloped surfaces shall be built so that the formwork can be placed board- by-board immediately ahead of concrete placement so as to enable ready access for placement, vibration inspection and finishing of the concrete.
- b) The formwork shall also be built so that the boards can be removed one by one from the bottom up as soon as the concrete has attained sufficient stiffness to prevent sagging. Surfaces of construction joints and finished surfaces with slopes steeper than 2 horizontals: 1 vertical shall be formed as required herein.

4.6 Formwork for Curved Surfaces:

- a) The contractor shall interpolate intermediate sections as necessary and shall construct the forms so that the curvature will be continuous between sections. Where necessary to meet requirements for curvature, the form lumber shall be built up of laminated splices cut to make tight, smooth form surfaces.
- b) After the forms have been constructed, all surface imperfections shall be corrected and

all surface irregularities at matching faces of form material shall be dressed to the specified curvature.

4.7 FORMWORK FOR WAFFLE SLAB:

Shuttering for Waffle Slab/ Coffered Slab shall be with Fibre Glass moulds of approved design. They can also be of Precast concrete unit as per design to form as part of structural concrete. The moulds shall be of uniform shape and dimension to give the desired shape of Coffered slab.

4.8 ERECTION OF FORMWORK:

The following shall apply to all formwork:

- a) To avoid delay and unnecessary rejection, the Contractor shall obtain the approval of the Engineer for the design of forms and the type of material used before fabricating the forms. (Ref. ACI 347 Formwork for Concrete or equivalent I.S. Code).
- b) All shuttering planks and plates shall be adequately backed to the satisfaction of the Engineer by sufficient number and size of walers or framework to ensure rigidity during concreting. All shutters shall be adequately strutted, braced and propped to the satisfaction of the Engineer to prevent deflection under deadweight of concrete and superimposed live load of workmen, materials and plant, and to withstand vibration.
- c) Vertical props shall be supported on wedges or other measures shall be taken where the props can be gently lowered vertically during removal of the formwork. Props for an upper level shall be placed directly over those in the level immediately below, and the lowest props shall bear on a sufficiently strong area. Care shall be taken that all formwork is set plumb and true to line and level or camber or better where required and as specified by the Engineer-in-Charge.
- d) Provision shall be made for adjustment of supporting struts where necessary. When reinforcement passes through the formwork care should be taken to ensure close fitting joints against the steel bars so as to avoid loss of fines during the compaction of concrete.
- e) If the formwork is held together by bolts, these shall be so fixed that no iron will be exposed on surfaces against which concrete is to be laid. In any case wires shall not be used with exposed concrete formwork. The Engineer-in-Charge may at his discretion allow the Contractor to use tie-bolts running through the concrete and the Contractor shall decide the location and size of such tie-bolts in consultation with the Engineer-in-Charge. Holes left in the concrete by these tie-bolts shall be filled as specified by the Engineer-in-Charge at no extra cost. These tie-bolts are not to be provided in structures with exposed surfaces.
- f) Provision shall be made in the shuttering for beams, columns, and walls for a port hole

of convenient size so that all extraneous materials that may be collected could be removed just prior to concreting.

- g) Formwork shall be so arranged as to permit removal of forms without jarring the concrete. Wedges, clamps and bolts shall be used wherever practicable instead of nails.

The formwork for beams and slabs shall be so erected so that forms on the sides of the beams and the soffit of slabs can be removed without disturbing the beam bottoms or props under beams.

- h) Surfaces of forms in contact with concrete shall be oiled with a mould oil of approved quality, form releasing agent or clean diesel oil. If required by the Engineer, the contractor shall execute different parts of the work with different mould oils to enable the Engineer to select the most suitable. The use of oil which results in blemishes on the surface of the concrete shall not be allowed. Oil shall be applied before reinforcement has been placed and care shall be taken that no oil comes in contact with the reinforcement while it is being placed in position. The formwork shall be kept thoroughly wet during concreting and the whole time that is left in place. Nothing extra shall be paid to contractor for oiling.

- i) Immediately before concreting is commenced, the formwork shall be carefully examined to ensure the following:

- 1 Removal of all dirt, shavings, sawdust and other refuse by brushing and washing.
 - 2 The tightness of joints between panels of sheathing and between these and any hardened core.
 - 3 The correct location of tie bars, bracing and spacers, and especially connections of bracing.
 - 4 That all wedges are secured and firm in position.
 - 5 That provision is made for traffic on formwork not to bear directly on reinforcing steel.
- j) The Contractor shall obtain the Engineer's approval for the dimension accuracies of the work and for the general arrangement of propping and bracing. (IS: 3696 - Safety Code of Scaffolds and Ladders, IS: 4014 Steel Tubular Scaffolding I & II). All scaffolding and

staging shall be either of steel tubes or built-up section of rolled steel with adequate bracing at several levels in each perpendicular direction connecting each prop. In addition to this diagonal bracing should be provided in elevation ideally at 45 degrees or between 30 and 60 degree. The Contractor shall be entirely responsible for the adequacy of propping, and for keeping the wedges and other locking arrangements undisturbed through the decentring period. (IS: 8989 Safety code for erection of concrete framed structures)

- k) Formwork shall be continuously watched during the process of concreting. If during concreting any weakness develops and formwork shows any distress the work shall be stopped, and remedial action as directed by the engineer shall be taken.
- l) Staging for portal girder and cross girder (in station zone) shall be in the form of portal frame. It shall be ensured that minimum two lanes of traffic with a restricted height of 5.5m can ply underneath it with adequate protection to portal legs.
- m) For concourse floor over road, the contractor shall design and fabricate prefabricated type of staging and shuttering which can be erected in very short duration. Such erection will be only permitted in the night. In such case staging has to span the full width of the road in a portal shaped profile. The portal frame shall have 4.5m (min) traffic clearance from the road for allowing safe movement of traffic below. In case no road runs beneath the concourse zone of station, the bidder may decide whether to use the above form of staging or any normal staging arrangement from the ground itself.

4.9 CONCRETE FINISHES:

This section deals with the surface of concrete on which forms had been fixed while concreting.

a) **Formed Surface:**

Allowable deviation from plumb or level and from the alignment profile, grades and dimensions shown on the drawings is defined as "tolerance" and is to be distinguished from irregularities in finishes as described herein. Tolerances in concrete construction are specified elsewhere.

The classes of finish and requirements for finishing of concrete surface shall be as shown on the drawings or as hereinafter specified. In the event of finishing not being definitely specified herein or in the drawings, finishes to be adopted shall be as directed by the Engineer-in-Charge.

Completed concrete surface shall be tested, where necessary to determine whether surface irregularities are within the limits specified hereinafter.

Surface irregularities are classified as "Abrupt" or "Gradual". Offsets caused by displaced or misplaced form sheathing, or form sections or by loose knots or otherwise defective timber form will be considered as abrupt irregularities and shall be tested by direct measurements. All other irregularities shall be considered as gradual irregularities and will be tested by use of template, consisting of a straight edge or the equivalent thereof for curved surfaces. The length of the template shall be 150 cm for testing of formed surfaces and 300 cm for testing of unformed surfaces.

The classes of finish for formed concrete surfaces are designated by one of the symbols F1, F2, F3 and F4. Unless otherwise specified or indicated on drawings, these classes of finish shall apply as follows:

Finish F1: This finish applies to surfaces where roughness is not objectionable, or surfaces that will otherwise be permanently concealed. Surface treatment shall be the repair of defective concrete, correction of surface depressions deeper than 25 mm and filling of tie rod holes. Form sheathing will not leak mortar when concrete is vibrated. Forms may be manufactured with a minimum of refinement.

Finish F2: This finish is required on surfaces permanently but not prominently exposed to public view for which other finishes are not specified except F1. Forms shall be manufactured in a workmanlike manner to the required offsets or bulges. Surface irregularities shall not exceed 5mm for abrupt and 8mm for gradual irregularities measured with a 1.5 m template.

Finish F3: This finish is required for coarse textured concrete surfaces intended to receive plaster, stucco or wainscoting. Surface irregularities shall not exceed 5mm for both abrupt and gradual irregularities.

Finish F4: This finish is designated for surfaces prominently exposed to public view where appearance is also of special importance. This shall include piers of bridges, viaducts, beams, parapets, railings and decorative features on the structure and on the bridges. To meet with requirements for F4 finish, forms shall be manufactured in a skillful, workmanlike manner, accurately to dimensions. There should be no visible offsets, bulges or misalignment of concrete. At construction joints, the forms shall be rightly set and securely anchored close to the joint. Abrupt and gradual irregularities shall not exceed 3mm. Irregularities exceeding this limit shall be reduced by grinding to a level of 1:20 ratio of height to length. Jute bag subbing or sand blasting shall not be used.

b) **Unformed Surfaces:**

The classes of finish for unformed surfaces are designated by symbols U1, U2, U3 and

U4. Unless otherwise specified or indicated on drawings, these classes of finish shall apply as follows:

Finish U1: This finish applies to unformed surfaces that will be concealed permanently or otherwise where a screeded surface finish meets the functional requirements. Finish U1 is also used as the stage of finishes for U2 and U3. Finishing operations shall consist of sufficient levelling and screeding to produce an even uniform surface. Surface irregularities shall not exceed 10mm.

Finish U2: This is floated finish, and used on all outdoor, unformed surfaces. Finish U2 is also used as the second stage of finish for U3. Floating to be performed manually or mechanically on stiffened screed surface shall be minimum to produce textured surface. If finish U3 is to be applied, floating shall be continued till a small amount of mortar without excess water is brought to the surfaces so as to permit effective trowelling. Surface irregularities shall be removed as directed by the Engineer.

Finish U3: This is a trowelled finish and shall be used for tops of parapets, etc prominently exposed to view. When the floated surface has hardened sufficiently, steel trowelling shall be started. Steel trowelling on hardened, floated surface shall be performed with firm pressure to produce a dense uniform surface free from blemishes and trowel marks and having slightly glossy appearance. Surface irregularities shall not exceed 5mm.

Finish U4: This is a steel-trowelled finish, similar to finish U3, except that light surface pitting and light trowel marks such as obtained from the use of machine trowelling will be acceptable, provided that surface irregularities do not exceed the limits specified for finish U3.

Unformed surfaces which are nominally level shall be sloped for drainage as shown on drawings or as directed by Engineer unless the use of other slopes or level surface is indicated on drawings. Narrow surface such as tops of parapets, walls and kerbs shall be sloped approximately 1cm per 30cm of width. Broader surface such as roadways, platform and decks, shall be sloped approximately half centimeter per 30cm of width. Finishes of floor and roof slabs shall be sloped, if required, by the Engineer.

4.10 EXPOSED CONCRETE WORK:

Exposed concrete surfaces shall be smooth and even originally as stripped without any finishing or rendering. Where directed by the Engineer, the surface shall be rubbed with Carborundum stone immediately on striking the forms. The Contractor shall exercise special care and supervision of formwork and concreting to ensure that the cast members are made true to their sizes, shapes and positions and to produce the surface patterns desired. No honeycombing shall be allowed. Honeycombed parts of

the concrete shall be removed by the Contractor as directed by the Engineer and fresh concrete placed without extra cost, as instructed by the Engineer. Contractor shall ensure that no air bubbles are formed on the exposed surface. Concrete pouring sequence, vibration methodology etc shall be planned to avoid air bubbles. All materials, sizes and layouts of formwork including the locations for their joints shall have prior approval of the Engineer.

4.11 AGE OF CONCRETE AT REMOVAL OF FORMWORK:

Age of Concrete at Removal of Formworks shall be in accordance with CPWD Specifications 96 or IS: 456. The Engineer-in-Charge may vary the periods specified if he considers it necessary. Immediately after the forms are removed, they shall be cleaned with a jet of water and a soft brush.

4.12 STRIPPING OF FORMWORK:

The work of form work removal should be planned and a definite scheme of operation worked out. Formwork shall be removed carefully without jarring the concrete, and curing of the concrete shall be commenced immediately. Concrete surfaces to be exposed shall, where required by the Engineer, be rubbed down with Carborundum stone or bush-hammer to obtain a smooth and even finish. Where the concrete requires plastering or other finish later the concrete surface shall be immediately hacked lightly all over as directed by the Engineer. No extra charge will be allowed to the Contractor for such work on concrete surfaces after removal of forms.

4.13 REUSE OF FORMS:

The Contractor shall not be permitted reuse of timber facing formwork brought new on the works more than 5 times for exposed concrete formwork and 8 times for ordinary formwork. 5 or 8 uses shall be permitted only if forms are properly cared for, stored and repaired after each use. The Engineer may in his absolute discretion order rejection of any forms he considers unfit for use for a particular item irrespective of no of items the shuttering has been used and order removal from the site of any forms he considers unfit for use in the Works. Used forms brought on the site will be allowed proportionately fewer uses as decided by the Engineer. Use of different quality boards or the use of old and new boards in the same formwork shall not be allowed. If any other type of special or proprietary form work is used, the no. of times they can be used will be determined by the Engineer.

4.14 FORMWORK FOR PRECAST/ PRESTRESSED CONCRETE:

- a) The provisions in this section shall be considered supplementary to the general provisions stated above and additional Technical Specifications for precast segments. Precast concrete members and panels shall be made in accurately constructed moulds, on a properly prepared casting bed. All aspects of the making, curing and erection of precast units shall be subject to the approval of the Engineer-in-Charge. the contractor shall submit detailed drawings of formwork for the approval of the Engineer. Finishing with cement mortar shall not be allowed.
- b) The formwork should be so designed that it does not restrain the shrinkage movements and possible shortening due to prestress of the concrete. The formwork shall be of sturdy construction with special considerations to shutter vibrators when used. All edges and joints of the formwork should be designed and sealed so that no cement grout can escape and there is no wedging or keying to the concrete. The effect of curing on the formwork should be given special consideration. Depending on care, curing erection and maintenance after stripping, the following number of uses can be made with different types of formworks.

Plywood with timber backed formwork - As per satisfaction of Engineer

Steel moulds - As per satisfaction of Engineer

Number of uses of shuttering be as per approval of the Engineer.

In cases concrete moulds can be satisfactorily provided by the contractor, the Engineer's approval shall be obtained before use on the works.

- c) **Stripping:**
As soon as the precast units have attained sufficient strength, the formwork shall be stripped. The precast unit shall be lifted uniformly out of the formwork without being subjected to tilting or restraint effects.

If proprietary system of form work is used, detailed information as given in clause 4.16 shall be furnished to Engineer for approval before use.

4.15 INFORMATION TO BE SUPPLIED BY MANUFACTURERS OF PROPRIETARY SYSTEMS OF FORM WORK

- a) **General**
 - i. The information which the manufacturer is required to supply shall be in such detail as to obviate unsafe erection and use of equipment due to the intention of the manufacturer not having been made clear or due to wrong assumptions on the part of the user.
 - ii. The user shall refer unusual problems of erection/assembly not in keeping with intended use of equipment, to the manufacturer of the equipment.

b) Information Required

The manufacturers of proprietary systems shall supply the following information;

- i. Description of basic functions of equipment.
- ii. List of items of equipment available, giving range of sizes, spans and such like, with manufacturer's identification number or other references.
- iii. The basis on which safe working loads have been determined and whether the factor of safety given applies to collapse or yield.
- iv. Whether the supplier's data are based on calculations or tests. This shall be clearly stated as there may be wide variations between results obtained by either method.
- v. Instructions for use and maintenance, including any points which require special attention during erection, especially where safety is concerned.
- vi. Detailed dimensional information, as follows:
 1. Overall dimensions, depths and widths of members.
 2. Line drawings including perspectives and photographs showing normal uses.
 3. Self-weight.
 4. Full dimensions of connections and any special positioning and supporting arrangements.
 5. Sizes of members, including tube diameters and thicknesses of material.
 6. Any permanent camber built into the equipment.
 7. Sizes of holes and dimensions giving their positions.
 8. Manner of fixing including arrangements for sealing joints.
- vii. Data relating to strength of equipment as follows:
 1. Average failure loads as determined by tests.
 2. Recommended maximum working loads for various conditions of use.
 3. Working resistance moments derived from tests.
 4. Working shear capacities derived from tests.
 5. Recommended factors of safety used in assessing recommended loads and deflections based on test results.
 6. Deflections under load together with recommended pre-camber and limiting deflections.
 7. If workload depends on calculations, working stresses should be tested. If deflections depend on theoretical moments of inertia or equivalent moments of inertia rather than tests, this should be noted.
 8. Information on the design of sway bracing against wind and other horizontal

loadings.

9. Allowable loading relating maximum extension of bases and/or heads.
10. Any restrictions regarding usage of any component or full assembly with regard to spans, heights

SECTION S.05

REINFORCEMENT

- 5.1** These specifications shall be read in conjunction with latest version of the CPWD specifications with upto date correction slips, MOST/MORTH Specifications and other relevant specifications described in the section 1.1 of these specifications.

Any steel specified for reinforcement shall conform in every respect to the latest relevant Indian Standard Specifications and shall be of tested quality under the ISI Certification Scheme.

All reinforcement work shall be executed in conformity with the drawings supplied and instructions given by the Engineer and shall generally be carried out in accordance with the relevant Indian Standard Specifications IS: 2502- Bending and Fixing of Bars for Concrete Reinforcement.

The reinforcement steel shall be from primary producers as per approved vendor list and no re-rolled steel shall be supplied.

- 5.1.1** Mechanical couplers of threaded type with enlargement at connection by cold forging may be used at appropriate locations after prior approval of engineer.

5.1.2 Coupler Specifications

a) Introduction

Only cold-forged, parallel threaded mechanical coupler system are recommended. All mechanical couplers shall be of Type 2 (or Class H as specified in IS-16172) and should be simple to install and which can be confirmed by quick visual inspection to have been correctly installed and to have achieved the required full-strength connection. Any other types of mechanical coupler systems are not permitted provided the same meet the specification indicated below.

The couplers shall be of standard parallel thread type. Ends of the reinforcement bars, which are to be joined, shall be enlarged by cold forging/upsetting, threaded in such a way that root thread diameter is not lesser than the parent bar to be joined. The coupler shall be of TYPE – II and qualified/Certified as per UK CARES, IS code 16172:2014, ACI 318, ASME, Section III, and Div.2, Caltrans.

Couplers installed shall be strictly in accordance with the manufacturer's recommendations. Couplers shall preferably be located away from high stress zones in the various structural elements and shall be staggered.

All the couplers should be manufactured in a factory which is ISO 9001:2008 (or higher revision) certified for "Manufacturing of Mechanical Steel Rebar Couplers & Accessories" and also be certified for "Site Management of Threading & Processing of Rebar including Sales and Distribution". All the couplers shall undergo quality checks on uniformity of threads, dimensional accuracy etc. Each coupler shall be clearly stamped indicating batch number and diameter. This

number shall be traceable to the original cast. The relevant material mill certificate shall be submitted with supply of a particular lot.

The certificate shall give salient material properties. The coupler manufacturer shall operate at least an ISO 9000 approved quality assurance programme or equivalent for the manufacture of couplers.

b) Threading of ends of the reinforcing bars:

This threading activity shall preferably be done at Site. The various stages involved in threading are as given below:

i. Cutting (Rebar End Preparation):

The ends of reinforcement bars shall be cut by mechanical means to get a perfect plain and surface perpendicular to the axis of the bar.

ii. Cold forging & threading:

After cutting the ends of the bar shall be enlarged by cold forging such that the area of cross section after threading shall not be less than the area of cross section of the parent bar. The length of cold forging shall be adequate for proposed thread length as per manufacturer's design. Threading shall be done preferably on threading machine. The threads shall be square parallel type to suit the couplers. The thread length and depth shall be as per manufacturer's design. After threading is completed, the threaded length of the bars shall be protected by providing plastic end caps before taking the bars out of the shop.

c) Quality control in making of threads:

Double forging of bars is not permitted. In case of improper cold forging the forged of the bar shall be square cut and fresh cold forging shall be undertaken. 100% threading at threaded rebars shall be checked with 'go' and "no go' gauges for the correctness of the thread profile on the rebar. A proper record for same shall be maintained at site.

d) Qualification tests

The coupler shall be qualified as per IS code 16172:2014, ACI 318, ASME - Section III, and Div.2, Caltrans and must have conducted & qualified for the following tests:

i. Static tensile test

Mechanical connections shall be tested for all reinforcing rebar sizes. For each rebar size, a minimum of three connections (3 joints + 1 Parent bar) in each load direction shall be tested in accordance with ASTM A370 test method to meet code requirement. A tensile test on an unsliced specimen from the same bar used for the spliced specimens shall be performed to establish actual tensile strength. The tensile strength of an individual splice system shall not be less than the 125% of the specified minimum yield strength (fy of rebar) of the spliced bar.

ii. Cyclic tension and compression test

Mechanical connections shall be tested in all reinforcing rebar sizes. For each rebar size, a minimum of three connections shall be tested for cyclic tension &

compression test. Each specimen shall withstand cycles of stress variation of the specified minimum yield strength of the reinforcing bar. The test should be carried out as per the table mentioned below:

Loading Stages and Cycles per stage for cyclic load test

Stage	Tension	Compression	Cycles
1	0.95 fy	0.5 fy	20cycles
2	2 εy	0.5 fy	4cycles
3	5 εy	0.5 fy	4cycles

Note:

fy is specified yield strength of the reinforcing bar.

εy is the strength of reinforcing bar at actual yield stress

iii. Cyclic tensile test

Mechanical connections shall be tested in all reinforcing rebar sizes. For each rebar size, a minimum of three connections shall be tested for low cyclic tensile test. Each specimen shall withstand 100 cycles of stress variation from 5% to 90% of the specified minimum yield strength (fy) of the reinforcing bar. One cycle is defined as an increase from the lower load to the higher load & return.

iv. Low cycle fatigue test (for 10,000 cycles)

Fatigue test shall be conducted on splice sample from +173 Mpa to -173 Mpa for 10,000 cycles. A sine wave form @ 0.5 Hz shall be followed for bar dia 36 mm & above and 0.35 Hz shall be followed for bar dia less than 36 mm. Test shall be conducted confirming to IS 16172:2014 & Caltrans specifications. Past certificates for low cycle fatigue test shall be accepted; however, these should not be more than 3 years old.

v. High cycle fatigue test (for 2,000,000 cycles)

In high cycle fatigue test, the test specimen is subjected to an axial tensile load which varies cyclically according to the sinusoidal wave form of constant frequency in the elastic range, as accordance with IS-16172. Past certificates for high cycle fatigue test shall be accepted; however, these should not be more than 3 years old.

vi. Slip test

Slip Test Shall be performed on each diameter coupler specimen as per ASTM A 370 section 10. Test shall be conducted confirming to IS 16172:2014 & Caltrans specifications. Total slip shall not exceed the max value of 0.1 mm. Refer table below for more details:

Bar diameter	TOTAL Slip (μ m)
8 mm to 20 mm	250
25 mm to 28 mm	350
32 mm to 40 mm	450
45 mm	600
56 mm	750

vii. Proof loading test

Every cold-forged, threaded bar end shall undergo a proof load test prior to leaving system supplier's workshop. Every threaded bar must be subjected to proof load testing to a minimum test loading of 75% of the characteristic strength (theoretical f_y). The system supplier shall essentially install a proof load tester equipment within its threading workshop premises and ensure to test each and every threaded bar. A positive indication shall be marked on the rebar to indicate that this operation has been carried out.

INSTALLATION OF COUPLERS IN THE FIELD:

The installation of couplers in the field, for joining reinforcing bars shall be undertaken by trained manpower and as per manufacturer's instructions. Threads of both the couplers and the bars shall be thoroughly cleaned just before installation. Where couplers are cast-in the concrete, but connection is not to be completed immediately, the couplers shall be internally greased and plastic capped to a protection detail acceptable to the engineer. This cap shall be removed only when next bar is to be attached, then the same to be cleaned before joining the next bar.

The contractor shall arrange for a suitably qualified manufacturer's representative experienced in mechanically connecting reinforcement to be present at site before the start of work for initial training of personnel, and also to demonstrate the equipment and techniques as necessary. The threading workshop is to be fully supervised by the manufacturer's representative.

The contractor shall submit to the Engineer-in-Charge, for his acceptance a method statement for mechanically connecting the reinforcement and for the installation and verification in the field. This shall take into account any special requirements for horizontal, vertical and inclined couplers and shall include a rectification procedure, if the connection is incorrectly made. It shall also cover the correct methodology for handling of tools and equipment for mechanical connection on site. The following information shall also be included:

1. Requirements for cleanliness
2. Equipment for threading bars
3. Method of locking the connections on both rebars
4. Method of verification of final rebars alignment and coupler integrity

Each coupler shall be visually examined prior to use to ensure the absence of rust and of any foreign material on the inside surface. All completed couplers shall be inspected and verified in accordance with the approved QAP. The Contractor shall ensure the acceptance of the Engineer for a procedure for documenting the inspection of the couplers. The contractor shall retain inspection records and shall submit copies to the Engineer-in-Charge within 7 days. The Couplers that do not meet the acceptance shall be completely removed and the bars re-connected as required.

5.2 REINFORCEMENT COATING

Reinforcement bars used for elevated structures shall not be coated as per IRS CBC

clause 7.1.5, as the resistance against corrosion is provided by the use of anti-carbonation coating for elevated structures as stipulated in clause 3.26 of this specification.

For underground structures, the resistance against carbonation/corrosion is being provided by the use of crystalline durability admixture as stipulated in clause 3.21 of this specification.

5.3 INSPECTION & TESTING:

Every bar shall be inspected before assembling on the works and any defective, brittle, excessively rusted or burnt bars shall be removed. Cracked ends of bars shall be cut out.

No work shall be commenced without the Engineer's approval of the bar bending schedule.

Manufacturer's Certificate shall be supplied for each lot of supply.

The frequency of tests on reinforcement consignment delivered at site from one manufacturer should be as per CPWD specifications.

5.4 BAR BENDING AND BAR BENDING SCHEDULE:

All bars will be carefully and accurately bent by approved means in accordance with IS: 2502, and relevant drawings. It shall be ensured that depth of crank is correct as per the bar cutting and bending schedule and bent bars are not straightened for use in any manner that will injure the material.

Prior to starting bar bending work, the Contractor shall prepare bar bending schedule from the structural drawings supplied to him and get the same approved by Engineer. Any discrepancies and inaccuracies found by the Contractor in the drawings shall be immediately reported to the Engineer whose interpretation and decision there to, shall be accepted.

5.5 LAPPING & WELDING/MECHANICAL SPLICING

- a) As far as possible bars of the maximum length available shall be used. Laps shown on drawings or otherwise specified by the Engineer will be based on the use by the Contractor of bars of maximum length. In case the Contractor wishes to use shorter bars, laps/couplers (approved make with permission of concerned organisation) shall be provided in the manner and at the locations approved by the Engineer.
- b) Bars having butt or lap welds shall be provided as specified in the drawings or as instructed by the Engineer.

5.6 SPACING, SUPPORTING AND CLEANING:

- a) All reinforcement shall be placed and maintained in the positions shown on the drawings to be prepared by contractor.
- b) The Contractor shall provide approved types of supports for maintaining the bars in position and ensuring required spacing and correct cover of concrete to the

reinforcement as specified on the drawings. Cover blocks of required shape and size, M.S. Chairs and spacer bars shall be used to ensure accurate positioning of reinforcement. Cover blocks shall be cast well in advance and shall consist of approved proprietary pre-packaged free flowing mortars (Conbextra HF of Fosroc or equivalent). They shall be circular in shape for side cover and square for bottom cover. The cost of cover block shall be deemed to have been included in the rates. The strength of cover block shall be same or higher than the strength of concrete used.

- c) Bars must be cleaned, before concreting commences, of all scale, rust or partially set concrete which may have been deposited there during placing of previous lift of concrete.
- d) Only Fe500D/Fe550D TMT bars complying to IS:1786 shall be provided.
- e) G.I. wire shall be used for binding reinforcement.

5.7 **WELDING:**

- a) Wherever specified all lap and butt welding of bars shall be carried in accordance with IS: 816:1989. Only qualified welders shall be permitted to carry out such welding.
- b) For cold twisted reinforcement welding operations must be controlled to prevent a supply of large amounts of heat larger than that can be dissipated. The extreme non twisted end portion shall be cut off before welding. Electrodes with rutile coating should be used.
- c) For welding on TMT bars shall be only allowed for special welding grade reinforcement as per 1606.2 of MORTH specifications.
- d) Bars shall be free from rust at the joints to be welded.
- e) Slag produced in welding after alternative run should be chipped and removed by brush.
- f) Electrode should not be lighted by touching the hot bar.
- g) The welding procedure shall be approved by the Engineer and tests shall be made to prove the soundness of the welded connection.
- h) E8018 electrode shall be used for Fe500D/Fe550D above as per AWS (American Welding Society) standards.

SECTION – S.06

PRESTRESSED CONCRETE

Structural concrete containing prestressed steel reinforcement to introduce pre-compression is termed as prestressed concrete.

6.1 GENERAL

The work shall be carried out in accordance with the drawing and these specifications or as approved by the Engineer.

Concrete and un-tensioned steel for the construction of prestressed concrete members shall conform to the requirements of sections respectively in so far as the requirements of these Sections apply and are not specifically modified by requirements set forth herein.

Contractor shall ensure that different components of prestressing such as jacks, bearing plates, wedges, anchorages, strands and HDPE ducts are compatible to each other and the same shall be exchanged in between all the suppliers to ensure the same.

6.2 MATERIALS

6.2.1 Sheathing

Material for all pre-stressing sheathing duct shall be HDPE in the form of corrugated. The Thickness of the HDPE sheathing ducts shall be as per conforming to IRS Concrete Bridge Code-1997 & IRC -112:2011, with modifications as stated below).

For Anchorage system 19 K 15, HDPE ducts of 124mm OD/ 107mm ID (tolerance ± 1 mm) with minimum thickness of ducts 3.00 mm

For Anchorage system 12 K 15, HDPE ducts of 100 mm OD/ 85 mm ID (tolerance ± 1 mm) with minimum thickness of ducts 2.50 mm

For Anchorage system 7 K 15, HDPE ducts of 84 mm OD/ 69 mm ID (tolerance ± 1 mm) with minimum thickness of ducts 2.50 mm

The material for the ducts shall be high-density polyethylene with more than 2 percent carbon black to provide resistance to ultra-violet degradation and shall have the following properties:

Density (IS 2530) : 0.94 – 0.96 g/cm³ at 23⁰C

Tensile Strength at yield (BS EN ISO 527-3): 20-26 N/mm² Shore Hardness D (BS EN ISO 2039-1) : 55-65

Elongation at Yield (BS EN ISO 527-3) : 7 % (min)

Melt Flow Index (MFI) (IS:2530) : 0.5-1.2 g / 10 minutes

(Temperature 190 °C under a mass of 5 kg)

Charpy Impact strength of notched specimen (BS EN ISO 179)

At 23 °C : 1 kJ/m²

-40 °C : 4 kJ/m²

Coefficient of Thermal Expansion for 20 °C – 80 °C (DIN 53 752): 1.50 x 10⁻⁴/ °C

Environmental Stress Crack Resistance (ASTM D-1693) at 70 °C: 192 Hrs

The residual wall thickness after loss (wear resistance) shall not be less than 1.5mm for ducts upto 85mm diameter and 2mm for ducts diameter above 85mm as per IRC – 112:2011.

The ducts shall be corrugated on both sides. The duct shall transmit full tendon strength from the tendon to the surrounding concrete over a length not greater than 40 duct diameters. Material and formulation of sheathing ducts shall conform to test and acceptance criteria of IRC-112:2011.

These ducts shall be joined by adopting any one or more of the following methods, as convenient to suit the individual requirements of the location, subject to satisfactory pressure tests, before adoption.

- Screwed together with male and female threads
- Joining with thick-walled HDPE shrink couplers with glue. This can also be used for connection with trumpet, etc.
- Welding with electro fusion couplers.

The joints shall be able to withstand an internal pressure of 0.5 bar for 5 minutes as per water loss test procedure given in Appendix-B of IRS Concrete Bridge Code-1997

The initial acceptance tests such as bond test, compression test are required to be performed as acceptance criteria for system. In addition to above, the HDPE ducts supplier must have conducted friction test at least once as given in FIB bulletin No-7 to establish/confirm the friction values (K & μ) using the HDPE ducts produced by them , submit the test details and obtain approval prior to commencing supplies .

The routine test such as workability test, transverse load rating test, tension load test and water loss test shall be applicable for both post threading and pre – threading

system of cables. Loads to be imparted on the 107mm ID sheathing during transverse load rating test and tension load test shall be extrapolated from values given for smaller dia sheathing as per IRC 112:2011. At least 3 samples for one lot of supply (not exceeding 7000 meter length) shall be tested.

In viaduct constructed by precast segmental construction, cables shall be threaded after application of temporary prestressing. In continuous unit, constructed by cantilever construction techniques the cantilever cables will be stressed as various segments are cast progressively. Such cables shall be threaded after concreting. In such cases a temporary flexible PVC tube of 90 mm O.D shall be homed through sheathing which will provide adequate stiffness to sheathing during concreting and also prevent blockage of sheathing in case of possibility of leakage. The temporary PVC tube shall be pulled out before threading of the permanent cables.

6.2.2 Anchorages

- 6.2.2.1** Anchorages shall be procured from authorized manufacturers only. Anchorages shall conform to BS: 4447.

The load transfer test and anchorage efficiency shall be conducted as defined in FIP-1993. Engineer in-charge shall select at random, the required anchorage / wedges sample from completed lots for testing by the manufacturer. The concrete unit of required size/R/F will be made by contractor using same design mix of concrete which will be required for the load transfer test. The load transfer test shall be conducted at the strength of concrete at which stressing are proposed in the drawings.

No damaged anchorages shall be used. Steel parts shall be protected from corrosion at all times. Threaded parts shall be protected by greased wrappings and tapped holes shall be protected by suitable plugs until used. The anchorage components shall be kept free from mortar and loose rust and any other deleterious coating.

After completion of pre-stressing and grouting of cable in PSC girders, the extra length pre-stressing strands projecting outside the anchorage are required to be cut and an anchored end is to be sealed.

- 6.2.2.2** Swages of prestressing strand shall develop strength of at least 95 per cent of the specified breaking load of the strand.
- 6.2.2.3** Untensioned Steel reinforcements, around anchorages shall be furnished by prestressing system supplier. Requirement of the same should be job specific and based on edge distance of anchorage and strength of concrete at the time of stressing of cables

as defined in drawings. The same R/F shall be provided in unit required for load transfer test.

A minimum of 3 tests each are required to be conducted for load transfer test and anchorage efficiency test. The manufacturer shall complete the required testing and determine compliance the result with FIP-1993 recommendations before transporting the lot to site.

6.2.3 Prestressing Steel

Uncoated stress relieved low relaxation steel conforming to IS: 14268, class – 2 shall be used. Nominal dia shall be 15.2 mm with minimum breaking strength of 260.7 KN and minimum 0.2 % proof load of 234.6 KN various test as recommended in IS: 14268 shall be conducted before transporting the lot to site. Apart from 1000 hrs relaxation test conducted by manufacturer, at least two such tests are required to be conducted by independent agency in the beginning of project.

6.2.4 Prestressing Strands/Wires Storage

All high tensile steel for prestressing work shall be stored about 30cm above the ground in a suitably covered and closed space to protect it from dampness. It shall also be invariably wrapped in gunny cloth or tar paper or any other suitable materials, as per approval of Engineer. Even if it is to be stored in an area at the site for short time during transit it shall be suitably covered. Protection during storage and repacking or application of washable protective coating to the H.T. steel shall be given by the contractor at no extra cost if the packing of H. T. Strand/wire during unloading and storage / handling in the stores gets damaged.

Stock piling of H. T. Steel on the work site shall not be allowed any time, especially before and during the monsoon.

Engineer or his authorized representative shall always have an easy access to the store-yard for inspecting the H. T. Wire/strands/Bars and satisfying themselves regarding the condition thereof. Any modifications regarding storage suggested by the Engineer shall scrupulously be followed by the contractor. During monsoon days, H.T wires/strands shall be kept in reasonable airtight stores, if required by the Engineer, at no extra cost.

6.2.5 TESTING OF PRESTRESSING STEEL AND ANCHORAGES

All materials specified for testing shall be furnished free of cost and shall be delivered in time for tests to be made well in advance of the anticipated time of use.

All strands to be transported to the site shall be assigned a lot number and tagged for

identification purposes. Anchorage assemblies to be transported shall be like-wise identified.

All samples submitted shall be representative of the lot to be furnished and in the case of strand, shall be taken from the same master roll. The Contractor shall furnish samples of at least 5.0m length selected from each lot for testing. Also, two anchorage assemblies, complete with distribution plates of each size or types to be used, shall be furnished along with short lengths of strands as required.

6.3 WORKMANSHIP

6.3.1 Cleaning

Tendons shall be free from loose rust, oil, grease, tar, paint, mud or any other deleterious substance.

Cleaning of the steel may be carried out by immersion in suitable solvent solutions, wire brushing or passing through a pressure box containing Carborundum powder. However, the tendons shall not be brought to a polished condition.

6.3.2 Straightening

High tensile strand shall be supplied in coils of sufficiently large diameter such that tendons shall retain their physical properties and shall be straight as it unwinds from the coil. Tendons of any type that are damaged, kinked or bent shall not be used.

The packing of prestressing strand shall be removed only just prior to making of cable for placement. Suitable stands shall be provided to facilitate uncoiling of strands without damage to steel. Care shall be taken to avoid the possibility of steel coming into contact with the ground.

6.3.3 Positioning

6.3.3.1 Post-Tensioning

Prestressing tendons shall be accurately located and maintained in position, both vertically and horizontally, as per drawings.

Tendons shall be so arranged that they have a smooth profile without sudden bends or kinks.

The location of prestressed cables shall be such as to facilitate easy placement and vibration of concrete in between the tendons.

Sheathing shall be placed in the correct position and profile by providing suitable ladders

and spacers. Such ladders may be provided at intervals of approximately 1.0 m. Sheathing shall be tied rigidly with such ladders/spacer bars so that they do not get disturbed during concreting.

The method of supporting and fixing shall be such that profile of cables is not disturbed during vibrations, by pressure of wet concrete, by workmen or by construction traffic.

- 6.3.3.2** Each anchorage device shall be set square to the line of action of the corresponding prestressing tendon and shall be positioned securely to prevent movement during concreting.

The anchorage devices shall be cleaned to the satisfaction of the Engineer prior to the placing of concrete. After concreting, any mortar or concrete which adheres to bearing or wedging surfaces shall be removed immediately.

6.3.3.3 Cutting

Cutting and trimming of wires or strands shall be done by suitable mechanical or flame cutters. When a flame cutter is used, care shall be taken to ensure that the flame does not come in contact with other stressed steel. The location of flame cutting of strand shall be kept beyond 75 mm of where the tendon will be gripped by the anchorage or jacks.

In post-tensioning the ends of prestressing steel projecting beyond the anchorages, shall be cut after the grout has set.

6.3.3.4 Protection of Prestressing Steel

Prestressing steel shall be continuously protected against corrosion, until grouted. The corrosion protector shall have no deleterious effect on the steel or concrete or on the bond strength of steel to concrete. Grouting shall conform to these specifications or as directed by the Engineer.

6.3.3.5 Sheathing

The joints of all sheathings shall be watertight. Special attention shall be paid to the junction at the anchorage end, where the sheathing must tightly fit on the protruding trumpet end of anchorage and thereafter sealed preferably with adhesive waterproof tape as per approved manufacturer.

The sheathing and all joints shall be watertight. Any temporary opening in the sheathing shall be satisfactorily plugged and all joints between sheathing and any other part of the prestressing system shall be effectively sealed to prevent entry of mortar, dust, water or

other deleterious matter. Sheathing shall be neatly fitted at joints without internal projection or reduction of diameter. Sheathing shall be firmly tied so that while concreting they should not float up. Sheathing shall be aligned accurately with respect to vertical and horizontal coordinate.

Enlarged portions of the sheathing at couplings or anchorages shall be of sufficient length to provide for the extension of the tendons.

6.3.3.6 Grout Vents

Grout vents of at least 20 mm diameter shall be provided at both ends of the sheathing and at all valleys and crests along its length. Additional vents with plugs shall also be provided along the length of sheathing such that the spacing of consecutive vents does not exceed 20 m. Each of the grout vents shall be provided with a plug or similar device capable of withstanding a pressure of 1.0 MPa without the loss of water, air pressure or grout.

6.3.3.7 Anchorages

All bearing surfaces of the anchorages shall be cleaned prior to concreting and tensioning. Anchor cones, blocks and plates shall be securely positioned and maintained during concreting such that the centre line of the duct passes axially through the anchorage assembly.

The anchorages shall be recessed from the concrete surface as per drawings.

After the prestressing operations are completed and prestressing strands are cut, the surface shall be painted with two coats of epoxy of suitable formulation having a dry film thickness of 80 microns per coat and entire recess shall be filled with concrete or non-shrink/pre-packaged mortar or epoxy concrete.

6.3.3.8 Handling and Storage

Care shall be taken to avoid mechanically damaging, work-hardening or heating prestressing tendons while handling. All prestressing tendons shall be stored clear of the

ground and protected from the weather, from splashes from any other materials, and from splashes from the cutting operation of an oxy-acetylene torch, or arc-welding processes in the vicinity.

In no circumstances shall prestressing tendons after manufacture be subjected to any welding operation, or 'on-site' heat treatment or metallic coating such as galvanising. This does not preclude cutting as specified.

All wires, strands or bars stressed in one operation shall be taken, where possible, from the same parcel. Each cable shall be tagged with its number from which the coil numbers of the steel used can be identified. Cables shall not be kinked or twisted. Individual wires and strands for which extensions are to be measured shall be readily identifiable at each end of the member. No strand that has become unraveled shall be used.

6.4 SUPERVISION

All prestressing and grouting operations shall be undertaken by trained personnel only. A representative of supplier of the prestressing system shall be present during all tensioning and grouting operations and shall ensure, monitor and certify their correctness.

6.5 TENSIONING EQUIPMENT

The tensioning apparatus shall meet the following general requirements: -

- a) The means of attachment of the tendon to the jack or tensioning device shall be safe and secure.
- b) Where two or more wires or strands are stressed simultaneously, they shall be approximately equal length between anchorage points at the datum of load and extension measurement. The degree of variation shall be small compared with the expected extension.
- c) The tensioning apparatus shall be such that a controlled total force is imposed gradually, and not dangerous secondary stresses are induced in the tendons, anchorage or concrete.
- d) The force in the tendons during tensioning shall be measured by direct-reading load cells or obtained indirectly from gauges fitted in the hydraulic system to determine the pressure in the jacks. Facilities shall be provided for the measurement of the extension of the tendon and of any movement of the tendon in the gripping devices. The load-measuring device shall be calibrated to an accuracy within $\pm 2\%$ and checked at intervals to the approval of the Engineer. Elongation of the tendon shall be measured to an accuracy within 2% or 2 mm, whichever is the more accurate.
- e) The tension equipment shall be calibrated before the tensioning operation and at intervals of the months or as approved by the Engineer.

Any indication in the loss of strength in tendons during the tensioning operation shall be brought to the attention of the Engineer. Any corrective measures which may be required in procedures and/or material shall be approved by the Engineer.

When friction must be reduced, water soluble oil may be used subject to the approval of the Engineer. This oil may be flushed from the duct as soon as possible after stressing is completed by use of water pressure. These ducts shall be flushed again just prior to the grouting operations. Each time the ducts are flushed, they shall be immediately blown dry with oil-free air.

6.6 TESTING BY CONTRACTOR

For the purpose of accurately determining the tendon elongations while stressing, the Contractor shall bench test two samples of each size and type of strand tendon to determine the modulus of elasticity prior to stressing the initial tendon. The bench should be at least 6 metres long, with concrete anchorage blocks having a constant area end section of at least four times that of the anchorage assembly area. The tendon shall be straight and centered on the cross-sectional area of the bench. The test procedure shall consist of stressing the tendon at an anchor assembly with the dead end consisting of a load cell. The test specimen shall be tensioned to 80 percent of ultimate to 0 in 10 increments. For each increment, the gauge pressure, elongation and load cell force shall be recorded. The data shall be furnished to the Engineer. The theoretical elongations shown on the post-tensioning working drawings shall be reevaluated by the Contractor using the results of the tests and corrected as necessary. Revisions to the theoretical elongations shall be submitted to the Engineer for approval. Apparatus and methods used to perform the tests shall be proposed by the Contractor and be subject to the approval of the Engineer. After the initial testing, five more tests shall be performed. These tests shall be spaced evenly throughout the duration of the Contract.

6.7 PRETENSIONING

Where pretensioning methods are used, the tension shall be fully maintained by some positive means during the period between tensioning and transfer. The transfer of stress shall take place slowly to minimize shock.

a) Straight Tendons

In the long line method of pretensioning, sufficient locator plates shall be distributed throughout the length of the bed to ensure that the wires or strands are maintained in their proper position during concreting. Where a number of units are made in the line, they shall be free to slide in the direction of their length and thus permit transfer of the prestressing force to the concrete along the whole line.

In the individual mould system, the moulds shall be sufficiently rigid to provide the reaction to the prestressing force without distortion.

b) Deflection Tendons

Where possible the mechanisms for holding down or holding up tendons shall ensure that the part in contact with the tendon is free to move in the line of the tendon so that frictional losses are nullified. If, however, a system is used that develops a frictional force, this force shall be determined by test and due allowance made as agreed by the Engineer.

For single tendons the deflector in contact with the tendon shall have a radius of not less than 5 times the tendon diameter for wire or 10 times the tendon diameter for a strand, and the total angle of deflection shall not exceed 15° . Where the radius is less than 5 times the diameter of the tendon and the angle of deflection exceeds 15° , the loss of strength of the tendon shall be determined by test and due allowance made.

The transfer of the prestressing force to the concrete shall be affected in conjunction with the release of hold-down and hold-up forces as approved by the Engineer.

6.8 POST-TENSIONING

a) Arrangement of Tendons

Where wires, strands or bars in a tendon are not stressed simultaneously, the use of spacers shall be in accordance with the recommendations of the system manufacturer.

b) Anchorages

- i. Anchorages shall be tested in accordance with the requirements of BS 4447.
- ii. For each anchorage system used in the Works, the characteristic value for anchorage efficiency shall be not less than 90%.
- iii. Proprietary anchorages shall be handled and used strictly in accordance with the manufacturer's instructions and recommendations.

c) Deflected Tendons

The deflector in contact with the tendon shall have a radius of not less than 50 times the diameter of the tendon, and the total angle of deflection shall not exceed 15 degrees unless otherwise agreed by the Engineer.

d) Tensioning Procedure

Before tensioning, the Contractor shall demonstrate that all tendons are free to move in the ducts unless the geometry of the ducts makes this impracticable as agreed by the Engineer. Tensioning shall be carried out in such a manner that the stress in the tendons increases at a gradual and steady rate.

Unless otherwise described in the Contract, concrete shall not be stressed until it has reached at least the age at which 2 test cubes taken from it attain the specified transfer strength. The test cubes shall be made and tested as described in BS 1881. They shall be

cured in similar conditions to the concrete to which they relate in a manner approved by the Engineer.

The Contractor shall cast sufficient cubes to demonstrate that the required strength of the concrete at transfer has been reached.

The Contractor shall ensure that those carrying out the stressing are provided with particulars of the required tendon loads, order of stressing and extensions. Allowance shall be made during stressing for the friction in the jack and in the anchorage, although the former is not necessary when using load cells.

Any allowance for draw-in of the tendon during anchoring shall be in accordance with the Engineer instructions.

Stressing shall continue until the required extension and tendon load are reached or are approved by the Engineer.

The extension shall allow for any draw-in of the tendon occurring at the non-jacking end, but measurement shall not commence until any slack in the tendon has been taken up.

Immediately after anchoring, the forces in the prestressing tendons shall not exceed 70% of their characteristic strength. During stressing the value may exceed 70% of their characteristic strength, with the approval of the Engineer, but shall not exceed 80%.

After the tendons have been anchored, the force exerted by the tensioning apparatus shall be decreased gradually and steadily so as to avoid shock to the tendon or the anchorage. Full records shall be kept of all tensioning operations, including the measured extensions, pressure-gauge or load-cell readings, and the amount of draw-in at each anchorage. Copies of these records shall be supplied to the Engineer within 24 hours of each tensioning operation.

Unless otherwise agreed by the Engineer tendons shall not be cut less than 3 days after grouting.

6.9 PRESTRESSING TENDONS - PROTECTION AND BOND

The prestressing tendons shall be protected in their permanent positions from both mechanical damages shall be applied to all unbonded prestressing tendons within 28 days of installation of the tendon in the duct.

The tendon protection compound applied to the and corrosion as described in the

Contract and the following sub-clauses.

The exposed tendons at the anchorages and the anchorages themselves shall be sealed within a closed box and protected from both mechanical damage and corrosion. Suitable access shall be left for jacking equipment for the later removal of the strands of unbonded tendons. The means of protection shall be designed by the prestress supplier and approved by the Engineer.

A tendon protection compound tendon shall be a micro-crystalline wax (petrolatum) base material containing additives to enhance the corrosion inhibiting, wetting, and moisture displacing properties, as well as the ability to form a polar bond with the tendon steel.

The compound Manufacturer shall provide test data verifying that the following properties are met for the service life of 100 years and temperature range of 0°C to 50°C evaluation and acceptance by the Engineers:

- i. Freedom from cracking and brittleness;
- ii. Continuous self-healing film over the coated surfaces;
- iii. Chemical and physical stability;
- iv. Non reactivity with the surrounding and adjacent materials such as concrete, tendons, and ducts;
- v. Moisture displacing characteristics.

Additionally, it shall remain flexible to allow removal and replacement of the tendons. The tendon protection compound and its method of installation shall be approved by the Engineer.

Provision shall be made for expansion of the tendon protection compound during the lifetime of the structure.

Before installing the tendon protection compound it shall be demonstrated that the ducts, U- bend anchorage and anchorages are clean and free of water and chlorides.

The tendons, internal face of the steel u-bend anchorage, stressing anchorages and any other metallic components of the prestressing system shall additionally be pre-treated with a protection compound before delivery to site. The protection compound shall be applied to each strand of the tendon and shall be compatible with the tendon protection compound injected into the ducts. The protection compound shall be approved by the Engineer-in- Charge.

The supplier of the tendon protection compound shall submit for the Engineer's approval

proposals which shall describe how the tendon protection compound can be removed and re- injected into ducts, including buried ducts, within the permanent works.

All materials used in the prestressing systems shall not give off toxic fumes at temperatures below 50°C and shall not support combustion.

6.10 DUCTS FOR BONDED TENDONS

6.10.1 Ducts

Ducts for longitudinal, transverse or vertical tendons embedded into the concrete may be of flexible, semi-rigid, or rigid galvanized, ferrous metal capable of withstanding concrete pressures without deforming or permitting the entrance of cement paste during casting of the member. They must retain their shape and be capable of transferring bond stresses. The semi-rigid duct must be rigid enough to remain straight when supported at 1200 mm maximum intervals but flexible enough to allow 3600 mm radius curves. Flexible duct shall be secured or supported at not more than 300 mm intervals.

6.10.2 Grouting of Prestressing Tendons

a) General

The Contractor shall undertake grouting trials when required by the Engineer.

b) Materials

Unless otherwise directed or agreed by the Engineer as a result of grouting trials, the grout shall consist only of Ordinary Portland Cement and water. The water/cement ratio shall be as low as possible consistent with the necessary workability, and under no circumstances shall the W/C ratio exceed 0.45 by weight.

The grout shall not be subject to bleeding in excess of 2% after 3h or 4% maximum when measured at 25°C or such other temperature as may be approved by the Engineer, in a covered cylinder approximately 100 mm diameter with a height of grout of approximately 100 mm, and the water shall be reabsorbed by the grout during the 24h after mixing.

Admixtures may be used with the written permission of the Engineer and shall be applied strictly in accordance with the manufacturer's instructions. Admixtures shall not contain chloride ions in excess of 0.25 percent by weight.

Dry materials shall be measured by weight.

c) Ducts

Air vents shall be provided at any crests in the duct profile and elsewhere as specified.

All ducts shall be thoroughly clean before grouting. Ducts formed without metal sheathing shall be provided with effective drainage and, unless otherwise directed by the Engineer, shall be flushed with water before grouting. All surplus water shall be removed by compressed air injection. All anchorages shall be sealed or fitted with grouting connections.

d) Grouting Equipment

The mixing equipment shall produce a grout of homogeneous consistency and shall be capable of providing a continuous supply to the injection equipment.

The injection equipment shall be capable of continuous operation with little variation of pressure and shall include a system for recirculating the grout while actual grouting is not in progress. Compressed air shall not be used.

The equipment shall have a sensibly constant delivery pressure not exceeding 1 N/mm^2 . All piping to the grout pumps shall have a minimum of bends, valves and changes in diameter. All baffles to the pump shall be fitted with 1.18 mm sieve strainers. All equipment, especially piping, shall be thoroughly washed through with clean water after every series of operations and at the end of use for each day. The interval between washing shall not exceed 3h.

The equipment shall be capable of maintaining pressure on completely grouted ducts and shall be fitted with a valve that can be locked off without loss of pressure in the duct.

e) Mixing

Water shall be added to the mixer first, then the cement. When these are thoroughly mixed, the admixture, if any, shall be added. Mixing shall continue until a uniform consistency is obtained. Mixing shall not be by hand.

f) Injecting Grout

Grouting shall be carried out as soon as is practicable after the tendons in them have been stressed and anchors trimmed and the Engineer's permission to commence has been obtained. Injection shall be continuous, and it shall be slow enough to avoid producing segregation of the grout. The method of injecting grout shall ensure complete filling of the ducts and complete surrounding of the steel. Grout shall be allowed to flow from the free end of the duct until its consistency is equivalent to that of the grout injected. The opening shall then be firmly closed. Any vents shall be closed in a similar manner one after another in the direction of the flow. After an appropriate time, further injections shall be carried out to fill any possible cavities.

The injection tubes shall then be sealed off under pressure until the grout has set. The filled ducts shall not be subjected to shock or vibration within 1 day of grouting.

Not less than 2 days after grouting, the level of grout in the injection and vent tubes shall be inspected and made good as necessary.

The Contractor shall keep full records of grouting including the date each duct was grouted, the proportion of the grout and any admixtures used, the pressure, details of any interruptions and topping up required. Copies of these records shall be supplied to the Engineer within 3 days of grouting.

Where required by the Engineer, the Contractor shall provide facilities and attendance for the radiographic testing of duct.

g) Strength of Grout

The compressive strength of 100 mm cubes made of the grout shall exceed 17 N/mm^2 at 7 days. Cubes shall be cured in a moist atmosphere for the first 24h, and subsequently in water.

h) DUCTS FOR UNBONDED TENDONS

Unless shown otherwise on the Drawings, ducts and injection tubes in the superstructure and substructure shall be formed from high density polyethylene (HDPE) which shall incorporate a stabilizing agent to prevent Ultraviolet Light (UVL) degradation.

The minimum wall thickness of the ducts shall be such that the ducts are capable of resisting the pressures developed during installation of the protection compound. The ducts shall be smooth bore.

Ducts with external diameters greater than 70 mm shall be transported and stored in straight lengths. The distance between supports shall be limited to 3m and the height of storage to 1.5 m. Alternatively, ducts may be transported and stored in coils provided that they are fixed to the tolerances required by the Designer. Damaged ducts shall not be used in the Works.

No boring of any No boring holes in the ducts shall be permitted once the tendons are installed.

U-bend anchorages shall be formed from smooth-bore unwelded steel tubes and shall comply with the requirements of BS 4360.

Joints between ducts, ducts and anchorages and ducts and U-bend anchorages shall be formed by a coupling device using thermo-fusion techniques which shall provide a watertight seal to the ducts and shall be capable of resisting the pressure developed during installation of the tendon protection compound. The inner surfaces of the joints shall form a smooth transition between ducts and U-bend anchorages to allow satisfactory installation of the tendons. All coupling devices shall be approved by the Engineer.

Injection tubes shall be provided at the U-bend anchorages, the stressing anchorages and at any other positions on the length of the ducts which are required to achieve satisfactory installation of the tendon protection compound. The injection tubes at the U-bend anchorages shall also be used as drainage points for the U-bend. The connection between the ducts and the injection tubes shall be watertight and capable of resisting the pressure developed during installation of the tendon protection compound.

All injection tubes shall be sealed after use to prevent the ingress of water to the satisfaction of the Engineer.

After completion of all duct joints and before completion of the insitu joints between precast segments and before installation of the tendons, all ducts shall be air tested to an equivalent 100 mm water gauge unless otherwise directed by the Engineer. The test shall be performed in accordance with BS 8301 Section 5.

Any ducts which do not contain tendons shall remain empty and shall be sealed at each end to prevent the ingress of water.

6.11 PRESTRESSING TENDONS - TRIAL CONSTRUCTION-UNBONDED TENDONS

Before commencing construction of the precast segments, a trial shall be carried out which shall demonstrate the satisfactory installation, removal and replacement of a prestressing strand together with the proposed techniques for duct jointing, duct testing and installation of the tendon protection compound.

- i. The tendons shall be stressed in accordance with this Specification.
- ii. The ducts shall be filled with a tendon protection compound in accordance with the specification as detailed in relevant sub-sections and the tendon extension and anchorage shall be protected as if they were to be included in the permanent works.
- iii. The trial shall demonstrate that any one strand may be destressed, removed, inspected, replaced and re-stressed and that no voids are created within the tendon protection compound, all to the satisfaction of the Engineer.
- iv. The trial shall also demonstrate that all of the strands in a duct may be removed and that the tendon protection compound can be removed from the ducts and U-bend

anchorage to the satisfaction of the Engineer.

- v. The trial shall be undertaken using the prestressing system to be used in the permanent works and shall be approved by the Engineer.

6.12 PRESTRESSING TENDONS - TEMPORARY TENDONS

Temporary tendons may be re-used as temporary tendons elsewhere provided special precautions are incorporated at the anchorages to ensure tendons are not damaged. These precautions shall be approved by the Engineer.

The tendons shall be enclosed within a duct throughout their length.

The tendons shall be pre-treated in accordance with the specifications as detailed in relevant subsections and the protection compound shall be applied to the outer surfaces of the tendon after each use.

The maximum jacking force for the re-usable temporary tendons shall not exceed 70 percent of their guaranteed minimum breaking load.

After removal of the tendons the ducts shall be sealed at each end to prevent the ingress of water.

6.13 PREPARATION FOR CASTING

- a) The Contractor shall submit for approval, in accordance with the provisions of the Authority's Requirements, working drawings of the prestressing system proposed for use. For initial review, 3 sets of such drawings shall be submitted.
- b) After review, between 6 and 12 sets, as requested by the Engineer, shall be submitted for final approval and for use during construction.
- c) The working drawings of the prestressing system shall show complete details and be accompanied by substantiating calculations of the method and materials the Contractor proposes to use in the prestressing operations, including any additions or rearrangement of reinforcing steel from that shown on the Drawings. Such details shall outline the method and sequence of stressing and shall include complete specifications and details of the prestressing steel and anchoring devices, working stresses, anchoring stresses, type of ducts, and all other data pertaining to the prestressing operation, including the proposed arrangement of the prestressing steel in the members.
- d) Working drawings shall be A1 size and each drawing and calculation sheet shall include the job site, name of the structure as shown on the Contract Drawings and Contract

name.

- e) Working drawings shall be submitted sufficiently in advance of the start of the affected work to allow time for review by the Engineer and correction by the Contractor of the drawings without delaying the work. Such time shall be proportional to the complexity of the work but in no case shall such time be less than eight (8) weeks.
- f) At the completion of each structure, one set of reproducible mylars of the corrected original tracing of all working drawings for said structure shall be furnished to the Engineer. Drawings which are common to more than one structure shall be provided for each structure. An index prepared specifically for the drawings for each structure containing sheet numbers and titles shall be included.
- g) Reinforcing steel shall be fabricated and placed in accordance with the Drawings and as required herein. No reinforcing steel shall be cut and removed to permit proper alignment of stressing ducts. Any bar that cannot be fabricated to clear the conduits shall be replaced by additional bars with adequate lap lengths and shall be submitted

to the Engineer for approval. In the plane of the steel parallel to the nearest surface of concrete, bars shall not vary from plan placement by more than 12 mm or one-tenth (1/10) of the spacing between bars, whichever is less.

- h) All prestressing steel shall be protected against physical damage and rust or other results of corrosion at all times from manufacture to grouting or encasing in concrete. Prestressing steel that has sustained physical damage at any time shall be rejected. The development of visible rust or other results of corrosion shall be cause for rejection, when ordered by the Engineer.
- i) Prestressing steel shall be packaged in containers or shipping forms for the protection of the steel against physical damage and corrosion during shipping and storage. A corrosion inhibitor which prevents rust or other results of corrosion shall be placed in the package or form or shall be incorporated in a corrosion inhibitor carrier type packaging material, or when permitted by the Engineer, may be applied directly to the steel. The corrosion inhibitor shall have no deleterious effect on the steel or concrete or bond strength of steel to concrete. packaging or forms damaged from any cause shall be immediately replaced or restored to original condition.
- j) The shipping package or form shall be clearly marked with a statement that the package contains high-strength prestressing steel, and the care to be used in handling; and the type, kind and amount of corrosion inhibitor used, including the date when placed, safety

orders and instructions for use.

- k) Prestressing steel for post-tensioning which is installed in members prior to placing and curing of the concrete, shall be continuously protected against rust or other corrosion, until grouted, by means of a corrosion inhibitor placed in the ducts or applied to the steel in the duct. The corrosion inhibitor shall conform to the requirements specified herein.
- l) When steam curing is used, prestressing steel for post-tensioning shall not be installed until the steam curing is completed.
- m) All water used for flushing ducts shall contain either quick lime (calcium oxide) or slaked lime (calcium hydroxide) in the amount of 13g. per litre. All compressed air used to blow out ducts shall be oil free.
- n) When acceptable prestressing steel for post-tensioning is installed in the ducts after completion of concrete curing, and if stressing and grouting are completed within 10 calendar days after the installation of the prestressing steel, rust which may form during said 10 days will not be cause for rejection of the steel. Prestressing steel installed, tensioned and grouted in this manner, all within 10 calendar days, will not require the use of a corrosion inhibitor in the duct following installation of the prestressing steel. Prestressing steel installed as above but not grouted within 10 calendar days shall be subject to all the requirements in this section pertaining to corrosion protection and rejection because of rust.
- o) Any time acceptable prestressing steel for pretensioning is placed in the stressing bed and is exposed to the elements for more than 36 hours prior to encasement in concrete, adequate measures shall be taken by the Contractor, as approved by the Engineer, to protect said steel from contamination or corrosion.
- p) All ducts shall be located within 5 mm of the locations given on approved fabrication plans. Method and spacing of supports for ducts shall be shown on the working drawings. After installation in the forms, the end of the ducts shall at all times be sealed to prevent entry of water and debris. Following each pour of concrete, the Contractor will be required to demonstrate that all empty ducts are free of water and are unobstructed and undamaged. Immediately prior to installation of the prestressing steel, the Contractor shall again demonstrate to the satisfaction of the Engineer that all ducts are unobstructed and that they are free of water and debris.

Where tendons are described in the Contract as debonded from the concrete they shall be covered with sleeves approved by the Engineer. The ends of the sleeves shall be taped to the tendon to prevent the ingress of grout.

- q) Concrete shall not be deposited into forms until the entire set-up of the forms, reinforcement, ducts, and anchorage has been thoroughly inspected and checked. The placing of concrete will not be permitted until the Engineer is satisfied that the rate of producing and placing concrete will be sufficient to complete the proposed pour and finishing operations within the scheduled time, that experienced concrete finishers are available where required for finish work and all necessary finishing tools and equipment are on hand at the site of the work and are in satisfactory condition for use.
- r) The conveying equipment shall be of a size and design that will permit the placing of concrete within the time limits specified. Conveying equipment shall be cleaned at the end of each operation or workday and just prior to reuse shall again be checked and cleaned of hardened concrete and foreign materials. Belt conveyors shall be horizontal or at a slope which will not cause excessive segregation or loss of ingredients. Concrete shall be protected against undue drying or rise in temperature. An approved arrangement shall be used at the discharge end to prevent aggregate segregation. Mortar shall not be allowed to adhere to the return length of the belt. Concrete shall be discharged into a hopper or through a baffle.
- s) The concrete shall be first placed in the web forms followed by placement at the bottom slab and then in the top form. Any alternate sequence shall be submitted to the Engineer for approval.
- t) All concrete shall be consolidated by means of approved vibrators together with any other equipment necessary to perform the work as specified. Internal vibrators shall have a minimum frequency of 8,000 vibrations per minute and sufficient amplitude to consolidate the concrete effectively. At least two (2) stand-by vibrators in working condition shall be provided for emergency use in case of malfunction. The use of external vibrators for consolidating concrete will be permitted and may be required when the concrete is inaccessible for adequate consolidation. When external vibration is used, the forms shall be constructed sufficiently rigid to resist displacement or damage. Vibrating of concrete shall be done with care and in such a manner as to avoid displacement of reinforcing, conduits, and other items to be fixed in place.

6.14 SAFETY PRECAUTIONS DURING TENSIONING

Care shall be taken during tensioning to ensure the safety of all persons in the vicinity. Jacks shall be secured in such a manner that they will be held in position, should they lose their grip on the tendons. No person shall be allowed to stand behind the jacks or close to the line of the tendons while tensioning is in progress.

The operations of the jacks and the measurement of the elongation associated operations shall be carried out in such a manner and such a position that the safety of all concerned is ensured.

A safety barrier shall be provided at both ends to prevent any tendon, which might become loose from recoiling unchecked.

During actual tensioning operation, warning sign shall be displayed at both ends of the tendon. After prestressing, concrete shall neither be drilled nor any portion cut nor chipped away nor disturbed, without express approval of the Engineer.

No welding shall be permitted on or near tendons nor shall any heat be applied to tendons. Any tendon which has been affected by welding, weld spatter or heat shall be rejected.

6.15 TOLERANCES

Permissible tolerances for positional deviation of Prestressing tendons in cast-in-situ construction shall be limited to the following

- a) Variation from the specified horizontal profile : 5 mm
- b) Variation from the specified vertical profile : 5 mm
- c) Variation from the specified position in member : 5 mm

6.16 Transportation and Storage of Unit:

Precast members shall be transported in an upright position. Points of support and the direction of reactions with respect to the girder shall approximately be the same during transportation, and storage as when the girder is placed in final position.

When members are to be stacked, they shall be firmly supported at such bearing positions as will ensure that the stresses induced in them are always less than the permissible design stresses. Further, inclined side supports shall be provided at the ends and along the length of a precast girder to prevent lateral movements or instability.

Care shall be taken during storage, hoisting and handling of the precast units to prevent their cracking or being damaged. Units damaged by improper storing or handling shall be replaced by the Contractor at his expense

6.17 TESTS AND STANDARDS OF ACCEPTANCE

The materials shall be tested in accordance with these Specifications and shall meet the prescribed criteria.

The work shall conform to these Specifications and shall meet the prescribed standards of acceptance.

SECTION – S.07

STRUCTURAL STEEL WORKS

7.1 STRUCTURAL STEELWORK SPECIFICATIONS- GENERAL

7.1.1 Scope of Specification

This specification covers the scope of work of structural steel works, submittals by the Contractor, applicable codes of practice for structural steel work and the specifications for the materials to be used, including steel, bolts & nuts, washers etc. and the storage thereof. These specifications shall be read in conjunction with the Latest version of CPWD specifications, MORTH Specifications and other relevant reference specifications described in section 1.1 of these specifications.

7.1.2 Scope of Work

The scope of work for the contractor in respect of structural steel work shall cover, but shall not be limited to the following:

- a) Preparation of complete detailed fabrication drawings and erection marking drawing based on the design drawings, required for all the permanent and temporary structures
- b) Submittal of revised design, with calculations and detailed fabrication drawings, in case any substitution of the designed sections is required.
- c) Submittal of design calculations for joints and connections to be developed by the contractor along with detailed fabrication drawings.
- d) Supply of all raw steel materials for fabrication, taking into account wastage margin, including storage and upkeep of the materials.
- e) Furnishing of all materials, labour, tools and plant and all consumables required for fabrication and supply of all necessary bolts, nuts, washers, tie rods and welding electrodes for field connections, with necessary wastage margins.
- f) Fabrication of the steel works in accordance with the approved fabrication drawings, including all shop assembling, matching and marking. Design, manufacture / fabrication and provision of all jigs, fixings, manipulators etc. required for the fabrication.
- g) Provision of shop painting and requisite site painting to all fabricated steelwork, as per requirements of the related specification of the painting.
- h) Suitability marking, bundling and packing for transport of all fabricated materials.
- i) Preparing and furnishing detailed bill of materials, drawing Office dispatch lists, Bolts Lists and any other lists of bought out items required in connection with the fabrication and erection of the structural steelwork.
- j) Loading, Transportation and unloading of all fabricated structural steel materials from site storage yard to erection site, handling, assembling, bolting, welding and satisfactory installation of all fabricated structural steel materials in proper location, according to approved erection drawings and/or as directed by the Engineer.

- k) The contractor shall submit, for examination by the Engineer, detailed particulars of his proposed methods of erection of the superstructure steelwork, together with complete calculations relating to strength and deflection. If the erection scheme necessitates the attachment of strength steelwork to the permanent steel work, the contractor shall submit, for approval of the Engineer, the methods he proposes for making good the permanent steelwork after removing the temporary work. The contractor shall also submit the design and fabrication drawings of all temporary support, staging, braces etc. required for safe erection, for approval of the Engineer. All the enabling works, erection schemes, design and drawings of temporary structures shall be approved by an independent agency appointed by the contractor.
- l) The contractor shall provide all construction and transport equipment, tools, tackle, and consumables, materials, labour and supervision required for the erection of the structural steelwork.
- m) Receiving, unloading, checking and moving to storage yard, storage, guarding and upkeep of fabricated steelwork and other consumable materials and fasteners at site.
- n) Transportation of all fabricated structural steel materials from site storage yard, handling, assembling, bolting, welding and satisfactory installation of all fabricated structural steel materials in proper location, according to approved erection drawings and/or as directed by the Engineer.
- o) Setting out, aligning, plumbing, levelling, bolting, welding and securely fixing the fabricated steel structures in accordance with the erection scheme, or as directed by the Engineer-in- Charge.
- p) Provision of requisite site painting to all fabricated steelwork, as per requirements of related specifications of the painting.
- q) Providing protective treatment to the erected steel structures, as per Specification.
- r) All major modifications of the fabricated steel structures, as directed by the Engineer-in- Charge, including but not limited to the following:
 - i) Removal of bends, kinks, twists etc. for parts damaged during transport and handling.
 - ii) Cutting, chipping, filling, grinding etc. if required or preparation and finishing of site connections.
 - iii) Reaming of holes for use of higher size bolt if required.
 - iv) Re-fabrication of parts damaged beyond repair during transport and handling or re- fabrication of parts which are incorrectly fabricated.
 - v) Fabrication of parts omitted during fabrications by error, or subsequently found necessary.
 - vi) Drilling of holes which are either not drilled at all or are drilled in incorrect location during fabrication.
 - vii) Carry out tests in accordance with the related Specification.
- s) Preparing and furnishing detailed bill of materials of fabricated parts received from concerned organisation or its authorized fabricator.
- t) The Contractor shall observe all safety requirements for erection of structural

steelwork as covered in IS: 7205.

7.1.3 Submittals

- a) On commencement of the Project, the Contractor shall submit the following:
 - i) Prior to the technical submittals, the contractor shall submit the proposed overall schedule for documentation such as calculations, shop/ working drawings, plan/ procedures and records. Submission of samples, process of fabrication / delivery / erection for the approval of the Engineer .
 - ii) Complete fabrication drawings, materials lists, cutting lists, bolt lists, welding schedules and QC schedules, based on the design drawing furnished to him and in accordance with the approved schedule. It is highlighted that structural steel members dimensions indicated in tender drawings are tentative only, and may be modified during final design stage.
 - iii) Results of any tests, as and when conducted and as required by the Engineer-in-Charge.
 - iv) Manufacturers mill test reports in respect of steel materials, bolts, nuts and electrodes, as may be applicable.
 - v) A detailed list of all constructional Plant & Equipment, such as cranes, derricks, winches, welding sets, erection tools etc. their make, model, present condition and location, available to the contractor and the ones he will employ on the job to maintain the progress of work in accordance with the contract.
 - vi) The total number of experienced personnel of each category, like fitters, welders, riggers etc., which he intends to deploy on the project.
- b) The contractor shall submit a detailed erection programme for completion of the work in time and in accordance with the contract. This will show, in a Performa approved by the Engineer, the target programme, with details of erection proposed to be carried out in each week, details of major equipment required and an assessment of required strength of various categories of workers.
- c) The contractor shall submit complete design calculations for any alternative sections proposed by him, for approval of the Engineer. Use of any alternative section shall be subject to approval of the Engineer. However, no escalation in unit rates of work shall be allowed for such cases.

7.1.4 Furnishing of Information

- a) Design drawings shall be furnished to the contractor and all such drawings shall form part of these Specifications.
- b) The Engineer reserves the right to make changes in the design drawings even after release for preparation of shop drawings to reflect addition, omission & modifications in data/details and requirements. The contractor shall consider such

changes as part of these Specifications and the contract, and no extra claims shall be entertained on this account.

- c) Design drawings, approved by the Engineer, will show as appropriate the salient dimensions, design loads, sizes of members, location of openings at various levels and other necessary information required for the preparation of fabrication drawings, designs and erection details.
- d) It shall be clearly understood that the drawings of the Engineer are design drawings. The typical details of connection, cuts, notches, bends, etc. were shown in the design drawings are only for general guidance of the contractor. The contractor shall design and develop all such details based on the design forces and functional requirements.
- e) In case of variations in design drawings and specifications, the decision of the Engineer shall be final. If the Contractor finds any discrepancy in the information furnished by the Engineer, same shall be immediately brought to the notice of Engineer for resolution. The contractor shall obtain clarifications on discrepancies from the Engineer before proceeding with the work.
- f) No detailed shop drawings, erection plants, enabling structures, lifting plants, temporary structures etc. will be accepted for examination by the Engineer unless the same, have first been completely checked by the Contractor's qualified structural engineer (independent agency to be appointed by contractor) and are accompanied by an erection plan showing the location of all pieces detailed. The contractor shall check and ensure that detailing of connections is carefully planned to obtain ease in erection of structures, including field-welded connections and/or bolting.
- g) No fabrication work shall be started by the contractor without having obtained the approval of the Engineer on the relevant drawings. Approval by the Engineer of any of the drawings shall not relieve the contractor of his responsibility to provide correct design of connections, workmanship, fit of parts, details, materials and errors or omissions of all work shown thereon. The approval of Engineer shall constitute approval of the size of members, dimensions and general arrangement, but shall not constitute approval of the connections between members and other details.
- h) Drawings, for approval, shall be submitted by the contractor in an orderly manner commensurate with erection sequence and approved construction programme.
- i) The contractor shall furnish ten prints of all approved final drawings for field use and record purpose.
- j) The drawings prepared by the Contractor, and all subsequent revisions thereof

shall be at the cost of the Contractor, and no separate payments shall be made for the same. Revisions shall incorporate all modifications, field changes, substitutions etc. effected. The rates/prices quoted for fabrication work shall be deemed to include the cost of such drawing work.

- k) The Contractor shall give due consideration to the need of trial assemblage at shop, weight and size limitation of elements for transportation from shop to construction site, temperature variation of 25 degree centigrade between the fabrication shop and site, site measurements of the as-built dimensions and avoidance of site welding except for fixtures. All the drawings shall be prepared in metric units. The drawings should preferably be of A-1 standard size, and the details shown therein should be clear and legible. These drawings shall include but shall not be limited to the following:
 - i) Assembly drawings, giving exact sizes of the sections to be used and identification marks of the various sections.
 - ii) Dimensional drawings of base plans, anchorages details in foundation, foundation bolts' location etc.
 - iii) Complete Bills of Materials and detailed drawings of all sections including their billing weights.
 - iv) Shop details of temporary structures together with detailed calculations duly approved by an independent agency.
 - v) Detailed shop drawings for proper co-ordination with the concrete components to which the steel members shall be connected, as required.
 - vi) Any other drawings or calculations that may be required for proper completion of the works and clarification of the works or substituted parts thereof.
 - vii) All 'as-built' drawings.

7.1.5 Applicable Codes of Practice

The following specifications, standards and codes are included as part of this Specification. All Standards, specifications, codes of practice current on the date of signing of agreement and referred to herein shall be applicable.

1. IS: 800 Code of Practice for General Construction in Steel.
2. IS: 808 Dimensions for Hot Rolled Steel Beam, Column, Channel and Angle Sections.
3. IS: 814 Covered Electrodes for Manual Metal Arc Welding of Carbon & Carbon Manganese Steel.
4. IS: 816 Code of Practice for Use of Metal Arc Welding for General Construction in Mild Steel.
5. IS: 817 Code of Practice for Training and Testing of Metal Arc Welders.
6. IS: 919 ISO System of Limits & Fits (Part 1 & Part 2)
7. IS: 1148 Hot Rolled Rivet Bars (upto 40mm) for Structural Purposes.
8. IS:1182 Recommended Practice for Radio Graphic Examination of

Fusion Welded Butt Joints in Steel Plates.

9. IS: 1363 Hexagon Head Bolts, Screws and Nuts of Product grade C. (Part 1 to Part 3)
10. IS: 1364 Hexagon Head Bolts, Screws and Nuts of Product Grades A & B (Part 1 to 5)
11. IS: 1367 Technical Supply Conditions for Threaded Steel Fasteners.
12. IS: 1821 Dimensions for Clearance Holes for Bolts and Screws.
13. IS: 4206 Dimensions for Nominal Lengths and Thread Lengths for Bolts, Screws and Studs.
14. IS: 1852 Rolling & Cutting Tolerances for Hot-Rolled Steel Product.
15. IS: 15911 Structural Steel (Ordinary Quality).
16. IS: 2016 Specification of Plain Washers.
17. IS: 2062 Hot Rolled Medium and high Tensile Structural Steel.
18. IS: 2595 Code of Practice for Radio Graphic Testing.
19. IS: 3600 Methods of Testing Fusion Welding Joints. (Part 1 to Part 9)
20. IS: 3613 Acceptance Tests for Wire Flux Combinations for Submerged Arc Welding.
21. IS: 3658 (Code of Practice for Liquid Penetrant Flow, Detection.
22. IS: 3757 High Strength Structural Bolts.
23. IS:4000 High Strength Bolts In Steel Structures-Code of Practice
24. IS: 4353 Recommendations for Submerged Arc Welding of Mild Steel and Low Alloy Steel.
25. IS: 4943 Assessment of Butt and Fillet Fusion Welds in Steel Sheet, Plate and Pipe.
26. IS: 5334 Code of Practice for Magnetic Particle Flow Detection of Welds
27. IS: 5369 General Requirements for Plain Washers and Lock Washers.
28. IS: 5372 Taper Washers for Channels
29. IS: 5374 Taper Washers for I Beams.
30. IS: 6623 Specification for High Strength Structural nuts

31. IS:6649 Specifications for hardening and tempering washers for high strength structural nuts
32. IS: 6755 Double Coil Helical Spring Washers.
33. IS: 7215 Tolerances for Fabrication of Steel Structure.
34. IS: 7318 (Part I) Approval Tests for Welders When Welding Procedure Approval is not required -fusion Welding of Steel.
35. IS:8500 Structural steel -Micro alloyed (Medium and High Strength Qualities) .
36. IS:8910 General requirements of Supply of Weldable Structural Steel.
37. IS: 9595 Recommendations for Metal Arc Welding of Carbon & Carbon- Manganese Steels.

7.1.6 Products

7.1.6.1 Materials

- a) All materials to be supplied by the Contractor shall conform to relevant Indian Standards or equivalent, as approved by the Engineer.
- b) Steel materials required for the work shall be free from imperfections, mill scales, slag intrusions, laminations, pittings, rusts etc. that may impair strength, durability and appearance. All materials shall be of tested quality only. If desired by the Engineer test Certificates in respect of each consignment shall be submitted in triplicate. Whenever the materials are permitted for procurement from identified stocks, a random sample shall be tested at an approved laboratory, as directed by the Engineer.

7.1.6.2 Structural Steel

All structural steel shall be of tested quality and shall conform to one of the following standards:

- i. IS: 2062 Grade –BR (with mandatory impact test) Structural steel (Fusion welding quality)
- ii. IS: 961 High Tensile Structural Steel (Ordinary)
- iii. IS: 1161 Steel Tubes for Structural purposes specifications
- iv. IS: 4923 Hollow steel section for structural use specification

The Contractor shall supply to the Engineer copies of the manufacturer's certificate that the steel brought to the site for incorporation in the works is of a quality fully complying with the specification. If required by the Engineer, the

Contractor shall arrange for testing of the steel samples as per IS: 1608/ IS: 1599.

7.1.6.3 Bolts and Nuts

For splicing of any structural member wherever required HSFG bolts and nuts of property grade-8.8 and above conforming to IS:3757 and IS:6623 (2004) respectively shall be used. Unless specified otherwise, the bolts shall be hexagonal.

All anchor bolts shall be of property class of 8.8 and above and nuts shall conform to IS:1363(1992), IS:1364 (1992) and IS:1367, as applicable, and unless specified otherwise, shall be hexagonal. All nuts shall conform to property class compatible with the property class of the bolt used.

7.1.6.4 Washers

For HSFG bolts, washer shall be conforming to IS:6649 (1985). Plain washers shall be conforming to IS:5369, unless otherwise specified. One washer shall be supplied with each bolt and, in case of special types of bolts, more than one washer as needed for the purpose shall be supplied. An additional double coil helical spring washer, conforming to IS:6755, shall be provided for bolts carrying dynamic or fluctuating loads and those in direct tension. Tapered washers, conforming to IS:5372 and IS:5374, shall be used for channels and beams respectively wherever required.

7.1.7 Storage of Materials

7.1.7.1 General

All materials shall be so stored as to prevent deterioration, and to ensure the preservation of their quality and fitness for the work. If required by the Engineer, the materials shall be stored under cover and suitably painted for protection against weather. Any material which has deteriorated or has been damaged shall be removed from the site and replaced by new members, as directed by the Engineer at no extra cost and time.

- a) The steel to be used in fabrication shall be stored in separate stack clear of the ground section wise and lengthwise.
- b) The storage area shall be kept clean and properly drained. Structural steel shall be so stored and handled in such a manner that members are not subjected to excessive stresses and damage. Girders and beams shall be placed in upright position. Long members shall be supported on closely spaced skids to avoid unacceptable deflection.

7.1.7.2 Yard

- a) The Contractor shall be required to establish a suitable yard, at site, for storing the fabricated steel structures and other materials which will be delivered to

site. The yard shall have proper facilities such as drainage and. lighting including access for cranes, trailers and other heavy equipments.

- b) The Contractor shall have been deemed to have visited the site, prior to submission of his tender, to acquaint himself with the availability of land and the development necessary by way of filling, drainage, access roads, fences, sheds etc., all of which shall be carried out by the Contractor at his own cost and as directed by the Engineer

7.1.7.3 Covered Store

All field connection materials, paints etc. shall be stored on racks and platforms, off the ground in a properly covered building by the contractor.

7.2 STRUCTURAL STEELWORK SPECIFICATION -WELDED STRUCTURE

7.2.1 General

Scope of Specification

This Specification covers the supply, fabrication and delivery to Site of welded structural Steelwork, including the supply of all consumables, electrodes and other materials required for fabrication and field connections of all structural steelwork covered under the scope of the Specification.

7.2.2 Products

Ref. Specification 7.1.6 for Structural Steel

7.2.3 Execution

7.2.3.1 Workmanship

7.2.3.1.1 General

All workmanship shall be in accordance with the best practices in modern structural shops. The greatest accuracy shall be maintained in the manufacture of every part of the work and similar parts shall be strictly interchangeable. The contractor shall not proceed with any welding until the Engineer has approved his welding plan, which shall include.

- i. All information on welding procedures, equipment, additives and preheating during welding operation.
- ii. Details of non-destructive testing methods
- iii. Precautions with regard to welding shrinkage

- iv. Possible treatment of completed welds by grinding
- v. Procedure and programme of welding sequence

7.2.3.1.2 Templates

Templates used throughout the work shall be of steel in cases where actual materials have been used as templates for drilling similar pieces, the Engineer shall decide whether such materials are fit to be used as parts of the finished structure.

7.2.3.1.3 Straightening

All materials shall be straight and free from twists, and if necessary, before being worked, shall be straightened and/or flattened by pressure, unless required to be of curvilinear form.

7.2.3.1.4 Clearance

The clearance between fraying surface of bolted connections shall not be greater than 1mm at each end. If the separation is between 1 to 3mm, the surface should be tapered to eliminate the separation. Over 3mm separation shall be filled with filler plates.

7.2.3.1.5 Shearing, Cutting and Planning

Cutting shall be done automatically. Cutting by shearing machine may be used for plates not exceeding 10 mm in thickness provided that the plate edges be fully enclosed in a weld. Oxygen cutting may be used provided a smooth and regular surface free from cracks and notches is secured.

- i. Chipping of angle flanges and edges of plates, wherever necessary, shall be done without damaging the parent metal. Chipped edges shall be ground to a neat finish and sharp corners and hammered rough faces shall be rounded off.
- ii. The edges and ends of all cut/sheared plates members, flange plates, web plates of plate girders, and all cover plates, and the ends of all angles, tees, channels and other sections forming the flanges of plate girders, shall be planed/ground. Edge preparation for welding may be done by machine-controlled flame cutting, with edges free from burrs should be clean and straight.

The butting surfaces at all joints of girders shall be planed so as to butt in close contact throughout the finished joint.

- iii. All flame cut surfaces shall be ground to remove the burned/ hardened portion of the material for flame cut surfaces.

7.2.3.1.6 Assembly

- a) All parts assembled for welding shall be in as close contact as practicable over

the whole surface.

- b) The component parts shall be so assembled that they are neither twisted nor otherwise damaged. Specified cambers, if any, shall be provided.
- c) All parts of bolted and welded members shall be held firmly in position by means of jigs or clamps while bolting or welding. No drifting of holes shall be permitted, except to draw the parts together and no drift used shall be larger than the nominal diameter of the bolt. Drifting done during assembling shall not distort the metal or enlarge the holes.
- d) Trial assemblies shall be carried out at the fabrication stage to ensure accuracy of workmanship. These checks shall be witnessed by the Engineer and such trial assemblies shall be at the cost of the Contractor.

7.2.3.2 Welding

7.2.3.2.1 General

The welding and the welding work shall conform to welded bridge code, IS:816 (1969) and IS:9595 (1980), unless otherwise specified. As much work as possible shall be welded in shops and the layout and sequence of operations shall be so arranged as to eliminate distortion and shrinkage stresses.

7.2.3.2.2 Electrodes

All electrodes shall be kept under dry conditions. Any electrode damaged by moisture shall not be used unless it is guaranteed by the manufacturer that, when it is properly dried, there will be no detrimental effect. Any electrode, which has part of its flux coating broken or is otherwise damaged, shall be rejected. Any electrode older than six (6) months from the date of manufacture shall not be used. Batch certificates for electrodes shall be submitted by the Contractor.

Manual Metal Arc Welding electrodes shall be adopted as per following details:

S No.	Classification	Remarks
1	E-6013	For Structural Steel having thickness upto 15mm
2	E-7018	For Structural Steel having thickness more than 15mm

For MIG and SAW welding the suitable product/brand of above-mentioned manufacturer shall be used.

7.2.3.2.3 Preparation of Joints

The edges shall be prepared, with an automatically controlled flame cutting torch, correctly to the shape, size and dimensions of the groove, prescribed in the design and fabrication drawings. In case of U-groove joints, the edges shall be prepared with an automatic false cutting torch in two phases, following a bevel out with a gouging pass, or by machining.

The welding surfaces shall be smooth, uniform and free from fins, tears, notches or any other defects, which may adversely affect welding, and shall be free of loose scale, slag, rust, grease, paint, moisture or any other foreign material.

7.2.3.2.4 Welding Procedure

- a) All welding procedures shall be submitted to the Engineer for approval, well before starting fabrication.
- b) The welding procedures shall be arranged by the Contractor to suit the details of the joints, as indicated in the drawings and the position at which welding has to be carried out. Welding procedure shall cover the following:
 - 1 Type and size of electrodes
 - 2 Current and (for automatic welding) arc voltage
 - 3 Length of run per electrode; or (for automatic welding) speed of travel
 - 4 Number and arrangement of runs in multirun welds
 - 5 Position of welding
 - 6 Preparation and set-up of parts
 - 7 Welding sequence
 - 8 Pre or post heating
 - 9 Any other relevant information.
- c) The welding procedures shall be so arranged that distortion and shrinkage stresses are reduced to the minimum, and that the welds meet the requirement of quality specified.
- d) Any weld found defective shall be removed, by using either chipping hammer or gouging torch, in such a manner that parent material is not injured in any way.

7.2.3.2.5 Fusion Faces and Surrounding Surfaces

- a) Fusion faces and the surrounding surfaces within 50mm of the welds shall be free from all mill scales and free from oil, paint or any substance which might affect the quality of the welds or impede the quality/progress of welding. These shall be free from irregularities, which would interfere with the deposition of the specified size of weld or be the cause of defects.

- b) All mill scale within 50mm of welds shall be removed prior to welding, either by pickling followed by thorough power wire brushing, or by other approved methods.
- c) If preparation or cutting of the fusion faces is necessary, the same shall be carried out by shearing, chipping, gas cutting or flame gouging.
- d) Where hand gas cutting or hand gouging is employed, the blowpipe or gouging blowpipe shall be properly guided.

7.2.3.2.6 Assembly for Welding

Parts to be welded shall be properly assembled and held firmly in position by means of jigs and clamps prior to and during welding.

7.2.3.2.7 Welded Girders and Other Plate

Automatic submerged arc welding shall be employed for fabrication of welded girders and other plate construction, wherever specified. Metal inert gas welding (CO₂) may be done for short length where access to the location of the weld does not permit submerged arc welding subject to approval of Engineer.

7.2.3.2.8 Accuracy of Fit-Up

Parts to be fillet welded shall be brought into as close contact as practicable, and the gap due to faulty workmanship or incorrect fit-up shall not exceed 1.5mm. If greater separation occurs at any position, the size of fillet weld shall be increased at such positions by the amount of the gap.

7.2.3.2.9 Jigs and Manipulators

Jigs and manipulators shall be used, where practicable, and shall be designed to facilitate welding and to ensure that all welds are easily accessible to the operators.

7.2.3.2.10 Ends of Butt-Welded Joints

The ends of butt joints shall be welded so as to provide full throat thickness. This may be done by the use of extension pieces, cross-runs or other approved means.

7.2.3.2.11 Weld Face and Reinforcement of Butt welds

The weld face shall, at all places, be deposited projecting the surface of the parent metal. Where a flush surface is required, the surplus metal shall be dressed off.

7.2.3.2.12 Testing of Butt Welds

Butt-welded joints are to be 25% radiographically tested by the Contractor at his

own cost. If such tests indicate the joints to be defective, the cost of rectification of defective welds shall also be borne by the Contractor.

7.2.3.2.13 Minimum Leg Length & Throat Thickness in Fillet Welds

The minimum leg length of a fillet weld as deposited shall be not less than the specified size. In no case shall a concave weld be deposited, unless specifically permitted. Where permitted, the leg length shall be increased above that specified length, so that the resultant throat thickness is as great as would have been obtained by the deposition of a flat-faced weld of the specified leg length.

7.2.3.2.14 Dislodging

After making each run of welding, all slag shall be thoroughly removed, and the surface cleaned.

7.2.3.2.15 Quality of Welds

The weld metal, as deposited (including tack welds), shall be free from-cracks, slag inclusions, porosity, cavities and other deposition faults. The weld metal shall be properly fused with the parent metal without under cutting or overlapping at the toes of the weld. The surface of the weld shall have a uniform consistent contour and regular appearance.

7.2.3.2.16 Weather Conditions

Welding shall not be done under weather conditions, which might adversely affect the efficiency of welding.

7.2.3.2.17 Qualification and Testing of Welders

The Contractor shall satisfy the department that the welders are suitable for the work for which they will be employed, and shall produce evidence to the effect that welders, have satisfactorily completed appropriate tests, as described in IS:817 Part I (1992). The Engineer- in-Charge may, at his own discretion, order periodic tests of the welders and/or of the welds produced by them. Such tests shall be at the expense of the Contractor.

7.2.3.2.18 Supervision

The Contractor shall employ competent welding supervisors to ensure that the standard of workmanship and the quality of the materials comply with the requirements laid down in this Specification.

7.2.3.2.19 Machining of Butts and Bases

Splices and butt joints of compression members, depending on contact for stress transmission, shall be accurately machined over the whole section. In column bases, the ends of shafts together with the attached gussets, angles, channels etc., after bolting and/or welding together as the case may be, shall be accurately

machined so that the parts connected butt over the entire surface of contact. Care shall be taken that connecting angles or channels are fixed with such accuracy that they are not reduced in thickness by machining by more than 0.8mm.

7.2.3.2.20 Requirement of Welded Joints

Apart from the requirements of welding specified under the above sub clauses, sections above, the Contractor shall ensure the following requirements in the welded joints.

- i) Strength-quality with parent metal.
- ii) Absence of defects
- iii) Corrosion resistance of the weld shall not be less than that of parent material in an aggressive environment.

7.2.3.3 Shop Assembly

- a) The steelwork shall be temporarily shop assembled, as necessary, so that the accuracy of fit may be checked before dispatch. The parts shall be shop assembled with a sufficient number of parallel drifts to bring and keep the parts in place
- b) Since parts drilled or punched, with templates having steel bushes shall be similar and, as such, interchangeable, such steelwork may be shop erected in part only, as agreed by the Engineer.

7.2.3.4 Erection Marking

- a) Each fabricated member, whether assembled prior to dispatch or not so assembled, shall bear an erection mark, which will help to identify the member and its position in respect of the whole structure, to facilitate re-erection at site.
- b) These erection marks shall be suitably incorporated in the shop detail and erection drawings.

7.3 STRUCTURAL STEELWORK SPECIFICATION BOLTED STRUCTURE

7.3.1 General

7.3.1.1 Scope of Specifications

These specifications cover the supply, fabrication and delivery to site of bolted structural steelwork, including the supply of all consumables and other materials required for fabrication and field connections of all structural steelwork covered under the scope of the Specification.

7.3.2 Products

Ref. Specification 7.1.6 for Structural Steelwork -General

7.3.3 Execution

7.3.3.1 Workmanship

7.3.3.1.1 General

All workmanship shall be in accordance with the best practice in modern structural shops. The greatest accuracy shall be maintained in the manufacture of every part of the work and all similar parts shall be strictly interchangeable.

7.3.3.1.2 Templates

Templates used throughout the work shall be of steel. In cases where actual materials have been used as templates for drilling similar pieces, the Engineer shall decide whether such materials are fit to be used as parts of the finished structure.

7.3.3.1.3 Straightening

All materials shall be straight and free from twists, and if necessary, before being worked, shall be straightened and/or flattened by pressure, unless required to be of curvilinear form.

7.3.3.1.4 Clearance

The clearance between fraying surface of bolted connections shall not be greater than 1 mm at each end. If the separation is between 1 to 3 mm the surface should be tapered to eliminate the separation. Over 3mm separation shall be filled with filler plates.

7.3.3.1.5 Shearing, Cutting and planning

- a) Cutting shall be done automatically. Cutting by sheathing machine may be used for plates not exceeding 10mm in thickness provided that the plate edges be fully enclosed in a weld. Oxygen cutting may be used provided a smooth and regular surface free from cracks and notches is secured.
- b) Chipping of angle flanges and edges of plates, wherever necessary, shall be done without damaging the parent metal. Chipped edges shall be ground to a neat finish and sharp and sharp corners and hammered rough faces shall be rounded off.
- c) The edges and ends of all cut/sheared flange plates, web plates of plate girders, and all cover plates, and the ends of all angles, tees, channels and other

sections forming the flanges of plate girders, shall be planed/ground.

- d) The butting surfaces at all joints of girders shall be planed so as to but in close contact throughout the finished joint.
- e) The ends of all build up girders and of all columns shall be faced in an end-milling machine after the members have been completely assembled. Bearing edges for girder bearing stiffeners and column bases shall be machined.
- f) Unless clean, square and true to sharp, all flame-cut edges shall be planed. Cold sawn ends, if reasonably clean and flame-cut ends of sections not inferior to sawn ends in appearance need not be planned, except for butting ends.

7.3.3.1.6 Drilling

- a) Holes for bolts shall be drilled to conform to Clause 10 of IS:7215-1974. Punching of holes shall not be permitted. All holes, except as stated hereunder, shall be drilled to the required size, 3mm less in diameter and reamed thereafter to the required size. All matching holes for bolts shall register with each other so that a gauge of 0.8mm less in diameter than the hole can pass freely through the members assembled for bolting, in the direction at right angle to such members.
- b) All drilling shall be free burrs.
- c) No holes shall be made by the gas cutting process.

7.3.3.1.7 Assembly

- a) All parts assembled for bolting shall be in close contact over the whole surface.
- b) The component parts shall be so assembled that they are neither twisted nor otherwise damaged. Specified cambers, if any, shall be provided.
- c) All parts of bolted and welded members shall be held firmly in position by means of jigs or clamps while bolting or welding. No drifting of holes shall be permitted, except to draw the parts together and no drift used shall be larger than the nominal diameter of the bolt. Drifting done during assembling shall not distort the metal or enlarge the holes.
- d) Trial assemblies shall be carried out at the fabrication stage to ensure accuracy of workmanship, and these checks shall be witnessed by the Engineer. Such trial assemblies shall be at the cost of the contractor.

7.3.3.1.8 Field Bolts

- a) Requirements stipulated under bolting shall apply for field bolts. Field bolts nuts and washers shall be furnished by the Contractor in excess of the nominal

numbers required. He shall supply the full number of bolts, nuts and washers and other necessary fittings required to complete the work, together with the additional bolts, nuts and washers totaling to 10% of the requirement subject to minimum of 10 Nos. Only HSFG bolts of class 8.8 shall be used.

- b) At the time of assembly, the surfaces in contact shall be free of paint or any other applied finish, oil, dirt, loose rust, loose scale, burrs and other defects which would prevent solid seating of the parts or would interfere with the development of friction between them.
- c) If any other surface condition, including a machined surface, is specified, it shall be the responsibility of the Contractor to work within the slip factor specified for the particular case.
- d) Each bolt and nut shall be assembled with washers of appropriate shape, quality and number in cases where plane parallel surfaces are involved. Such washers shall be placed under the bolt head or the nut, whichever is to be rotated during the tightening operation. The rotated nut or bolt head shall be tightened against a surface normal to the bolt axis, and the appropriate tapered washer shall be, used when the surfaces are not parallel. The angle between the bolt axis and the surface under the non-rotating component (i.e. the bolt head or the nut) shall be $90 + 3$ degrees. For angles outside these limits, a tapered washer shall be placed under the non-rotating component. Tapered washers shall be correctly positioned.
- e) No gasket or other flexible material shall be placed between the holes. The holes in parts to be joined shall be sufficiently well aligned to permit bolts to be freely placed in position. Driving of bolts is not permitted. The nuts shall be placed so that the identification marks are clearly visible after tightening. Nut and bolts shall always be tightened in a staggered pattern and where there are more than four bolts in any one joint, they shall be tightened from the centre of the joint outwards.
- f) If, after final tightening, a nut or bolt is slackened off for any reason, the bolt, nut and washer or washers shall be discarded and not used again.

7.3.3.2 Shop Assembly

The steelwork shall be temporarily shop assembled, as necessary, so that the accuracy of fit may be checked before dispatch. The parts shall be shop assembled with a sufficient number of parallel drifts to bring and keep the parts in place.

7.3.3.3 Erection Marking

Each fabricated member, whether assembled prior to dispatch or not so assembled, shall bear an erection mark, which will help to identify the member and its position in respect of the whole structure, to facilitate re-erection at site.

This erection mark shall be suitably incorporated in the shop detail and erection drawings.

7.4 STRUCTURAL STEEL SPECIFICATIONS -PAINTING WORKS

7.4.1 General

7.4.1.1 Scope of Specification

This Specification covers the scope of painting, methods for the surface preparation, application of paints and precautions to be taken for the painting of structural steel work. It covers the supply and delivery of all necessary materials, labour, scaffolding tools, equipment and everything that is necessary for the job completion on schedule.

7.4.1.2 Applicable Codes

The following Specifications, Standards and Codes are included as part of this Specification. All standards and codes of practice referred to herein shall be the current editions during the currency of the project including all applicable official amendments and revisions.

In case of discrepancy between this Specification and those referred to herein, this specification shall govern. In case of discrepancy between Contract drawings and this specification, the Contract drawings shall govern.

- a) IS: 102: Ready Mixed Paint, Brushing, Red lead, Non-Setting, Priming.
- b) IS: 159: Ready Mixed Paint, Brushing, Acid Resisting for protection against Acid Fumes, Colour as Required.
- c) IS: 341: Black Japan, Types A, B & C.
- d) IS: 384: Brushes, Paints and Varnishes, Flat.
- e) IS: 487: Brush, Paint and Varnish i) Oval Ferrule Bound ii) Round Ferrule Bound.
- f) IS: 958: Temporary Corrosion Preventive Grease, Soft Film, Cold Application.
- g) IS: 1153: Temporary Corrosion Preventive, Fluid, Hard Film, Solvent Deposited.
- h) IS: 1477: Code of Practice for Painting of Ferrous Metals in Building.
Part I -Pretreatment Part II -Painting
- i) IS: 1674: Temporary Corrosion Preventive Fluid, Soft Film, Solvent Deposited.
- j) IS: 2074: Ready Mixed Paints, Red Oxide -Zinc Chrome, Priming.

7.4.2 Products

7.4.2.1 Materials

7.4.2.1.1 Paint

- a) All paint delivered to the fabrication shop/Site shall be ready mixed, in original sealed containers, as packed by the paint manufacturers, and no thinners shall be permitted.
- b) Paint shall be stirred frequently to keep the pigment in suspension.

7.4.2.1.2 Storage of Paints

- a) All paints shall be stored strictly in accordance with the requirements laid down by the paint manufacturers. The storage area shall be well ventilated and protected from sparks, flames, direct exposure to sun or excessive heat, preferably located in an isolated room or in a separate building.
- b) All paint containers should be clearly labelled to show paint identification, date of manufacture, batch number, order number and special instructions in legible form. The containers shall be opened only at the time of use. Paints which have liveried, gelled or otherwise deteriorated during storage, shall not be used. Paints for which the shelf life specified by the supplier has expired shall not be used without inspection and approval by the Engineer.

7.4.3 Execution

7.4.3.1 Paint System

- a) Sand blasting where specified shall be carried out in accordance with IS:1477.
- b) Painting work shall be carried out as follows:

DESCRIPTION	GENERAL SURFACE	
	EXTERNAL SURFACES	INTERNAL SURFACES
FABRICATION SHOP		
Surface Treatment	Abrasive blast cleaning to minimum SA-2.5 SIS-055900 near – white blast cleaning	Abrasive blast cleaning to minimum SA-2.5 SIS-055900 near – white blast cleaning
1 st Under-Coat	Inorganic zinc silicate primer (self-curing solvent type) DFT – 75 m shall	Epoxy zinc phosphate primer polyamide cured

DESCRIPTION	GENERAL SURFACE	
	be Berger Zinc Anode 11 or approved equivalent. The primer should be applied by spray only.	DFT35 m μ
2 nd Under-Coat	Epoxy zinc phosphate primer polyamide cured DFT-35 m shall be Berger Epilux 610 Primer or approved equivalent. The primer should be applied by spray or brush only.	Epoxy zinc phosphate primer polyamide cured DFT35 m shall be Berger Epilux 610 Primer or approved equivalent. The primer should be applied by spray or brush only.
3 rd Under-Coat	Epoxy zinc phosphate primer polyamide cured DFT-35 m shall be Berger Epilux 610 Primer or approved equivalent. The primer should be applied by spray or brush only.	Polyamide cured coal tar epoxy coating DFT100 m μ
4 th Under-Coat	Epoxy high build micaceous iron oxide coating polyamide cured DFT90 m shall be Berger Epilux 4 High Build MIO OR approved equivalent. The primer should be applied by spray or brush only	Polyamide cured coal tar epoxy coating DFT -100 m μ
ERECTION SITE	EXTERNAL SURFACES	INTERNAL SURFACES
Intermediate Coat	Acrylic polyurethane finish aliphatic isocyanate cured DFT30 μ m shall be Bergerthane or approved equivalent applied by spray or brush in approved colour.	NA
Finish Coat	Acrylic polyurethane finish aliphatic isocyanate cured DFT30 μ m shall be Bergerthane or approved equivalent applied by spray or brush in approved colour.	NA

INTERNAL SURFACE = Internal surfaces are those which will become inaccessible after fabrication.

EXTERNAL SURFACE = All other surfaces which are prone to humidity and moisture from the atmosphere.

The following precautions must be taken:

- After abrasive blast cleaning, the first undercoat (primer coat) should be applied well before surface deterioration.

- ii. At least EPOXY MIO coating application should be completed before giving any long overcoating interval for external surface.
- iii. At least up to one coat of coaltar epoxy shall be completed before giving any long overcoating interval for internal surface.
- iv. Overcoating intervals, application parameters shall conform to manufacturer's instruction manual.
- v. The DFT (Dry film thickness) shall be measured after completion of each coat.

7.4.3.2 Surface Preparation

7.4.3.2.1 General

All surfaces shall be cleaned of loose substances and foreign materials. e. g. dirt, rust, scale, oil, grease, welding flux etc so that the prime coat adheres to the original metal surface. The work shall be carried out in accordance with IS: 1477 (1971) (Part I). Any oil, grease, dust or foreign matter deposited on the surface after preparation shall be removed and care shall be taken to ensure that the surface is not contaminated with acids, alkalis or other corrosive chemicals. The primer coat shall be applied immediately after the surface preparation is completed. .

Before the application of any paint the surfaces to be treated shall be thoroughly cleaned freed from all scale, loose paint, rust and other deleterious matters. Oil and grease shall be removed from the surface by washing with solvents or with a detergent solution before blast cleaning operation of metal polish with metal pellets. If any traces of oil or grease remain after blasting, they shall be removed by solvent cleaning and the area will be re-blasted thereafter.

All welding areas shall be given special attention for removal of weld flux slag, weld metal splatter weld head oxides, weld flux fumes silvers and other foreign objects before blasting. If deemed necessary by the Engineer, acid washing and subsequent washing with clean water shall be used.

Any rough seams will have to be ground and must be inspected and approved by the Engineer before application of the coatings.

All structural steel to be painted shall be cleaned blast cleaning in accordance with SA 2 1/2 Near- White Blast cleaning (equivalent Swedish Standard SIS 055900). For SA 2 1/2 the profile should be in the range of 40-70 microns and should be measured with comparator. Mill scale, rust and foreign matter shall be removed to the extent that the only traces remaining are light stains in the form of spots or stripes. Finally, the surface shall be cleaned with a vacuum cleaner or clean dry compressed air.

The blast cleaning shall produce a surface roughness complying with the one specified by the paint manufacturer for the primer concerned. If cleaned surfaces are rusted or are contaminated with foreign material before painting is accomplished, they shall be re-cleaned by the Contractor at his expenses.

The surface shall be cleaned by impingement of abrasive materials, such as grit of cast iron, malleable iron, steel or synthetic material, at high velocity created by

clean and dry compressed air blast. Prior to application of the blast, heavy deposits of oil and grease shall be removed by solvent cleaning and excessive surface scale removed by hand tool or power tool cleaning.

The last finish paint shall be applied after structural steel erection and slab construction.

7.4.3.3 Mixing and Thinning

- a) All ingredients in a paint container shall be thoroughly mixed to break-up lumps and disperse pigments, before use and during application, to maintain homogeneity. All pigmented paints shall be strained after mixing to remove skins and other undesirable matters.
- b) Dry pigments, pastes, tinting pastes and colours shall be mixed and/or made into paint so that all dry powders get wetted by vehicles and lumps and particles are uniformly dispersed.
- c) Additives that are received separately such as curing agents, catalysts, hardeners etc. shall be added to the paint as per the manufacturer's instructions. These shall be promptly used within the pot life specified by the manufacturers and unused paint thereafter shall be discarded.
- d) Thinners shall not be used unless essential for proper application of the paint. Where thinners are used, they shall be added during the mixing process and the type and quantity of thinner shall be in accordance with the instructions of paint manufacturer.

7.4.3.4 Paint Application

7.4.3.4.1 General

- a) Paint shall be applied in accordance with the manufacturer recommendations, as supplemented by these Specifications. The work shall generally follow IS:1477 (1971) (Part II). Prior approval of the Engineer shall be taken with respect of all primers and/or paints, before their use in the works.
- b) Paint shall generally be applied by brushing except that spraying may be used for finish coats only when brushing may damage the prime coats. Roller coat or other method of paint application shall not be used unless specifically authorized.
- c) Spraying paint shall not be adopted on red lead or zinc rich paints. Daubers may be used only when no other method is practicable for proper application in difficult accessible areas.
- d) Paint shall not be applied when the ambient temperature is 10°C and below. For paints which dry by chemical reaction the temperature requirements specified by the manufacturer shall be met with. Also, paint shall not be applied in rain, wind, fog or at relative humidity of 80% and above or when the surface

temperature is below dew point, resulting in condensation of moisture. Any wet paint exposed to damaging weather conditions shall be inspected after drying and the damaged area repainted after removal of the paint.

- e) Each coat of paint shall be continuous, free of pores and of even film thickness without thin spots. The film thickness shall not be so great as to detrimentally affect either the appearance or the service life of the paint.
- f) Each coat of paint shall be allowed to dry sufficiently before application of the next coat, to avoid damage such as lifting or loss of adhesion. Undercoats having glossy surface shall be roughened by mild sand papering to improve adhesion of subsequent coats. Successive coats of the same colour shall be tinted. Whenever practical, to produce contrasts and help in identifying the progress of the work.

7.4.3.4.2 Brush Application

- a) Proper brushes shall be selected for a specific work piece. Round or oval brushes which conform to IS:487(1985) are better suited for irregular surfaces, whereas flat brushes which conform to IS:384(1979) are convenient for large flat areas. The width of flat brushes shall not generally exceed 1.25mm.
- b) Paint shall be applied in short strokes depositing a uniform amount of paint in each stroke followed by brushing the paint into all surface irregularities, crevices and corners and finally smoothening or levelling the paint film with long and light strokes at about right angles to the first short strokes. All runs and sags shall be brushed out. The brush marks left in the applied paint shall be as few as practicable.

7.4.3.4.3 Spray Application

- a) The spraying equipments shall be compatible with the paint material and provided with necessary gauges and controls. The equipment shall be cleaned of dirt, dried paint, foreign matter and solvent before use.
- b) The paint shall be applied by holding the gun perpendicular to the surface at a suitable distance and moved in a pattern so as to ensure deposition of a uniform wet layer of paint. All runs and sags shall be brushed out immediately. Areas not accessible to spray shall be painted by brush or dauber.
- c) A water trap acceptable to Engineer shall be furnished and installed on all equipment used in spray painting.

7.4.3.5 Shop Painting

- a) The painting system specified in Table shall be followed.

- b) Surfaces in contact during shop assembly shall not be painted. Surfaces which cannot be painted but require protection shall be given a rust inhibitive grease conforming to IS: 958-1975 or solvent deposited compound conforming to IS: 1153 (1975) or IS: 1674 (1960) or treated as specified in the drawing.
- c) Surface to be in contact with concrete shall not be painted.
- d) The shop coats shall be continuous over all edges, including ends meant for jointing at site by bolting, except where the paint could be detrimental to bolting. In such cases, no paint shall be applied within 50mm, and the unprotected surface shall be given a coat of corrosion inhibitive compound.
- e) The unpainted area shall be cleaned prior to welding. The welded joint shall be cleaned and de-slagged, and immediately after covered by the same paint as has been used for the remaining surface.

7.4.3.6 Protection of Paintwork

- a) The Contractor shall provide measures as necessary to prevent damage to the work and to other property or persons from all cleaning and painting operations. Paint or paint stains which result in other unsightly appearances on surfaces not designated to be painted shall be removed or obliterated by the contractor at his cost.
- b) All painted surfaces that in the opinion of the Engineer are damaged in any way, shall be repaired by the contractor at his cost with materials and to a condition equal to that of the requirements specified in these specifications.
- c) Upon painted surfaces that in the opinion of any other work that would cause dust, grease or foreign materials to be deposited upon the painted surfaces, the painted surfaces shall be thoroughly cleaned. At the time of opening the flyovers to public traffic, the painting shall be completed, and the surfaces shall be undamaged and clean.
- d) The areas for high-strength bolts shall be protected by masking tape against undercoat application at the fabrication shop. Immediately prior to erection any rust in the paint area shall be removed by power wire brushing to a standard equivalent to SA3.

7.4.3.7 Site Painting

- a) After the erection of structures at the site, the contractor shall provide the necessary treatment as specified in Table "PAINTING SPECIFICATIONS".
- b) Surfaces which have not been shop coated but require surface treatment shall be given necessary surface preparation and coats at site as specified in Table.

7.5	STRUCTURAL STEEL WORK - QUALITY REQUIREMENTS	CONTROL	& TESTING

7.5.1 General

7.5.1.1 Scope of Specification

The scope of work of these specifications is to establish the norms for ensuring the required Quality Control through established testing norms of the welded structural steelwork.

7.5.1.2 Codes / Standards

Relevant IS codes for tolerance and tests of welding procedures as specified in the specification for Structural Steelwork -General.

7.5.1.3 Submittals

The Contractor shall submit the followings:

- a) Proposed overall schedule for documentation of calculations, shop drawings, plan/procedures and records, submission of procedure of fabrication.
- b) The contractor shall himself inspect all materials, shop work and fieldwork to satisfy the specified tolerance limits and Quality norms before the same are inspected by Engineer or his authorized representative.

7.5.2 Products

List of preferred Manufacturers/Supplier is given in APPENDIX 9 – List of Preferred manufacturers/supplier (Vol-III, Part-1)

7.5.3 Execution

7.5.3.1 Tolerances

The contractor shall through appropriate planning and continuous measurements in the workshop and the erection at site, ensure that the tolerance specified below are strictly adhered to.

7.5.3.1.1 Dimensional & Weight Tolerance

The dimensional and weight tolerance for rolled shapes shall be in accordance with IS: 1852. The acceptable limits of straightness for rolled or fabricated members as per IS: 7215 are:

Struts and columns: $1/1000$ or 10 mm whichever is smaller where L is the length of finished member A limit for distortion in transverse direction δ from the true axis of plate and box girder shall not be more than $L/1000$ where L is the length of diagonal of profile.

Tolerance in specified camber of members shall be 3mm in 12m length Tolerance

in specified lengths shall be as follows:

- Column finished for contact bearing + 1 mm
- Other members (cols.) upto and over 10 m + 5 mm
- Including 10 m L/2000 sub to max of + 8 mm
- Other members (beams) upto 12 m + 3 mm
- Over 12m L/4000 sub max. of ± 5 mm

7.5.3.1.2 End of Members

Beam to beam and beam to column connection -Where the abutting parts are to be joined by butt welds, permissible deviation from the squareness of the end is :

Beam upto 600 mm in depth : 1.5 mm

Beam over 600 mm in depth: 1.5 mm for increase in depth of every 600 mm subjected to max of 3 mm.

Where abutting parts are to be joined by bolting through cleats or end plates, the connections require closer tolerance, permissible deviation from the squareness of the end is:

Beams upto 600 mm in depth 1mm per 600mm of depth subject to a max of 1.5 mm.

For full bearing, two abutting ends of columns shall first be aligned to within 1 in 1000 of their combined length and then the following conditions shall be met :

- i. Over at least 80% of the bearing surface the clearance between the surfaces does not exceed 0.1mm.
- ii. Over the remainder of the surfaces the clearance between the surfaces does not exceed 0.3 mm.

Where web stiffeners are designed for full bearing on either the top flange or the bottom flange or both, at least half the stiffener shall be in positive contact with the flange. The remainder of the contact face could have a max. gap of 0.25 mm.

7.5.3.1.3 Depth of Members

Acceptable deviation from the specified overall depth as per IS:7215 (1974) is: Upto and including 1000mm : 1.0 mm

Over 1000 mm : 2.0mm

7.5.3.1.4 Web Plates

An acceptable deviation from flatness in girder webs in the length between the stiffeners or in a length equal to the girder depth shall be

Upto 500 mm depth : 0.5 mm

Over 500 mm & including 1000 mm : 1.0 mm

Over 1000 mm : 2.0 mm

7.5.3.1.5 Flange Plates

A reasonable limit for combined warpage and tilt on the flanges of a built-up member is 1/200 of the total width of flange or 2 mm whichever is smaller measured with respect to centerline of flange.

Lateral deviation between centreline of web plate and centreline of flange plate at contact surfaces measured as the difference δ between diagonals of nominal length **L shall not be greater than L/1000.**

7.5.3.1.6 End Milling

Column ends bearing on each other or resting on base plates and compression joints designed for bearing shall be milled true and square to ensure proper bearing and alignment. Base plates shall also have their surfaces milled true and square.

7.5.3.2 Quality Control

In order to exercise proper control of the quality of the welding, Contractor shall enforce methods of control as tabulated below:

S. No.	Purpose	Control subjects	Methods of control
	1	2	3
1.	Control of welding materials and basic metal quality	Quality control of electrodes, welding wire, flux and protective gases	Weldability test to determine the technological properties of materials.
		Checking of quality and Weldability of the basic metal and welded members	Mechanical test of weld metal Metallographically investigations of welds macro-structure and microstructure Checking of weld metal resistance for intercrystalline corrosion. Study if weld metal solidity by physical control methods.
2.	Checking of welder's qualifications	Welding of specimens for quality determination	Mechanical tests, metallographical investigation & checking of welded joints by physical control methods
3.	Control of welded	Control of assembly accuracy and technological welding process	Checking of assembly quality & centering of welded members Checking of welding equipment conditions. Checking correctness of

S. No.	Purpose	Control subjects	Methods of control
	1	2	3
			welding procedure. Visual examination of welds

7.5.3.3 Tests & Testing Procedures

Agency for testing of weld shall be approved by the Engineer prior to testing.

7.5.3.3.1 Visual Examination

The contractor shall conduct visual examination and measurement of the external dimensions of the weld for all joints. Before examining the welded joints, areas close to it on both sides of the weld for a width not less than 20 mm shall be cleaned of slag and other impurities. Examination shall be done by a magnifying glass which has a magnification power of ten (10) and measuring instrument which has an accuracy of ± 0.1 mm or by weld gauges. Welded joints shall be examined from both sides. The contractor shall examine the following during the visual checks.

- i) Correctness and shape of the welded joints
- ii) Incomplete penetration of weld metal.
- iii) Influx
- iv) Burns
- v) Unwelded craters
- vi) Undercuts
- vii) Cracks in welded spots and heat affected zones
- viii) Porosity in welds and spot welds
- ix) Compression in welded joints as a result of electrode impact while carrying out contact welding
- x) Displacement of welded element

The contractor shall, document all data as per sound practices.

7.5.3.3.2 Mechanical Test

The Contractor shall carry out various mechanical tests to determine weldability, metal alloyability, nature of break, correct size and type of electrodes, degree of pre-heat and post- heat treatment. The type, scope and sample of various mechanical tests shall be determined in agreement with the purchaser. The number of tests conducted shall depend on the result obtained to satisfy the Engineer that the correct type and size of electrode, degree of pre- heating and

post-heating and weldability of metal are being followed.

7.5.3.3.3 Dye Penetration Test

All welds shall be tested by “Dye Penetration test” as per current practices.

7.5.3.3.3 Radiography Test

Radiography test shall be conducted by the contractor to determine gas inclusion (blow holes, hollows) slag inclusion, shallow welds and cracks for 50% lengths at all butt joints.

Before conducting the examination, the welded joints shall be cleaned of slag and scales and visually examined. The welds shall be marked into separate portions depending on the length of photograph. The length of the photograph shall be such as to ensure that there are no distortions and shall reveal the defect correctly. The length shall not be more than 0.75 of the focal distance and the width of the photograph would depend on the width of the welded joint plus 20 mm on either side of the weld. The cassette with film shall be protected by sheet of lead or equivalent of proper thickness against incidental, diffused and secondary radiation. The direction of the ray with relation to the film shall be as specified hereunder.

Welds of butt joints without edge slopes with edge processing shall be examined by central ray directed at right angles to the weld.

In special cases examination of welds with inclined rays directed along edge slopes may be permitted by the Engineer.

Lap joints shall be examined by directing rays at 45° to the bottom plate. Welding in T- joints without any edge preparation shall be examined by rays directed at 45° to the weld. Angle welds in lap and tee-joints shall be examined by the rays in opposite direction i.e. the film will be on the side of the weld. Welding in angle joints shall be checked by directing ray along the bisector of the angle between the welded elements. Opposite direction of the ray and location of the film may also be permitted by the Authority.

7.5.3.3.4 Ultrasonic Test

Ultrasonic test shall be conducted by the contractor to detect gas inclusion (pores), slag inclusion, shallow welds, cracks, lamination and friability etc. Prior to starting of ultrasonic test, the welded joint shall be thoroughly cleaned of slag and other material. Surface of the basic metal adjacent to welded joint on both sides shall be mechanically cleaned by the grinder or a metal brush to provide the contact of the whole ultrasonic probe surface with surface of basic metal. The width of the clean surface shall be as directed by the Engineer. The welded joint then shall be covered with a thin coat of transformer oil, turbine or machine oil to ensure acoustic contact. The joints so treated shall be marked and the marks shall be entered into the documentation; subsequent to this, ultrasonic test shall be carried out as directed by the Engineer. At least 50% of weld shall be tested by ultrasonic testing

7.6 STRUCTURAL STEEL SPECIFICATIONS -ERECTION

7.6.1 General

7.6.1.1 Scope of Specification

This Specification covers the delivery to site, storage and erection of structural steelwork at site. This includes plant and equipment requirements, installation of fabricated steel work in position and grouting all complete as per drawings, specifications and other provisions of the Contract.

7.6.1.2 Submittals

- a) Ref. Specification for Structural Steelwork -General
- b) The contractor shall submit for approval a full description of his proposed erection method including sequence of erection, use of temporary supports, connection details and erection camber diagram and design calculations covering various stages of erection process.

7.6.2 Execution

7.6.3.1 Delivery, Storage & Handling

- a) Before the shop assembling is dismantled, all members and sections shall be appropriately marked with paint or grooved with their identification numbers as detailed in shop drawings.
- b) The Contractor shall deliver the fabricated structural steel materials to site, with all necessary field connection materials, in such sequence as will permit the most efficient and economical performance of the erection work. As per the scheduled programme, the Engineer may, at his discretion, prescribe or control the sequence of delivery of materials.
- c) Fabricated parts shall be handled and stacked in such a way that no damage is caused to the components. Measures shall be taken to minimize damage to the protective treatment on the steelwork. All work shall be protected from damage in transit. Particular care shall be taken to stiffen free ends, prevent permanent distortion and adequately protect all machined surfaces. All bolts, nuts, washers, screws, small plates and articles generally shall be suitably packed and identified.

7.6.3.2 Plant and Equipment

All erection tools and plant & equipment proposed to be used shall be efficient, dependable and in good working condition, and the suitability and adequacy of such shall be determined by the Engineer. The Contractor shall, in his technical proposal submittal, specify the plant and equipment proposed by him for erection of structural steelwork at Site.

7.6.3.3 Storage

Materials to be stored shall be placed on skids above the ground and shall be kept clean and properly drained.

7.6.3.4 Method and Sequence of Erection

The method and sequence of erection shall have the prior approval of the Engineer. The contractor shall arrange for the most economic method and sequence consistent with the drawings and Specifications and such information as may be furnished to him prior to the execution of the Contract. The erection of steelwork shall be planned so as to ensure safe- working conditions at all times. The Contractor shall be solely responsible for enhancing the safety of his construction activities at the Site.

7.6.3.5 Assembly & Erection

- a) During erection, the members and sections shall be accurately assembled as shown on the approved shop drawings and any matchmarks shall be followed. The material shall be carefully handled so that no sections will be bent, broken or otherwise damaged. Hammering which will damage or distort the members shall not be done. Bearing surfaces and surfaces to be in permanent contact shall be cleaned before the members are assembled. Splices and field connections shall have one half of the holes filled with bolts and cylindrical erection pins (half bolts and half pins) before bolting with high-strength bolts. Fitting-up bolts shall be of the same nominal diameter as the high-strength bolts, and cylindrical erection pins shall be 1 mm or larger.
- b) The correction of minor misfits involving harmless amounts of reaming, cutting and chipping will be considered a legitimate part of the erection. However, any error in the shop fabrication or deformation resulting from handling and transportation which prevents the proper assembling and fitting up of parts by the moderate use of drift pins or by a moderate amount of reaming and slight chipping or cutting, shall be reported immediately to the Engineer and his approval of the method of correction obtained. The contractor shall be responsible for all misfits, errors and injuries and shall make the necessary corrections and replacements.
- c) The straightening of plates, angles, other shapes and built-up members, when permitted by the Engineer, shall be done by methods that will not produce fracture or other damage. Distorted members shall be straightened by mechanical means or, if approved by the Engineer, by the carefully planned and supervised application of a limited amount of localized heat, each application subject to the approval of the Engineer.
- d) The responsibility in respect of temporary bracing and guys shall rest with

the Contractor until the structural steel is located, plumbed, leveled, aligned and grouted within the tolerances permitted under the Specification, and the permanent bracing/framing system has been installed.

- e) The temporary guys, braces, false work and cribbing shall not be the property of the department and may be removed by the Contractor, with the approval of the Engineer, without any charge, once the permanent framing system has been installed to the satisfaction of the Engineer and when the temporary bracing, guys etc. can be removed without any potential danger/damage to the erected structure.

7.6.3.6 Setting Out

- a) Positioning and leveling of all steelworks, plumbing and placing of every part of the structure, with accuracy, shall be in accordance with the approved drawings and to the satisfaction of the Engineer. The Contractor shall check the positions and levels of the anchor bolts etc. before concreting and ensure that they are properly secured against disturbance during pouring operations. The Contractor shall remain responsible for correct positioning and shall set proper screed bars to maintain the proper level. No extra payment shall be made on this account.
- b) No permanent field connections by bolting shall be carried out until proper alignment and plumbing guides have been attached.

7.6.3.7 Field Bolting

- a) Bolts shall be inserted in such a way that they remain in position under gravity, even before fixing the nut. Bolted parts shall fit solidly together when assembled and shall not be separated by gaskets or any other interposed compressible materials. When assembled all joint surfaces including those adjacent to the washers shall be free of scales. They shall be free of dirt, loose scales, burns and other defects that would prevent solid seating of the parts.
- b) Holes for turned bolts to be inserted in the field shall be reamed in the field. All drilling and reaming for turned bolts shall be done only after the parts to be connected are assembled. Tolerances applicable in the fit of the bolts shall be in accordance with relevant Indian Standard Specifications.
- c) All high tensile bolts shall be tightened to provide when all fasteners in the joint are tight, the required minimum bolt tension as per relevant Indian Standard/Specification.
- d) The manufacturer and use of high strength friction grip bolts shall comply with the requirements of IS:3757.

- e) Load indicating bolts or washers may be used, subject to the approval of the Engineer.

7.6.3.8 Holes, Cutting and Fitting

- a) No cutting of sections, flanges, webs, and cleats, rivets, bolts, welds etc. shall be done unless specifically approved and / or instructed by the Engineer.
- b) The erector shall not cut, drill or otherwise alter the work of other trades, or his own work to accommodate other trades, unless such work is clearly specified in the Contract, or directed by the Engineer. Wherever such work is specified, the Contractor shall obtain complete information as to size, location and number of alterations, prior to carrying out any work.

7.6.3.9 Drifting

- a) Correction of minor misfits will be considered as permissible if approved by the Engineer. For this, light drifting may be used to draw holes together and drills shall be used to enlarge holes, as necessary, to make connections. Reaming, that weakens the member or makes it impossible to fill the holes properly or to adjust accurately after reaming, shall not be allowed.
- b) Any error in shop work which prevents the proper assembling and fitting of parts by moderate use of drift pins and reamers shall immediately be called to the attention of the Engineer, and approval of the method of correction obtained. The use of gas cutting torches at the erection site is prohibited.

7.6.3.10 Grouting

- a) The positions to be grouted shall be cleaned thoroughly with compressed air jet and wetted with water, and any accumulated water shall be removed. Grouting shall be carried out under expert supervision; taking care to avoid air locks. Edges shall be finished properly.
- b) Whatever method of grouting is employed, the operation shall not be carried out until the steelwork has been finally leveled. Immediately before grouting, the space under steel is thoroughly cleaned. Where packing is to be left in place, they shall be placed such that they are completely covered with grout.
- c) The grout to be used shall be non-shrink grout Conbextra GP-2 of M/S Fosroc or equivalent.
- d) All steel in foundations shall be solidly encased in Portland Cement Concrete of minimum characteristic strength at 28 days as specified in the drawings, subject to a minimum of 35 N/mm². A minimum cover of 100mm shall be provided to all steelwork where surrounding concrete is in contact

with soil.

7.6.3.11. Inserts and Embedments

Various steel inserts and embedments are required under the contract to be fabricated, positioned and secured firmly into place inside the formwork prior to concrete being poured. There are also requirements of jointing, threading, bolting and welding inserts and embedments of different concrete and structural steel elements in order to establish structural continuity and connection. Great care shall be exercised by the contractor in executing all aspects of the work related to inserts and embedments, including tolerances, so that the final assembly of the concrete elements can meet satisfactorily the continuity and contiguity requirements intended in the structure.

7.6.3.12. Painting after Erection

- a) Steelwork coated with rust inhibitor shall not be left exposed for a period exceeding 15 days otherwise, such steelwork shall be re-cleaned and re-coated with such finish until encased in concrete.
- b) No steelwork with shop paint shall be left exposed at site for a period exceeding that approved by the Engineer.
- c) The surfaces required to remain unpainted at shop, shall be given a protective coating after the structure is erected, leveled, plumbed, aligned in its final position, and accepted by the Engineer. However, touch up painting, making good any damaged shop painting and completion of any unfinished portion of the shop coat shall be progressively carried out by the Contractor.
- d) Painting shall not be done in frost or foggy weather, or when humidity is such as to cause condensation on the surfaces to be painted. Before, commencing painting of steel, which is delivered unpainted, all surfaces to be painted shall be dried and thoroughly cleaned from all loose scale and rust.
- e) All field bolts, welds and abrasions to the shop coat, and surfaces delivered unpainted from fabrication shop, shall receive the full protective treatment as specified in Table defined in painting specifications before delivery to Site.
- f) Surfaces, which will be inaccessible after field assembly, shall receive the full-specified protective treatment before assembly. Bolts and fabricated steel members, which are galvanized or otherwise treated, shall not be painted.
- g) The contractor shall be responsible for any damage caused to other components of the structure including the substructure. In particular, he shall take all necessary precautions to minimize concrete splash onto completed steelwork or rust staining of concrete due to erected steel work

and clean and/or repair all stains and other damages to completed work prior to tests on completion.

7.6.3.13. Final Cleaning up

Upon completion of erection, and before final acceptance of the work by the Engineer, the Contractor shall remove, free of cost, all falsework, rubbish and all temporary works, resulting from or in connection with the performance of his work.

SECTION - S.08

FOUNDATION

8.1 PILE FOUNDATION:

8.1.1 General

i) Piling plant and Methods:

The suggested method for piling is cast in situ-bored piles with hydraulic drilling rigs using partial depth casing with polymer and oscillator arrangement.

- i. Not less than 2 weeks before any piling work is commenced the Contractor shall submit to the Engineer for approval full details of his proposed piling plant and detailed method statements for carrying out the Works.

Details of casings and concreting methods in respect of bored cast in place concrete piles are to be provided.

- ii. The Contractor shall not commence any piling until the plant and methods which he proposes to use have been approved by the Engineer, but such approval shall not relieve the Contractor from any of his obligations and responsibilities under the Contract. If for any reason the Contractor wishes to make any change in the plant and methods of working which have been approved by the Engineer, he shall not make any such change without having first obtained the Engineer approval thereof.
- iii. The list and nos. of equipments & accessories proposed to be used for the present job shall be submitted along with the technical bid.

ii) Records:

The Contractor shall keep complete records of all data required by the Engineer covering the fabrication, driving and installation of each pile and shall submit two signed copies of these records to the Engineer not later than noon of the next working day after installation of the piles.

iii) Programme and Progress Report:

- i. The Contractor shall inform the Engineer each day of the programme of piling for the following day and shall give adequate notice of his intention to work outside normal hours and at weekends, where approved.
- ii. The Contractor shall submit to the Engineer on the first day of each week, or on such other date as the Engineer may decide, a progress report showing the rate of progress to that date and progress during the previous week or period of all

main items of piling works, as required by the Engineer.

iv) Setting Out:

The Contractor shall establish and maintain permanent datum level points, base lines and grid lines to the satisfaction of the Engineer and shall set out with a suitable identifiable pin or marker the position of each pile. The setting out of each pile shall be agreed with the Engineer at least 8 working hours prior to commencing work on a pile and adequate notice for checking shall be given by the Contractor.

Notwithstanding such checking and agreement, the Contractor shall be responsible for the correct and proper setting out of the piles and for the correctness of the positions, levels, dimensions, and alignment of the piles.

- v) After all piles are cast and weak concrete is chipped out the Contractor shall submit the drawing showing the exact location of piles with respect to the column centre line.

vi) Disturbances and Noise:

- i. The Contractor shall carry out the piling work in such a manner and at such times as to minimize noise and disturbance.
- ii. The Contractor shall take precautions adequate enough to avoid damage to existing services and adjacent structures. IS: 2974 (Part 1) – 1982 may be used as a guide for studying qualitatively the effect of vibration of persons and structures. In case of deep excavation adjacent to piles, proper shoring or other suitable arrangement shall be done to guard against the lateral movement of soil stratum or releasing the confining soil stress. Any such damage shall be repaired by the contractor to the satisfaction of the Engineer.
- iii. The Contractor shall ensure that damage does not occur to the complete piling works and shall submit to the Engineer for approval his proposed sequence and timing for driving or boring piles having regard to the avoidance of damage to adjacent piles.

vii) Obstructions:

If during the execution of the Works the Contractor encounters obstructions in the ground, he shall forthwith notify the Engineer accordingly, submit to him details of proposed methods for overcoming the obstruction and proceed according to the Engineer instructions.

8.1.2 Scope of Work:

- i. These specifications cover the work of providing pile foundations. Work included consists of all necessary services and furnishing of all labour material, tools, equipment and related items for the full and satisfactory performance of the contract, conforming to these specifications and as shown

in the Contract Drawings or reasonably implied therein or any authorized conditions or alterations thereof.

- ii. The tenderer is advised to visit the site and familiarize himself with the conditions at site. The Engineer shall not be held responsible for the accuracy of the soil data, furnished in good faith with the tender.
- iii. The construction of piles shall be in accordance with the following Indian Standard Codes of Practice for Design and Construction of Pile Foundations: IS: 2911 (Part 1/ Section 2):
- iv. 2010 Bored Cast in-situ Concrete Piles Or IRC:78 Standard specifications and code of practice for road bridges Foundation and Substructure
- v. With the tender the Contractor shall submit the detailed method of construction to be used. For cast-in-situ concrete piles the Contractor shall indicate the methods he proposes to concrete the piles in order to prevent necking of piles.
- vi. The items of work will generally be as follows:
 - i. Boring/drilling including provision of temporary casing.
 - ii. Supplying, fabrication, and placement of all reinforcing bars.
 - iii. Casting of concrete piles as per specifications.
 - iv. Load testing of piles.

8.1.3 Materials:

i) General:

Unless otherwise specified in this section all materials shall conform to the requirements specified in separate sections for Concrete, Formwork and Reinforcement.

ii) Cement:

The cement to be used for piling and all foundation work shall be conforming to Table 4 of IS: 456. Cement shall be free from lumps and caking.

- i. Concrete Mix Design:
- ii. The minimum grade of concrete shall be M35. The maximum size of coarse aggregate shall not exceed 20mm. For cast-in-situ piles concrete with a slump of 150 to 175mm (consistent with the method of concreting) will be required. For slumps more than 150mm the workability should be tested by

“determination of flow” as per IS:9103. The minimum cementitious contents for design mix shall not be less than 400 kg/m³ of concrete in piling. For piling quantity of cement shall be as per the design mix or the minimum cementitious content whichever is greater shall be used.

- iii. The contractor shall submit mix design calculations and get the same approved by the engineer well before the starting of installation of piles and carry out adequate numbers of tests to ensure the minimum specified strength as indicated in drawings.
- iv. Concrete cube tests: Concrete cubes shall be cast, tested and evaluated as specified in relevant Appendix of Authority’s Requirement.

iii) Reinforcement:

- i. The reinforcement shall conform to the requirements specified in Section 5 extending for the full length of the pile and shall project above the cut off level as specified in the drawing. Only circular concrete cover blocks (of at least same grade as of the pile) threaded on to the outermost reinforcement shall be used for ensuring the specified cover.
- ii. Joints in main longitudinal bars will be permitted only where, in the opinion of the Engineer, each bar cannot be supplied in one complete length. Where permitted, joints shall be provided at agreed centres, designed to develop the full strength of the bar across the joint, provided with adequate extra links or stirrups and staggered in position from those of adjacent longitudinal bars, all to the approval of the Engineer.
- iii. All main longitudinal bars shall be tack welded at lapping if any and to the pile cap reinforcement. The last one circle of helical stirrups at each end shall be welded to main longitudinal bars.

iv) Casings and Tremie Pipes:

The casings and tremie pipes shall be made of mild steel. The temporary casing plates and permanent liners shall have adequate wall thickness and strength to withstand driving stresses, stresses due to soil pressure, etc. without damage or distortion. All joints shall be watertight. The internal diameter of the casing shall not be less than the nominal diameter of pile.

8.1.4 Cast In-Situ Bored Piles:

i) General:

- i. The diameters of the piles shall be the concrete shaft diameters and shall not be less than the diameters specified in the drawing.

- ii. These shall be formed by boring to the founding strata specified on the drawings or as directed at site. The sides of the boring shall be prevented from collapsing by one of the following:
 - permanent mild steel liner (cased pile)
 - removable mild steel casing (uncased pile)
- iii. Piles shall be constructed in a sequence approved by the Engineer. During boring, the Contractor shall, where required by the Engineer, take soil, rock or ground water samples and transport them to an approved testing laboratory or carry out soil tests as directed.
- iv. The method adopted shall be chosen giving due consideration to the subsoil data, groundwater conditions and to the other relevant conditions at site as well as to the presence of adjacent structures.
- v. The bottom of the steel lining shall be sufficiently in advance of the boring tool so as to prevent settlement of outside soil and formation of cavities.
- vi. d) Removable mild steel casings shall be used only with extreme caution. Individual casings shall be joined together by screwing or any other approved method and not by direct butting with external lug connections. The inner surface of casings shall be smooth and free of all internal projections.

ii) Boring:

- i. Boring shall be done using hydraulic drilling rigs with oscillator arrangement suiting to different kinds of strata encountered.
- ii. As a general guideline, the size of cutting tool shall in no case be less than the diameter of the pile minus 75mm. However, the size of cutting tool shall be chosen by contractor depending on the type of substrata and equipment employed by contractor so that executable pile shall not have diameter less than nominal diameter of pile as specified in drawing. The contractor shall also ensure that there is no reduction in poured concrete quantities. These calculations shall be based on consumption of concrete poured in bore (as recorded in pour log) and actual concrete required in bore on theoretical basis i.e. based on nominal diameter of pile and actual bore hole length (based on actual sounding of founding level). Although a 5% reduction in consumption of poured concrete quantities in pile may be rejected. In general piling shall be done by using a hydraulic rig with temporary liner. Use of liner for top 4 to 6 m from ground level or more depth, to protect loose soil falling in bore hole as directed by engineer, is essential. No extra payment shall be made to the contractor for using temporary liner.
- iii. Polymer Slurry, as approved by Engineer shall only be used. Use of bentonite slurry is strictly prohibited. The polymer slurry shall conform to the following specifications:

Acceptable Range of Values for Polymer Slurry

Property	In Hole at Time of Test Concreting	Method
Density (1) pounds per cubic foot (kilograms per cubic meter)	64 max. (1025 max.)	Density balance API 13B-1(2), Section 1
Viscosity Seconds per quart (seconds per liter)	32-135 (34-143)	Marsh Funnel AP 13B-1(2), Section 2.2
pH	8-11	pH paper or meter
Sand content, %	1.0 max.	API 13B-1(2), Section 5

1 Density values shown are for fresh water. Increase density values by 2 pounds per cubic foot (23 kilograms per cubic meter) for salt water. Perform tests when slurry temperature is above 40°F (4.5 °C).

2 American Petroleum Institute, API 13B-1, Recommended Practice for Field Testing Water-based Drilling Fluids.

iii) Concreting:

- i. Prolonged delays in the commencement of concreting after the completion of the boring shall not be permitted. The time interval between the completion of boring and placing of concrete shall not exceed 6 hours. Measures to prevent the collapse of bore shall continue to be in force during the gap between boring completion and concreting. The depth of bore shall be ensured before the start of concreting.
- ii. The concrete shall have a minimum slump of 150mm and maximum 175 mm in case of concreting in a water-free bore. Suitable precautions shall be taken for prevention of segregation. Internal vibrators shall not be used unless the Contractor is satisfied that segregation will not result because of vibration and unless the method of use has been approved by the Engineer.
- iii. The concrete for piling underwater or in drilling mud shall be placed with a tremie pipe. The tremie pipe shall not be less than 200mm diameter for 20mm aggregate. The joint between the hopper and tremie pipe as well as the joints in the tremie pipe shall be watertight and the tremie pipes shall be thoroughly cleaned after each use. The concrete shall have a minimum slump of 150mm and maximum 175 mm.

- iv. It is essential that the water level within the pile bore be in equilibrium before commencement of concreting.
- v. The Contractor shall ensure that heavily contaminated drilling mud has not accumulated at the base of boring since this could impair free flow of concrete from the tremie pipe.
- vi. If the specific gravity of the drilling mud at the base of the bore exceeds 1.20 the placing of concrete shall not proceed.
- vii. The first charge of concrete shall be placed in the hopper over a sliding plate of the bottom of the hopper. The charge should be adequate in volume to ensure flushing action to prevent mixing of water or drilling mud and concrete. Alternatively, floating plugs of approved specification may be used before the first charge of concrete.
- viii. The tremie pipe shall at all times penetrate the previously placed concrete with adequate margin against accidental withdrawal. The tremie pipe shall not be withdrawn until the completion of concreting. At all times a sufficient quantity of concrete shall be maintained within the pipe to ensure that the pressure from it exceeds that from the seepage water.
- ix. Spot measurements shall be taken at suitable intervals to check that the tremie pipe has an adequate penetration into previous concrete.
- x. The concreting of the pile shall be in one single and continuous operation. In case of long piles of large diameter, large size mixers or more mixers shall be used so that the entire concreting operation is completed in not more than two hours.
- xi. The top of concrete in a pile shall be brought above the cut-off level since the top concrete is loose and is weak because of contamination with water/drilling mud. This ensures good concrete at the cut-off level.
- xii. Cut off level (COL)

Cut off level of piles (150mm inside the pile cap) shall be indicated in working drawings or as indicated by Engineer.

The top of concrete in pile shall be brought above the cut off level to remove all laitance & weak concrete and to ensure good concrete at cut off level.

As general guidelines, for cut off level up to 1.5m below working level, the concrete shall be cast of 300mm above COL. For each additional 0.3m increase in depth of COL an additional coverage of 50mm shall be required. In the circumstance where COL is below ground water level, the need to maintain a pressure should be observed & accordingly length of extra concrete above COL shall be determined by the Contractor and approval of Engineer obtained before concreting.

In case of concrete being placed by tremie method and pile cut off level less

than 1.0meter below the ground level, concrete shall be cast to the piling platform level to permit overflow of concrete for visual inspection. In case COL of pile is more than 1.0 meter below working level then concrete shall be cast to a minimum of one meter above COL. Before concreting contractor shall obtain the approval of the Engineer of the height above COL up to which the concrete is to cast.

Any defective concrete in the head of the completed pile shall be cut away and made good with new concrete.

- xiii. When a casing is being extracted a sufficient quantity of concrete shall be maintained within the bore to ensure the pressure from external ground water and soil is adequately exceeded by the pressure of concrete. Otherwise necking of the pile may result. A minimum embedment of 1.5 to 1.8 m is required.
- xiv. No concrete shall be placed in the bore once the bottom of the casing has been lifted above the top of concrete.
- xv. After each pile has been cast any empty bore shall be protected and carefully backfilled as soon as possible with approved materials.
- xvi. Complete boring and concreting records shall be submitted to the Engineer for each pile. The records shall include the duration of concreting, tremie lengths (individual and cumulative), tremie pipe lengths removed, theoretical sounding, actual sounding, actual lengths of pile concreted, and the volume of concrete placed, cut off level, founding levels etc. For piles with temporary casings, records of sequence of casing withdrawal and levels of concrete before and after withdrawal shall also be included in the reports. Data about used polymer slurry shall also be placed on record.

8.1.5 Alignment of Piles:

- i. Piles shall be installed as accurately as possible according to the drawings either vertically or to the specified batter. All deviations will be measured at the cut off level of the piles. The deviation from the true axis shall not be more than 1.5% for vertical piles and 4% for rake piles. Piles should not deviate in location by more than 75mm when used in groups. For single or 2 piles used under columns, deviation shall not be more than 50mm.
- ii. The Contractor shall maintain a record of actual pile locations in the form of drawing and submit the information to the Engineer at suitable intervals.

8.1.6 Pile Cap:

Pile caps shall be of reinforced concrete. A minimum offset of 250 mm shall be provided beyond the outer faces of the outer most piles in the group. If the pile cap is in contact with earth at the bottom, a leveling course of minimum 75 mm thickness of PCC of grade M15 shall be provided or as shown in the drawings.

The attachment of the pile head to the cap shall be adequate for the transmission of loads and forces. A portion of pile top may be stripped of concrete and the reinforcement anchored into the cap. Manual chipping may be permitted after three days of pile casting while pneumatic tools for chipping shall not be used before seven days after pile casting. The top of pile after stripping shall project at least 150mm into the pile cap. Concreting of the pile cap shall be carried out in dry conditions. All the operations and tools required for making the pile dry condition is included in the item.

The road surface after casting of pile cap should be repaired immediately. If the surface is not repaired immediately, penalty will be imposed as decided by the Engineer.

8.1.7 Testing of Piles:

- i. The load tests shall be in accordance with the Indian Standard Code of Practice for Design and Construction of Pile Foundations IS 2911 (Part IV) Load Tests on Piles. For initial load test, test load will be 2.5 times the theoretical designed capacity of pile. For initial load, test arrangement to be designed shall also cater for additional 25% above test load and nothing extra will be paid on this account. Permissible stresses in test arrangement (steel truss or plate girder) to cater for test load plus additional 25% load shall be within permissible stresses as per IS: 800 (as for permanent structure). For test frame, steel of Grade –B conforming to IS: 2062 shall be used.
- ii. Engineer will decide the locations of initial and routine horizontal and vertical load test. One no. initial load test is to be performed in each km for each diameter of pile being used in viaduct. The contractor shall undertake test piles required for initial pile load test in the initial stages of work using the same methodology and equipments which will be subsequently used for working piles. These tests shall be undertaken well in advance of working pile. No working pile would be allowed to undertake till initial satisfactory initial pile load tests have been completed.
- iii. Non-granting of permission for pile/ pile cap by Engineer in such respect will not be considered as reason for delay or any claim thereof. The test arrangement to be employed shall be of nature which is quick to install and remove and easily transferable.
- iv. Routine horizontal & vertical load tests are performed as a check on the load carrying capacity and settlements of the pile foundations. At least one routine test shall be performed for every 100 piles unless otherwise specified by the Engineer.
- v. The Contractor shall give the Engineer at least 48 hours' notice of the commencement of construction of these piles which are to be subjected to Initial Tests.

- vi. The load tests shall not normally be conducted unless the concrete is at least 28 days old. However, in special circumstances, permission can be given by Engineer for prior testing.
- vii. All testing shall be done under the direction of experienced personnel conversant with the equipment and the testing procedure.
- viii. Before the commencement of the tests all the particulars regarding the test pile including boring data and concrete cube strengths shall be made available at site and shall form a part of the test report.
- ix. On completion of each load test the Contractor shall submit a report of the load test which shall include the following information.
 - a) Description of soil conditions, ground water table, actual boring and installation records, concrete cube test results.
 - b) Method of load application
 - c) Load settlement readings during loading and unloading
 - d) Time load-settlement curve
 - e) All other observation relevant to the test being conducted.

x. Integrity test

Two types of pile integrity tests will be performed:

Dynamic Integrity Test:

The Dynamic Integrity test using pile driving analyser or approved equivalent for pile integrity shall be performed on all the piles. The top of the pile shall be made accessible, chipped off up to hard concrete, levelled by trimming it back as far as practicable. The reinforcing bars of the piles tested shall be bent sideways. The test shall be performed after removal of bad/ weak concrete at top so that the wave propagation is steady through hard concrete. The test shall be carried out at minimum 3 locations on each pile in such a way that the entire cross section of the pile is evenly covered. The test shall be conducted with a minimum age of concrete of 15 days. A specialist approved agency shall be employed for the test and the tests shall generally be as per recommendations of the agency unless directed by the Engineer. A complete report indicating the graphical display of wave propagation under each flow shall be submitted along with interpretation of results showing discontinuities, cross- sectional changes or material changes if any are to be co-related with Site data.

Cross Sonic Logging Test

'Cross Sonic Logging' test should be conducted to verify the structural integrity of piles by means of the measurement of the time travel of a sound waveform an

emitter to a receiver through the concrete of a pile. The emitter and the receiver shall generally be at the same level. Cross-hole Sonic logging testing is compulsory for 25% of piles with 100% of piles installed with recess tubes and equipped for testing. The Engineer in Chief from client will randomly select and conduct tests of 25% of piles.

a) **Sonic Logging Tubes**

Material

Every pile must be provided with sonic logging tubes cast into it. The tubes shall be manufactured from steel of 50mm ID and 1mm thick. The tubes assembly should be manufactured in a factory which is ISO 9001.2008 (or higher revision) certified. To form single tube the pipes to be connected with an enlarged end Bell Mouth – push fit arrangement provided with rubber gasket only. The bell mouth should have serrations so as to ensure the proper engagement of joint and avoid any leakages. The bell mouth connection should be provided strictly with rubber gasket to ensure a concrete-tight joint to maintain the tube integrity and prevent entry of foreign material. PVC or any kind of plastic material is strictly prohibited as it cannot resist great compression pressure. The expansion factor between PVC and concrete is not the same (unlike steel and concrete). When the concrete is setting, its temperature goes up and leads to the expansion of the PVC. Once the concrete has set and the temperature goes back to normal there will be a void between the tube and the concrete; this will lead to bad reading of the test and the rejection of the pile. One tube in each pile should be installed of internal diameter 50mm in order to allow for coring of the concrete at the base of the pile.

Tests to be conducted for Sonic Tubes assembly and desired results

The entire lot supplied to site should be batch-tested for the following test with pressure test conducted on 100% of sonic tubes. The supplier should have an in-house testing facility so as to ensure 100% pressure test and batch-test is conducted on sonic tubes before supply to site. The Sonic Tubes assembly should be tested for following tests –

1. **External Pressure Test –**

The 50 mm diameter, 1 mm thickness should be applied with external pressure upto 5 Mpa. Following are the desired results –

Description	Pressure (Mpa)	Hold Time (second)	Desired Results
Sonic Tubes Diameter 50 mm X 1.0 mm Thick	≥ 5	≥ 60	No Leakages from Inner Surface of Tubes and No Distortion of Tubes

100% sonic tubes to be tested prior dispatch

2. **Pull Out Test for Tubes-**

Description	Tensile Force to be applied	Desired Results
Sonic Tubes Diameter 50 mm X 1.0 mm Thick	≥ 0.5 KN	No Distortion found and should withstand the test load of ≥ 0.5 KN

Minimum 3 samples to be tested of the lot being dispatched.

3. Pull Out Test for tubes 'Fixing Ears'

Description	Tensile Force to be applied	Desired Results
Sonic Tubes Diameter 50 mm X 1.0 mm Thick	≥ 0.5 KN	No Distortion found and should withstand the test load of ≥ 0.5 KN

Minimum 3 samples to be tested of the lot being dispatched.

4. Crush Test –

For 50 mm diameter and 1 mm tick Tube following is the criteria for Crush test

Sr. No.	Descriptions	Test	Desired Results
1	Direction tube	1500 mm	No Cracks after test 30 mm Steel ball can go through the tubes.
2	Drop Weight	4000 + 150/-0g	
3	Diameter of Drop	50.03 mm	

Minimum 3 samples to be tested of the lot being dispatched.

Installation

The agency supplying sonic tubes should submit a detailed installation methodology and conduct a demo for one pile before being implemented for all piles.

Frequency

Four tubes shall be required for each pile, any other configuration is not allowed.

b) Sonic Coring

At least 7 days after the pile has been cast, but before carrying out any sonic logging test, a core of concrete and soil or rock from the founding material shall be taken. The core shall be taken from the base of the 50mm diameter sonic logging tube. The core shall be kept in a suitable wooden box with depths clearly recorded on rigid markers, shall be photographed along with a scale and colour chart. Thereafter, these shall be delivered to a core store designated by the Engineer. The scanning of the pile toe for its integrity by measuring the propagation time of transmitted waves between the vertical tubes and the pile toe/ founding strata shall also be carried out.

c) Sonic Logging Equipment

The equipment shall be properly maintained and calibrated. Where necessary, means

shall be provided to centralise the probes within the tubes, so that variation in the separation of the emitter and receiver resulting from clearance between the probes and the tubes does not occur.

d) **Test Procedure**

The tubes shall be filled with water. The tests shall be repeated for each pair of tubes, i.e. three runs for a pile with three tubes and six runs for a pile with four tubes.

e) **Analysis of Test Results**

A report shall be prepared for each pile tested. The photographic record of the oscilloscope displays shall be analysed in detail. Any deviation from the record to be expected from a pile constructed entirely of sound concrete and without defect shall be reported. The report shall indicate the nature, location and severity of the defect and recommendations shall be made for further testing. The implication of the existence of the defect on the performance of the pile shall be evaluated.

f) **Submission of Results**

Immediately after testing, a signed copy of all the raw test data of a pile shall be given to the Engineer. A test report shall be submitted to the Engineer within 7 days after testing.

g) **Anomalous Sonic Logging Test Results**

The piles with anomalous sonic logging results shall be rejected at the Engineer discretion unless the Contractor is able to demonstrate that the pile integrity is acceptable through proof coring.

h) **Grouting of Pile after Testing**

Upon completion of sonic logging test, the access tubes and sonic coring holes, if any, shall be grouted up.

8.2 SHALLOW FOUNDATIONS

8.2.1 Description

The work shall cover furnishing and providing plain or reinforced concrete foundation placed in open excavation, in accordance with the drawings and as per MORTH Specifications or as directed by the Engineer.

8.2.2 Materials

Materials shall conform to Section 1000 of MORTH Specifications.

8.2.3 General

A method statement indicating the following shall be submitted by the Contractor for approval of the Engineer, well in advance of the commencement of construction of

open foundation:

- i. Sources of materials
- ii. Design, erection and removal of formwork
- iii. Production, transportation, laying and curing of concrete
- iv. Personnel employed for execution and supervision
- v. Tests and sampling procedures
- vi. Equipment details
- vii. Quality Management System to be adopted including Quality Manual
- viii. Any other relevant information

Details of necessary arrangements for execution under water wherever necessary, shall be included in the method statement.

Dimensions, lines and levels shall be set out and checked with respect to permanent reference lines and permanent benchmark so that the foundations are located correctly and in accordance with the drawings.

Formwork, steel reinforcement and structural concrete for open foundations shall conform to Sections 1500, 1600 and 1700 respectively of MORTH Specifications.

8.2.4 Workmanship

8.2.4.1 Preparation of Foundations

Excavation for laying the foundation shall be carried out in accordance with Section 300 of MORTH Specifications. The last 300 mm of excavation shall be done just before laying of lean concrete below foundation. Excavation shall be made only to the exact depth as shown on the drawing. In the event of excavation having been made deeper than that shown on the drawing or as ordered by the Engineer, the extra depth shall be made up with M10 concrete in case of foundation resting on soil and with concrete of the same grade as that of the foundation, in case of foundation resting on rock. This shall be done at the cost of the Contractor and shall be considered as incidental to the work.

Open foundations shall be constructed in dry conditions and the Contractor shall provide for adequate dewatering arrangements, wherever required, to the satisfaction of the Engineer.

Where light blasting is required for excavation in rock or other hard strata, the same shall be carried out in accordance with Clause 302 of MORTH Specifications. Where blasting is likely to endanger adjacent foundations or other structures, controlled blasting with all necessary precautions shall be resorted to.

8.2.4.2 Setting Out

The plan dimensions of the foundation shall be set out at the bottom of foundation

trench and checked with respect to original reference line and axis.

8.2.4.3 Construction

- i. Excavation for open foundations shall be carried out in accordance with Section 300 of MORTH Specifications. For guidance regarding safety precautions to be taken, IS: 3764 may be referred.
- ii. For foundation resting on soil, a layer of M10 concrete of minimum thickness 100 mm shall be provided above the natural ground to provide an even surface to support the foundation concrete. Before laying of lean concrete layer, the earth surface shall be cleaned of all loose
- iii. material and wetted. Care shall be taken to avoid muddy surfaces. If any part of the surface has become muddy due to over-wetting, the same shall be removed. If required, the M10 concrete may be laid to a thickness of more than 100 mm, as per the direction of the Engineer. No construction joint shall be provided in the lean concrete. For foundations resting on rock, the rock surface shall be cleaned of any loose material and then levelled with a layer of concrete of the same grade as that of the foundation, so as to provide an even surface.
- iv. No point of the surface of the lean concrete, in the case of foundation on soil or the surface of hard rock, in the case of foundation on hard rock, shall be higher than the founding level shown on the drawing or as ordered by the Engineer. Levels of the surface shall be taken at intervals of not more than 3 metres centre-to-centre in each direction, subject to a minimum of nine levels on the surface.
- v. No formwork is necessary for the lean concrete layer. Side formwork shall be used for foundation concrete Work. When concrete is laid in slope without top formwork, the slump of the concrete shall be carefully maintained to ensure that compaction is possible without slippage of freshly placed concrete down the slope. In certain cases it may be necessary to build the top formwork progressively as the concreting proceeds up the slope. Reinforcement shall be laid as shown on the drawing.
- vi. Before laying foundation concrete, the lean concrete or hard rock surface shall be cleaned of all loose material and lightly moistened. Foundation concrete of required dimensions and shape shall be laid continuously up to the location of construction joint shown on the drawing or as directed by the Engineer.
- vii. The concrete surface shall be finished smooth with a trowel. The location of construction joint and its treatment shall be done as per requirements of Section 1700 of MORTH Specifications. Formwork shall not be removed earlier than 24 hours after placing concrete. Where formwork has been provided for top surface, the same shall be removed as soon as concrete has hardened. Curing of concrete shall be carried out by wetting of formwork before removal. After its removal, curing shall be done by laying not less than 100 mm thickness of loose moistened

sand free from clods or gravel, over the concrete. The sand shall be kept continuously moist for a period of 7 days. Before backfilling is commenced, the loose sand shall be removed and disposed of as directed by the Engineer.

- viii. Normally, open foundations shall be laid dry. Where dewatering is necessary for laying of concrete, it shall be carried out adopting anyone of the following methods or any other method, approved by the Engineer:
- a) A pit or trench of suitable size, deeper than the founding level as necessary, is dug beyond the foundation excavation so that the water flows into it and the excavated surface at founding level is fully drained.
 - b) Water table is depressed by well point system or other methods.
 - c) Steel/concrete caissons or sheet piling are used for creating an enclosure for the foundations, which can subsequently be dewatered. No pumping of water shall be permitted from the time of placing of concrete up to 24 hours after placement.
- ix. In situations where foundations cannot be laid dry or where percolation is too heavy to keep foundation strata dry, concrete may be laid under water only by tremie. In case of flowing water or artesian spring, the flow shall be stopped or reduced to the feasible extent at the time of placing the concrete.
- x. Where blasting is required, it shall be carried out in accordance with Section 300 of MORTH Specifications, observing all precautions indicated therein. Where blasting is likely to endanger adjoining foundations or other structures, necessary precautions such as controlled blasting, providing rubber mat cover to prevent flying of debris etc., shall be taken to prevent any damage.
- xi. All spaces excavated and not occupied by the foundations or other permanent works shall be refilled with earth up to surface of surrounding ground with sufficient allowance for settlement.
- xii. All backfill shall be thoroughly compacted and in general, its top surface shall be neatly graded. Backfilling shall be in accordance with Section 300 of MORTH Specifications.
- xiii. In case of excavation in rock, the annular space around the footing shall be filled with M15 concrete up to the level of top of rock. Filling with M 15 concrete shall also be carried out for excavations having depth up to 1.5 m in ordinary rock or 0.6 m in hard rock. In case the excavations are even deeper so as to require further filling up to the level of top of rock, the same shall be done by boulders grouted with cement.
- xiv. Protective works, where provided shall be completed before the onset of floods so as to avoid the risk of the foundation getting undermined.

8.2.5 Tests and Standards of Acceptance

The materials shall be tested in accordance with these Specifications and shall meet the prescribed criteria.

The work shall conform to these Specifications and shall meet the prescribed standards of acceptance.

8.2.6 Tolerances

i.	Variation in dimensions :	+50
	mm, -10 mm	
ii.	Misplacement from specified	
	position in plan	: 15mm
iii.	Surface unevenness	
	measured with 3 m straight edge	: 5mm
iv.	Variation of levels at the top	
		: ± 25 mm

SECTION - S.09

MISCELLANEOUS

9.1 Metal Railings

9.1.1 General

All complete steel/ aluminum railing elements, terminal sections, posts, and other fittings shall be of shape, size and designation of approved material and make as given in the item of work or as directed by Engineer. In the case of steel railing all these elements shall be painted with an approved paint. If straightening is necessary, it shall be done by methods approved by the Engineer.

Aluminum sections shall be of approved quality, designation and free from scratches, stains and discoloration.

The Contractor shall take every precaution against damage of the components during fixing in position.

Damaged galvanised surfaces shall be cleaned and regalvanised. Special care shall be taken to prevent staining of all products rust, mortar, etc. before it is put into use.

9.1.2 Fixing

The railing shall be carefully adjusted prior to fixing in place to ensure proper matching at abutting joints, correct alignment and camber throughout their length.

Fixing shall be strictly as per fixing details shown on drawing or as directed by Engineer.

If sections are not galvanised, the railing shall be given one shop coat of paint, and three coats of paint after erection.

All necessary holes, chases, etc., required in fixing shall be made by the contractor and made good after installation, without any extra charge.

9.2 DRAINAGE SPOUTS AND DRAINAGE PIPE

9.2.1 General

This work shall consist of supply and fixing in position of drainage spouts and drainage pipes for bridge decks and piers true to lines, levels and position in accordance with details shown on drawings and to the requirements of these specifications and drainage plan for structure. Where details are not given on drawings, contractor should prepare and submit his own drawings for approval of Engineer before commencement of work.

All drainage pipes to be embedded in pier shall be HDPE corrugated double wall as approved by engineer-in-charge.

9.2.3 Fabrication

Drainage assembly shall be fabricated to dimensions shown in drawings. All materials shall be corrosion resistant; steel components shall be of mild steel conforming to IS:2062. The drainage assembly shall be seam welded for water tightness and then hot dip galvanized.

9.2.3 Placement

The galvanised assembly shall be given two coats of bituminous paint before placement. The whole assembly shall be placed in true position, lines and level as shown in drawing with necessary cut-out in the shuttering for deck slab and held in position firmly. Where reinforcement of the deck is required to be cut, equivalent reinforcement shall be placed at the corners of the assembly.

9.2.4 Finishing

After setting of deck slab concrete, shrinkage cracks around the assembly shall be totally sealed with polysulphide sealant or bituminous sealant as per IS:1834 and excess sealant trimmed to receive the wearing coat. After the wearing coat is completed, similar sealant, finished to cover the wearing coat surface all-around the drainage assembly, shall be provided at least 50 mm.

9.3 CINDER

9.3.1 General

Cinder to be used for filling in floors shall be obtained from furnace of steam boilers using coal fuel only. It shall be clean and free from clay dirt, wood ashes or other deleterious matter. It shall pass through IS Sieve designation 3.35 mm with at least 50% of it passing through IS Sieve designation 1.70 mm. Cinder obtained from brick kilns shall not be used. At site of work, the cinder shall be protected from dirt collecting on it and could be used for filling in drops only.

9.4 SEALANTS

9.4.1 General

Joint sealing compounds shall seal joints in concrete against the passage of water, prevent the ingress of grit or other foreign material and protect the joint filler. The compound shall have good extensibility and adhesion to concrete surfaces and shall be resistant to flow and weathering.

Approved Sealant where specified on the drawings shall be provided strictly in accordance with the manufacturer's written instructions, such joints shall be formed to the correct dimensions, thoroughly cleaned and treated with recommended primer strictly in accordance with the

manufacturer's written instructions prior to sealing. Wherever width of gap to be sealed is wide enough to necessitate the use of backer rod, the same shall be provided at no extra cost. The contractor shall use only competent personnel experienced in the application of sealant for such work.

Where specified in the drawings, silicon/ poluaurithane/ polysuphide based sealants shall be of an approved manufacture. The treatment of the joint and the use of sealing compound shall be strictly in accordance with the manufacturer's written instructions. The entire work shall be carried out as per IS:3414, IS:6509, IS:11433.

Sealants shall be as follows:

Silicon sealant shall be one-part gun grade type with minimum movement capability of 25% and elongation at break of 450% confirming to BS 5889 or TTS 001543A. This Sealant shall be of approved color and shall be non-staining to the parent concrete surface.

9.4.2 Ancillary Materials

The Contractor shall provide all ancillary materials such as cleaning solutions, epoxy mortar, primer, tool cleaner, bond breaker type, filler boards, back up material, backing rods, polyethylene foam, masking tapes, sealant slot former etc.

9.4.3 Primer

Primer for sealants shall only be as recommended by the sealant manufacturer, Primer shall have been tested for compatibility and durability with the sealant to be used and on samples of the surfaces to be selected.

9.4.4 Backdrop Material

Backdrop material shall be an expanded polyethylene of nominal density 35 kg/cum as recommended by the sealant manufacturer. It shall be of non-absorbent and non-staining material compatible with the sealant used. Tube or rod stock shall be rolled into the joint cavity.

9.4.5 Bond-preventive Materials

Bond-preventive materials shall be pressure-sensitive adhesive polyethylene tape or aluminium foil.

9.4.6 Equipment

The Contractor shall inter alia provide the following plant and equipment for the work.

T-paddle, follower plate, solid barrel gun, plastic nozzle, wire brush, heavy duty 500 rpm electric drill, palette knife, masking tape and paint brush for priming etc.

9.4.7 Working Life

Care shall be taken to ensure that material with adequate shell life is provided. Material whose shell life is over shall not be used in the works and shall be removed from the site forthwith. Depending on the storage, temperature and humidity, only one unit shall be drawn from the storage.

9.4.8 Curing Period

No portion of the work where sealant has been applied shall be allowed to be submerged or be wetted by any liquid for a period of 7 days after application of the sealant. This period may be modified depending on the temperature and humidity prevalent at the time.

9.4.9 Environmental Requirements

The ambient temperature shall be within the limits as given by the manufacturer, when the sealants are applied. The work shall not be carried out in a dusty atmosphere or when it is raining or when the humidity is high.

Sealants shall not be applied when the ambient temperature is below 4 °C. When the ambient temperature is below 10 degree C but greater than 4 degree C, the sealant containers shall be stored for some hours at 21 degree C, to ease mixing and application.

9.4.10 Delivery and Storage

Materials shall be delivered to the job site in the manufacturer's original unopened containers. The containers shall include the following information on the label.:

- a) Name of supplier,
- b) Name of material,
- c) Formula,
- d) Lot number,
- e) Colour
- f) Date of manufacture,
- g) Mixing instructions
- h) Shell life and
- i) Curing time

Materials shall be carefully handled and stored to prevent contamination of foreign materials to exposure to temperatures exceeding 35 degree C.

9.4.11 Joints

The effective width to depth ratio shall be as per the table given below unless directed otherwise by the Engineer.

Table

Surfaces	Joint Width	Joint Depth	
		Minimum	Maximum
For concrete masonry or	6 mm	6 mm	6 mm
stone:	Over 6 mm up to 12 mm	6 mm	Equal to width
	Over 12 mm	½ of width	½ of width

9.4.12 Surface Preparation General

The surface of joints to be sealed shall be clean, dry, sound and free of all release agents, water repellents, laitance, oil, grease, dirt, chalk, particles of mortar, dust, loose rust, loose mill scale and other foreign substances. Oil and grease shall be removed with solvent and the surfaces shall be wiped with clean clothes.

9.4.13 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil or other such materials, the materials shall be removed by sandblasting or wire brushing, Litanse, efflorescence and loose mortar shall be removed from the joint cavity. The surfaces/edges shall be repaired with epoxy mortar to give smooth and even surfaces to correct lines and levels with a uniform gap for the length to be sealed.

9.4.14 Application

Masking Tape

Masking tape shall be placed on the finished surface on one or both sides of a joint cavity to protect adjacent finished surfaces from primer or compound smears. The masking tape shall be removed within 10 minutes after the joint shall be filled and tolled.

9.4.15 Bond-preventive materials

Bond-preventive materials shall be installed on the bottom of the joint cavity and other surfaces to prevent the sealant from adhering to the surfaces covered by the bond- preventive materials. The materials shall be carefully applied to avoid contamination of adjoining surfaces or breaking bond with surfaces other than those covered by the bond-preventive materials.

9.4.16 Backstops

The back or bottom of joints constructed deeper than specified shall be packed tightly with an approved backstop material to provide a joint of the depth specified.

9.4.17 Primer

The primer shall be used in accordance with the manufacturer's instructions. The primer shall be applied to the joint surfaces to be sealed only and not spill over or be applied to surfaces adjacent to the joints.

9.4.18 Application of Sealant

The sealant shall be gun-applied with a nozzle of proper size to fit the width of the joint indicated and shall be forced into grooves with sufficient pressure to expel air and fill the groove solidly. The sealant shall be uniformly smooth and free of wrinkles.

The plastic nozzles shall be inserted on the gun and cut to appropriate size. The sealant shall be gunned into joints using an even trigger pressure. The nozzle shall be cleaned occasionally.

The sealant shall be pressed into joints with a wet spatula and tooled within five minutes of application. The joint shall be tooled slightly concave after the sealant is installed. The tooled joint shall present a smooth and professional joint giving the desired finish and shape. The masking tape shall be removed immediately after tooling.

Application equipment shall be cleaned with a tool cleaner, recommended by the manufacturer, after wearing PVC or rubber gloves and whilst the sealant is still in an uncured state.

9.4.19 Cleaning

The surfaces adjoining the sealed joints shall be cleaned of smears and other soiling resulting from the sealing application as the work progresses. Sealant adhering to, porous surfaces shall be left until it is just cured and then removed by abrasion or other mechanical means.

9.5. FIREPROOFING OF STEEL STRUCTURES

9.5.1 Scope

This specification covers the general requirements of materials and the method of application for internal protection of platform structural steel girder (in a limited length) and steel door where high voltage cable are crossing from track girder to off- road station building, against fire by vermiculite cementitious coating.

9.5.2 Materials

All materials to be used shall conform to the requirements of respective UL codes / IS codes. Sample and test results for all the materials shall be submitted to the Engineer and got approved by him in writing before

execution of work. Acceptance criteria of commonly used materials is given below.

9.5.2.1 Vermiculite Cementitious Coating

Branded product with base as Vermiculite mixed with ordinary Portland cement shall have a max loose dry density of 400kg/m^3 while in moulded condition, density shall not exceed 800kg/m^3 . Sulphate content in the branded product shall not exceed 1%, when the sulphate content is expressed as sulphur trioxide.

9.5.2.2 Reinforcement

Welded wire fabric to be used as reinforcement shall conform to IS:1566 and shall be of approved type. Mesh size shall be 50mm x 50mm and thickness of wire shall be 3mm.

9.5.2.3 Attachments

(a) Tie wire

Tie wire shall be of mild steel not thinner than 16SWG.

(b) Nuts

Nuts shall be made of mild steel and shall conform to IS:1367 and IS:2585 of required size as recommended by manufacturer.

9.5.3 Surface Preparation

9.5.3.1 Surface cleaning, Welding nuts and application of primer

All steel surface to be in contact with the fireproofing coating materials shall be cleaned of all oil/grease, loose rust/scales/dust by using detergent and wire brushing.

9.5.3.2 M-16 or of required size as recommended by manufacturer nuts shall be welded with all the steel members to be fireproofed. The maximum spacing of nuts shall be 400mm centre to centre in both directions. Nuts shall be welded to the steel surface in the shop. Epoxy zinc phosphate primer polyamid as specified in table of painting specification or as recommended by manufacturer's shall be also applied to the MS nuts and effected surfaces of the members due to welding after cleaning.

9.5.3.3 Placement of reinforcement

Reinforcement shall be placed in the middle of coated material thickness. It shall be bent confirming with outlines of finished encasement and rigidly secured in place by tie wire with all the nuts. The minimum lap at ends and sides shall be 100mm and lapped wire fabric shall be tied firmly.

9.5.4 Application

- a) Application of fireproofing material coating shall be carried out by skilled and experienced operators.
- b) Before start of application, zone which is not to be fireproofed shall be covered with polythene/ tarpaulin to protect them against damage.
- c) For vertical webs of steel girder, the coating materials shall be applied in horizontal bands working upwards from the bottom. All outside edges of the fireproofing shall be chamfered by 20mm.
- d) The thickness of fireproof coating shall be established by measuring it with electrometer.

The fireproofing material, after application shall be cured by keeping it in moist condition for a period of at least 14 days or else the surface shall be coated with a membrane of approved curing compound. Brand name, name of manufacturers, test results and method of application shall be submitted to and got approved from the Engineer prior to procurement of curing compound.

9.5.5 Approach Working Platform & Scaffolding

The contractor shall arrange all approaches, scaffoldings, stairways, ladder, working platform etc. for carrying out the entire work safely. The working area shall be neatly maintained, and all the facilities required by the Engineer for proper supervision of the work shall be provided. In case, any special precaution is needed for the safety of the structure till the completion of application, the contractor shall make and provide all such arrangement to the complete satisfaction of the Engineer and shall remove the same after completion of works.

9.5.6 Specific Requirement

9.5.7 Vermiculite Cementitious Coating

9.5.7.1 Design Requirement

- (a) Vermiculite cementitious coating shall restrict the temperature of structure, below the maximum permissible temperature of 538 C for structural steel members, for a minimum time period of 2 hours and also it shall not fail till the end of the specified period.
- (b) The coating shall be non-corrosive to the steel members & shall not be affected by environmental conditions. It shall also be asbestos free.
- (c) The coating materials shall be durable and easily repairable.

- (d) Application procedure of the coating shall be easy, nonhazardous and also shall not interfere with the working of the adjoining areas.
- (e) The contractor shall submit coating thickness based on test results for structural steel sections to be fireproofed for review/approval of the Engineer for the offered branded product as per UL-1709 when tested on W10 x 49 steel I-beam.

9.5.7.2 Application

- (a) Vermiculite cementitious coating shall be mixed with water on a clean platform or in a clean mixing box or in a suitable mixer as per manufacturer's specifications. Water cement shall be adjusted so that vermiculite cementitious coating adheres properly to steel surface and does not sag or slide upon application.
- (b) Primer compatible with the vermiculite cement coating as recommended by the manufacturer's shall be applied over the steel surface after cleaning the shop primer if required as per the manufacturer's specifications.
- (c) Mixed vermiculite cementitious coating shall generally be applied, over the steel surface with the help of spray gun except for small area and inaccessible location, where application with conventional hand tools shall be permitted. Mixed vermiculite shall be used within the pot life specified by the manufacturer. Under no circumstances rebound material shall be used.
- (d) The full specified thickness shall be developed in three successive coats. rendering coat, floating coat, finishing coat and thickness of each coat shall be as manufacture's requirement.

Each successive layer shall only be applied after the preceding layer has developed its initial set and is also properly scratched with steel brush to develop proper bond. If the application is interrupted and does not satisfy successive layers criteria, the coating shall be cut back to the steel surface/preceding layer with a trowel at an inclined angle. The exposed surface of this coating shall be thoroughly wet before resuming the work.

- (e) Application of mixed vermiculite shall not be carried out if the air temperature or the temperature of the surface to be fireproofed to 4 °C or less. Provision shall be made for adequate ventilation during and after application, until the coating is dry.

9.5.8 Finishing And Joint Sealing

Fireproof coating shall be finished with 2 coats of microporous exterior

topcoat as recommended by manufacturer, compatible to cement surfaces of approved make and colour conforming to IS: specifications.

9.5.9 Test

The contractor shall submit the certificate of test results for the vermiculite cementitious coating over structural member from a laboratory, approved by the Engineer. Test shall be performed as per the requirements laid down in UL-1709 for 2 hours duration when tested on W10 x 49 I-beam.

9.5.10 Measurement

Measurement for fireproofing coating of 2hrs shall be in Sqm based on the net surface of structural steel on which it is applied.

9.5.11 Approved Manufacturers/ Supplier

All materials and products shall conform to the relevant standard specification, IS codes and other relevant codes etc. and shall be of approved makes and design.

9.6 POLYCARBONATE ROOF/WALL PANELS

The multi-cell polycarbonate panel to be used for Roofing/Wall Panels should have the following specifications:

- a) Two side Co-extrusion for UV rays' protection
- b) Panels have to be joined together by protected polycarbonate connector/aluminum connector/any other mechanism that makes joint perfectly watertight.
- c) year warranty
- d) Thermal Insulation $\geq 1.50 \text{ W/m}^2 \cdot \text{K}$ Acoustic Insulation $\geq 20 \text{ dB}$
- e) Linear Thermal Expansion $= .065 \text{ mm/m degree C}$ Temperature Range (-20 degree to 120 degree C) Fire Reaction BS1d0 or better as per EN 13501.

9.7 FLY ASH BASED PRODUCTS:

Fly ash-based products such as Mechanized Autoclaved Sand Lime Flyash Bricks/ Fly Ash Lime Gypsum Bricks/Autoclaved Aerated Concrete (AAC) Blocks have to be used in all construction activities.

9.8 ROOF TOP (SOLAR)

The roof top solar PV system shall be mandatorily implemented at depots and metro stations with the specifications as below.

- a) Hot dip galvanized MS mounting structures (with 1000 gm/m² zinc mass coating) may be used for mounting the modules/ panels/arrays. Each structure should have an angle of inclination as per the site conditions to take maximum irradiation. However, to accommodate more capacity the angle inclination may be reduced until the plant meets the specified performance ratio requirements.
- b) The Mounting structure shall be designed to withstand the speed for the wind zone of the location where a PV system is proposed to be installed (like Delhi-wind speed of 180 km/ hour). It may be ensured that the design has been certified by a recognized Lab/ Institution in this regard and submit wind loading calculation sheet to DMRC. Suitable fastening arrangements such as clamping should be provided to secure the installation against the specific wind speed.
- c) The mounting structure steel shall be as per latest IS 2062 and as per Contract condition.
- d) Structural material shall be corrosion resistant and electrolytically compatible with the materials used in the module frame, its fasteners, nuts and bolts. Aluminum structures also can be used which can withstand the wind speed of respective wind zone. Necessary protection against rusting need to be provided either by coating or iodization.
- e) The fasteners used should be made of stainless steel. The structures shall be designed to allow easy replacement of any module. The array structure shall be so designed that it will occupy minimum space without sacrificing the output from the SPV panels. Installation of solar structure should not damage the roof in any way. If any concrete or foundation is required, it should be preferably precast type.
- f) The bidder needs to take care of the load bearing capacity of the roof and needs arrange suitable structures based on the quality of roof.
- g) The total load of the structure (when installed with PV modules) on the terrace should be less than 80 kg/m².

9.9 TEMPORARY GROUND ANCHOR

The temporary ground anchors installed to support the diaphragm wall or secant piles shall be as follows:

9.9.1 General

This specification deals with temporary ground anchors and shall be read in conjunction with the conditions of contract and the Specification for Excavation. A temporary ground anchor means wherein the contractor proposes to use ground anchors as part of his Temporary Works. A ground anchor is a structural element installed in soil or rock that is used to transmit an applied tensile load (as a result of horizontal earth pressure)

into the ground. The Contractor shall comply fully with the requirements of this specification in the design, erection and installation of ground anchors.

Where works are ordered to be performed by the Contractor but are not specified in this specification, the Contractor must carry them out with full diligence and expedience as are expected for works of this nature and shall comply with the relevant clauses of the codes – IS14448, IS10270, FHWA recommendations, BS 8081, ACI440.6, IS456 and PTI recommendations for prestressed rock and soil anchors (2004).

This contract to be carried out by specialized agency which has capability in following:

1. to design and supply the anchor
2. to assemble, install, grout and stress the anchor.

There can be one specialized agency for both of the above or there can be two separate specialized agencies for each of the activities. However, each of the specialized agency must have completed at least one project in India of similar material, nature and job application.

9.9.2 Reference Standards

IS14448, IS10270, FHWA recommendations, BS 8081, ACI440.3, ACI440.6, IS456 and PTI recommendations for prestressed rock and soil anchors (2004).

9.9.3 Design By Specialised Contractor

The Contractor shall include in the submission, for the Engineer's review, his proposed design of ground anchor with Assembly drawings. Unit rates of ground anchors shall be based on the allowable anchor forces required for the safe and adequate performance. The Contractor's submission of calculations and shop drawings shall include the following information:

- a) Anchor layout
- b) Anchor design details
- c) Anchor structural and geotechnical design capacity
- d) Grade and properties of the tendon material
- e) Percent of tendon ultimate load at working load
- f) Grout - cement type, strength, additives
- g) Anchor load, length, and bond diameter
- h) Anchor free stressing length and de-bonding details
- i) Initial lock-off load of anchor
- j) Anchor bond length or fixed length design details
- k) Endorsement by the Contractor's Professional Engineer

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

The Contractor's design calculations and specifications shall comply fully with the relevant recommendations of reference codes. In matters not specifically covered by the reference codes 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 itemize those matters.

The review of the Contractor's design by the Engineer does not in any way absolve or reduce the duties and responsibilities of the Contractor to ensure the safety and adequacy of his works.

9.9.4 Method Statement for Construction Operations

Prior to commencement of work, the Contractor shall submit to the Engineer a detailed method statements, 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 grouting, stressing method and equipment
- e) Material and plant requirements at each construction stage.
- f) Shop drawings.
- g) Methods of testing.

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

9.9.5 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.

9.9.6 Compliance Inspection

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

9.9.7 Acceptability

Acceptance test shall be carried out on all temporary ground anchors; in accordance with EN1537:1999. 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 requires reassessment of the anchor design and installation practices.

9.9.7.1 Materials

9.9.7.1 General Requirements

The temporary ground anchor should be a grouted multi-strand system that is post-tensioned prior to excavation.

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

9.9.7.2 Tendons

Post-tensioned tendons shall comply with the following:

- a) Hybrid GFRP/Steel system with minimum system ultimate tensile strength of 250 kN
- b) GFRP bar shall be solid round bar of 19mm dia conforming to ASTM D2583, nominal c/s area 284sqmm, Ultimate tensile load of min 300 KN, modulus of elasticity of 50 GPa and ultimate strain of 2.11%.
- c) Stressing tail of not more than 2m to be made of high tensile steel strand with a diameter of 15.2mm and minimum ultimate tensile stress of 1860 MPa, a modulus of elasticity of 195 GPa, maximum relaxation of 2.5% and c/s area of 140mm²; conforming to IS14268/1995 class 2.
- d) PT steel strand and GFRP bar to be connected with a steel coupler. Usage of glue or grout for bonding of the couplers with FRP profile is not permitted. The steel connection should not be more than 350mm in length.
- e) In the case of GFRP tendon longer than 11.8m, steel coupler to be used. The steel connection should not be more than 350mm in length.

A manufacturer's certificate shall be submitted to the Engineer containing all the relevant information as mentioned above. A full system ultimate

loading (FRP + Coupler + PT Strand) to be submitted for at least 5 samples per lot.

GFRP material is cuttable or breakable in nature, with coherent inert properties, and so can be left inside the ground. Since both the free length and bond length of the temporary ground anchor is made of GFRP, it doesn't need to be removed from the ground once redundant.

9.9.7.3 Cement Grout

Grout shall consist of ordinary Portland cement OPC43/OPC53 grade or more obtained from approved manufacturer/supplier.

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/mm² at 3 days and 35 N/mm² at 28 days. Collection of grouts shall be from the grout overflowing from the drillhole 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 prestressing 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.

9.9.7.4 Plastics

PVC Pipe – UNBONDED LENGTH

A PVC sleeve encasing individual tendon shall be used as part of the corrosion. The PVC tube shall be conforming to DIN 8074 & DIN 8075 and IRC:18-2000. The ends of the sleeve shall be sealed with neutral mastic.

9.9.7.5 Corrosion Protection

Being GFRP (an inert material) used for anchor, no specific corrosion protection is required for tendons.

9.9.8 System Components

9.9.8.1 General

The anchor shall be designed to provide an ultimate load holding capacity of not less than specified.

9.9.8.2 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.

9.9.8.3 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.

9.9.8.4 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 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.

The anchor head design for temporary anchorages shall permit in-service tests to be made as long as such tests are required.

9.9.9 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.

Anchor stressing shall be in the manner specified in the approved shop drawings and approved method statement. 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 $\pm 3\%$ of the load applied.

9.9.10 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.

9.9.11 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 $\pm 75\text{mm}$. Deviation in alignment shall not exceed 1 in 30.

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

9.9.12 Anchor Installation

The installation of the tendons shall be supervised by suitably qualified personnel familiar with this type 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.

The Contractor shall maintain a record showing the anchor type, length, position and installation date for each anchor.

9.9.13 Anchor Testing

a) Suitability Test

As per EN1537

b) Pull Out Test As per EN1537

c) Performance Test

100% anchors will be stressed up to 125% of working load during installation and then reduced to lock-off load of 110% of pre-load (no incremental loading or hold time); such that all anchors will be subjected to performance test during installation.

9.9.14 JOINT FILLER BOARD

Synthetic Joint filler board for expansion joints shall be used only at abutting structures like bridges and shall be 20-25mm thickness within a tolerance of +1.5mm and of a firm compressible material and complying with the requirements of IS:1838, with a compressibility more than 25 percent. It shall be 25mm less in depth than the thickness of the slab within a tolerance of ± 3 mm and provided to the full width between the side forms. It shall be in suitable lengths which shall not be less than one lane width. If two pieces are joined to make up full width, the joint shall be taped such that no slurry escapes through the joint. Holes to accommodate dowel bars shall be accurately bored or punched out to give a sliding fit on the dowel bars.

9.10 PAINTS FOR FINISHING WORKS

Various types of paints are used in the station areas for finishing works. However, considering the advancements in the painting/coating system, the paints/coatings having the necessary certificate for the fire-retardant properties may be used for the finishing works only after the approval of engineer-in-charge.

SECTION S.10

ROOF SHEETING & PRE-ENGINEERED STRUCTURES

10.1 GENERAL

10.1.1 Work Site

The location of the work and the general site particulars are shown in the Site Layout enclosed in the bid drawings.

10.1.2 Scope Of Work

General

The work content in this contract consists of:

- i. Design, Fabrication, Supply and erection of PEB buildings for Workshop & Inspection Bay, Blow Down Plant, Pit Wheel Lathe, Interior cleaning, Shed for RGM, S & T Stores, Cable & Diesel Store, Sheds and Watch Towers including gantry girders wherever required.
- ii. Design, fabricating and erection of hot dipped galvanized Rainwater Gutters
- iii. Providing and fixing pre coated galvalume sheets in single and double layer for roofing and side cladding. Double layer sheeting must be insulated by 50 mm thick glass wool of 24kg/cum density.
- iv. Providing and fixing 3 mm Polycarbonate sheets and 6mm thick toughened glass.
- v. Design, fabrication, supply and erection of structural steel for roof inspection platforms, catwalks and cable tray support brackets & hangars.
- vi. Providing structural steel for support columns and car/cycle/scooter sheds
- vii. Supply, Installation and testing of supporting structures for EOT cranes.
- viii. The roof structure shall be planned as per solar module installation arrangements.
- ix. Providing lifeline for maintenance / cleaning purpose
- x. Providing ladder to access roof.

The work is to be constructed and maintained as per relevant IS Codes, Relevant International Standard, CPWD Specifications, Particular Specifications, and Tender Drawings and or as directed by the Engineer.

Technical Requirements

Tenderers must have their own fabrication unit with fully computerized and automatic machinery for cutting, bending, drilling, moulding, welding, grinding etc. with full flagged facilities of sand blasting, painting and testing equipment

complete.

The following requirements are to be followed by the Contractor:

- i. All aspects of quality assurance, including procurement & testing of materials and other components of the work, as specified or as directed;
- ii. Clearing of site and handing over of all the Works, as directed;
- iii. Maintenance of the completed Work during the maintenance period.
- iv. Submission of Design Drawings, Erection Drawings, Fabrication Drawings, completion (i.e. 'as built') drawings, calculation, analysis and other related documents as specified;

10.1.3 Associated Works

Works to be performed shall also include:

- i. All general works preparatory to the PEB buildings, OHE arrangements and EOT Crane arrangements of Depot & Workshop for MRTS project
- ii. Works of any kind necessary for the due and satisfactory construction, completion and maintenance of the works to the intent and meaning of the drawings adopted, technical specifications, to best Engineering standards and orders that may be issued by the Engineer from time to time, compliance by the agency with all Conditions of Contract,
- iii. Supply of all materials, apparatus, plants, equipment, tools, fuel, water, strutting, timbering, transport, offices, stores, workshop, staff, labour and the provision of proper and sufficient protective works, diversion, temporary fencing, lighting and watching required for the safety of the public and protection of works on adjoining land.
- iv. First-aid equipment, sanitary accommodation for the staff and workmen, effecting and maintenance of all insurances,
- v. The payment of all wages, salaries, provident fund, fees, royalties, duties or other charges arising out of erection of works and regular clearance of rubbish, clearing up, leaving the site perfect and tidy on completion.

10.2 DESIGN CRITERIA

The Design of temporary works covers all the items pertaining to:

- i. Form work, casting and stacking yard, staging, launching Scheme and/or transportation scheme.
- ii. Drawings furnished with the Tender Documents show the level of work based on

available soil investigation data. These may require change at the time of actual execution of works.

10.3 STANDARD CODES OF PRACTICE

10.4 AVAILABILITY

The contractor shall provide at site all relevant Codes of practice, and CPWD Specifications.

Legend

ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing Materials
BS	British Standard
CPWD	Central Public Works Department
DIN	Deutsche Institute for Normunge.V.
IRC	Indian Road Congress
IRS	Indian Railway Standards
IS	Indian Standards
JIS	Japanese Industrial Standard
MOST	Ministry of Surface Transport
MORTH	Ministry of Road Transport and Highways

10.5 ORDER OF PRECEDENCE

Wherever Indian Standards do not cover some particular aspects of design/construction, relevant British/European/American Standards will be referred to.

In case of discrepancy among Standard codes of practice, CPWD Specifications,

General and particular Specifications, and Bill of Quantities, the order of precedence will be as below:

- i. Particular Specifications
- ii. General Specifications
- iii. CPWD Specifications.
- iv. Standard Codes of Practice.

In case of discrepancy among Standard Codes of Practice, the decision of the Engineer will be final and binding.

10.6 APPLICABLE CODES

The summarized list of codes is applicable to structural and architectural works. This will not preclude the Engineers right to refer to any other code applicable for the satisfactory execution of the work.

10.7 DIMENSIONS

- i. Figured dimensions on drawings shall only be followed and drawings to a large scale shall take precedence over smaller scale drawings. All dimensions shall be checked on site prior to execution.

The dimensions where stated do not allow for waste, laps, joints, etc. but the Contractor shall provide at his own cost sufficient labour and materials to cover such waste, laps, joints, etc.

- ii. The levels, measurements and other information concerning the existing site as shown on the drawings are believed to be correct, but the Contractor should verify them for himself and also examine the nature of the ground as no claim or allowance whatsoever will be entertained on account of any errors or omissions in the levels or the description of the ground levels or starts turning out different from what was expected or shown on the drawings.

10.8 STEEL STRUCTURES

10.8.1 General

10.8.1.1 This section covers the general requirements of designing, preparing necessary drawings, and, providing, fabricating, painting, transporting, erecting, fixing in position structural steel work for buildings, including all necessary temporary works and conducting of associated tests.

10.8.1.2 Contractor shall ensure that the Technical specifications detailed herein are

carefully read and understood in conjunction with, and related to bill of quantities, and, the contractor in his rates includes all requirements defined herein and in other parts of the Contract Document.

10.8.2 Applicable Codes and Standards

The codes and standards generally applicable to the work of this section are listed below. These are in addition to all relevant Indian Standard Codes as specified in the referenced documents. Latest revisions of the codes shall only be applicable.

IS: 102	Ready mixed paint, brushing, red lead non-setting, priming
IS: 104	Ready mixed paint, brushing, zinc-chrome, priming
IS: 210	Gray Iron Castings
IS: 451	Technical Supply Conditions for Wood Screws
IS: 800	Code of Practice for General Construction in Steel
IS: 801	Code of Practice for use of Cold Formed Light Gauge Steel Structural Members in General Building Construction.
IS: 806	Code of Practice for use of Steel Tubes in General Building Construction
IS: 808	Dimensions of Hot Rolled Steel beam, channel and angle sections
IS: 811	Cold Formed Light Gauge Structural Steel Sections
IS: 813	Scheme of Symbols for Welding
IS: 814	Covered Electrodes for Manual Metal Arc Welding of Carbon and Carbon-Manganese Steel
IS: 816	Code of Practice for use of Metal Arc Welding for General Construction in Mild Steel
IS: 818	Code of Practice for Safety and Health requirements in electric and Gas Welding and Cutting Operations
IS: 822	Code of Procedure for Inspection of Welds
IS: 875	Code of Practice for Structural Safety of Building, Loading Standards.
IS: 1024	Code of Practice for use of Welding in Bridges and Structures Subject to Dynamic Loading
IS: 1030	Carbon Steel Castings for General Engineering Purposes
IS: 1120	Coach Screws
IS: 1161	Steel Tubes for Structural Purposes
IS: 1182	Recommended Practice for Radiographic Examination of Fusion Welded Butt Joints in Steel Plates
IS: 1363	Hexagon Head Bolts, Screws and Nuts (Grade-C)
IS: 1364	Hexagon Head Bolts, Screws and Nuts (Grades A & B)
IS: 1365	Slotted Counter-sunk Head Screws
IS: 1367	Technical Supply Condition for Threaded Fasteners
IS: 1852	Rolling and Cutting Tolerances for Hot Rolled Steel Products
IS: 1977	Low Tensile Structural Steel
IS: 2016	Plain Washers

IS: 2062	Steel for General Structural Purposes
IS: 2074	Ready Mixed Paint, Air drying, Red Oxide-Zinc Chrome Priming
IS: 3063	Fasteners- Single Coil Rectangular Section Spring Washers
IS: 3400	Methods of Test for Vulcanized Rubber
IS: 3443	Crane Rail Sections
IS: 3600	Testing Methods of Fusion Welded Joints and Weld Metal in Steel
IS: 3613	Acceptance Tests for Wire Flux combination for submerged, welding
IS: 3757	High Strength Structural Bolts
IS: 4000	Code of Practice for High Strength Bolts in Steel Structures
IS: 4923	Hollow Steel Sections for Structural Use
IS: 5369	General Requirements for Plain Washers and Lock Washers
IS: 5624	Foundation Bolts
IS: 6227	Code of Practice for use of Metal Arc Welding in Tubular Structures
IS: 6623	High Strength Structural Nuts
IS: 6639	Hexagonal bolts for steel structures.
IS: 8500	Structural Steel Micro-alloyed (Medium and High strength Qualities)

10.8.3 Design

10.8.3.1 The contractor will be required to carry out detailed design of the structures, prepare engineering drawings and detailed 'shop drawings', get these approved from Engineer, and then carry out the fabrication work based on approved drawings.

10.8.3.2 Contractor's designs shall, unless otherwise specified, be based on provisions of relevant BIS codes. Design guidelines and design parameters are mentioned in ANNEXURE - C to these specifications.

Where corresponding parameters mentioned in BIS codes are different from those mentioned in ANNEXURE-C, the latter shall take precedence.

10.8.3.3 Contractor's designs shall be based on general descriptions of buildings given in tender documents and those shown in Tender Drawings.

Where information given in tender documents do not tally with the Tender Drawings, information given in Tender drawings shall take precedence.

10.8.3.4 Where codes and standards listed in clause 10.8.2 do not cover the requirements of design, only in those cases the contractor may refer to other International Standards of design. However, such references should be made only with the approval of the Engineer.

10.8.3.5 The contractor shall submit his design calculations and 'Engineering Drawings' to the Engineer for his approval. The contractor is advised to discuss his design philosophy and design procedure with the Engineer before proceeding with the final design work.

10.8.3.6 It shall be the responsibility of the contractor to obtain all relevant design information from the Engineer for preparing his designs, including all special loading like loads from cranes and other utility services supported by the structure.

10.8.4 Drawings

10.8.4.1 'Tender Drawings' shall be the 'Basic' drawings for developing design drawings. Design drawings shall then be developed into final 'Shop Drawings' to be prepared by the contractor. For preparing shop drawings, the contractor shall obtain written approval from the Engineer.

10.8.4.2 Tender drawings furnished to the Contractor shall form a part of these specifications. The Contractor shall consult these in detail for all the information contained therein, which pertains to and is required for his work.

10.8.4.3 Revisions to drawings, even after release for preparation of shop drawings, are likely to be made to reflect additional data, or, additional details defining updated requirements. Revisions to drawings and any new drawings made to include additional work for the Contractor shall be considered a part of this specification and contract. Extra claims by the contractor on this account shall not be entertained.

10.8.4.4 Tender drawings show all relevant dimensions, and if necessary, clearances of structures, special loading where necessary, general location of openings at various levels and all other information required to enable the Contractor to prepare drawings for general engineering / fabrication and erection.

10.8.4.5 It shall be clearly understood that the Tender drawings are only informative drawings and are not intended to show exact and final information or specific connection details.

10.8.4.6 In case of variations in 'Drawings' and 'Specifications', the decision of the Engineer shall be final and binding. Should the Contractor during the execution of his work, find discrepancies in the information furnished to him, he shall refer such discrepancies to the Engineer before proceeding with such work.

10.8.4.7 The contractor shall prepare all fabrication and erection drawings necessary for completing the work satisfactorily.

10.8.4.8 Drawings shall be of one standard size and shall be clear and legible. Drawings shall be based on Tender drawings supplied to the contractor, but he shall verify actual clearances and dimensions from site on works executed by other agencies and from Engineer

10.8.4.9 Shop drawings shall include, but not be limited to:

- (a) Detailed marking plans.
- (b) Details of member connections and connections to other structures/ components of buildings.
- (c) Detailed dimensions for fabrication indicating dimensional modifications required for field conditions.
- (d) Welding and bolting procedures to be used both at shop and field.
- (e) Cambers required to be provided, and permissible tolerances in fabrication.
- (f) Assembly and erection sequences indicating components to be connected at field.
- (g) Complete bill of materials for each component (preferably drawing wise).

10.8.4.10 Before submitting shop drawings and calculations to the Engineer for his approval, these shall be checked and certified by the contractors own structural engineer. Till such time shop details of a component are approved by the CM, fabrication work for the component shall not be started.

10.8.4.11 If necessary and called for by the Engineer, shop drawings shall be revised to suit modified requirements as mentioned in 10.8.4.3, and these shall be resubmitted for approval of the Engineer.

10.8.4.12 While the shop drawings prepared by the contractor, and approved by the Engineer represent the correct interpretation of work to be done, the contractor is not relieved of his responsibilities for: -

- (a) Dimensional accuracy
- (b) Correctness of engineering and design of connections
- (c) Fit of parts
- (d) Details

- (e) Errors or omissions
- (f) Material and workmanship
- (g) Methodology of fabrication and erection
- (h) Safety of performance

10.9 SUBMITTALS

On commencement of the Project, the Contractor shall submit the following to the Engineer:

- i. Prior to the technical submittals, the contractor shall submit detailed baseline program and methodology indicating the proposed overall schedule for documentation such as calculations, shop/ working drawings, plan/ procedures and records. Submission of samples, process of fabrication / delivery to site storage yard for the approval of the Engineer.
- ii. Complete fabrication drawings, materials lists, cutting lists, bolt lists, welding schedules and QC schedules, based on the design drawing furnished to him and in accordance with the approved schedule. It is highlighted that structural steel members, dimensions thereof indicated in tender drawings are tentative only and may be modified during final design stage.
- iii. Results of any tests, as and when conducted and as required by the Engineer.
- iv. Manufacturer's mill test reports in respect of steel materials, bolts, nuts and electrodes, wires as may be applicable.
- v. A detailed list of all constructional Plant & Equipment, such as cranes, derricks, winches, welding sets etc. their makes, model, present condition and location, available to the contractor and the ones he will employ on the job to maintain the progress of work in accordance with the contract.
- vi. The total number of experienced personnel of each category, like fitters, welders, riggers etc., which he intends to deploy on the project.
- vii. The contractor shall submit complete design calculations for any alternative sections proposed by him, for approval of the Engineer. Use of any alternative section shall be subject to approval of the Engineer. However, no extra payment will be made on this account.

10.10 MATERIALS

10.10.1 Structural Steel

- i. All structural components other than purlins and side cladding runners shall be made from Hot Rolled Sections and plates with Grade-B0 (with mandatory impact testing) having a minimum yield stress of 250 Mpa conforming to IS:2062. Minimum metal thickness for Hot Rolled sections shall be 6mm. Such steel shall be procured from approved manufacturers.
- ii. Whenever high strength steel is specified, it shall conform to IS: 8500.
- iii. All steel tubes shall be hot finished seamless steel tubes (HFG) of the specified strength and as approved by the Engineer and shall conform to IS: 1161. Tubes made by other processes, and which have been subjected to cold working, shall be regarded as hot finished if they have subsequently been heat treated and are supplied in the normalized condition.
- iv. Purlins and side cladding runners only shall be made from cold formed sections and shall conform to ASTM A570 Gr 50 with minimum yield strength of 345 Mpa. Minimum metal thickness for cold formed sections shall be 3.15mm UNLESS SPECIFICALLY PERMITTED by Engineer/Structural Consultants.

10.10.1.1 Steel Supplied by the Contractor

- i. The Contractor shall furnish to the Engineer all mill orders covering the material ordered by him for this project and also the test reports received from the Mills for his approval and information. It is not intended that all the steel materials to be supplied by the Contractor for the work shall be specially purchased from the rolling mills. The Contractor's stock material may be used, provided the mill test reports identified with the materials, satisfactorily demonstrate the specified grade and quality. The Engineer shall have the right to test random samples to prove the authenticity of the test certificates produced by the Contractor, at the Contractor's cost.
- ii. All steel materials supplied by the Contractor shall be in a sound condition, of recent manufacture, free from defects, loose mill scale, slag intrusions, laminations, pitting, flaky rust, etc. and be of full weight and thickness specified.
- iii. Wherever the Contractor, in order to accommodate his other materials in stock, desires to substitute structural steels or plates for the sizes shown on drawings, such substitutions shall be made only after authorization in writing by the Engineer.
- iv. The Engineer may direct that substitution be made, when he considers such substitutions is necessary.

10.10.2 Threaded Fasteners

- i. Technical supply conditions for bolts and nuts shall comply with IS: 1367. Unless specified otherwise all field connections shall be bolted with high strength bolts of property class 8.8. Unless specified otherwise, the bolts and nuts shall be hexagonal.
- ii. All anchor bolts and nuts shall be of property class 4.6 (Grade-B) of IS: 1367 and shall conform to IS: 5624. All nuts shall be hexagonal and shall conform to property class compatible with the property class of the bolt used.
- iii. Plain washers shall conform to IS: 5369, unless otherwise specified. One washer shall be supplied with each bolt and, in case of special types of bolts, more than one washer as needed for the purpose shall be supplied. An additional double coil helical spring washer, conforming to IS: 6755, shall be provided for bolts carrying dynamic or fluctuating loads and those in direct tension.

10.10.3 Electrodes

10.10.3.1 Electrodes used for metal are welding of mild steel shall be heavy coated type electrodes conforming to IS: 814 (Part I & II) and shall be of the best quality approved by the Engineer. All electrodes/ wires / flux shall be kept under dry conditions. Any electrode / wires /flux damaged by moisture shall not be used unless it is guaranteed by the manufacturer that, when it is properly dried, there will be no detrimental effect. Any electrode, which has part of its flux coating broken or is otherwise damaged, shall be rejected. Any electrode /wires/ flux older than six (6) months from the date of manufacture shall not be used. Batch certificates for electrodes/ wires /flux shall be submitted by the Contractor. Welding consumables for Manual metal arc welding shall conform to IRS-M-28, Wire and Flux combination for Submerged Arc welding to IRS-M- 39 and filler wires for CO2 welding to RDSO/ M & C, Specification.

10.10.4 Handling And Storage

- 10.10.4.1 Proper storage of steel (sections and fabricated members) at the job site shall be the responsibility of the Contractor.
- 10.10.4.2 Structural steel shall be stored out of mud and dirt. Proper drainage of the storage area shall be provided. These shall be protected from damage or soiling by adjacent construction operations.
- 10.10.4.3 Fabricated steel shall not be handled until the paint has thoroughly dried. Care shall be taken to avoid paint abrasions and other damage. Steel work shall be transported in such a way so as not to over stress the fabricated sections. All pieces bent or otherwise damaged shall be rejected and shall be replaced by the contractor at his own cost.

- 10.10.4.4 Checking and inspection of fabricated structural steel work by the Engineer shall be done at various stages of completion of fabrication work. The contractor is required to ensure that fabricated steel work is properly stacked such that all joints of all members are either visible or accessible for inspection at all stages of inspection work. Care should also be taken to ensure that fabricated members are not subjected to stresses due to defective stacking.

10.11 FABRICATION

- 10.11.1 All fabrication work shall be done in accordance with IS: 800, read in conjunction with relevant codes mentioned therein.
- 10.11.2 Fabrication shall be done in workshops approved by the Engineer, unless specifically permitted by Engineer that fabrication can be done at site. Under such circumstances work shall be done on a specially designed and constructed platform. Location, size, specification and construction of such a platform shall have prior approval of Engineer. Loads associated with such platforms shall be provided to Engineer.
- 10.11.3 Mild steel rolled sections and plates shall be cut by shearing/machining and grinding the surfaces to true sizes and shapes. Gas cutting of mild steel may be permitted by the Engineer, provided that every cut face and edge is smoothed by grinding operation. Prior approval of Engineer must be obtained for using gas-cutting techniques either by mechanized gas cutters or manually operated gas cutters. While, using gas-cutting methods, proper allowance must be made for grinding to bring the cut piece to exact required dimensions.
- 10.11.4 Extensive use of templates shall be made in doing fabrication work. Templates shall be clean and should have true surfaces prepared for every successive use.

Reinforcements for the structural steel members if required shall be included. In case actual members are used as templates for similar pieces, it will be at the discretion of the Engineer to decide whether such pieces are fit to be incorporated in the finished structure. Jigs and manipulators shall be used, where practicable, and shall be designed to facilitate welding and to ensure that all welds are easily accessible to the operators.

- 10.11.5 All material shall be straight and free from twist and bends unless required to be curvilinear in form. If necessary, the material shall be straightened and / or flattened / straightened by pressure. Heating of rolled sections and plates for purpose of straightening shall not be permitted.

- 10.11.6 Curvilinear members shall be formed by bending with the help of pneumatic press. Final shaping, to a very limited extent, however, may be done by local heat application. This shall be done only on receiving approval from the Engineer.

10.11.7 Holing

- 10.11.7.1 All holes shall be made at right angles to the surface of the member. Holes shall be clean cut without any torn or jagged edges. Holes shall be done by drilling. Punching shall not be resorted to, unless previously approved by the Engineer. In any case, punching of holes in materials having a thickness in excess of the connector diameter, or, for materials thicker than 16 mm, the hole shall be punched 3 mm less in diameter than the required size and then reamed to the full size. Holes shall not be formed or enlarged by burning or gas cutting under any circumstances.

10.12 WELDING

10.12.1 General

In general, only Automatic submerged arc welding will be used for fabrication. Subject to approval of Engineer, Metal inert gas welding may be done for short length where access to the location of the weld does not permit submerged arc welding. The welding and the welded work shall conform to IS: 816, unless otherwise specified. As much work as possible shall be welded in shops and the layout and sequence of operations shall be so arranged as to eliminate distortion and shrinkage stresses. Unless otherwise specified all weld shall be for full contact for all sides.

- 10.12.2 Electrodes for shielded-arc manual welds shall comply with the requirements of IS:814 and shall be amenable to radiographic tests and shall be of approved make. The electrodes for manual arc welding shall be suitable for use in the position and type of work, as laid down in the above specifications and as recommended by the manufacturers. Electrodes classification group 1 or 2 as given in IS: 814 shall be used for welding steel conforming to IS: 2062. Electrodes shall conform to IS-1442 for steel conforming to IS: 8500. Joints in materials above 20 mm thick, and all important connections shall be made with low hydrogen electrodes. Electrode flux covering shall be sound and unbroken. Broken or damaged coating shall cause the electrodes to be discarded. Covered electrodes for manual arc-welding shall be properly stored in an oven prior to use in a manner recommended by the Manufacturer and only an hour's quota shall be issued to each welder from the oven.

- 10.12.3 Electrodes larger than 5 mm diameter shall not be used for root-runs in butt-weld.

Welding plant and accessories shall have capacity adequate for the welding procedure laid down and shall satisfy appropriate standards and be of approved make and quality, the Contractor shall maintain all welding plant in good working order. All the electrical plant in connection with the welding operation shall be properly and adequately earthed and adequate means of measuring the current shall be provided.

All welds shall be made only by welders and welding operators who have been properly trained and previously qualified by tests to perform the type of work required as prescribed in the relevant applicable standards.

All welds shall be free from defects like blow holes, slag inclusions, lack of penetration, undercutting, cracks etc. All welds shall be cleaned of slag or flux and show uniform sections, smoothness of weld metal, feather edges without overlap and freedom from porosity.

- 10.12.4 Fusion faces and surfaces adjacent to the joint for a distance of at least 50 mm on either side shall be absolutely free from grease, paint, loose scales, moisture or any other substance which might interfere with welding or adversely affect the quality of the weld. Joint surfaces shall be smooth, uniform and free from fins, tears, laminations etc. Preparation of fusion faces shall be done in accordance with the approved fabrication drawings by shearing, chipping, machining or machine flame cutting except that shearing shall not be used for thickness over 8 mm.
- 10.12.5 In the fabrication of cover-plated beams and built-up members all shop splices in each component part shall be made before such component part is welded to other parts of the member. Wherever weld reinforcement interferes with proper fit-up between components to be assembled for welding, these welds shall be ground flush prior to assembly.
- 10.12.6 Members to be joined by fillet welding shall be brought and held as close together as possible and in no event shall be separated by more than 3 mm. If the separation is 1.5 mm or greater, the fillet weld size shall be increased by the amount of separation. This shall only apply in the case of continuous welds. The fit-up of joints at contact surfaces which are not completely sealed by welds shall be close enough to exclude water after painting.
- 10.12.7 The separation between fraying surfaces of lap joints and butt joints with backing plate shall not exceed 1.5 mm. Abutting parts to be butt welded shall be carefully aligned and the correct root gap maintained throughout the welding operation. Misalignments greater than 25 percent of the thickness of the thinner plate or 3 mm whichever is smaller shall be corrected and in making the correction the parts shall not be drawn into a slope sharper than 2 degrees (1 in 27.5).

- 10.12.8 Welding procedures recommended by appropriate welding standards and known to provide satisfactory welds shall be followed. A welding procedure shall be prepared by the Contractor and submitted to the Engineer for approval before the start of welding.
- 10.12.9 Approval of the welding procedure by the Engineer shall not relieve the Contractor of his responsibility for correct and sound welding without undue distortion in the finished structure.
- 10.12.10 Voltage and current (and polarity if direct current is used) shall be set according to the recommendations of the Manufacturer of the electrode being used, and suitable to thickness of material, joint form etc. The work shall be positioned for flat welding wherever practicable and overhead weld shall be avoided.
- 10.12.11 No welding shall be done when the surface of the members is wet, nor during periods of high wind unless the welding operator and the worker are properly protected. In joints connected by fillet welds, the minimum sizes of single run fillet welds or first runs and minimum full size of fillet welds shall conform to the requirements of IS: 816 and IS: 823. Fillet welds larger than 8 mm shall be made with two or more passes.
- 10.12.12 All 'full penetration butt welds' made by manual arc-welding, except when produced with the aid of backing material or welded in flat position, from both sides in square- edge material, not over 8 mm thick with root opening not less than one-half the thickness of the thinner part joined, shall have the root of the initial layer gouged out on the back side before welding is started from that side, and shall be so welded as to secure sound metal and complete fusion throughout the entire cross section.
- 10.12.13 Butt welds shall be terminated at the ends of a joint in a manner that will ensure their soundness. Where abutting parts are 20 mm or more in thickness, run-on and run-off plates with similar edge preparation end having a width not less than the thickness of the thicker part joined shall be used. These extension pieces shall be removed upon completion of the weld and the ends of the weld made smooth and flush with the abutting parts. Where the abutting parts are thinner than 20 mm the extension pieces may be omitted but the ends of the butt welds shall then be chipped or gouged out to sound metal and side welded to fill up the ends to the required reinforcement.
- 10.12.14 Each layer of a multiple layer weld except root and surface runs may be moderately peeled with light blows from a blunt tool. Care shall be exercised to prevent scaling or flaking of weld and base metal from over-peeling.

10.12.15 Before commencing fabrication of a member or structure in which welding is likely to result in distortion and/or locked up stresses, a complete programme of fabrication, assembly and welding shall be made and submitted to the Engineer for his approval. Such a programme shall, include, besides other appropriate details, full particulars in regard to the following:

- i) Proposed pre-bending of components such as flanges and presetting of joints to offset expected distortion.
- (ii) Make up of sub-assemblies proposed to be welded before incorporation in final assembly.
- (iii) Proposed joint forms, classification of wire and flux or covered electrodes, welding process including fitting and welding sequence with directions in which freedom of movement is to be allowed.
- (iv) Proposed number, spacing and type of strong details of jigs and fixtures for maintaining proper fit up and alignment during welding.
- (v) Any other special features like assembling similar members back-to-back or stress relief.

Suggestive Minimum Preheating of Metals:

Thickness Of Thickest Part At Point of Welding	Minimum Preheat & Inter-pass Temperature			
	Other than low-hydrogen welding electrodes		Low Hydrogen welding electrodes	
	IS: 226 steel or IS: 2062 steel	IS: 961 steel	IS: 226 steel or IS: 2062 steel	IS: 961 steel
Upto 20 mm incl.	None	Welding with this process not allowed	None	10°C
Over 20 mm to 40 mm incl.	65°C		10°C	65°C
Over 40 mm to 63 mm incl.	110°C		95°C	110°C
Over 63 mm	150°C		110°C	150°C

Minimum preheat temperature for metal thickness up to 50 mm shall be 100C.

- 10.12.16 If so desired by the Engineer, mockup welding shall be carried out at the Contractor's cost to establish the efficacy of the proposed programme, with any modification suggested by the Engineer in limiting distortion or/and residual stress to acceptable levels. Such modifications will not relieve the Contractor of any of his responsibilities.
- 10.12.17 The ends of butt joints shall be welded so as to provide full throat thickness. This may be done by the use of extension pieces, cross-runs or other approved means. The weld face shall, at all places, be deposited projecting the surface of the parent metal. Where a flush surface is required, the surplus metal shall be dressed off. Splices and butt joints of compression members, depending on contact for stress-transmission, shall be accurately machined over the whole section. In column bases, the ends of shafts together with the attached gussets, angles. Channels etc., after bolting and/or welding together as the case may be, shall be accurately machined so that the parts connected butt over the entire surface of contact. Care shall be taken that connecting angles or channels are fixed with such accuracy that they are not reduced in thickness by machining by more than 0.8mm.
- 10.12.18 The minimum leg length of a fillet weld as deposited shall be not less than the specified size. In no case shall a concave weld be deposited, unless specifically permitted. Where permitted, the leg length shall be increased above that specified length, so that the resultant throat thickness is as great as would have been obtained by the deposition of a flat-faced weld of the specified leg length.
- 10.12.19 After making each run of welding, all slag shall be thoroughly removed, and the surface cleaned. The weld metal, as deposited (including tack welds), shall be free from-cracks, slag inclusions, porosity, cavities and other deposition faults. The weld metal shall be properly fused with the parent metal without under cutting or overlapping at the toes of the weld. The surface of the weld shall have a uniform consistent contour and regular appearance.

10.13 INSPECTION OF WELDS

- 10.13.1 All welds shall be inspected for flaws by any of the methods described in these specifications, and as per IS: 822. The choice of the method to be adopted shall be determined by the Engineer.
- 10.13.2 The Contractor shall arrange for all tests as called for in the schedule of quantities, at his own cost.
- 10.13.3 In case the tests uncover defective work, such tests shall be at the Contractor's cost and the Contractor shall correct such defects at his own cost and prove the soundness of rectified work.

10.13.4 The correction of defective welds shall be carried out as directed by the Engineer without damaging the parent metal. When a crack in the weld is removed, magnetic particle inspection or any other equally positive means as prescribed by the Engineer shall be used to ensure that the whole of the crack and material up to 25 mm beyond each end of the crack has been removed. Cost of all such tests and operations incidental to correction shall be to the Contractor's account.

10.14 FABRICATION TOLERANCES

10.14.1 Unless otherwise shown on drawings, the fabrication tolerances shall generally be as detailed hereunder.

10.14.2 Straightness

10.14.2.1 The dimensional and weight tolerance for rolled shapes shall be in accordance with IS: 1852 for indigenous steel and equivalent applicable codes for imported steel. The acceptable limits for straightness (sweep and camber) for rolled or fabricated members shall be: Struts and columns: $L/1000$ or 10 mm whichever is smaller for all other members not primarily in compression such as purlins, beams, bracings & web members of trusses and latticed girders: $L/500$ or 15 mm whichever is smaller. Where L is the length of finished member, or such lesser length as the Engineer may specify.

10.14.3 Twists

10.14.3.1 A limit for twist (prior to erection) in:-

Box girders and heavy columns: $L/1500$

Other members: $L/1000$

The twist of the member between any two sections shall be measured with the web vertical at one of the sections.

10.14.4 Camber

10.14.4.1 Tolerance in specified camber of structural members shall be + 3 mm.

10.14.5 Length

10.14.5.1 Tolerance in specified length shall be as follows:

Type of Member	Tolerance
Outline Construction Specifications for Civil Works	

A column finished for contact bearing:	+ 1 mm
Other members (e.g. beams) under 10 m:	+ 0 and - 3 mm
Other members (e.g. beams) 10 m long and over:	+ 0 and - 5 mm

10.14.6 Square-Ness at End of Members

10.14.6.1 Beam to beam and beam to column connections where the abutting parts are to be joined by butt welds, permissible deviation from the square-ness of the end is :

Beams up to 600 mm in depth:	1.5 mm
Beams over 600 mm in depth:	1.5 mm every 600 mm depth
Up to a max of 3 mm	

10.14.6.2 Where abutting parts are to be joined by bolting through cleats or end plates, the connections require closer tolerance. Permissible deviation from square ness of the end is -

Beams up to 600 mm in depth:	1 mm
Over 600 mm in depth:	max of 1.5 mm.

10.14.7 Butt Joints

10.14.7.1 For full bearing, two abutting ends of columns shall first be aligned to within 1 in 1000 of their combined length and then the following conditions shall be met:

- (a) Over at least 80% of the bearing surface the clearance between the surfaces does not exceed 0.1 mm.
- (b) Over the remainder of the surfaces the clearance between the surfaces does not exceed 0.3 mm. Where web stiffeners are designed for full bearing on either the top flange or bottom flange or both, at least half the stiffener shall be in positive contact with the flange. The remainder of the contact face could have a max. gap of 0.25 mm.

10.14.8 Depth of Member

10.14.8.1 Acceptable deviation from the specified overall depth is :

For depths of 900 mm and under:	+ / - 3 mm
For depths over 900 mm and under 1800 mm:	+ / - 5 mm
For Depths of 1800 mm and over:	+ 8 mm; - 5 mm.

10.14.9 Web Plates

10.14.9.1 Acceptable deviation from flatness in girder webs in the length between the stiffeners or in a length equal to the girder depth shall be 1/150th of the total web depth.

10.14.10 Flange Plates

11.14.10.1 The limit for combined warp-age and tilt on the flanges of a built up member is 1/200 of the total width of flange or 1.5 mm whichever is smaller measured with respect to centre-line of flange.

11.14.10.2 Lateral deviation between Centre-line of web plate and centre-line of flange plate at contact surfaces, in the case of built up sections shall not exceed 3 mm.

10.15 INSPECTION

10.15.1 **The** Contractor shall give due notice to the Engineer in advance of the materials or workmanship getting ready for inspection.

- i) All rejected material shall be promptly removed from the shop and replaced with new material for the Engineer's approval / inspection. The fact that certain material has been accepted at the Contractor's shop shall not invalidate final rejection at site by the Engineer, if it fails to be in proper condition or has fabrication in-accuracies which prevent proper assembly. No materials shall be painted or dispatched to site without inspection and approval by the Engineer unless, such inspection is waived in writing by the Engineer.
- ii) Shop inspection by the Engineer or his authorized representative, or submission of test certificates and acceptance thereof by the Engineer, shall not relieve the Contractor from the responsibility of furnishing material conforming to the requirements of these specifications. Nor should it invalidate any claim which the Engineer may make because of defective or unsatisfactory material and/or workmanship.

- iii) The Contractor shall provide all the testing and inspection services and facilities for shop work except where otherwise specified. For fabrication work carried out in the field, the same standard of supervision and quality control shall be maintained as in shop fabricated work. Inspection and testing shall be conducted in a manner satisfactory to the Engineer.

10.15.2 Testing

10.15.2.1 Material Testing

- i) If mill test reports are not available for any steel materials, the same shall be tested by the Contractor to the satisfaction of Engineer to demonstrate conformity with the relevant specification.

10.15.2.2 Tests on Welds

Magnetic Particle Test

Only where the Engineer requires that flaw-detection of welds be done by 'Magnetic Particle Test', in such cases the tests are to be done in accordance with IS: 3703. If heat treatment is performed, the completed weld shall be examined after the heat treatment. All defects shall be repaired and re-tested. Magnetic particle tests shall be carried out using alternating current. Direct current may be used with the explicit written permission of the Engineer.

10.15.2.3 Dye Penetration Test

Where welds are required to be examined by dye penetration inspection method, such tests shall be carried out in accordance with IS: 3658.

10.15.2.4 Radiographic Inspection

Whether instructed by Engineer, or not, all 'Butt' welds shall be fully inspected by radiographic examination method. Such examination shall be done in accordance with the recommendations of IS: 1182.

10.15.3 Test Failure

At any stage, in the event of any material or work failing to meet an inspection or test requirement, which is not overseen by the Engineer, the Contractor shall notify the Engineer immediately. The Contractor must obtain permission from the Engineer before repair is undertaken. The quality control procedures to be followed to ensure satisfactory repair shall be subject to approval by the Engineer. The Engineer has the right to specify additional inspection or testing

as he deems necessary, and the additional cost of such testing shall be borne by the Contractor. The Contractor shall maintain records of all inspection and testing which shall be made available to the Engineer on demand.

10.15.4 Shop Matching

Some steel work, particularly columns along with tie beams, bracings etc. may have to be shop assembled to ensure satisfactory fabrication. If the Engineer so desires, he may order such assembly at shop for verification. The Contractor shall comply with such instructions without claiming any extra cost.

10.15.5 Shop Assembly

10.15.5.1 The steelwork shall be temporarily shop assembled, as necessary, so that the accuracy of fit may be checked before dispatch. The parts shall be shop assembled with a sufficient number of parallel drifts to bring and keep the parts in place.

11.15.5.1 Since parts drilled or punched, with templates having steel bushes shall be similar and, as such, interchangeable, such steelwork may be shop erected in part only, as agreed by the Engineer.

10.15.6 Assembly

- i) All parts assembled for bolting shall be in close contact over the whole surface.
- ii) The component parts shall be so assembled that they are neither twisted nor otherwise damaged. Specified cambers, if any, shall be provided.
- iii) All parts of bolted and welded members shall be held firmly in position by means of jigs or clamps while bolting or welding. No drifting of holes shall be permitted, except to draw the parts together and no drift used shall be larger than the nominal diameter of the bolt. Drifting done during assembling shall not distort the metal or enlarge the holes.
- iv) Trial assemblies shall be carried out at the fabrication stage to ensure accuracy of workmanship, and these checks shall be witnessed by the Engineer/ Authorized inspecting agency. Such trial assemblies shall be at the cost of the contractor.
- v) Field Bolts

- a. Requirements stipulated under bolting shall apply for field bolts also. Field bolts nuts and washers shall be furnished by the Contractor in excess of the nominal numbers required. He shall supply the full number of bolts, nuts and washers and other necessary fittings required to complete the work, together with the additional bolts, nuts and washers totaling to 10% of the requirement subject to minimum of 10 Nos.
- b. At the time of assembly, the surfaces in contact shall be free of paint or any other applied finish, oil, dirt, loose rust, loose scale, burrs and other defects which would prevent solid seating of the parts or would interfere with the development of friction between them.
- c. If any other surface condition, including a machined surface, is specified, it shall be the responsibility of the Contractor to work within the slip factor specified for the particular case.
- d. Each bolt and nut shall be assembled with washers of appropriate shape, quality and number in cases where plane parallel surfaces are involved. Such washers shall be placed under the bolt head or the nut, whichever is to be rotated during the tightening operation. The rotated nut or bolt head shall be tightened against a surface normal to the bolt axis, and the appropriate tapered washer shall be used when the surfaces are not parallel. The angle between the bolt axis and the surface under the non-rotating component (i.e. the bolt head or the nut) shall be $90 + 3$ degree. For angles outside these limits, a tapered washer shall be placed under the non-rotating component. Tapered washers shall be correctly positioned.
- e. No gasket or other flexible material shall be placed between the holes. The holes in parts to be joined shall be sufficiently well aligned to permit bolts to be freely placed in position. Driving of bolts is not permitted. The nuts shall be placed so that the identification marks are clearly visible after tightening. Nut and bolts shall always be tightened in a staggered pattern and where there are more than four bolts in any one joint, they shall be tightened from the centre of the joint outwards.
- f. If, after final tightening, a nut or bolt is slackened off for any reason, the bolt, nut and washer or washers shall be discarded and not used again.

10.15.7 Marking of Members

After checking and inspection, all members shall be marked for identification during erection. This mark shall correspond to distinguishing marks on approved erection drawings and shall be legibly painted and stamped on it. The

erection mark shall be stamped with a metal dye with figures at least 20 mm high and to such optimum depth as to be clearly visible, even after a member is galvanized.

All erection marks shall be on the outer surface of all sections and near one end, but clear of boltholes. The marking shall be so stamped that they are easily discernible when sorting out members. The stamped marking shall be encircled boldly by a distinguishable paint to facilitate easy location. Erection marks on like pieces shall be at identical location. Members having lengths of 7.0 m or more shall have the erection mark at both ends.

Each fabricated member, whether assembled prior to dispatch or not so assembled, shall bear an erection mark, which will help to identify the member and its position in respect of the whole structure, to facilitate re-erection at site. This erection mark shall be incorporated in the shop detail and erection drawings.

10.15.8 Errors

Any error in shop work which prevents proper assembling and fitting up of parts in the field by moderate use of drift pins or moderate amount of reaming will be classified by the Engineer as defective workmanship. All charges incurred by the Engineer either directly or indirectly because of the poor workmanship will be deducted from the amount due to the Contractor before payment is made. The amount of such deduction will consist of the sum total of the costs of labour direct or indirect, material, plant, transportation, equipment rental and overhead expenses. In case the Engineer chooses to reject the material because of poor workmanship, the cost of all handling and returning the material to the Contractor, if he so desires, shall entirely be to the Contractor's account. All the replacement materials shall be supplied free and in all such cases, the cost of handling, transport and delivery to site shall be borne by the Contractor.

10.15.9 Erection

- 10.15.9.1 Erection of structural steel fabricated components shall be done generally in accordance with provisions of IS: 800.
- 10.15.9.2 Before starting of erection work, the contractor shall ensure the fulfillment of the following activities:
- The contractor shall submit, for examination by the Engineer, detailed particulars of his proposed methods of erection of the superstructure steelwork, together with complete calculations relating to strength and

deflection. If the erection scheme necessitates the attachment of strength steelwork to the permanent steel work, the contractor shall submit, for approval of the Engineer, the methods he proposes for making good the permanent steelwork after removing the temporary work. The contractor shall also submit the design and fabrication drawings including detailed calculations of temporary nose, counterweight, all temporary support, staging, braces etc. required for safe erection, for approval of the Engineer.

- ii) The contractor shall provide all construction and transport equipment, tools, tackle, and consumables, materials, labour and supervision required for the erection of the structural steelwork.
- iii) Handling, assembling, bolting, welding and satisfactory installation of all fabricated structural steel materials in proper location, according to approved erection drawings and/or as directed by the Engineer.
- iv) Setting out, aligning, plumbing, leveling, bolting, welding and securely fixing the fabricated steel structures in accordance with the erection scheme, or as directed by the Engineer.

10.15.9.3 Grouting under base plates shall be done after erection of the structural steel, unless otherwise approved by the Engineer. All bearing plates and bearing assemblies shall be set level and to the elevations shown on drawings. These shall be shimmed with approved means and grouted to ensure full bearing on the supporting substrate regardless of the tolerances otherwise permitted. The grout to be used in superstructure or stanchion bases shall be shrink resistant grouting compound of approved make and manufacture and shall have a 28 day compressive strength of at least 30 N/sqmm. The surfaces which have to receive the grout shall be thoroughly cleaned immediately prior to the grouting operation. The grout shall be carefully worked under the base plates and shall completely fill the space under the base plates. After the grout has had its initial set, the grout shall be cut back flush with the base plate as shown in drawings and surplus grouting material removed. The surplus material thus removed shall not be re-used. If inserts in concrete are required, the contractor shall furnish all inserts including any reinforcement required for embedding in the concrete to the concrete contractor. It should include providing layout drawings to the concrete contractor for placement of such inserts into concrete.

10.15.9.4 Erection Tolerances

Erection tolerances shall be as per table-1 of ANNEXURE-A.

10.16 QUALITY CONTROL & TESTING REQUIREMENTS

10.16.1 Quality Control through established testing norms of the welded structural steelwork as mentioned below or directed by the Engineer.

- i) The Contractor shall submit the following:
 - Proposed overall schedule for documentation of shop drawings, plan/procedures and records, submission of procedure of fabrication.
 - The contractor shall himself inspect all materials and shop work to satisfy the specified tolerance limits and Quality norms before the same are inspected by Engineer.
- ii) The contractor shall through appropriate planning and continuous measurements in the workshop and the erection at site, ensure that the tolerance specified in ANNEXURE-A are strictly adhered to.

10.16.2 The fabricating agency shall have in house facilities for all testing of weld.

10.16.3 Visual Examination

The contractor shall conduct visual examination and measurement of the external dimensions of welds for all joints. Before examining the welded joints, areas close to it on both sides of the weld for a width not less than 20 mm shall be cleaned of slag and other impurities. Examination shall be done by a magnifying glass which has a magnification power of ten (10) and measuring instrument which has an accuracy of + 0.1 mm or by weld gauges. Welded joints shall be examined from both sides. The contractor shall examine the following during the visual checks.

- i) Correctness and shape of the welded joints
- ii) Incomplete penetration of weld metal.
- iii) Influx
- iv) Burns
- v) Unwelded craters
- vi) Undercuts
- vii) Cracks in welded spots and heat affected zones
- viii) Porosity in welds and spot welds
- ix) Compression in welded joints as a result of electrode impact

- while carrying out contact welding
x) Displacement of welded element

The contractor shall, document all data as per sound practices.

- 10.16.4 In order to exercise proper control of the quality of the welding, Contractor shall enforce methods of control as tabulated below:

Purpose	Control subjects	Methods of control
1	2	3
(i) Control of welding materials and basic metal quality	Quality control of electrodes, welding wire, flux and protective gases. Checking of quality and Weldability of the basic metal and welded members	Weldability test to determine the technological properties of materials. Mechanical test of weld metal. Metallographical investigations of welds macro-structure and microstructure.
		Checking of weld metal resistance for intercrystalline corrosion. Study if weld metal solidity by physical control methods
(ii) Checking of welder's qualifications	Welding of specimens for quality determination	Mechanical tests, metallographical investigation & checking of welded joints by physical control methods Checking of assembly quality & centering of welded members
(iii) Control of welded joint quality	Control of assembly accuracy and technological welding process	Checking of welding equipment conditions. Checking correctness of welding procedure. Visual examination of welds

- 10.16.5 Mechanical Test

The Contractor shall carry out various mechanical tests to determine weldability, metal alloy ability, and nature of break, correct size and type of electrodes, degree of pre-heat and post-heat treatment. The type, scope and

sample of various mechanical tests shall be determined in agreement with the purchaser. The number of tests conducted shall depend on the result obtained to satisfy the Engineer that the correct type and size of electrode, degree of pre-heating and post-heating and weldability of metal are being followed.

10.16.6 Dye Penetration Test

All welds (100 %) shall be tested by “Dye Penetration test” as per current practices.

10.16.7 Radiography Test

Radiography test shall be conducted by the contractor to determine gas inclusion (blow holes, hollows) slag inclusion, shallow welds and cracks for 100 % lengths all butt joints. Before conducting the examination, the welded joints shall be cleaned of slag and scales and visually examined. The welds shall be marked into separate portions depending on the length of photograph. The length of the photograph shall be such as to ensure that there are no distortions and shall reveal the defect correctly. The length shall not be more than 0.75 of the focal distance and the width of the photograph would depend on the width of the welded joint plus 20 mm on either side of the weld. The cassette with film shall be protected by sheet of lead or equivalent of proper thickness against incidental, diffused and secondary radiation.

The direction of the ray with relation to the film shall be as specified hereunder.

Welds of butt joints without edge slopes with edge processing shall be examined by central ray directed at right angles to the weld.

In special cases examination of welds with inclined rays directed along edge slopes may be permitted by the Engineer/ Authorised inspecting agency.

Lap joints shall be examined by directing rays at 45 degrees to the bottom plate. Welds in T-joints, without any edge preparation shall be examined by rays directed at 45 degrees to the weld. Angle welds in lap and tee-joints shall be examined by the rays in opposite direction, i.e. the film will be on the side of the weld. Weld in angle joints shall be checked by directing ray along the bisector of the angle between the welded elements. Opposite direction of the ray and location of the film may also be permitted by the Authority.

10.16.8 Ultrasonic Test

Ultrasonic test shall be conducted by the contractor to detect gas inclusion (pores), slag inclusion, shallow welds, cracks, lamination and friability etc for

the fillet joints. Prior to starting of ultrasonic test the welded joint shall be thoroughly cleaned of slag and other material. Surface of the basic metal adjacent to welded joint on both sides shall be mechanically cleaned by the grinder or a metal brush to provide the contact of the whole ultrasonic probe surface with surface of basic metal. The width of the clean surface shall be as directed by the Engineer/ Authorised inspecting agency. The welded joint then shall be covered with a thin coat of transformer oil, turbine or machine oil to ensure acoustic contact. The joints so treated shall be marked and the marks shall be entered into the documentation; subsequent to this, ultrasonic test shall be carried out as directed by the Engineer. Unless otherwise directed by the Engineer 10% of welds shall be subjected to ultrasonic testing. The Engineer may at his discretion reduce the frequency of such tests depending on the performance record of earlier tests.

10.16.9 Magnetic particle Test

Based on other test results, or considerations that raises doubts on welded joints at important locations in the structure, the Engineer may call for Magnetic Particle Tests of joints. The Contractor shall comply with such requirements and arrange for such tests at his own cost.

10.17 PAINTING OF PRE-ENGINEERED STRUCTURAL STEEL WORK

10.17.1 Paint

- i) All paint delivered to the fabrication shop shall be ready mixed, in original sealed containers, as packed by the paint manufacturers. Addition of thinners shall not be permitted.
- ii) Opened containers of Paint shall be stirred frequently to keep the pigment in suspension

10.17.2 Storage of Paints

- i) All paints shall be stored strictly in accordance with the requirements laid down by the paint manufacturers. The storage area shall be well ventilated and protected from sparks, flame, direct exposure to sun or excessive heat, preferably located in an isolated room or in a separate building.
- ii) All paint containers shall be clearly labeled to show paint identification, date of manufacture, batch number, order number and special instructions in legible form. The containers shall be opened only at the time of use. Paints that have liveried, gelled or otherwise deteriorated during storage, shall not be used. Paints, for which the shelf life specified by the supplier has expired, shall

not be used without inspection and approval by the Engineer-in-charge.

10.17.3 Execution

i) Paint System

- a. In general, except where specified otherwise in approved shop drawings Sand blasting of steel surfaces shall be carried out in accordance with IS:1477.
- b. Painting work shall be carried out as follows:

DESCRIPTION	GENERAL SURFACE	
	External Surfaces	Internal Surfaces
Fabrication Shop		
Surface Treatment	Abrasive blast cleaning to minimum SA-2.5 (ISO 8501-1:1988) – near white blast cleaning. If oxidation occurs between blasting and application of paint, the surface shall be re blasted to the specified standard.	Abrasive blast cleaning to minimum SA-2.5 SIS- 055900 near – white blast cleaning
1st-Coat	1 coat two component, high Solid Zinc Phosphate Epoxy primer and buildcoat, DFT-200 microns shall be Sigmafast 278 or approved equivalent applied by conventional/airless spray or brush only in shop.	1 coat two component, high Solid Zinc Phosphate Epoxy primer and buildcoat, DFT-200 microns shall be Sigmafast 278, or approved equivalent applied by conventional/airless spray or brush only in shop.
2nd Under-Coat	1 coat two component, high solids, high- build Aliphatic Acrylic Polyurethane finish, DFT-50 microns shall be Sigmadur 550 or approved equivalent applied by conventional/airless spray or brush in approved colour only in shop.	NA

DESCRIPTION	GENERAL SURFACE	
Finish Coat	1 coat two components, high solids, high- build Aliphatic Acrylic Polyurethane finish, DFT-50 microns shall be Sigmadur 550 or approved equivalent applied by conventional/airless spray or brush in approved colour. This coat shall be applied after transportation and erection of the structure.	NA

* Note: The product shall be meet the requirement of ISO 12944.

INTERNAL SURFACE = Internal surface is those which will become inaccessible after fabrication and are not prone to humidity and moisture from the atmosphere.

EXTERNAL SURFACE = All other surfaces which are prone to humidity and moisture from the atmosphere.

The following precautions must be taken:

- After abrasive blast cleaning, the first undercoat (primer coat) should be applied well before surface deterioration.
- Over coating intervals, application parameters shall conform to manufacturer's instruction manual.
- The DFT (Dry film thickness) shall be measured after completion of each coat.

10.17.4 Surface Preparation

10.17.4.1 General

All surfaces shall be cleaned of loose substances and foreign materials. e. g. dirt. rust, scale, oil, grease, welding flux etc so that the prime coat adheres to the original metal surface. The work shall be carried out in accordance with IS: 1477 (1971) (Part I). Any oil. grease, dust or foreign matter deposited on the surface after preparation shall be removed and care shall be taken to ensure that the surface is not contaminated with acids, alkalis or other corrosive chemicals. The primer coat shall he applied immediately after the surface preparation is completed.

Before the application of any paint the surfaces to be treated shall be thoroughly cleaned freed from all scale, loose paint, rust and other deleterious matters. Oil and grease shall be removed from the surface by washing with solvents or with a detergent solution before blast cleaning operation of metal

polish with metal pellets. If any traces of oil or grease remain after blasting, they shall be removed by solvent cleaning and the area will be re-blasted thereafter.

All welding areas shall be given special attention for removal of weld flux slag, weld metal splatter, weld head oxides, weld flux fumes, silvers and other foreign objects before blasting. If deemed necessary by the Engineer, acid washing and subsequent washing with clean water shall be used.

Any rough seams will have to be ground and must be inspected and approved by the Engineer before application of the coatings.

All structural steel to be painted shall be cleaned. Blast cleaning in accordance with SA 2 1/2 Near- White Blast cleaning (equivalent Swedish Standard SIS 055900). For SA 2 1/2 the profile should be in the range of 40-70 microns and shall be measured with comparator. Mill scale, rust and foreign matter shall be removed to the extent that the only traces remaining are light stains in the form of spots or stripes. Finally, the surface shall be cleaned with a vacuum cleaner or clean dry compressed air.

The blast cleaning shall produce a surface roughness complying with the one specified by the paint manufacturer for the primer concerned. If, cleaned surfaces are rusted or are contaminated with foreign material before painting is accomplished, they shall be re- cleaned by the Contractor at his own expenses.

The surface shall be cleaned by impingement of abrasive materials, such as grit of cast iron, malleable iron, steel or synthetic material, at high velocity created by clean and dry compressed air blast. Prior to application of the blast, heavy deposits of oil and grease shall be removed by solvent cleaning and excessive surface scale removed by hand tool or power tool cleaning.

10.17.5 Mixing and Thinning

- a) All ingredients in a paint container shall be thoroughly mixed to break-up lumps and disperse pigments, before use and during application, to maintain homogeneity. All pigmented paints shall be strained after mixing to remove skins and other undesirable matters.
- b) Dry pigments, pastes, tinting pastes and colours shall be mixed and/or made into paint so that all dry powders get wetted by vehicles and lumps and particles are uniformly dispersed.

- c) Additives that are received separate such as curing agents, catalysts, hardeners etc. shall be added to the paint as per the manufacturer's instructions. These shall be promptly used within the pot life specified by the manufacturers and unused paint thereafter shall be discarded.
- d) Thinners shall not be used unless essential for proper application of the paint. Where thinners are used, they shall be added during the mixing process and the type and quantity of thinner shall be in accordance with the instructions of paint manufacturer.

10.17.6 Paint Application

- a) Paint shall be applied in accordance with the manufacturer recommendations, as supplemented by these Specifications. The work shall generally follow IS:1477- (Part II). Prior approval of the Engineer shall be taken in respect of all primers and/or paints before their use in the works.
- b) Paint shall generally be applied by brushing except that spraying may be use for finish coats only when brushing may damage the prime coats. Roller coat or other method of paint application shall not be used unless specifically authorized.
- c) Spraying paint shall not be adopted on red lead or zinc rich paints. Daubers may be used only when no other method is practicable for proper application in difficult accessible areas.
- d) Paint shall not be applied when the ambient temperature is 10°C and below. For paints which dry by chemical reaction the temperature requirements specified by the manufacturer shall be met with. Also, paint shall not be applied in rain, wind, fog or at relative humidity of 80% and above or when the surface temperature is below dew point, resulting in condensation of moisture. Any wet paint exposed to damaging weather conditions shall be inspected after drying and the damaged area repainted after removal of the paint.

Each coat of paint shall be continuous, free of pores and of even film thickness without thin spots. The film thickness shall not be so great as to detrimentally affect either the appearance or the service life of the paint.

Each coat of paint shall be allowed to dry sufficiently before application of the next coat, to avoid damage such as lifting or loss of adhesion. Undercoats having glossy surface shall be roughened by mild sand papering to improve adhesion of subsequent coats. Successive coats of the same colour shall be tinted. Whenever practical, to produce contrasts and help in identifying the progress of the work.

10.17.7 Brush Application

- i) Proper brushes shall be selected for a specific work piece. Round or oval brushes which conform to IS: 487 are better suited for irregular surfaces, whereas flat brushes which conform to IS: 384 are convenient for large flat areas. The width of flat brushes shall not generally exceed 125mm.
- ii) Paint shall be applied in short strokes depositing a uniform amount of paint in each stroke followed by brushing the paint into all surface irregularities, crevices and corners and finally smoothening or leveling the paint film with long and light strokes at about right angles to the first short strokes. All runs and sags shall be brushed out. The brush marks left in the applied paint shall be as few as practicable.

10.17.6 Spray Application

- (i) The spraying equipment shall be compatible with the paint material and provided with necessary gauges and controls. The equipment shall be cleaned of dirt, dried paint, foreign matter and solvent before use.
- (ii) The paint shall be applied by holding the gun perpendicular to the surface at a suitable distance and moved in a pattern so as to ensure deposition of a uniform wet layer of paint. All runs and sags shall be brushed out immediately. Areas not accessible to spray shall be painted by brush or dauber.
- (iii) Water trap acceptable to Engineer/ Authorized inspecting agency shall be furnished and installed on all equipment used in spray painting.

10.17.7 Shop Painting

- (i) The painting system specified in Table shall be followed. Surfaces, which will be inaccessible after field assembly, shall receive the full-specified protective treatment before assembly.
- (ii) Surfaces in contact during shop assembly shall not be painted. Surfaces which cannot be painted but require protection shall be given a rust inhibitive grease conforming to IS:958-1975 or solvent deposited compound conforming to IS: 1153 (1975) or IS: 1674 (1960) or treated as specified in the drawing.
- (iii) Surface to be in contact with concrete shall not be painted.

- (iv) The shop coats shall be continuous over all edges, including ends meant for jointing at site by bolting, except where the paint could be detrimental to bolting. In such cases, no paint shall be applied within 50mm, and the unprotected surface shall be given a coat of corrosion inhibitive compound.
- (v) The unpainted area shall be cleaned prior to welding. The welded joint shall be cleaned and deslagged, and immediately after covered by the same paint as has been used for the remaining surface.

10.17.8 Protection of Paintwork

- (i) The Contractor shall provide measures as necessary to prevent damage to the work and to other property or persons from all cleaning and painting operations. Paint or paint stains which result in other unsightly appearances on surfaces not designated to be painted shall be removed or obliterated by the contractor at his cost.
- (ii) All painted surfaces that in the opinion of the Engineer/ Authorised inspecting agency are damaged in anyway, shall be repaired by the contractor at his cost with materials and to a condition equal to that of the requirements specified in these specifications.
- (iii) Upon painted surfaces that in the opinion of any other work that would cause dust, grease or foreign materials to be deposited upon the painted surfaces, the painted surfaces shall be thoroughly cleaned.
- (iv) The areas for high-strength bolts shall be protected by masking tape against undercoat application at the fabrication shop. Immediately prior to erection any rust in the paint area shall be removed by power wire brushing to a standard equivalent to SA3.

10.17.9 Contractor shall make provision for requisite site painting to all fabricated steelwork, as per requirements of related specifications of the painting.

10.17.10 Repair of Paint Defects:

All damage to the previous paint shall be repaired. All loose paints shall be removed back to firm edge. Surface irregularities and contaminants shall be removed. Hard, glossy surfaces may require abrading to obtain a suitable surface for painting. Surfaces, which are to be over coated, and which have become contaminated shall be either be solvent cleaned in accordance with SSPC-SP-1 "Solvent Cleaning" or high-pressure fresh water washed and if required, a suitable detergent may be used.

10.17.11 Inspection:

Testing:

The final paint shall be free from obvious defects and shall be tested by the contractor as follows:

Film Thickness:

All dry-film thickness limits as specified shall be strictly adhered to. It is recommended that, in order to achieve the specified dry-film thickness, frequent checks of ET-film thickness are carried out during the paint application with wet-film thickness gauges such as the Elcometer wheel or comb type wheel gauge. The dry film thickness of individual coats and of the total coating system shall be checked at random over an area representative of the total work. A minimum of 5 readings shall be taken for each 10 m² of coated surface. For a surface area less than 10m² a minimum of 3 readings shall be taken. Additional readings shall be taken if there have been any changes in application of equipment, spray nozzle size, thinning of paint, etc.

Inspection:

The application work is to be inspected at all stages and finished paint work shall have the correct shade, degree of gloss and evenness and be free from defects such as cracks, holidays, runs sags, wrinkles, patches, brush or roller marks, or other defects that may be detrimental to the quality of the coating. Prior to acceptance of the paintwork, a final inspection shall be made.

10.18 PRE-COATED STEEL SHEETING FOR ROOFS AND WALLS

10.18.1 Scope of Work

Coated steel profiled sheet of approved colour shall be installed at roof and side cladding on steel framing or on any other material at any other location as directed by the Engineer and shall be executed as per the details shown on the “Good for Construction” and approved shop drawings and as per specialist manufacturers recommendation, complete in all respects. The work shall be executed in flat, tapered, curved form both in plan and section as required.

10.18.2 Materials

The base material of sheet shall be polyester coated high tensile cold rolled steel as per AS 1397, coating class AZ 150 (min. 150 gm/m² zinc aluminium alloy coating mass, total of both sides) in 0.45 BMT (Base Metal Thickness) with hot-dip metallic coating of aluminium zinc alloy (ALUMINIUM 55% AND ZINC 45 %) and having a yield strength not less than 550 Mpa.

10.18.3 Coating

Exterior coating shall be silicone modified polyester (SMP) with 30-50% silicone content (min.) or Super Polyester XRW quality paint coat of approved colour and 35 microns total thickness consisting of 20 microns top coat over 5 micron polyester back coat and a 5 micron primer coats on both surfaces including side and end laps.

10.18.4 Sheeting Profile

Sheets shall be profiled with 28-35 mm high crests at 200-300 mm centres, 1000-1015 mm cover width. Lengths up to 12 m shall be in single sheets. Larger lengths, if practicable, should be used in longer slopes. Sheets to have wide pans with intermediate stiffening ribs for efficient water shedding and strength. Sheets shall be factory cut and supplied in required sizes based on approved shop drawings. The panels possess a curved profile as per the overall profile of the roof.

10.18.5 Single Sheeting

Single skin trapezoidal profiled sheeting should have 1000-1015mm effective covered width 28-35 mm crests @ 200-300 mm pitch manufactured out of 0.5 mm TCT (Total Coated Thickness) Hi-Tensile Galvalume/zincalume steel. The sheets shall have wide pans with 2-3 nos. stiffening ribs for effective water shedding and special male/female ends with full return legs on side laps for purlins support and anti-capillary flute inside lap. The sheets shall have a hot-dip metallic Zinc-Aluminium alloy coating (150 gms/sq.m zinc (45%)/alum (55%). Coating mass total on both sides, AZ-150 or equivalent as per AS 1397-1993), minimum 550 Mpa yield strength with Silicon Modified Polyester (SMP) coating (min. silicone content 30%-50%) or Super Polyester XRW quality paint coat of approved colour. The coating shall be as per AS/NZS-2728 :1997 (category 3). The total coating thickness of 35 microns, comprising of 20 microns exterior coat of SMP over superpolyester XRW on top surface and 5-micron polyester reverse on back surface over 5-micron primer coats on both surfaces including side and end laps. End laps shall not be less than 225 mm.

10.18.6 Double sheeting with Insulation

The top and bottom sheets should be trapezoidal profiled sheeting with 1000-1015mm effective covered width and 28-35 mm crests @ 200-300 mm pitch manufactured out of 0.45mm BMT (0.5 mm TCT (Total Coated Thickness) excluding paint thickness) Hi- Tensile Zincalume steel. The sheets shall have subtle flute/wide pans with 2-3 nos. stiffening ribs for effective water shedding and special male/female ends with full return legs on side laps for purlins support and anti-capillary flute inside lap. The material shall be high tensile having 550 Mpa and shall be hot-dip coated with Zinc-Aluminium alloy (55% Aluminium, 43.5% Zinc, 1.5% Si) as per AS1397/ IS 15961 - AZ150 (minimum

150g/sqm total on both sides) with Silicon Modified Polyester (SMP) coating (minimum Silicon content 30% - 50%) or Super Polyester XRW quality paint coat of approved colour. The coating shall be as per AS/NZS-2728:1997 (category 3) and IS 15965. The total coating thickness of 35 microns, comprising of 20 microns exterior coat of SMP or super durable polyester XRW on top surface and 5-micron reverse polyester coat on back surface over 5-micron primer coat on both surfaces including side and end laps for the top and bottom sheets. End laps shall not be less than 225mm.

The paint system should have stable resin and inorganic pigments for paint durability and lead free for water harvesting. The fastener size shall be calculated as per the design for the top and bottom sheet. The sheets shall sandwich a Glass Wool insulation layer (24kg/cum density) of 50mm thickness with Single side Aluminium Foil facing. GI Spacer channel/sub girt shall be provided and fixed between the top & bottom sheets as per the design required and as recommended by the manufacturer. The entire double skin system shall be installed over the structure purlin.

10.18.7 Fixing

Sheets shall be fixed to roof purlins and side rails/runners at crest as per manufacturer's recommendation and water-tightness provisions using polymer coated galvanized hex head self-drilling self-tapping (SDST) screws with integral washers and EPDM seals. The side laps in sheets shall be provided with sealing tapes and screw fasteners with following properties.

- i. Case Hardened Carbon Steel AISI1018/10B21
- ii. Screw diameter 5.5mm (In case of Stitching 4.8mm)
- iii. Metal Bonded EPDM Washer 2-3mm width 16mm diameter (in case of stitching 14mm diameter)
- iv. Organic/Geomet/Dorken/Xylin coating insuring 1000-hour salt spray life
- v. EOTA approved

Before laying the sheets, the purlin spacing shall be verified. The sheets shall be laid starting from the eaves or from bottom upward in case of cladding (IS: 3007). The sheets shall be laid from the end of the building away from prevailing wind so that exposed edges face down wind. The laps shall be as shown in the approved shop drawing.

If slope of roof is less than 15 degree, the end lap on roof shall be minimum 225mm and single length sheets with joint sealed with double sided self-sticking tapes fixed between two sheets are to be provided.

The contractor shall ensure that panel erector is familiarized with erection

procedure and all the supporting members are straight, level, plumb and true (according to AISC) before starting panel erection. Panels shall be erected according to approved shop drawings.

The steel sheet shall be fastened with min. 40 μ m zinc coated or min. 20 μ m Zinc-Tin alloy coated, Hex head, self-drilling screw as per AS 3566 Class 3 fasteners of approved make) with EPDM washer on each crest/ Valley of sheets for connecting with purlin (as per design). The panels to possess a curved profile as per the overall profile of the roof (drawings attached).

Approved Sealing tapes shall be used on side laps and end laps of sheets and closers to be provided at the last end of sheet. Contractor shall give minimum 10-year guarantee for the sheets against deterioration, disintegration, loss of lustre, variation in color etc. and leakages across laps, fasteners etc. All types of steel sheets shall be load tested to safely carry 1.10 times the design wind loads and coating thickness to the satisfaction of Engineer-In-charge. Fasteners shall also be load tested. The contractor is to submit design and shop drawings for approval on the sheet profile, design and details before installation. The item includes all necessary flashings, trims ridge capping accessories and fasteners to ensure insulated buildings which is not only functionally compliant but aesthetically pleasing with contemporary international look.

10.18.8 Shop Drawings and Approvals

Shop drawings shall be prepared for all sheeting work by the contractor and show the entire installation system including purlin layout, sheet layout, sizes and colour, fixing details etc. Shop drawings shall be submitted to the Engineer for his approval.

The Contractor shall submit catalogues, design calculations for sheet profile confirming safe distributed load capacity, samples of all items to be used and samples of workmanship for approval of the Engineer-in-Charge.

10.18.9 Accessories

The specification for capping, flashing and trims materials shall be same as that for sheeting and shall be factory formed to required shape and profile based on shop drawings.

Roofing accessories like flashings (straight or crimp curved), capping etc. shall be provided from similar coating as used for sheets and shall be fixed by means of self- drillingself-tapping screws with EPDM washer seals.

10.18.10 Tolerances

Length : +0-10mm
Cover width : + or –6mm

10.18.11 Structural Stability and Guarantee against Rusting/Corrosion

The Contractor shall provide design calculations for sheeting taking into account wind loads, seismic and other code requirements and guarantee structural stability.

The contractor shall also give a guarantee for the sheets against rusting/corrosion, leakages through laps and fasteners, colour fading etc. for a period of ten years.

10.19 RAINWATER GUTTER

Rainwater gutters shall be fabricated out of 3.15 mm thick galvanized M.S. Sheets. All arrangements for incorporating outlets for rainwater down take pipes shall be incorporated in the fabrication, as per approved drawings and instructions. Gutters shall be Hot dip galvanized and painted as per painting specifications of structural steel work. The thickness of galvanized coating shall not be less than 50 microns. Connections between each section shall be made water-tight by site seal welding.

10.20 SPECIFICATION FOR LOUVERS

The work for provision of Aluminium Louver pre powder coated for ventilation shall be for easy escape of hot air which accumulates at the roof of workshop shed to normalize the ambient temperature in depot shed and result the comfortable feeling of environment for workmen and normal working of machinery & plants. The work shall comprise:

- (i) Design, Fabrication, supply, modification, installation testing and commissioning as per drawing and BOQ.
- (ii) Louver shall consist extruded section of aluminium 4"x1" rectangular pipe frame, c- channel 2½" x ½ "with metal framework of 3mm thick sheets, 1.5mm thick S-type louvers as per drawing enclosed.
- (iii) Louver bracket/frame shall be permanently fastened to the existing structure without damage.
- (iv) Any additional support and angle etc. required shall be aluminium and pure polyester pre powder coated before fabrication/installation.
- (v) All friction parts, fastenings or any part remaining, as machined / unpainted shall be coated with a product to protect them from corrosion until the unit is commissioned.
- (vi) The paint (if required) shall be done by two coat of epoxy/polyester paint and

- one coat of epoxy primer.
- (vii) The contractor shall arrange free of cost supply of resources, scaffolding, materials, tools, plant, transportation and manpower for fabrication and installation of the Louver.
 - (viii) The contractor shall arrange free of cost all material, equipment and accessories even if not particularly mentioned, necessary to achieve a complete installation in perfect operating condition.
 - (ix) The quantity specified in BOQ is approximate and is likely to vary as per site requirement and performance at the same rate as accepted by competent authority.

Note:

- a) Before taking up mass production of louvers, contractor will offer one sample to the ENGINEER/AUTHORITY engineer for inspection and approval.
- b) Before taking up fitment of louvers on a large scale, contractor will set up a mockup free of cost at site and will offer it to ENGINEER/AUTHORITY engineer for inspection and approval.

10.21 POLYCARBONATE SHEETS FOR ROOF LIGHTING

10.21.1 General

- 10.21.1.1 This section covers the requirements of providing, erecting and fixing polycarbonate sheets of approved colour and approved transparency on roofs for the purpose of lighting. Sheets shall be procured from established and approved manufacturers.

10.21.2 Material

- 10.21.2.1 Material to be used on roofs shall not be less than 3.0 mm thick and shall be profiled to exactly match the profile of pre-coated metal sheets to be used for general roof and side claddings.
- 10.21.2.2 Sheets shall be supplied in maximum lengths that can be transported and erected without causing damage to the sheets, but in any case, the lengths shall not be less than 10.0 m.
- 10.21.2.3 Material shall be free from scratches and other surface damages. These shall be stored in sheltered places and stacked with intermediate layers of soft puffed plastic sheets. Stacks shall be covered with and wrapped around with polyethylene sheets to prevent dust accumulation on the sheets.
- 10.21.2.4 Material shall be U-V treated and shall be of tested quality. The contractor shall ensure that the manufacturer provides with the test certificates for the following

properties:

Test	Procedure	Results
Flammability		
Self-ignition	ASTM 1929-3	570 °C
Smoke density	ASTM D 2843	0.54
Burning extent	ASTM D 635	less than 1.0
Weathering		
Weathering evaluation Concentrated	ASTM D 4364-84	Successful exposure to Sunlight radiation
Colour change	ASTM D 2244	Not more than 3 units 60 months
Light transmission	ASTM D 1003	Shall not decrease more 10 points after 60 months
Light transmission	ASTM D 1003	Shall not decrease more 6% after 10 years
Heat exposure	300°F / 25 mins	No darkening effect
Water penetration	ASTM E 331	No penetration
Impact	ASTM E 822-81	Repels hail storm of 25 mm at Velocity of 21m/sec
Expansion/contraction		Linear thermal change of 0.065mm / m /°C
U-V Filtration	Australian Standard No. 1067	Transmission less than 0.1%
Modulus of Elasticity	DIN 53457	24000 kg / sq cm

10.21.3 Submittal

10.21.3.1 The Contractor shall submit test reports from manufacturer on all tests.

10.21.3.2 The contractor shall also submit a guarantee that the performance of the sheets supplied by him shall meet with the requirements of the test certificates to be produced by him.

10.21.4 Installation

10.21.4.1 Sheets shall be installed in sequence as shown in approved shop drawings, and fixed to purlins with polymer coated, galvanized, hexagon headed self-drilling, self-tapping screws.

10.21.4.2 Side laps shall be as per manufacturers specification. End laps shall be 225 mm. Joints with metal sheets shall be sealed with Butyl-based adhesive. The

edges shall be sealed with silicone sealant as per manufacturers specification, and then covered with butyl- based adhesive tapes.

10.22 TOUGHENED GLASS FOR WINDOWS

10.22.1 General

- 10.22.1.1 This section covers the requirements of providing, erecting and fixing of 6mm thick glass (toughened) of approved color and approved transparency on windows and north lights for the purpose of lighting. Glass shall be procured from established and approved manufacturers.

10.22.2 Submittal

- 10.22.2.1 The Contractor shall submit test reports from manufacturer on all tests.
- 10.22.2.2 The contractor shall also submit a guarantee that the performance of the toughened glass supplied by him shall meet with the requirements of the test certificates to be produced by him.

Annexure-A

Tolerances mentioned below shall be achieved whether the entire structure or part thereof is erected and made in line, level and in plumb.

S. No.	Structure	Tolerance
1	Columns	
a	Deviation of axes at foundation level or at top of anchor level with respect to true axes: - About both directions	+ 5 mm / - 5 mm
b	Deviation in level of bearing surface with respect to true level at centre line	+ 3 mm / - 3 mm
c	Out of plumb-ness of column measured at top of Column: - For columns up to 15 m in height: Axis true vertical,	+/- 1/1000 of column height in mm -or- +/- 15mm whichever is less.
i	For columns up to 15 m in height:	1/1000 of column height in mm -or- +/- 15 mm whichever is less.
ii	For columns exceeding 15 m in height	+/- 1/1000 of column height in mm-or- +/- 20 mm whichever is less.
2.	Trusses and Beams	
a	Shift at the center of span of the top chord member with respect to vertical plane passing through the center of bottom chord member	+/- 1/250 of truss height in mm-or- +/- 10 mm whichever is less.
b	Lateral shift of top chord of truss / beam at center of span from the vertical plane passing through the center of supports of the truss	+/- 1/1500 of span of truss in mm-or- +/- 5 mm whichever is less.
c	Lateral shift in location of truss / beam from its true vertical position	+/- 5 mm
d	Lateral shift in in-plane location of beam / purlin from true position:	+/- 5 mm
e	Deviation in difference of bearing levels of trusses or beams from true levels	+/- 10 mm for trusses -and- +/-5mm for beams

Annexure – B

A. Approved Manufacturers/ Supplier

All materials and products shall conform to the relevant standard specification, IS codes, IRS and other relevant codes etc. and shall be of approved makes and design.

The list of approved makes for products and materials is given below. Other equivalent manufacturers will only be considered with prior approval of the Authority in case of non- availability or unforeseen difficulties.

B. List of Approved Manufacturers/ Suppliers

The Contractor Shall obtain approval of each Manufacturer's /Suppliers from Engineer/Authority.

Annexure- C

Design Criteria and Material Specifications for Pre- Engineered Buildings (PEB)

- 1.0 For the purpose of preparing their offers, all bidders are required to follow the general and special requirements of design criteria and material specifications as laid down in this Annexure to the particular specifications.
- 2.0 Requirements given below are in addition to the Particular specifications laid down for the various items of work.
- 3.0 ENGINEER/AUTHORITY reserves the right to modify these requirements at the final design stage. Suppliers will not be entitled to claim extra over their quoted prices on account of such changes in requirements.

4.0 Part 1: General Requirements for all Buildings

4.1 General

Pre-Engineered Buildings or building components wherever specified shall be designed, supplied and erected by a specialist agency called PEB manufacturer approved by the Engineer. All codes and standards for material, design, fabrication and erection shall generally be as indicated for structural steel work unless the following specifications call for a deviation otherwise. PEB manufacturer shall use Submerged Arc Welding for built-up sections, meeting the applicable requirements of the American Welding Society (A.W.S) D1.1.98.

The agency responsible for design, fabrication and erection shall not be allowed to sub-let any of the activities/operations to another sub-agency in anyway unless a prior written approval of the Engineer is taken. The agency for PEB should have an ISO 9001 certification for manufacture of PEBs. Contractor shall submit all design drawings, erection drawings, fabrication design and drawings for approval by ENGINEER/AUTHORITY prior to commencement of fabrication works.

4.2 Design Specifications for PEB Buildings

The PEB manufacturer shall be responsible for carrying out all the design of PEB's as per following relevant IS codes only.

- a) IS:800 Code of Practice for general construction in steel
- b) IS:801 Cold formed sections

- c) IS:811 Cold formed sections
- d) IS:875 Code of Practice for design loads for building and structure
- e) IS:2062 for Steel for General Structural Purposes

Only in absence of design criteria not available in mentioned IS codes, reference can be made to other international codes/manuals as applicable to PEB's and same shall be subject to approval of ENGINEER/AUTHORITY in case of deviation from IS codes.

A.0 **LOADING**

A.1 Dead Load

Self-weights from all supported and supporting elements.

A.2 Live Load

A.2.1) As per provisions of IS: 875 (Part – 2)

A.2.2) Other Imposed loads -

Loads from suspended utilities, OHE fittings etc as per specific requirement of different buildings.

A.2.3) Material Handling loads supported on structures like EOT cranes, under-slung cranes, all as per specific requirement of individual buildings.

A.2.4) Solar Panels: 30 kg/sqm in addition to (75 Kg/sqm and 150 Kg/sqm) for inaccessible and accessible roof respectively.

A.3 Wind Load

As The design of PEB's are mainly governed by Wind load, no increase in permissible stresses is allowed for wind load combinations as per IS:800.

Parameters

As per provision of IS: 875 (Part – 3), with the following parameters:

A.3.1) Basic wind speed: As per IS: 875

A.3.2) Value of k_1 , corresponding to mean probable design life of building of 120 years : as per table –1 of IS: 875 (part-3).

A.3.3) Value of k_2 , corresponding to Class – B/C structures as per Table –2 of IS: 875 (Part-3). Minimum value of k_2 shall be = 1.0

A.3.4) Value of k_3 , as per clause 5.3.3.1 of IS: 875 (Part-3)

A.3.5) Local wind effects to be taken as per provisions of IS: 875 (Part-3), corresponding to building plan size, height, shape and direction of wind.

The local external wind pressure coefficient shall be taken strictly for the local zones as shown in relevant tables of IS:875. The internal and local external coefficients shall be combined for design of roof sheeting, glass panels, individual cladding units, girts and purlins falling in high local pressure zones shown in relevant tables of IS:875.

A.4 Earthquake Load

As per provisions of IS: 1893 for Zone –IV.

A.5 Temperature Effects:

As per IS: 875 (Part-5).

A.6 Load Combinations: As per IS: 800 (2007)

B.0 DESIGN REFERENCES

B.1 All designs shall be done in accordance with BIS- Standards as per specification of works.

B.2 Only in the case of design criteria not being available in Indian Standard Codes, reference can be made to other International Codes / Standards / Manuals, as applicable to Design of Steel structures of the type specified.

Use of standards other than BIS Codes shall be subject to approval of ENGINEER/AUTHORITY.

C.0 DEFLECTION LIMITS

Deflection limits of members shall generally be as per relevant clause of IS: 800, but with the following provision –

- ii) Maximum deflection limit for purlins checked under various combinations of dead loads and imposed loads is to be restricted to span/250.
For combinations of dead, imposed and wind loads, purlin deflection is to be

limited to span / 200.

- iii) For columns in a single storey building, maximum horizontal deflection at the cap of columns due to worst combination of forces should not exceed the following limits:

Load combination supporting (Worst of)	For columns not supporting crane gantry girders	For columns supporting crane gantry girders DL, LL, WL/EQ
WL/EQ	$l / 325$	$l / 425$
DL, LL, WL/EQ & Temp	$l / 250$	$l / 425$

‘l’ is the actual length of the column.

- iv) Maximum permissible deflection at tip of cantilevers shall be limited to span / 750.. For deflection of cantilevers at any other locations a limit of Span / 500 shall be followed.
- v) For other load combination permissible deflection shall be as per Table 6, IS-800-2007

.For rafter L/750 for Inspection Bay only due to Under Slung Crane.

D.0 GENERAL INSTRUCTION & RESPONSIBILITY

- D.1 It's the responsibility of PEB supplier to account for design loads of the cranes, gantries, OHE drop arm loads etc. in design of PEB's. The connection detail and related accessories/fixtures to fix all above miscellaneous units to PEB frames is also the responsibility of PEB supplier. Sufficient strengthening measures shall be taken in the portals due to these loads.
- D.2 The fabrication drawings along with necessary design calculation for connections etc. should also be submitted by PEB supplier before the start of fabrication for ENGINEER/AUTHORITY's approval.
- D.3 The cold-formed sections shall be designed strictly based on IS: 801-1975. The cold formed sections should be designed as stiffened /unstiffened section based on lip dimension satisfying the section requirements of stiffened/unstiffened section.
- D.4 The overlapping of two cold formed sections to enhance section properties is normally not permitted. However, if PEB contractor wants to use nested purlin then connection of nested purlin should also be designed to cater for in plane shear and moment so that nested behaviour can be achieved. At the locations of splicing in the continuous purlins separate splicing piece, suitably designed, shall be

provided.

D.5 Following items shall be reviewed/clarified and clearance obtained by the PEB supplier before start of design of PEB buildings: -

- (i) Plan dimensions of the buildings.
- (ii) Height of cladding for buildings.
- (iii) Door opening sizes
- (iv) Crane load requirement and OHE drop arm loading details.
- (v) Specification for painting accounting for exposure condition.
- (vi) Steel grade for portals and cold formed sections.
- (vii) Minimum thickness requirements for cold formed sections and structural steel members.
- (viii) Use of stiffener plates for built-up portals.
- (ix) Use of HSFG bolts for base connections.
- (x) Liberty of using portal spacing to achieve economy providing they satisfy the architectural/operational requirement and door/window opening sizes.
- (xi) Expansion joint requirements for PEB's.
- (xii) Pitch for rafter members.
- (xiii) No. of continuous span for design of purlin and roof sheeting.

E.0 MATERIAL SPECIFICATION

E.1 All structural components other than purlin /side runners shall be made from Hot Rolled sections and plates with Grade B0 having a minimum yield stress of 250 Mpa, conforming to IS 2062.

Minimum plate thickness shall be 6mm.

E.2 Purlin and side runners only, shall be made of from cold form sections out of material shall conform to ST-34 -1079 of IS 1079/ASTM A570 Gr 50 with min Yield Strength of 345 Mpa or Equivalent (IS 5986:2009 –Gr Fe 490, Yst 355 Mpa/ IS 1079:2009, Gr HR5, Yst 340 Mpa).

Minimum metal thickness for Cold Formed Sections shall be 3.15 mm, UNLESS SPECIFICALLY PERMITTED BY Engineer-in-Charge / Structural Consultants.

- E.3 Unless noted otherwise all field connections shall be bolted with high strength bolts of Class. 8.8. Close tolerance, or bolts in clearance holes shall be used as per requirement of design.
- E.4 Holding down bolts shall be of property class 4.6 (Grade-B) conforming to IS: 1367 And shall be in accordance with IS: 5624.
- E.5 Cladding on roof and sides of buildings shall be done with pre-formed, polyester coated galvanized steel sheets of minimum thickness 0.50 mm (TCT) of approved colour.
- E.6 Roof lighting sheets shall be out of 3 mm thick, high impact strength, U-V treated, Polycarbonate sheets of approved colour / transparency, placed at suitable locations on roofs (in place of metal cladding sheets). Area of such sheets shall be generally limited to a maximum of 15% of the total roof area.
- E.7 Rainwater gutters for all buildings shall be made out of 3.15 mm thick hot dipped galvanized mild steel sheets, with provision for connecting down-take pipes of appropriate size and at designed locations. Sizes of rainwater pipes and their locations will be decided at the time of final design.
- F.0 ROOF SLOPE
- F.1 All buildings in steel construction shall have normally slopes of 1-vertical to 10 – horizontal or as per drawing.
- F.2 Purlins shall be placed normal to the slope.
- G.0 LIMITATIONS ON DESIGN ASSUMPTIONS
- G.1 Purlins & Side-Cladding Runners
- G.1.1 If purlins / runners are assumed to be continuous over supports, continuity shall have to be developed at supports through proper connections to absorb the continuity moments.
- G.1.2 In case of continuous purlins / runners, temperature effects need to be considered, and such forces need to be transferred down to the foundation through the main structure and appropriate bracing or other force transfer- systems.
- G.1.3 Sag-rods and / or sag-struts may be provided as per requirements of economic design.

G.2 Columns/Portal Frame

G.2.1 Portal Frame Not Supporting Crane Gantry Girder:

The portal frame shall be analyzed semi fixed base with 70% fixity and 30% release and hinge base and the combination of load cases which gives maximum forces shall be considered for design of foundation, holding down bolts, column main rafters and connections.

G.2.2 Portal Frame Supporting Crane Gantry Girder:

Column supporting crane gantry girder shall be considered as “Fixed Base”.

However portal frame shall be analyzed for fixed base & hinge base the combination of load cases which gives maximum forces shall be considered for design of foundation, holding down bolts, column main rafters and connections.

G.2.3 All columns shall be of ‘Solid web’ sections. These can be of standard hot rolled sections or ‘built up’ sections. Profiling of the sections is permissible if so desired by the suppliers.

G.3 Roof Rafters

G.3.1 Roof rafters shall also be solid web sections, either standard hot rolled or built-up, depending on suppliers design. Trusses and castellated sections will not be acceptable.

G.3.2 Connections of rafters to columns shall be through rigid welded/ bolted joints only.

G.4 Other Elements

G.4.1 Eaves beams, other longitudinal beams along column lines shall also be of solid web sections. These may be connected through bolts or welds as per design requirements of supplier.

G.4.2 Crane gantry girders shall be of solid-web sections, either compound or single built up.

G.4.3 Foundation and other holding down bolts shall be sized as per design requirement of various components being connected.

G.4.4 For the purpose of analysis and design of sections, starting level of columns at base shall generally be considered as 800 mm below floor level. The exact depth of fixity of columns shall be got clarified from Structural Consultants before the final analysis / design is taken up by the supplier.

Part 2:Special Requirements for Individual Buildings

A.0 A uniform load of 15 kg/sqm of plan area shall be considered as load from suspended utilities to be supported by the structure.

B0 PARKING, STORE SHED, VANJEX PARKING AND DIESEL STORE ETC.

B1 These are proposed to be made out of tubular steel pipes/I-Sections. Cantilever structures supported with central row of built up columns supporting inverted butterfly roof in Metal sheet with no insulation are to be provided for car and cycle parking. For cable stores and Vanjex parking the structure is to be supported at all ends with tubular columns & beams/I - Sections and supporting inclined roof in metal corrugated sheeting.

C0 WATCH TOWERS

These are proposed to be made out of I-sections. The structure is supported with built up columns and beams tied at approx. every 3m with overall height of approx. 15m from FFL. and supporting the inclined roof in metal corrugated sheet with no insulation. It should also have a railing along the staircase and the upper deck level. The railing should have an overall height of 1200mm with metal sheeting upto a height of 1000mm.

Section – S.11

ROADWORK

11.1 GENERAL

The new work shall be opened to traffic only after it is authorized by the Engineer.

The contractor shall submit a detailed traffic diversion/or control and regulation plan taking all safety measures during the course of work permitted by the concerned authorities to the Engineer for his consent before start of work.

The contractor shall take all precautions to avoid or minimise delays and inconvenience to road users during the course of the work. Where adequate detours or sidetracks are available, traffic shall be temporarily diverted while the work is in progress depending on volume of traffic and subject to approval by Traffic Police. Adequate signs, signals, barriers and lamps for the warning and guidance of traffic shall be provided at all times during the course of the work till it is opened to traffic.

The Contractor shall take all reasonable precautions to protect traffic against accident, damage or disfigurement by construction equipment, tools, and materials, splashes and smirches of bitumen/ bituminous material or any other construction materials and shall be responsible for any claims arising from such damage or disfigurement.

Traffic signs erected shall be in accordance with the IRC Standards and/or as prescribed and approved by the Traffic Police Department.

11.2 GRANULAR SUB-BASE (NON-BITUMINOUS)

This work shall consist of laying and compacting well-graded material on prepared subgrade in accordance with the requirements of these specifications or as per MORTH standards, as acceptable to Highway authorities & road owing agency. The material shall be laid in one or more layers according to lines, grades and cross-sections shown on the drawings.

11.2.1 Material

The Material to be used for the work shall be natural sand, moored, gravel, crushed stone, or combination thereof depending upon the grading specified in MORTH specifications for Roads and Bridges. The material shall be free from organic or other deleterious constituents.

11.2.2 Physical requirements

The material shall have a 10 percent fines value of 50 KN or more (for sample in soaked condition) when tested in compliance with BS:812 (Part III). The water

absorption value of the coarse aggregate shall be determined by IS:2386 (Part 3); if this value is greater than 2 percent, the soundness test shall be carried out on the material delivered to site as per IS:

383. CBR Value shall be determined at the density and moisture content likely to be developed in equilibrium conditions which shall be taken as being the density relating to a uniform air voids content of 5 percent.

11.2.3 Strength of sub-base

It shall be ensured prior to actual execution that the material to be used in the sub-base satisfies the requirements of CBR and other physical requirements when compacted and finished.

11.2.4 Construction Operations

a) Preparation of sub-grade

Immediately prior to the laying of sub-base, the sub-grade already finished or existing surface shall be prepared by removing all vegetation and other extraneous matter, lightly sprinkled with water if necessary and rolled with two passes of 80 – 100 KN smooth wheeled roller. Damage to the subgrade shall be made good before the subbase is laid.

b) Spreading and compacting

The approved sub-base material shall be spread on the prepared sub-grade by a grader of suitable type and adequate capacity.

When the sub-base material consists of a combination of materials, mixing shall be done mechanically by the mix-in-place method.

The equipment used for mix-in-place construction shall be approved equipment capable of mixing the material to the desired degree.

Moisture contents of the loose material at the time of compaction shall be checked in accordance with IS: 2720 (Part 7) and suitably adjusted.

Rolling procedure shall be as described under relevant Subsection except stated herein.

Rolling shall be continued till the density achieved is at least 98% of the maximum dry density for the material determined as per IS:2720 (Part 8).

11.3 WATER-BOUND MACADAM SUB-BASE/ BASE (NON-BITUMINOUS)

11.3.1 Description

The work shall consist of furnishing, placing, watering and compacting sub-base

material mechanically interlocked by rolling and bounded together with screening and/ or binding material to the required degree on a prepared sub-grade/ sub-base or the existing surface as the case may be in accordance with these Specifications, and to the lines, levels, grades, dimensions and cross sections as shown on Drawings and/ or required by the Engineer.

11.3.2 Materials

c) Coarse aggregate

The coarse aggregates shall be hard and durable crushed stones, free from deleterious matter conforming to one of the gradings as set forth in Table 15.3.1, the physical requirements given in Table 15.3.2 subject to the Engineer's consent.

d) Screenings

Screenings to fill voids in the coarse aggregate shall generally consist of the same material as the coarse aggregate or of gravel (other than round material) or moorum as approved by Engineer. However, where permitted non-plastic material such as moorum may be used for this purpose provided liquid limit and plasticity index of such material are below 20 and 6 respectively and fraction passing through 75-micron sieve does not exceed 10 percent.

e) Binding material

Binding material to be used for water-bound macadam as a filler material meant for preventing ravelling, shall be a suitable material and having a Plasticity Index (PI) value of less than 6 as determined in accordance with IS: 2720 (Part-5).

Table 11.3.1

Grading requirements of coarse aggregates

Grading	Size Range	IS Sieve Designation	Percent Passing by weight
1	90 mm to 45 mm	125 mm	100
		90 mm	90-100
		63 mm	25-60
		45 mm	0-15
		22.4 mm	0-5
2	63 mm to 45 mm	90 mm	100
		63 mm	90-100
		53 mm	25-75
		45 mm	0-15
		22.4 mm	0-5
3	53 mm to 22.4 mm	63 mm	100

Grading	Size Range	IS Sieve Designation	Percent Passing by weight
		53 mm	95-100
		45 mm	65-90
		22.4 mm	0-10
		11.2 mm	0-5

Note: The compacted thickness for a layer with Grade 1 shall be 100 mm while for a layer with Grade 2, it shall be 75 mm.

Table 15.3.2

Physical requirements of coarse aggregates or water-bound macadam sub-base and base courses

S. No.	Test	Test Method	Requirement (Maximum)
1	* Los Angeles Abrasion value	IS: 2386 (Part-4)	50 per cent
2	* Aggregate Impact value	IS: 2386 (Part-4)	40 per cent
3	Flakiness Index	IS: 2386 (Part-1)	15 per cent

* Aggregate may satisfy requirements of either of the two tests.

11.3.3 Construction Method

a) Preparation of Sub-grade/ sub-base

- The surface of the sub-grade/ sub-base or existing surface shall be shaped and prepared to the lines, levels, grades, dimensions and cross sections as shown on the Drawings. Damage to or deterioration of sub-grade/ sub-base shall be made good before sub-base/ base is overlaid.

ii. Inverted Choke

If water bound macadam is to be laid directly over the sub grade, without any intervening pavement or soling course, a 25 mm course of screenings or coarse sand shall be spread and compacted on the prepared subgrade before application of the coarse aggregate. In case of fine sand or silty or clayey sub grade, a 100 mm insulating layer of screenings or coarse sand shall be laid, the gradation of which will depend on drainage requirements. Alternatively, appropriate geosynthetics performing functions of separation and drainage layer may be used over the prepared sub-grade subject to the satisfaction of the Engineer.

b) Spreading coarse aggregates

- The coarse aggregates of specified size and grading shall be spread uniformly in layers

with each compacted layer thickness not more than 100mm for Grading 1 and 75 mm for Grading 2 and in a manner that prevents segregation into fine and coarse materials.

- ii. Sub-base/ or base material shall contain moisture nearly equalising the optimum moisture content at the time of compaction.
- iii. Immediately after each layer has been spread and shaped satisfactorily, each layer shall be thoroughly compacted with suitable and adequate compaction equipment. Rolling operations shall begin from the outer edge of roadbed towards the centre, gradually in a longitudinal direction; except on super-elevated curves, where rolling shall begin at the lower edge and progress towards the upper edge.

The rolling shall be continued until the aggregates are thoroughly keyed, well- bounded and firmly set in its full depth.

c) Tolerance

The finished sub-base/ base at any point shall not vary more than 15mm below and 12mm above the planned grade or adjusted grade with 3m straight edge applied to the surface parallel to the centreline of the road. With the template laid transversely the maximum permissible variation from specified profile shall be 12mm and 8mm respectively.

The sub-base/ base course completed in each day's work shall have an average thickness not less than the required thickness.

Sub-base/ base course which does not conform to the above requirements shall be reworked.

11.4 BITUMINOUS MATERIALS

11.4.1 Materials

Materials shall meet the requirements of the relevant IS Codes. These shall be of the following types.

d) Cut back Bitumen

Cut back bitumen shall be Rapid Curing (RC), Medium Curing (MC) or Slow Curing (SC) conforming to IS : 217.

e) Cationic Emulsion

Bitumen emulsions of the cationic type for roads shall conform to IS: 8887. Emulsified bitumen shall be Rapid Setting (RS), Medium Setting (MS), or Slow Setting (SS).

The physical and chemical requirements of the three types emulsions shall comply with the requirements specified in Table 1 of IS: 8887.

f) Paving Bitumen

Paving bitumen shall be conforming to IS: 73 and of the following two types:

Type 1 Paving bitumen from non-waxy crude shall satisfy the requirements given in Table 1 of IS: 73.

Type 2 Paving bitumen from waxy crude shall satisfy the requirements given in Table 2 of IS: 73.

The temperature at application of bituminous materials shall be maintained as per manufacturer's instructions and/or as directed by the Engineer's Representative.

An anti-stripping and bonding agent should be used in all final restoration road works. It should conform to IS: 14982-2001 Specifications. The percentage can be from 0.5% to 1.25% by weight of bitumen content. The optimum dose can be ascertained using M.O.S.T. / BIS guidelines.

11.4.2 Methods of Storage and Handling

Asphaltic material shall be handled and stored with due regard for safety and in such a way that at the time of use in the work the material conforms to the Specifications. Following precautions shall be taken while using these materials:

- a) Work with these materials shall be carried out in good weather conditions and it shall be carried out in warm and dry weather, and not in wet or extremely cold weather.
- b) Emulsified asphalt shall be handled with care and not subjected to mechanical shocks or extremes of temperature likely to cause separation of the asphalt. Emulsified asphalt showing signs of separation shall not be used.
- c) During heating, no water or moisture shall be allowed to enter the boiler.
- d) Heating of bitumen shall be done to the correct temperature range, as prescribed by the manufacturer for the grade used. The temperature shall be controlled with the use of a suitable thermometer, and the material shall be drawn and used while still at such temperature as is prescribed by manufacturer or in accordance with MOST specifications.
- e) It shall be ensured that mixing of ingredients is thorough and all particles of aggregates are coated uniformly and fully.

11.5 PRIME COAT

11.5.1 Description

This work shall consist of the cleaning and preparing of the surface to be primed to

specified lines, grade, and cross-section, booming and clearing thoroughly and applying bituminous material in accordance with these Specifications.

11.5.2 Materials

The choice of the primer shall depend upon the porosity characteristics of the surface to be primed. The primer shall be Medium Curing Cutback (MC) and the particular grade to be used for the work shall have the consent of the Engineer. Slow setting Cationic emulsion conforming to IS: 8887 may also be used. Sampling and testing of bituminous primer shall be as per IS: 217, IS : 454 and IS : 8887.

11.5.3 Construction Methods

a) Weather Limitations

Prime coat shall not be applied at a time when the surface is wet or when the weather is foggy, rainy or windy.

b) Equipment

The equipment used for the work shall include a power broom and primer material distributor spraying it uniformly at specified rates and temperatures. It shall be equipped with self- heating arrangement, suitable pump, adequate capacity compressor and spraying bar with nozzles having constant volume or pressure system.

Spraying by manual methods may be allowed for inaccessible or small areas with the consent of the Engineer.

c) Cleaning Surface

Immediately prior to applying the prime coat the surface to be primed shall be swept clean from all loose dirt and other objectionable material and shall be shaped to the required lines, grades, cross section.

d) Application of bituminous primer

The primer material shall be applied by means of a distributor at rates usually from 0.8 to 1.4 litres per square metre and at a temperature within the allowable range corresponding to the material used and porosity condition of surface over which it is laid. The temperature of primer at time of application may vary from 40 °C to 60 °C for cutback bitumen and 40 °C to 60 °C for bitumen emulsion

Prime coat shall be allowed to penetrate for at least 48 hours to allow penetration into the base course and aeration of volatile from the primer material, then covered with clean dry sand or stone screening.

Areas containing an excess or deficiency of priming material shall be corrected by the addition of sand or primer.

11.6 TACK COAT

11.6.1 Description

This work shall consist of furnishing and applying bituminous material to an existing road surface or to an existing bituminous prime coat surface which has dried out or preparatory to laying another bituminous layer over it.

11.6.2 Materials

The material for tack coat shall be a bituminous or cut back emulsion of suitable type and grade.

11.6.3 Construction Methods

a) Cleaning Surface

The whole surface on which the tack coat is to be applied shall be cleaned of dust and any extraneous material before the start of application of tack coat by using a power broom or any other equipment/ method.

b) Application of tack coat material

The tack coat material shall be applied uniformly by means of a distributor at controlled rates as per MORTH specifications and at the temperature within the allowable range corresponding to the material used It shall be done with self-propelled or towelled bitumen.

The surfaces of structures and trees adjacent to the areas being treated shall be protected in such a way as to prevent their being spattered or marred.

11.7 BITUMINOUS MACADAM

11.7.1 Description

The work shall consist of one or more applications of compacted crushed aggregates premixed with bituminous binder (suitable grade) to a primed non-bituminous surface or previously constructed bituminous surface and in conformity with the lines, grades, dimensions and cross-sections shown on the Drawings This shall comprise of a single course of 50mm to 75mm thickness as specified in the approve or as Directed by Engineer.

11.7.2 Materials

a) Bitumen

The bitumen shall be paving bitumen of suitable grade approved by the Engineer and conforming to IS: 73.

b) Additives

Adhesion and Ant-stripping agent shall be added to the bitumen subject to Engineer's consent at the required percentage of additive. The additive shall be thoroughly mixed with the bituminous material in accordance with the manufacturer's instructions.

c) Aggregates

Aggregates shall consist of clean and hard crushed stone free from dust, clay, dirt and any other deleterious matter. The physical requirements shall be as given in Table 11.7.1.

Aggregates shall conform to one of the two gradings given in Table 11.7.2 depending on the compacted thickness; the actual grading shall have the consent of the Engineer.

Table 11.7.1

Physical requirements of aggregates for bituminous macadam

S. No	Test	Test Method	Requirement (maximum)
1	* Los Angeles Abrasion value	IS :2386 (Part-4)	40 per cent
2	* Aggregate Impact value	IS :2386 (Part-4)	30 per cent
3	Flakiness Index and Elongation Indices (Total)	IS: 2386(Part-1)	30 per cent
4	Coating and Stripping of Bitumen aggregate mixtures	AASHTO T-182	Minimum retained coating 95%
5	Soundness: (i) Loss with Sodium Sulphate 5 cycles (ii) Loss with Magnesium Sulphate 5 cycles		12 percent 18 percent
6	Water absorption	IS: 2386(Part-3)	2 per cent

* Aggregates may satisfy requirements for either of the two tests.

Table 11.7.2

Aggregate grading for bituminous macadam

IS Sieve Designation	Per cent by weight passing the sieve	
	Grading 1	Grading 2
45.0mm	100	-
26.5mm	75-100	100
22.4mm	60-95	75-100
11.2mm	30-55	50-85
5.6mm	15-35	20-40
2.8mm	5-20	5-20
90.0 micron		

Bitumen content for premixing shall be 4% by weight of total mix unless otherwise approved by Engineer.

11.7.3 Construction Methods

a) Weather and Control of Work

The work of laying shall not be undertaken during rainy or foggy weather or when the base course is damp or wet, or during dust storm or when the atmospheric temperature in shade is 15 °C or less.

The Engineer may order work to cease temporarily on account of adverse weather, unsatisfactory condition of materials, equipment or any conditions which he considers may affect the work adversely.

b) Cleaning and Preparation of Surface

Prior to the application of binder, loose dirt and other objectionable material shall be removed from the surface to be treated by means of the power broom or blower or both. If this does not provide a uniformly clean surface, additional sweeping shall be done by hand, using stiff brushes or similar brooms. The areas inaccessible to the cleaning means shall be cleaned manually. The sweeping shall extend 200mm beyond each edge of the area to be treated.

Adherent patches of objectionable material shall be removed from the surface by steel scraper or other approved method and where the Engineer so directs the scraped area shall be washed down with water and hand brooms.

No application of bituminous material shall be undertaken until the surface has been cleaned to the satisfaction of the Engineer.

Before application of the bituminous material any necessary preliminary patching of the surface of the road (To fill in potholes.) shall be done to the complete satisfaction of the Engineer.

Tack coat shall be applied in accordance with these Specifications. Prime coat if required, shall conform to Subsection 11.5.

c) Plant and Equipment

All plants used by the Contractor for the preparation, hauling and placing of asphalt mixtures shall be subject to the consent of the Engineer and shall minimize smock, dust and noxious emission and odours. These shall generally meet the following requirements:

- i. The mixing plant shall be a batching plant and shall have adequate capacity sufficient to supply the finisher on the road continuously when spreading the asphaltic mix at normal speed and required thickness.
- ii. The scale for any weigh box shall be designed to be accurate to within 1% of the maximum load required and shall be fully automatically controlled.

The Contractor shall provide and have at hand not less than ten 25 kilograms weights for frequent testing of all scales.

- iii. Weigh box or hopper shall include a means for accurately weighing each bin size of aggregate in a weight box or hopper, suspended on scales, ample in size to hold a full batch without running over.
- iv. The asphaltic materials shall be stored in storage tanks designed to keep the temperature of the asphaltic material at maximum temperature of 110 °C. The properties of the asphaltic material kept in that storage tanks shall be in good condition before mixing.

The plant shall be provided with a circulating system to ensure continuous circulation between the storage tank and the mixer.

- v. The plant shall be provided with a cold bin for feeding the aggregates. Bin shall have a calibration gate and a mechanical means to ensure uniform feeding of the aggregates into the drier as required by the Engineer.

- vi. The rotary drier shall be capable of drying and heating the aggregates to the specified temperature.
 - vii. The plant shall be provided with plant screens capable of screening all aggregates to the specified sizes.
 - viii. The plant shall include at least 3 hot bins for storing the aggregates fed from the drier after passing through the screen. Each bin shall be provided with an overflow pipe to prevent any backing up of material into other bins.
 - ix. The plant shall be provided with asphaltic control unit by weighing to obtain the proper amount of asphaltic material in the mix within the tolerance specified for the job-mix.
 - x. The batch mixer shall be an approved twin pugmill type and capable of producing a continuous uniform mixture within the job-mix tolerances. The mixer capacity shall not be less than 1,000-kilogram batch.
 - xi. An armoured thermometer reading from 50 °C to 200 °C shall be fixed in the asphaltic feed line at a suitable location near the discharge valve at the mixer unit.

The plant shall be further equipped with an electric pyrometer, or other approved thermometric instrument so placed at the discharge chute of the drier as to register automatically or indicate the temperature of the heated aggregate.
 - xii. The plant shall be equipped with a dust collector.
 - xiii. The plant shall be equipped with accurate positive means to govern the time of mixing and to maintain it constant. The time of mixing shall be divided into two steps, dry mixing and wet mixing. For dry mixing, the aggregate from hot bins shall be mixed for a period of 5-15 seconds. For wet mixing, the mixing time shall begin with the start of the asphalt spray after dry mixing. The wet mixing shall take about 30-45 seconds. The mixing time shall be extended if in the consideration of the Engineer the material obtained is not homogeneous.
- d) Equipment for Hauling and placing
- i. Trucks for hauling asphaltic mixtures shall have tight, clean, and smooth metal beds that have been sprayed with soapy water, thinned fuel oil, or lime solution to prevent the mixing from adhering to the beds (The amount of sprayed fluid shall however be kept to the practical minimum. Each load shall be covered with a canvas or other suitable material of such size as to protect the mixture from the weather). Any truck causing excessive segregation of material by its spring suspension or other contributing factors, or that shows oil leaks in detrimental amounts, or that causes undue delays, shall upon direction of the Engineer be removed from the work until such conditions are corrected.

- ii. The equipment for spreading and finishing shall be mechanical, self-powered pavers, capable of spreading and finishing the mixture true to the lines, grades, dimensions and cross sections.

The pavers shall be equipped with hoppers and distributing screws of the reversing type to place the mixture evenly.

The pavers shall maintain trueness of grade and confine the edges of the pavement to true lines without the use of stationary side forms. The equipment shall include blending or joint levelling devices for smoothing and adjusting longitudinal joints between lanes. The assembly shall be adjustable to give the cross-section shape prescribed and shall be so designed and operated as to place the thickness or weight per square metre of material required.

Pavers shall be equipped with activated screeds and devices for heating the screeds to the temperature required for the laying of the mixture without pulling or marring.

The term “screed” includes any cutting, crowing, or other practical action that is effective in producing a finished surface of the evenness and texture specified, without tearing, shoving, or gouging.

If, during construction, it is found that the spreading and finishing equipment in operation leaves in the pavement surface tracks or indented areas or other objectionable irregularities, the use of such equipment shall be discontinued, and other satisfactory spreading and finishing shall be provided by the Contractor forthwith.

- e) Preparation and transport of mix

The Bituminous macadam mix shall be prepared in a hot-mix plant either owned by the Contractor or it may be taken from an approved hot mix plant before supply of mix for the work, consent for the use of the mix shall be taken from the Engineer. The hot-mix plant should be of adequate capacity of batch mix type with the features as approved by the Engineer unless some work specific features are required and capable of yielding a mix of proper and uniform quality with thoroughly coated aggregates. The plant shall meet the overall requirements through stringent quality control practices.

The mineral aggregates shall be dried and heated to a temperature between 150 °C and 163 °C. The contractor shall submit for consent the exact temperature to the Engineer. The surfaces of aggregates shall be clean and free of carbon and unburnt fuel oil. The aggregates, immediately after heating, shall be screened into three or more fractions and conveyed into separate bins ready for combining and mixing with asphaltic material.

The dried mineral aggregates prepared as prescribed above shall be combined in the

plant in the amount of each fraction of aggregate required to meet the job-mix formula for the particular mixture. The proper amount of asphaltic material shall be distributed over the mineral aggregate and the whole thoroughly mixed for a period of at least 30 seconds, or longer if necessary to produce a homogeneous mixture in which all particles of the mineral aggregates are coated uniformly. The total mixing time shall be regulated by a suitable locking means.

The mixture shall, when emptied from the mixer, be at a temperature between 150 °C and 163 °C even for tolerances.

The mixture shall be transported from the mixing plant to the point of use in vehicles conforming to the requirements of Subsection 11.7.3 (4)(a) unless otherwise approved by the Engineer.

f) Application of the Pre-mix

The application of the mix shall proceed immediately after application of tack coat. The mix shall be spread immediately by means of self-propelled mechanical paver with suitable screeds capable of spreading, tamping, and finishing the mix true to lines, levels, dimensions and cross-sections specified. Any bare or insufficiently filled areas shall be re-treated by the mechanical spreader or covered by hand as necessary to give uniform and complete coverage. Any aggregate spread in excess of the agreed rate shall be scattered and evenly distributed on the road or otherwise removed and stockpiled.

The temperature of the mix at the time of laying shall be in the range of 120 to 160 °C.

g) Rolling

After the spreading of the mix, the rolling shall be done by road roller of suitable type and capacity. Rolling shall start as soon as possible after the material has been spread and it shall be completed within a limited time frame, and to meet this, the Contractor shall deploy a set of rollers. Rolling shall be done with care to avoid unduly roughening of the pavement surface. It shall commence at the edges and progress towards the centre longitudinally except that on super-elevated and unidirectional cambered portions, it shall progress from the lower to the upper edge parallel to the centre line of the pavement.

The speed of the rollers shall not exceed 5 kilometre per hour for steel wheeled rollers and 7 kilometre per hour for pneumatic tired rollers and shall be at all times slow enough to avoid displacement of the hot mixture. Any displacements occurring as a result of reversing the direction of the roller or from any other cause shall at once be corrected with rakes and fresh mixture where required. Care shall be exercised in rolling not to displace the line and grade of the edges.

Rolling shall progress continuously as may be necessary to obtain uniform compaction while the mixture is in a workable condition and until all roller marks are eliminated.

Heavy equipment or rollers shall not be permitted to stand on the finished surface until it has thoroughly cooled or set.

Any petroleum products dropped or spilled from the vehicles or equipment employed by the Contractor upon any portion of the pavement under construction is cause for the removal and replacement of the contaminated pavement by the Contractor.

When the roller has passed over the whole area once, any high spots or depressions which become apparent shall be corrected by removing or adding premixed material. Rolling shall then be continued until the entire surface has been rolled to 95% of the average laboratory density, and there is no crushing of aggregates. and all roller marks are eliminated. In each pass of the roller, preceding track shall be overlapped uniformly by at least $1/3^{\text{rd}}$ width. The roller wheels shall be kept damp to prevent premix from adhering to the wheels and being picked up. In no case shall fuel/ lubricating oil be used for this purpose.

Along kerbs, manholes etc., and at any other locations where proper consolidation by rollers is not practicable, alternative means such as steel rammers shall simultaneously be used to secure adequate consolidation.

11.7.4 Surface Control

a) Surface Regularity

Maximum permissible undulation in longitudinal profile with 3m straight edge shall be as 12mm.

Maximum permissible variation from specified cross profile under camber template shall be as 8mm.

Surface evenness requirements in respect of both longitudinal and cross profiles should be simultaneously satisfied.

Tests for conformity with the specified crown and grade shall be made immediately after initial compaction, and variations shall be corrected by removing or adding materials as may be necessary. Rolling shall then be continued as specified. After final rolling, the smoothness of the course shall be checked again and any irregularity of the surface exceeding the permissible limits corrected as agreed by the Engineer's Representative, including removal and replacement.

b) Surface Finish

The bituminous macadam shall be covered with either the next pavement course or wearing course, as the case may be, without any delay. If there is to be any delay, the course shall be covered with the seal coat. The seal coat in such cases shall be considered incidental to the work and shall not be paid separately.

11.8 OPEN-GRADED PRE-MIX CARPET

11.8.1 Description

This work shall consist of laying and compacting an open-graded carpet generally of 20mm thickness or as otherwise specified in a single course composed of suitable small sized aggregates premixed with a bituminous binder on a previously prepared base to serve as a wearing course.

11.8.2 Materials

a) Binder

Binder shall be bitumen of suitable grade meeting the requirements of the work and other environmental conditions. This shall be conforming to the requirements of IS : 73, IS : 217 and IS : 454 or other approved cut back bitumen as applicable.

b) Coarse aggregates

Coarse aggregates consist of crushed stones and shall be clean, strong, durable, and free from organic or other deleterious materials. The aggregates shall be hydrophobic and of low porosity. If hydrophilic aggregates are to be used, bitumen shall preferably be treated with anti-stripping agents of approved quality in suitable doses.

The aggregates shall meet the requirements given in Table 11.7.1 except that the water absorption shall be limited to 1 per cent. The Stone Polishing Value as measured by BS : 812-(Part-114) shall not be less than 55.

c) Proportioning of Materials

They shall comprise of a mix of stone chipping 13.2mm size (passing 22.4 mm sieve and retained on 11.2 mm size) and 11.2 mm size (passing 13.2 mm sieve and retained on 5.6 mm sieve.)

The contractor shall propose material proportions to the Engineer for his consent.

11.8.3 Construction Methods

a) Weather and Control of Work

This shall be as carried out per Subsection 11.7.3(1).

b) Cleaning and Preparation of Surface

This shall be as carried out per Subsection 11.7.3(3).

c) Tack Coat

This shall be applied as per Subsection 11.6.

d) Preparation and transport of Premix

The binder shall be heated to a temperature appropriate to the grade of bitumen in boilers of suitable design avoiding local overheating and ensuring a continuous supply.

The aggregates shall be dry and suitably pre-heated to the required temperature before they are placed in a mixer. After about 15 seconds of dry mixing, the heated binder shall be distributed over the aggregates at the rate specified. Mixing shall be continuous and thorough to ensure a homogeneous mixture in which all particles are coated uniformly, and the discharge temperature shall be within the specified range.

The mixing of binder with chippings shall be continued until the chippings are thoroughly coated with binder. The mix shall be discharged and immediately transported from mixer to the point of use in suitable vehicles or wheelbarrows. The vehicles employed for transport should be clean and the mix being transported should be covered in transit and protected from any kind of damage.

e) Spreading and Rolling

Immediately after the application of tack coat, premixed material shall be spread by means of mechanical paver finisher truly to lines, levels, dimensions and cross section as specified. The areas not covered by the mechanical means shall be treated with manual means for which the Engineer has given his consent.

f) Rolling

This shall be carried out as per Subsection 11.7.3(7)

11.9 BITUMINOUS CONCRETE

11.9.1 Description

This work shall consist of a surfacing of single-layer bituminous concrete of specified thickness on previously prepared bituminous surface to the lines, grades, dimensions and cross section as shown on Drawings. It shall be 25mm/40mm thick as required by Engineer.

Materials

g) Bitumen

The bitumen shall be paving bitumen of suitable penetration grade within the range S 35 to S 90 or A 90 to IS: 73. The actual grade of bitumen to be used shall be appropriate to the requirements of the work and environmental conditions.

h) Coarse aggregates

The aggregates shall satisfy the physical requirements given in Table 11.7.1. Flakiness index shall not exceed 30% and water absorbed not more than 1%

i) Fine aggregates

Fine aggregates shall be the fraction passing 2.36 mm sieve and retained on 75-micron sieve, consisting of crushed run screenings, natural sand or a mixture of both. These shall be clean, hard, durable, uncoated, dry and free from any injurious, soft or flaky pieces and organic or other deleterious substances.

j) Filler

Filter shall consist of finely divided mineral matter such as rock dust, hydrated lime or cement. The filter shall be graded within following limits:

IS Sieve	Per cent passing by weight
600 micron	100
300 micron	95 – 100
75 micron	85 – 100

The filter shall be free from organic impurities and have a Plasticity Index not greater than 4. The Plasticity Index requirement shall not apply if filter is cement or lime. When coarse aggregate is gravel, 2 per cent of mass of total aggregate of Portland cement or hydrated lime shall be added and percentage of fine aggregate reduced accordingly. Cement or lime is not required when the gravel is limestone.

k) Aggregate gradation

Mineral aggregates, including filler shall be so graded or combined as to conform to gradings set forth in Table 11.9.1 below.

Table 11.9.1

Sieve Designation	Per cent by weight passing through sieve for		
	25mm thick Grade 1	25-40mm thick Grade 2	>40mm thick Grade 1
26.5mm	--	--	100
22.4mm	--	100	75-100
13.2mm	100	80-100	--
11.2mm	90-100	75-95	50-85
5.6mm	60-80	55-75	20-40
2.8mm	40-55	40-55	20-May
710micron	20-30	20-30	--
300micron	15-25	15-25	--
180micron	20-Oct	20-Oct	--
90micron	11-May	11-May	0-5

11.9.2 Mix Design

a) Requirement of Mix

Apart from conformity with grading and quality requirements of individual ingredients, the mix shall also meet the requirements set forth in Table 11.9.2.

Table 11.9.2

Requirements of Bituminous Concrete Mix

S.NO	Description	Requirements
1	Marshall stability (ASTM Designation : D-1559) determined on Marshall specimens compacted by 75 compaction blows on each end	820 Kg (1800 pounds)
2	Marshall flow (mm)	Minimum 2-4
3	Per cent air voids in mix	5-Mar
4	Per cent voids in mineral aggregate (VMA)	Minimum 11-13
5	Percent voids in mineral aggregates filled by bitumen (VFB)	65-75
6	Binder content, per cent by weight of mix	Minimum 4.5
7	Water sensitivity (ASTM: D-1075) loss of Stability on immersion in water at 60 deg. C	Minimum 75% Retained strength
8	Swell Test (Asphalt Instt. MS-2, No. 2)	Maximum 1.5%

b) Binder content

Binder content shall be so determined as to achieve the requirements of the mix set forth in Table 15.9.2. Marshall method for arriving at binder content shall be adopted.

c) Job Mix Formula

Before starting work the Contractor shall submit to the Engineer for his consent. The job mix formula for the mixture shall fix a single percentage of aggregate passing each required sieve size, a single percentage of asphalt to be added to the aggregate, and a single temperature at which the mixture is to be delivered on the road, all of which shall fall within the ranges of the composition and the temperature limits. The formula shall give the following details:

- I. Source and location of all materials
 - II. Proportions of all materials as described under:
 - a) Binder - as percentage by weight of total mix
 - b) Coarse aggregate/Fine aggregate/ Mineral Filler - as percentage by weight of total aggregate including Mineral Filler
 - III. A single definite percentage passing each sieve for the mixed aggregate (Vide Table 11.9.1)
 - IV. The results of test as per specifications obtained by the contractor
 - V. Test results of physical characteristics of aggregates to be used
 - VI. Mixing temperature and compacting temperature
- d) Application of job-mix formula and Allowable Tolerances

The approved job mix formula shall remain effective unless and until modified. Each day as many samples of the materials and mixtures shall be taken and tested considered necessary for checking the required uniformity of the mixture.

All mixtures furnished shall conform to the job-mix formula within the range of tolerances set in forth in Table 11.9.3.

Table 11.9.3

Permissible variations from the job-mix formula

SL No	Description of Ingredients	Permissible Variation by Weight of Total mix in Percentage
1	Aggregate passing 13.2mm sieve and larger	±8

SL No	Description of Ingredients	Permissible Variation by Weight of Total mix in Percentage
2	Aggregate passing 9.5mm sieve and 4.75mm sieve	±7
3	Aggregate passing 2.36mm sieve & 1.18mm sieve	±6
4	Aggregate passing 600 micron sieve & 300 micron sieve	±5
5	Aggregate passing 150-micron sieve	±4
6	Aggregate passing 75-micron sieve	±3
7	Binder	±0.3
8	Mixing Temperature (Centigrade)	±10

When unsatisfactory results or changed conditions make it necessary, a new job mix shall be submitted to the Engineer.

Should a change in a material be encountered or should a change in a source of material be made, a new job mix formula shall be submitted before the mixture containing the new material is delivered.

11.9.3 Construction Methods

a) Weather Limitation

The control over the weather conditions shall be as described under Subsection 15.7.3 (1) above.

b) Progress of Work

No work shall be performed when there is insufficient hauling, spreading or finishing equipment, or labour to ensure progress at a rate not less than 75% of the capacity of the mixing plant.

c) Preparation of Existing Surface

The surface on which the mix is to be laid shall be swept thoroughly and cleaned of all loose dirt and other objectionable material using mechanical broom immediately before start of work. In portions where mechanical means cannot reach, the surface shall be prepared, shaped and conditioned to specified levels, grade and cross-fall (camber).

d) Preparation of Mix

A Hot-mix plant of adequate capacity and capable of producing a proper and uniform quality mix shall be used for preparing the mix. The plant may be either a

weigh batch type or volumetric proportioning continuous or drum mix type. The plant shall have a coordinated set of essential units capable of producing uniform mix as per the job-mix formula.

The temperature of the binder at the time of mixing shall be in the range of 150 to 163 °C and of aggregates in the range of 155 to 163 °C, provided also that at no time shall the difference in temperature between the aggregates and binder exceed 14 °C. The Contractor shall submit the exact temperatures and total mixing time with the consent of the Engineer.

Mixing shall be thorough to ensure that a homogeneous mixture is obtained in which all particles of mineral aggregates are coated uniformly.

e) Transportation and Delivery of Mix.

The mix shall be transported from the mixing plant to the point of use in suitable tipper vehicles. The vehicles employed for the transport shall be clean and be covered in transit.

f) Spreading and Finishing

The mix transported from the hot mix plant to the site and shall be spread by means of a self-propelled mechanical paver with suitable screeds capable of spreading, tamping and finishing the mix to specified grade, elevation, and cross-section. However, in restricted locations and narrow widths, where available equipment cannot be operated, other suitable means shall be employed subject to the consent of the Engineer. The mixture shall be laid upon an approved surface and only when weather conditions are considered suitable. The temperature of the mix, at the time of laying, shall be in the range of 120 °C to 160 °C.

The prime coat and tack coat to be applied shall be as per Subsections 11.5 and 11.6 respectively.

Spreading, finishing and compacting of the mix shall be carried out during daylight hours only, unless satisfactory illumination is provided by the Contractor.

g) Compaction of Mixture

Immediately after spreading of mix by paver, it shall be thoroughly and uniformly compacted by rolling with a set of self-propelled rollers moving at a speed not more than 5 km per hour, immediately following close to the paver. Generally, with each paver, two steel wheeled tandem rollers and one pneumatic tired roller will be required. The initial or breakdown rolling shall be with 8-to-10-ton static weight smooth three wheeled steel roller and finish rolling with

6-to-8-ton tandem roller. The breakdown rolling shall preferably be followed by an intermediate rolling with a smooth wheel pneumatic roller of 10 to 25 ton having a

tire pressure of 7kg/sqcm moving with a speed not more than 7 km per hour and shall be at all times slow enough to avoid displacement of the hot mixture. Means shall be provided for checking and adjusting the tire pressure on the job at all times. All compaction operations, i.e., breakdown rolling can be accomplished by using vibratory roller of 8 to 10 ton static weight. During initial or breakdown rolling and finished rolling, the vibratory shall be switched off. The joints and edges shall be rolled with a 8 to 10 ton three wheeled static roller.

No delays in rolling the paved surface shall be tolerated, the breakdown roller must be right up to the paver at all times and the intermediate pneumatic roller right up to the breakdown roller. The compaction of the asphaltic concrete shall be controlled by temperature as follows:

<u>Roller</u>	<u>Temperature</u>
Breakdown	1200 °C – 135 °C
Pneumatic	95 °C – 115 °C
Finishing	< 65 °C

Rolling procedure shall be as specified under Subsection 11.7.3 (7).

Rolling shall be continued till the density achieved is at least 98% of that of laboratory Marshall specimen. Rolling operations shall be completed in all respects before the temperature of the mix falls below 100 °C.

h) Joints

Both longitudinal and lateral joints in successive courses shall be staggered so as not to be one above the other. Longitudinal joints and edges shall be constructed true to delineating lines parallel to the centre line of the road. Longitudinal joints shall be offset by at least 150mm from those in the lower course.

Longitudinal and transverse joints shall be made in a careful manner so that well bonded and sealed joints are provided for the full depth of the course.

i) Surface regularity

Surface shall be tested for undulations in longitudinal and cross profiles with 3 m straight edge and crown template respectively. Crown template shall conform to the typical cross section.

Maximum permissible undulation in longitudinal profile with 3m straight edge shall be as 8mm.

Maximum permissible variation from specified cross profile under camber template shall be as 4mm.

Surface evenness requirements in respect of both longitudinal and cross profiles should be simultaneously satisfied.

- j) Protection of the pavement from traffic

Subsection 15.1 shall apply except as stated below.

Section of the newly finished works shall be protected from traffic of any kind until the mixture has cooled to approximately ambient air temperature and well set.

11.10 SEAL COAT

11.10.1 Description

This work shall consist of application of a seal coat for sealing the voids in a bituminous surface laid to the specified levels, grade, and cross fall. Seal coat used shall be of premix type unless otherwise approved by the Engineer.

11.10.2 Materials

- a) Binder

The binder shall be bitumen of a suitable grade appropriate to the requirements of the work and other environmental conditions as directed by the Engineer and satisfying the requirements of IS : 73, 217, 454 or other cut back as applicable.

- b) Aggregates

The aggregates shall be sand or grit and shall consist of clean, hard, durable, dry particles and shall be free from dust, soft or flaky/ elongated material, organic matter or other deleterious substances. The aggregates shall pass 2.36mm sieve and be retained on 180-micron sieve. The quantity used for premixing shall be 0.06 cum per 10 sq m area.

11.10.3 Construction Methods

- a) Preparation of base

The seal coat shall be applied immediately after laying of bituminous course which is required to be sealed. Before application of seal coat materials, the surface shall be cleaned free of any dust or other objectionable matter.

- b) Preparation and Application of Mix

Mixtures of approved type shall be employed for mixing aggregates with suitable bituminous binder.

The binder shall be heated in boilers of suitable design, to a temperature appropriate to the grade of bitumen. The aggregates shall be clean, dry and suitably heated to a temperature before the same are placed in the mixture. Mixing of binder with

aggregates to specified proportions shall be continued till the latter are thoroughly coated with the former.

The mix shall be immediately transported from the mixing plant to the point of use and spread uniformly on the bituminous surface to be sealed.

c) Rolling

As soon as sufficient length has been covered with pre-mixed material, the surface shall be rolled with 8–10-ton smooth wheeled steel, suitable vibratory or other equipment.

As regards the procedure for rolling it shall be as specified under Subsection 11.7.3 (7).

d) Control of Traffic Subsection 11.1 shall apply.

11.11 CEMENT CONCRETE PAVEMENTS

11.11.1 General

This work shall consist of constructing Plain/ or Reinforced Cement Concrete Pavements as required in accordance with these Specification and in conformity with the lines, levels, grades and dimension in accordance with the design.

11.11.2 Materials

a) General

The concrete materials viz. cement, aggregates, water, steel reinforcement, admixtures shall be in accordance with Section 3 (Concrete: Plain and Reinforced) except as specified herein.

b) Dowel and Tie bars

Dowel bars shall be plain round bars. They shall be free from burring or other deformation restricting slippage in the concrete. Before delivery to the Works, one half of the length of each dowel bar shall be painted with one coat of bituminous material.

Tie bars shall be deformed bars free from oil, dirt, loose rust and scale.

These shall conform to the requirements of IS: 432, IS : 1139 and IS : 1786 as relevant.

c) Sleeves

The sleeves for dowel bars of expansion joints shall be of plastic material. This shall be designed to cover the dowels specified by the Designer, with a closed end, and

with a suitable stop to hold the end of the sleeve a distance equal to the thickness of joint filler or at least 30mm from the end of the dowel bar. These shall be of such design that they do not deflect or collapse during construction, and the arrangement of sleeves shall be in accordance with these Specifications.

d) Waterproof Membrane

Where Waterproof membrane is to be provided, it shall be an impermeable polythene plastic sheeting. Where an overlap of underlay material is necessary this shall be at least 300mm. Water shall not be allowed to pond on the membrane which shall be completely dry when the concrete is laid.

e) Jointing Materials

i. Joint Filler

The expansion joint fillers shall conform to the requirements of IS: 1838. They shall be punched to admit the dowels where called for as specified by the Designer. The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint. When the use of more than one piece is authorized for a joint, the abutting ends shall be fastened closely together securely and accurately to shape by stapling or other satisfactory positive fastening.

ii. Joint Primer

The joint primer shall be fully compatible with the joint sealant and shall be applied strictly in accordance with the manufacturer's instructions.

iii. Joint Sealing Compound

The Sealing Compound of hot poured, elastomeric type shall conform to AASHTO M282 and cold applied sealant shall be in accordance with BS 5212 (Part 2).

11.11.3 Equipment and Tools

a) General

The concrete paving shall be carried out by use of mechanised method. Equipment and tools necessary for handling materials and performing the work shall have the consent of the Engineer as to design, type, capacity and mechanical, condition shall be at the site of the work before work is started. In special cases like a very short length of road to be laid at a location, other methods may be approved by Engineer.

b) Batching and Mixing Plant

This shall be of suitable type, capacity and make meeting the requirements of work.

c) Paving Equipment

The concrete shall be placed with an approved fixed form or slip form paver with independent units designed to (i)spread, (ii)consolidate, screed and float finish, (iii)texture and cure the freshly placed concrete in one complete pass of the machine in such a manner that a minimum of hand finishing will be necessary and so as to provide a dense and homogeneous pavement in conformity with the plans and Specifications.

Vibrators for full width vibration of concrete paving slabs may be either the surface pan type or the internal type. They may be attached to the spread finisher. They shall not come in contact with the joint, subbase or side forms.

The frequency of the surface vibrators shall not be less than 3500 impulses per minute and for the internal type not less than 5000 impulses per minute. The variable vibration setting shall be provided in the machine.

At least two spare vibrators and one generating unit shall be on hand in case of any breakdown of the vibrating equipment being used.

d) Concrete Saw for joint cutting

The mechanical saw for cutting concrete shall be adequately powered to cut rapidly with a water-cooled diamond edge saw blade to the depth required. A water tank with flexible hoses and pump shall be made available in this activity on a priority basis. The Contractor shall have at least one standby saw in good working condition.

e) Forms

Straight side forms shall be metal forms having a thickness of at least 5mm and have a depth equal to the prescribed edge thickness of the pavement slab.

Curved forms shall be of the radius called for as specified by the Designer and acceptable flexible forms shall be installed with that radius. Built-up forms with horizontal joints shall not be used. Forms shall be free from kinks, bends or wraps. Forms shall not deflect more than 6 mm when tested as a simple beam with a span of three metres under a load equal to that which the finishers or other construction equipment will exert on them. The top of the form shall not vary from a 3.0m straight edge by more than 3mm at any point and the side by more than 6mm at any point.

The forms shall contain provision for locking together tightly the ends of abutting from sections and for secure setting.

f) Curing Compounds

The curing compounds shall have a water retention efficiency index of 90% in accordance with BS 7542.

11.11.4 Construction Methods

a) Preparation of Sub-base

The sub-base, which shall generally be of water-bound macadam (WBM) conforming to Subsection 11.3. The subbase shall be wetted adequately or provided with a waterproof membrane so that it does not absorb any water from the concrete to be laid over it.

Concrete shall not be placed on any portion of the sub-base until the consent of the Engineer is given.

b) Setting Forms

The sub-base under the forms shall be compacted and cut to grade so that forms, when set to the position are within $\pm 3\text{mm}$ of a straight line formed by the top of the forms. If the sub-base is found to be below the required grade at the form line, the grade line shall be lifted by placing lean concrete mix 1:4:8 beneath the form and setting the form when it is set. Imperfections and variations above grade shall be corrected by tamping or cutting to the degree required.

The alignment and grade elevations of the forms shall be checked, and the necessary corrections made by the Contractor immediately before and after placing the concrete. When any form has been disturbed or any roadbed has become unstable, the form shall be reset and rechecked.

On final setting of the forms, these shall be checked for at least half the length of pavement to be concreted in a particular day before concreting commences on that day. While concreting long lengths, the setting up of forms to the exact grade and alignment shall be in advance of the concreting operation by at least 60 m.

Forms shall be cleaned and oiled prior to the placing of concrete. The forms shall be removed not earlier than 24 hours after the concrete has been laid.

c) Preparation of Concrete

i. Trial Mix / Mix Design

Subsection 11.2.1 shall be followed Minimum grade of concrete to be used is M25.

ii. Batching, Mixing and Transporting Materials Subsection 11.2.4 shall apply.

The Ready-Mixed Concrete (RMC) shall conform to Subsection 3.19.

d) Placing Concrete

Concrete shall be placed only on a prepared sub-base as specified in Subsection 11.11.4(1). No concrete shall be placed around structures until they have been brought to the required grade and alignment nor until expansion joint material has been placed around them.

The concrete shall be spread, compacted and finished by a mechanical paver and in accordance with Subsection 11.11.3 (3). The mixing and placing of concrete shall progress only at such a rate as to permit proper finishing, protecting and curing of the pavement.

The truck mixers, truck agitators and other approved hauling equipment shall be equipped with means for discharge of concrete into the hopper of the paver without segregation of the materials. In all cases, the temperature of the concrete shall be measured at the point of discharge from the delivery vehicle.

The acceptance criteria regarding level, thickness, surface regularity, texture, finish, strength of concrete and all other quality control measures for hand laid concrete shall be the same as in the case of machine laid work.

The concrete shall be thoroughly consolidated against and along the faces of all forms by means of vibrators inserted in the concrete. Vibrators shall not be permitted to come in contact with a joint assembly, the sub-base or a side form. In no case shall the vibrator be operated for longer than 30 seconds in any location. The vibrator shall be inserted in the concrete and worked along the full length and both sides of a joint.

Concrete shall be deposited as near to expansion and contraction joints as possible without disturbing them but shall not be dumped from the discharge bucket on to a joint assembly.

Except at construction joints, concrete shall be shovelled against both sides of the joint

simultaneously, maintaining equal pressure on both sides. It shall be deposited to a height of approximately 5 cm more than the depth of the joint and shall be vibrated so that all honeycombing and voids are prevented. The vibrator shall be inserted in the concrete and worked along the full length and both sides of the joints

e) Initial strike-off and Placement of Reinforcement

Where the concrete is laid in two layers, the bottom layer of concrete shall be struck off for the full width between longitudinal construction joint true to crown at the required distance below the finished surface elevation, for placement of reinforcement or for placement of a top layer of the required thickness.

The striking-off shall be accomplished by use of the finishing machine, unless some other approved device is allowed. The reinforcement shall be placed as called for by the Designer and pouring of concrete over it shall only be allowed after placement of reinforcement is proper in all respects and approved by the Engineer.

f) Joints

i General

Joints shall comply with the design approved for the construction.

A strip of the preformed expansion joint filler shall be placed around each structure which extends into or through the pavement before concrete is placed.

ii. Transverse Expansion Joints

These shall be formed at the design spacings. The material for a transverse joint shall be assembled at the roadbed, and placed into position as a unit.

iii. Transverse Contraction Joints

Transverse Contraction joints shall consist of planes of weakness created by forming or cutting grooves in the surface of the pavement. Transverse contraction joints shall also include load transfer dowel-bars where these are specified by the Designer.

The contraction joints shall be cut as soon as the concrete has undergone initial hardening and is hard enough to take up the load of joint sawing machine without causing damage to the slab. Grooves shall be at right angles to the centreline of the pavement and shall be true to line, subject to a tolerance of 5 mm in the width of the slab.

Any procedure for sawing joints that results in premature and uncontrolled cracking shall be revised immediately by adjusting the sequence of cutting the joints or the time interval involved between the placing of the concrete and cutting of the joints.

Load transfer assemblies for transverse contraction joints shall consist of dowel bars without sleeves and an approved auxiliary spacing and supporting element.

The assembly shall be placed into position so that the dowels are parallel to the centreline and shall be staked into position in such a way as to hold the assembly securely in position throughout construction.

iv. Longitudinal Joints

Longitudinal joints shall be constructed in conformity with the design. Planes of weakness shall be created by forming or cutting grooves in the surface of the pavement in accordance with the applicable provisions of this Section.

When adjacent lanes of pavement are constructed separately, steel side forms shall be used which will form a keyway along the construction joint. The bars may be bent at angles against the form of the first lane constructed and straightened into final position before the concrete of the adjacent lane is poured.

v. Transverse Construction Joint

Transverse construction joints shall be placed whenever concreting is completed after a day's work or is suspended for more than duration permissible for continuous pouring of concrete.

Joints shall be formed by placing installing bars or suitable bulkhead material so that a vertical face with approved key is formed or shall be butt joints formed with suitable material so that a vertical face is formed with no key. No tie bars shall be necessary when key joints are formed but dowel bars of the same dimensions and at the same spacing as for contraction joints shall be necessary at all butt joints.

g) Finishing

i Machine Finishing

As soon as the concrete has been placed, it shall be struck off and screeded by an approved finishing machine or tools to the grades and cross sections specified by the Designer and to a level slightly above grade so that when properly consolidated and finished the surface of the pavement will be at the exact level and grade. The machine or tool shall go over each area of pavement as many times and at such intervals as necessary to give the proper compaction and to leave a surface of uniform texture, true to grade and cross section.

Excessive operation over a given area shall be avoided. The tops of the forms shall be kept clean by an effective device attached to the machine and the travel of the machine on the forms shall be maintained true without lift, wobble or other variation tending to affect the precision finish.

After concrete has been placed on both sides of the joint and struck off, the installing bar or channel cap shall be slowly and carefully withdrawn, the concrete shall be carefully spaded, and additional freshly mixed concrete worked into any depression left by the removal of the installing bar.

A diagonal finishing machine shall be used if available.

ii. Hand Finishing

A portable screed shall be provided for use. The screed shall be at least 60 cm longer than the width of the slab to be struck off and consolidated. It shall be of approved shape, sufficiently rigid to retain its shape and constructed either of metal or of other material shod with metal. (If necessary, a second screed shall be provided for striking off the bottom layer of concrete).

The screed shall then be placed on the forms and slip along them, without lifting, in a combined longitudinal and transverse shearing motion moving always in the direction in which the work is progressing. If necessary, this shall be repeated until the surface is of uniform texture, true to grade and contour, and free from porous areas.

h) Edging at Forms and Joints

After the concrete's initial set, the edges of the pavement along each side of each slab, and on each side of transverse expansion joints, planes of weakness except when sawed transverse construction joints, and emergency construction joints shall be worked with an approved tool and rounded to a radius of 5 mm. A well defined and continuous radius shall be produced, and a smooth, dense mortar finish obtained. The surface of the slab shall not be unduly disturbed by tilting of the tool during use.

All joints shall be tested with a straight edge before the concrete has set, and correction shall be made if one side of the joint is higher than the other or if they are higher or lower than the adjacent slabs.

i) Surface Texture

The surface of the carriageway shall be textured by wire brushing in a direction at right angles to the longitudinal axis of the carriage-way. The pavement shall be given this broomed texturing as soon as surplus water has risen to the surface.

The wire brushes shall be either mechanically operated or manual methods may be allowed depending upon the type of paver being used on the Work. In either case the wire broom shall be not less than 450 mm wide with two rows of spring steel. At least two brooms in working order shall be on the site at all times.

The surface texturing shall be completed before the concrete is in such condition that the surface is torn or unduly roughened by the brooming. The broomed surface shall be free from rough areas, porous areas, irregularities, or depressions.

j) Surface Requirements

After the concrete has hardened sufficiently, the surface shall be given a further test for tureens, using an approved 3 m straight edge laid on the surface. Any portion of the surface, when tested in the longitudinal direction, which shows a variation or departure from the testing edge of more than 3.5mm but not exceeding 7mm shall be marked and immediately ground down with an approved grinding tool until the variation does not exceed 3.5mm.

Whenever the variation or departure from the testing edge is more than 7.0mm the

pavement shall be removed and replaced. Such removal shall be of the full depth and width of the slab and at least 3m long.

k) Curing

Immediately after the surface texturing, the surface and sides of the slab shall be cured by an approved curing method for not less than 7 days. During this period measures shall be taken to prevent the loss of moisture.

The concrete shall not be left exposed between stages of curing.

The surface shall be inspected regularly to ascertain the earliest time at which it is able to withstand the spreading of moisture retaining material. This shall be by ponding of water or spreading and wetting either two layers of burlap or two mats of cotton / jute or a layer of sand or other approved highly absorbent material. Whatever material is used it shall be kept continuously moist for not less than 7 days and to a degree which will ensure that 100% humidity is maintained adjacent to the concrete surface. A membrane curing compound meeting the requirements of BS 7542 may be used subject to the consent of the Engineer.

Concrete surfaces which are subjected to heavy rainfall within three hours after the curing compound has been applied shall be resprayed by the method and the coverage specified above.

Concrete surfaces to which membrane curing compounds have been applied shall be adequately protected for the duration of the entire curing period from the pedestrian and vehicular traffic, except as required for joint sawing operations and surfaces tests, and from any other cause which will disrupt the continuity of the membrane. The curing membrane so formed shall be maintained intact for a period of not less than 14 days. The entire surface shall be protected from the effects of solar radiation and in addition by the use of frames covered with material with heat and light reflecting properties.

Concrete liable to be affected by running water shall be adequately protected from damage during the setting period.

l) Removing Forms

Forms shall be removed only after the stipulated period and carefully so as to avoid damage to the pavement.

m) Protection of Pavement

The Contractor shall erect and maintain suitable barricades and shall employ

watchmen to exclude public traffic and that of his employees and agents from the newly constructed pavement until opened for use. These barriers shall be arranged as not to interfere with public traffic on any lane intended to be kept open and necessary signs and lights shall be maintained by the Contractor clearly indicating any lanes open to the public.

Where any stipulated public traffic lane is contiguous to the slab or lane being placed, the Contractor shall provide, erect, and subsequently remove a substantial temporary guard fence along the prescribed dividing line, which shall be maintained there and protected by signages until the slab is opened to traffic. The Contractor's plan of operation shall be such as to obviate any need for encroachment on the public traffic lane or lanes under use .

The same shall be approved by the local competent authority.

Any part of the pavement damaged by traffic or other cause prior to its final acceptance shall be repaired or replaced by the Contractor.

n) Sealing Joints

Before the pavement is opened to traffic, and as soon after the curing period as is feasible, all joints, both longitudinal and transverse, shall be filled with the material approved for use as seal.

Both primer and sealing compound shall be treated and applied strictly in accordance with the manufacturer's specifications/ instruction and by use of approved equipment.

The sealing material shall be poured into each joint opening as directed by the Engineer. The pouring shall be done in such a manner that the material will not be spilled on the exposed surfaces of the concrete. Any excess material on the surface of the concrete pavement shall be removed immediately and the pavement surface cleaned.

Section – S.12

BUILDING WORKS

12.1.1 General Requirements

12.1.2 Preambles to Outline Construction Specification

General

- a) For convenience, this document contains references to a variety of international standards which are included as indicative information only

Wherever practical Indian Standards [IS], Codes of Practice, etc. shall be utilized and take precedence

- b) The document and the individual clauses contained within it have been included for general and outline purposes only; - and, in consequence: -
- The contents are to be accepted as indicative only; and are to be reviewed, amended and developed, as deemed appropriate, to suit the formulated designs and site-specific requirements.
 - The contents, as included, are to be considered as limited in extent and overall scope; and shall be developed and expanded to specify the entirety and detail of the works.
 - Items included in this Outline Document may or may not be finally incorporated into the Contractor's working specification.

12.1.3 Technical

- a) The final Specification document shall be structured to clearly address both the Material and the Workmanship [including Protection] aspects of the works.
- b) Emphasis shall be placed on the Contractor and all Sub-contractors to abide by the requirement to take all appropriate site dimensions, as deemed necessary to undertake and complete the works.
- c) Equal emphasis is to be placed on the Contractor and all Sub-contractors, as considered appropriate, to abide by the requirement to prepare and submit shop drawings for approval by the Engineer, prior to commencement of any specialist works.
- d) It shall be made abundantly clear that the Contractor and all appropriate Sub-contractors / Suppliers shall be duty bound to furnish the Authority's Representative with a sufficient quantity of samples, mock-ups and process and the continuance of

the works at no additional cost to the Authority.

- e) Wherever deemed appropriate, materials and workmanship shall be in strict accordance with the manufacturer's recommendations.
- f) In all given circumstances, sufficient due care and attention shall be paid to prevent electrolytic corrosion between dissimilar materials and metals, in particular.
- g) Similarly, all necessary precautions shall be taken to ensure adequate corrosion protection for all exposed and hidden elements.

12.1.4 General Requirements Materials

The Contractor will note the requirement to use materials available in India as far as possible. These materials must meet the requirements of the relevant Indian Standard (IS), or, where appropriate an equivalent International Standard.

12.1.5 Compliance with Specification

The Contractor shall comply fully with the requirements of the following specifications in regard to quality of materials, submission of samples for approval prior to commencement of installation work and methods and procedure of installation.

All proprietary materials or processes submitted by the Contractor and approved by the Engineer shall be used or carried out strictly in accordance with the manufacturer's instructions and recommendations and also to comply with this Specification.

Where one or more proprietary materials or processes are named in this specification for Architectural and Building Works as acceptable materials or workmanship the Contractor shall still be responsible to ensure that these materials or workmanship comply with the requirements described in this Specification. In particular all materials shall comply with appropriate requirements for fire resistance.

Where materials are proposed by the Contractor for any part of the Works that require certain tests and where no previous test certificates have been issued by any competent authorities or approved testing laboratory, the Contractor shall at his own cost, submit the material for the appropriate test at an approved laboratory.

12.2 Materials

Cement and water for mortar shall be as specified under Section 3 "Concrete: Plain & Reinforced".

Lime shall be approved hydrated lime or quick lime to BS 890 delivered to site in

sealed bags bearing the manufacturer's name or brand. Lime shall be prepared to the appropriate requirements of BS 5628 and shall be soaked in water for not less than 16 hours before use.

Sand shall be clean and sharp, free from salts, loam and organic matter, complying with the requirements of BS 1199/1200, as appropriate and be well graded from 5mm down.

Plasticizers shall comply with BS 4887. Integral waterproofing agents for mortar may be either powder additive or equal approved mixed in accordance with the manufacturer's instructions.

- a) **FLY ASH BASED PRODUCTS:** Fly ash-based products such as Mechanized Autoclaved Sand Lime Fly ash Bricks/ Fly Ash Lime Gypsum Bricks/Autoclaved Aerated Concrete (AAC) Blocks have to be used in all construction activities.

Bricks shall be facings from an approved kiln, machine pressed, well burnt, hard, square, or uniform shape, colour and size with all sharp clean arises and free from all defects. Samples shall be submitted to the Engineer and approved before placing an order.

Concrete blocks shall be obtained from an approved manufacturer. Concrete blocks shall be hollow with a minimum average compressive strength of 7.0N/mm^2 .

Materials for precast concrete lintels shall be as specified under Section 3 "Concrete: Plain & Reinforced."

Horizontal wall reinforcement shall be galvanized steel mesh reinforcement, 22 gauge. Steel bar reinforcement shall be as specified under Section 3 "Concrete: Plain & Reinforced."

Movement joint filler shall be as approved by the Designer; [Engineer], sealer shall be coloured silicone sealant to the approval of the Engineer.

- b) Mortar

Mortar shall comprise one part cement, one part lime, and six parts sand, thoroughly mixed with just sufficient water to provide workability.

Plasticizers may only be used with the approval of the Engineer and shall be added strictly in accordance with the manufacturer's instructions.

Mixing of mortar shall be done by mechanical batch mixer or by hand on a clean, watertight platform of adequate size. All constituent materials shall be accurately gauged.

Mortar shall be used within one hour of mixing. Mortar that has started to set shall not be used. Detempering of hardened or partly hardened mortar will not be permitted.

c) Blockwork Generally

Blockwork shall, unless otherwise described, be built in stretcher bond of hollow cellular or solid blockwork.

Blocks shall be well wetted before lying and kept wet until laid.

Hollow blocks shall be grouted solid with mortar where required by the Design.

Blocks shall be laid in true and regular courses on a full bed of mortar of 10mm average thickness, exclusive of any key in the jointing surfaces of the blocks. Sufficient mortar shall be used in bedding and jointing to ensure that all keys are solidly filled.

All horizontal joints shall be properly level. The vertical joints shall be properly lined and quoins, jambs and other angles plumbed as the work proceeds. All walls shall be plumbed vertical.

Standard size blocks shall be used wherever possible. Broken blocks shall not be used except where required for bonding purposes. Walls and partitions shall be bonded to one another at angles and junctions.

Joints on faces of block walls which are to be rendered or plastered shall be raked out for a depth of 10mm as the work proceeds.

Walls shall be carried up regularly without leaving any part more than one metre lower than another unless the permission of the Engineer is first obtained. Work which is left at different levels shall be racked back.

Before commencing any blockwork the Contractor shall confer with other trades to ensure that all pipes, ducts, conduits, sleeves, bolts, frame lugs, etc. or any other materials necessary to be installed in the blockwork at the time it is built have been fixed or provided for.

Firepots around ducts, cable trays, waterpipes, drains and the like shall be of an approved intumescent material.

d) Blockwork Reinforcement

Blockwork shall be reinforced to BS 5628.

Mesh wall reinforcement is to be built in at every second course. Mesh shall be 100mm wide for 150mm blockwork and 150mm wide for 200mm blockwork.

Where shown on the Drawings, the block units are to be vertically reinforced through the core of the block units with high yield steel bars, securely tied to the starter bars left projecting from concrete structure. The core of block unit is to be grouted solid around bar with mortar or with a lean mix concrete with 10mm maximum aggregate.

e) Movement Joints

Movement joints shall be sealed by an approved sealer applied in strict accordance with the manufacturer's instructions. The surface of the concrete or blockwork to which the sealer is to adhere shall be straight and cleaned of all filler material, dirt, oil, grease and other matter. The sealer shall be applied by methods recommended by the manufacturer so that the sealer is brought flush to the surface of structure and a smooth surface is achieved. Excess material and spillage shall be properly cleaned off and removed.

f) Precast Concrete Units Precast concrete units shall be cast, reinforced, handled and erected all as all as specified under Section 3 "Concrete: Plain and Reinforced."



Ropeways and Rapid Transport System Development Corporation HP Ltd.

प्रदूषण मुक्त यातायात के लिए हिमाचल की पहल



“Design, Supply, Construction, Installation, Testing, Commissioning and Operation & Maintenance for 5 (five) years of Seamless Innovative Urban Transportation (Ropeways, Lifts & Escalators Etc.) Network in Shimla City (Himachal Pradesh) on Engineering Procurement and Construction (EPC) Mode.”

**AUTHORITY’S REQUIREMENTS
FOR
ELECTROMACHENICAL WORKS INCLUDING OUTLINE
CONSTRUCTION SPECIFICATIONS**

Volume III (Part -3)

October – 2024

**Externally Aided Project
(Under Consideration for funding by New Development Bank)**

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SECTION – S.01

ELECTROMACHENICALWORKS

1.0 GENERAL

1.1 The Design, Installation and Commissioning of the ropeway project shall be in accordance with relevant BIS Codes to be read in conjunction with CEN Codes. In case BIS standard is silent in any aspect of the project, CEN code should be followed. In case there is any conflict between the two standards, the CEN code shall prevail.

- a) Further in addition the necessary provisions as given in Himachal Pradesh Aerial Ropeways Act, 1968, shall also be followed.
- b) All Materials, works and construction shall conform to the relevant Specifications and Standards Specifications. Where the specification for a work is not given, Good Industry Practice shall be adopted.
- c) An indicative list of Indian and International Laws, Codes, Standards, and Specifications is given below for reference. Actual application of the following codes and standards will be defined in the respective sections of the manual.

2.0 DESIGN

2.1.1 APPLICABLE CODES

2.1.1.1 CEN and BIS

1. CEN: part of EN 12929-1:2022 (Safety requirements for cableway installations designed to carry persons - General requirements)
2. CEN: part of EN 1709:2019 (Safety requirements for cableway installations designed to transport persons – Pre-commissioning inspection and instructions for maintenance and operational inspection and checks)
3. Magnetic rope testing (MRT) - specification IS 17235:2019
4. Prevention and safety against fire in ropeways - code of practice IS 17236:2019
5. CEN: EN 12408:2005 (Safety requirements for cableway installations designed to carry persons - Quality assurance)
6. CEN: EN 13223:2022 (Safety requirements for cableway installations designed to carry persons - Drive systems and other mechanical equipment), parts of: EN 13243:2015 (Safety requirements for cableway installations designed to carry persons - Electrical equipment other than for drive systems)
7. EN 1090 (Execution of steel structures and aluminium structures) and EN ISO 12944

- (protective coating)
8. CEN: EN 12930:2015 (Safety requirements for cableway installations designed to carry persons – Calculations)
 9. CEN: parts of EN 12927:2019 (Safety requirements for cableway installations designed to carry persons – Ropes)
 10. parts of EN 1908:2015 (Safety requirements for cableway installations designed to carry persons – Tensioning devices)
 11. EN 1090 (Execution of steel structures and aluminium structures)
 12. EN 1907: Safety requirements for cableway installations designed to carry persons – Terminology 2018.
 13. EN 1908: Safety requirements for cableway installations designed to carry persons: Tensioning devices 2015.
 14. EN 1909: Safety requirements for cableway installations designed to carry persons Recovery and evacuation 2017.
 15. EN 12385-8: Steel wire ropes - Safety - Part 8: Stranded hauling and carrying-hauling ropes for cableway installations designed to carry persons 2003.
 16. EN 12397: Safety requirements for cableway installations designed to carry persons: Operation 2017.
 17. EN 12408: Safety requirements for cableway installations designed to carry persons: Quality control 2005.
 18. EN 12927: Safety requirements for cableway installations designed to carry persons: Ropes 2019.
 19. EN 12929-1: Safety requirements for cableway installations designed to carry persons: General requirements: Part 1: Requirements for all installations 2023.
 20. EN 12930: Safety requirements for cableway installations designed to carry persons: Calculations 2015.
 21. EN 13107: Safety requirements for cableway installations designed to carry persons: Civil engineering works 2016.
 22. EN 13223: Safety requirements for cableway installations designed to carry persons: Drive systems and other mechanical equipment 2023
 23. EN 13243: Safety requirements for cableway installations designed to carry persons - Electrical equipment other than for drive systems 2015.
 24. EN 13796-1: Safety requirements for cableway installations designed to carry persons: Carriers: Part 1: Grips, carrier trucks, on-board brakes, cabins, chairs,

carriages, maintenance carriers, tow-hangers 2017.

25. EN 13796-2: Safety requirements for cableway installations designed to carry persons: Carriers: Part 2: Slipping resistance test for grips 2022.
26. EN 13796-3: Safety requirements for cableway installations designed to carry persons: Carriers: Part 3: Fatigue tests 2023.
27. EN ISO 12944: Paints and varnishes _ Corrosion protection of steel structures by protective paint systems.
28. EN 17064: Safety requirements for cableway installations designed to carry persons - Prevention and fight against fire 2019.
29. EN 1090: Execution of Steel and Aluminium Structures.
30. EN 1993: Design of Steel Structure.

3.0 STATIONS

3.1 DRIVE STATIONS

3.1.1 The drive stations shall consist of the followings on CEN standards.

- i. Operating Floor with Boarding, De-boarding facilities, level, barrier-free carrier boarding/de-boarding.
- ii. Main drive with AC motors with variable speed, direct drive or Gear box.
- iii. Acceleration and deceleration arrangement, consistent speed tire conveyor.
- iv. Machinery Frame for direct drive/gearbox, main bearing and electric motor situated in the station steel construction.
- v. Drive Bull Wheel with insulated lining, drive Shaft, main bearing (spherical roller bearing) with additional bearing for emergency operation.
- vi. Provision of bull wheel, its stopper and rope catcher for drive bull wheel
- vii. Main electric cabinets with controls
- viii. Integrated Recovery system for rescue drive unit by an auxiliary motor, driven by independent generator, connected to the main bull wheel through a tooth crown.
- ix. In addition two vertical rescue systems shall be provided per drive station for vertical rescue of the passengers.
- x. Electric Brake (Dynamic Brake), Electro-Hydraulic/ Pneumatic Service and Emergency Brakes
- xi. Emergency drive by means of water-cooled diesel engine, hydrostatic power transmission for stepless control of travel speed up to $v = 1.0 \text{ m/s}$ in both Driving directions.
- xii. Placement of Tensioning arrangement equipment etc.
- xiii. A steel structure at station support level to accommodate the drive bull wheel including bearings. The diameter of the drive sheave would be according to the

- requirement of safety brakes chosen.
- xiv. Mast for station
- xv. Cabin guide (side way guide)
- xvi. Operators' cabin / panel room which should be designed to provide unimpeded view of operations.
- xvii. Parking of cabins as per station layout plan, movable platform, if needed.

3.2 RETURN STATIONS

3.2.1 The return stations shall consist of the followings on CEN standards.

- i. Operating Floor with Boarding, De-boarding facilities
- ii. Return Bull Wheel
- iii. Acceleration and Deceleration arrangement, consistent speed tire conveyor
- iv. Return Bull wheel with insulated lining, drive Shaft, main bearing (ball bearing) with additional bearing for emergency operation (plain bearing)
- v. Provision of return wheel, its stopper and rope catcher for return bull wheel
- vi. Integrated Recovery system for rescue
- vii. A steel structure at station support level to accommodate the return bull wheel including bearings.
- viii. Mast for station
- ix. Cabin guide (side way guide)
- x. Operators' cabin / panel room which should be designed to provide unimpeded view of operations.
- xi. Parking of cabins as per station layout plan, movable platform, if needed

3.3 INTERMEDIATE STATIONS

3.3.1 The intermediate stations shall consist of the followings on CEN standards.

- i. Operating Floor with Boarding, de-boarding facilities except for victory tunnel deflection stations without entry and exit cabin will pass through this station.
- ii. Deflection Bull wheel or sheave assemblies (depending to deflection angle)
- iii. Acceleration and deceleration arrangement, consistent speed tire conveyor
- iv. Deflection Bull wheel (or sheave assembly) with insulated lining, drive Shaft, main bearing (spherical roller bearing) with additional bearing for emergency operation.
- v. Provision of deflection wheel and rope catcher for deflection bull wheel
- vi. Integrated Recovery system for rescue.
- vii. A steel structure at station support level to accommodate the deflection bull wheel including bearings.
- viii. Cabin guide (side way guide)
- ix. Operators' cabin / panel room which should be designed to provide unimpeded view of operations. In addition, controls cum command centre to be provided at

103 Tunnel station from where movement of cabins of all lines can be seen through a mimic display system. Besides, faults of all sections shall be displayed here. In addition, all sections can be monitored and operated from this central command centre.

- x. Parking of cabins as per station layout plan, movable platform, if needed.

All stations should be equipped adequately with sensors to detect any anomaly to the safe and comfortable movement cabins.

4.0 ELECTRO-HYDRAULIC ARRANGEMENTS

- 4.1 The drive arrangement on CEN Standards shall be comprised of the following but not limited thereto.

4.1.1 DRIVE UNIT

a) BRIDGE DRIVE ADJUSTABLE

1. The drive shall be provided by a drive motor via a gearbox or direct drive onto a vertically arranged shaft, which shall lead to the bull wheel.
2. A machine frame shall be provided to hold (the gearbox,) the main drive motor(s), the flywheel and the safety brake.
3. A drive shaft shall be provided for transmitting power from the gearbox/direct drive to the bull wheel with separation options at the bull wheel bearing. A steel structure shall be provided at station support level to accommodate the drive bull wheel, bearings, safety brakes, lining, rope catcher, drive sheave stopper etc.
4. A fully enclosed **main reduction gear** running in an oil bath with gear heating and as oil filling or direct drive shall be provided.
 - i. The operating temperature of the lubricating oil should not exceed 65°C.
 - ii. Appropriate equipment for lubricating the gearbox shall be capable of emergency operation at reduced driving speed and in case of a power failure.

b) DRIVE ARRANGEMENTS

1. Flywheel mass shall be to achieve maximum inherent deceleration (fully open/empty down) of 0.5 m/s².
2. All Couplings necessary for power transmission shall be provided.
3. All necessary monitoring systems to monitor the position of sheaves and of couplings shall be provided.
4. Emergency drive shall be of water-cooled diesel engine and hydrostatic power transmission for steeples control of travel speeds up to $v = 1.0$ m/s in both driving directions. The emergency drive shall be located on the drive bridge.
5. The engine of the emergency drive has to fulfil requirement noise generation levels as prescribed in **“The Noise Pollution (Regulation and Control) Rules, 2000”**, Central Pollution Control Board, Ministry of Environment, Forest and Climate

Change, Government of India.

6. The power transmission of the emergency drive shall be hydrostatic via a gear rim directly to the rope sheave.
7. A machine frame to accommodate the emergency drive diesel engine including radiator, oil sump and oil tank shall be provided.
- 8.
9. The emergency drive shall be capable of operating from the command room as well as from the drive bridge.
10. Frames for the emergency drive motor, hydraulic lines, connections, oil cooler, oil fillings, etc. and ready-to-use assembly shall be provided.
11. Control for emergency drives shall be automated and manual (SB/EB).
12. Integrated Recovery system for rescue drive unit shall be integrated with auxiliary motor, driven by independent generator, connected to the main bull wheel through a teeth crown. In addition vertical rescue system shall also be provided.
13. Electro-hydraulic/ pneumatic service and emergency brakes shall be installed.
14. The drive bridge and rope deflectors shall be designed movable. The provisions of relevant codes shall be observed, in particular EN 13223.

4.2 BRAKES

4.2.1 Two types of brakes are to be provided as below.

a) SERVICE BRAKE

- Brake located in the drive station, used to keep Cabins stationary.
- The system shall be situated on the drive shaft between motor and gearbox (disk brake) or on the drive bull wheel.

b) EMERGENCY BRAKE/SAFETY BRAKE.

- Purpose of emergency brakes is to stop the system in the case of failure of the other braking devices.
- The braking system shall be situated on the drive bull wheel (calliper brake)

Service brakes and emergency brakes shall be provided with the control and actuating devices, frames, etc. Both the braking Systems be spring loaded with hydraulic / pneumatic / electrical opening.

The control of the brake system shall be intended to ensure the deceleration conforming to EN 13223. The brake system shall comply with CEN standards, particularly EN 12929- 1, EN12930 and EN 13223. The control of the braking system shall be intended to ensure the most even deceleration possible, regardless of the load, by combining the braking systems.

The brakes shall be fail-safe. They should work even in the condition of failure, regular power supply and DG set or with Emergency drive shall be provided. Battery backup should also be provided for opening and holding of service and emergency brakes.

4.2.2 Tensioning Device

4.2.2.1 An electro - hydraulic tensioning device shall be provided for the regulation of the constant rope tensioning force. It shall include a mobile frame to hold the deflecting bull wheel including bearing. bull wheel stopper and rope catcher shall be provided to safeguard against the overshooting moment of deflection.

4.2.2.2 All equipment of the hydraulic system necessary for the proper functioning of the rope tensioning, such as pump, pressure accumulator, hydraulic cylinder, control, lines, etc. shall be provided. The system shall also include a device to maintain the system pressure. The system pressure shall not be declined by more than 8% during operation.

4.2.2.3 The provisions of the relevant CEN standards shall be conformed, particularly EN 1908. All necessary assembly girders, working platforms, ladders, safety equipment, required inserts, anchor bolts, sub frames and gauges for relocation shall be provided.

4.2.3 DECELERATION AND ACCELERATION

4.2.3.1 The Decoupling and deceleration device including the necessary steel construction shall be provided. The deceleration device (tyre drive) shall be driven in the stations directly from the sheave or the haul rope or through independent geared motor, wherever required.

4.2.3.2 Transport facility of cabin shall be provided with the following.

- a) Transport device (tyre drive) for transporting the cabin, from the uncoupling to the Coupling, with forced detection of the driving equipment to maintain the vehicle distance.
- b) Drive of the transport device via friction wheel directly from the rope, transport of cabins with the aid of tyre drive.
- c) Guidance and control equipment for the Carriers.
- d) Any drive motors and controls that may be required, anti-collision-system, carrier spacing adjustment system.

4.2.3.3 The speed of entry and exit shall be within the limits as stipulated in applicable CEN standards. Station speeds shall be within 0.25-0.3m/s to ensure safe boarding and alighting.

4.2.3.4 The entry and exit areas shall be designed as comfortably as possible.

4.2.3.5 Locking ramp acceleration device with the necessary steel structures shall be provided.

4.2.3.6 The actuation (opening and closing) of the doors in the stations via wire rope hoist shall be provided.

5.0 GUIDING MANUFACTURING PARAMETERS

5.1 TECHNICAL

5.1.1 **Capacity of the Ropeway System:** The Ropeway line shall be designed to cater 3000PPHD. However, Gondolas/Cabins shall be provided for 1000 PPHD.

5.1.2 **Technology for the Ropeway system:** Monocable Detachable Gondola (MDG).

5.1.3 Travelling Speed:

- a) Operation speed: 6.0m/s in normal conditions.
- b) Operation speed: 1.0 m/s. in emergency.
- c) Maximum Crawling speed: 0.25 m/s to 0.3 m/s at the boarding/deboarding in station Area.

5.1.4 **Vertical Clearance from the existing building profile:** The minimum vertical clearance between the top of the existing buildings profile and bottom of the Gondola shall be minimum 10 m.

5.2 OTHER TECHNICAL PARAMETERS

5.2.1 The other technical parameters shall be adhered to as below.

S. No.	Parameter	Description
1	Alignment	As per Plan & Longitudinal section
2	Cabin capacity	10-seater
3	Direction of travel	Counterclockwise
4	Type of cabin	Cabin with windows and window insulation and automatic door operation, illumination, intercom system, charging System, ventilation windows/openings
5	Payload	75 kg per passenger
6	Operating hours	16 h per day 330 day per year.
7	System availability	Minimum 95%
8	Operating modes	Standard Operation Modes: Max. capacity: 100 % of carriages Min. capacity: 25 % of carriages Operation by daylight and darkness Special Operation Mode: Return station unmanned at start of operation.
9	Recovery System	Integrated Recovery system along with vertical rescue system
10	Transformer / DG set capacity	Refer Annexure – I

Note:

- a) The length of ropeway lines and ground levels are tentative. The Contractor shall confirm himself before undertaking the designs.
- b) The ropeway line shall be designed for trouble free operations in actual climatic conditions.

5.3 DRIVE, RETURN AND PARKING TERMINAL STATIONS

5.3.1 Details of Drive, Return, Parking and Terminal Stations are given in the following table.

Location	Description	Section
Red Line (Apple Line)		
Taradevi	Drive and parking Terminal	RL1
Chakkar	Intermediate station	RL1
ZPTH	Return Unit	RL1 / GL1
Green Line (Deodar Cedar Line)		
Tutikandi Parking (ZPTH)	Drive and parking Terminal	RL1 / BL1
ISBT	Intermediate station	GL1 / BL1
Railways Station	Intermediate station	GL1
Old Bus Stand	Return Unit	GL1 / GL2
Lift Point 2	Intermediate station	GL2
Secretariat	Drive and parking Terminal	GL2
Blue Line (Monal Line)		
ISBT	Drive Unit	GL1 / BL1
103 Tunnel	Intermediate station	BL1
Victory Tunnel	Deflection Station	BL1
ICR	Return Unit	BL1 / BL2
IGMC	Intermediate station parking Terminal	BL2
Sanjauli	Drive Unit Return Unit	BL2 / BL3
Navbahar	Intermediate station	BL3

The Plan and profile of Ropeway lines is given in Volume -IV of Bod Document.

6.0 ROPEWAY EQUIPMENT

6.1 CABIN, HANGER AND GRIPS

Cabin/Gondola/Carrier is the structural and mechanical assemblage in or on which the passengers of a ropeway system are transported. The cabin shall include the Cabin, Grip, and Hanger. Grips shall be used to attach the cabins with the cable. The Hanger shall be the load bearing structure from the grip to the carriage.

6.1.1 CABINS

6.1.1.1 The cabin shall be comprised but not limited to the of following:

- i. Service life for the cabin shall be a minimum of 30 years. The cabin shall be aesthetically pleasing from exteriors and interiors and shall conform to the highest safety standards internationally.

- ii. The structural frame shall be made of aluminum. All exposed aluminum elements to be anodized or painted. Entire painting inside and outside, hot dip galvanizing of the parts which are at risk of corrosion shall be done. Interior surfaces in a wear-resistant and condensation-absorbing design of the interior fittings to be in accordance with the applicable fire protection regulations.
- iii. The cabin door opening and closing shall be fully automated with smooth closing and opening providing comfort as per CEN standards.
- iv. Suitable devices shall be provided so that when the cabin is in motion, it cannot be opened from inside.
- v. Top-hung window on mast side. Installation Additional top-hung window on outside to be provided.
- vi. Heat-repellent screen filming shall be on all windows and doors.
- vii. Cabin seats should be of perforated steel with provision of sufficient nos. of Grab Handles.
- viii. Configuration of seating arrangement shall be approved by Engineer/Authority.
- ix. Cabins, statically designed for four-point suspension.
- x. The cabins shall have adequate large glass windows on all sides that create a pleasant viewing experience for riders.
- xi. The cabin must be designed to comfortably hold the weight of the required person per cabin, LWI (level walk-in) with seats for all passengers per cabin. The cabin shall be equipped with sufficient numbers of suspended hooks (similar to metro coaches).
- xii. Design of the cabin for seated passenger transport, internal clear height of min 2.05 m including step board for level access from the platform podium ("Level Walk In" design).
- xiii. Cabin Numbering and colouring scheme shall be provided by the Authority.
- xiv. The cabins shall have a pair sliding doors on one side. Door opening width shall be ≥ 800 mm.
- xv. Doors shall allow easy entrance and exit of passengers including handicapped.
- xvi. Some of the cabins shall be equipped with a platform and hand railings in the top for the purpose of maintenance. Personal protective equipment attachment points shall be provided as per CEN Standard.
- xvii. The cabin doors shall remain open for approx. 40 seconds. The cabin floor shall be at the same elevation as the station platform. The gap between the cabin and the platform shall be carefully adjusted to meet all accessibility standards.
- xviii. Door position detectors and locked door detectors shall be installed.

6.1.1.2 SPECIFICATIONS OF CABINS

6.1.1.2.1 The cabins shall be designed conforming relevant CEN standards.

- a) The Cabins shall be constructed so that the passengers cannot injure themselves.
- b) Cabins shall be constructed so that passengers cannot fall out in the event of a collision with parts of the installation or fixed obstacles.
- c) The outside surfaces of the cabins shall be fitted with suitable protective rails

and/or bumpers.

- d) The cabin interior shall not feature any flammable material. Any accumulators and electrical equipment must be fire-retardant as per applicable standards.

6.1.1.3 ELECTRICAL EQUIPMENT IN CABINS

- i. **Energy Supply Cabin:** Self-sufficient energy supply for the specified facilities in the cabin includes.
 - Battery pack,
 - Additional charging device in the garage, manually operated (in case of nonsufficient solar energy)
 - Wiring complete
- ii. **Communication Device Cabin:** Communication facility operator - passenger for announcements include
 - Radio receiver
 - Amplifier
 - Wiring complete
- iii. **Interior Lighting Cabin:** Lighting system for the cabin in the ceiling area for operation in the dark, including wiring and lighting units.

6.2 Hangers

- 6.2.1 The cabin shall be suspended from the carriage through a hanger made of high strength steel.
- 6.2.2 The connection to the cabin shall be made via a four-point suspension. This suspension shall be equipped with a damping unit to reduce the transmission of vibrations from the rope to the cabin.
- 6.2.3 A provision shall be made in the hanger for dampening the longitudinal swing of the cabin.
- 6.2.4 The hangers of cabin and all other exposed components shall be hot dip galvanized as per relevant standard.
- 6.2.5 The hangers shall comply with the relevant CEN Standard.

6.3 Grips

- 6.3.1 The grip devices for cabins shall be designed conforming applicable CEN standard. The grips shall be designed for maximum forces.
 - a. The slope of the track shall be coordinated.
 - b. The grip-devices shall be hot-dip galvanized.

6.3.2 Specification for Detachable Grips

- 6.3.2.1 The configuration of the grips shall be designed so that faulty attachment of a grip on the rope shall be detected by checking devices. Devices in the station shall ensure that a Cabin is stopped without any risk to the passengers, if a detachment fault is detected when entering the station or an attachment fault when leaving the station. The effectiveness of this device shall be verified by means of tests carried out during the installation.
- 6.3.2.2 The force of the grip springs shall be checked at each attachment during forward travel.
- 6.3.2.3 This check shall ensure that the slipping resistance force is at least twice the value of the gravitational driving force $F_T, \max$. The device for measuring the force supplied by the springs shall take into account the efficiency of the grip.
- 6.3.2.4 Attachment and detachment shall be monitored both for forwards and backwards travel. The following requirements shall be met:
- a) before making the attachment, the geometrical positions of the rope and the gripping jaws shall be monitored to detect any deviations that could cause an attachment fault;
 - b) when the attachment has been made, the position of the gripping jaw on the rope in the closed position shall be checked to detect any attachment faults;
 - c) before making the detachment, the position of the rope shall be checked to detect any position of the rope that could compromise entry into the attachment/detachment device;
 - d) detachment of the grips shall be monitored to detect any incomplete or faulty release of the grips from the rope. A mechanical device shall prevent incompletely detached grips to pass through the station.
- 6.3.2.5 The limit values for the deviations that shall trigger the safety devices shall be indicated in each case.
- 6.3.2.6
- 6.3.2.7 The reliability of a grip shall be verified by a test comprising a number of opening-closing cycles equivalent to at least 250,000 entries into the station.

The Detachable Grips shall be conforming provisions of applicable CEN standards.

7.0 SHEAVE ASSEMBLIES

- 7.1 All sheave assemblies are to be equipped with switch pulleys, rope catchers and rupture rod switches. The suspension on the prop yoke must ensure easy adjustment.
- 7.2 The steel construction parts of the rockers, frames and suspensions shall be hot dip galvanized. Maintenance platforms for the sheave assembly shall be provided on each

uphill and downhill side. The platforms shall be placed in such a way that extreme end of the sheave assembly is accessible. PPE attachment points and fall arrestors shall be provided.

- 7.3 Adapted to the respective rope inclination, steps made of grating, entire construction shall be of hot dip galvanized.
- 7.4 Execution of the stairs and landings according to the regulations for the protection of workers.
- 7.5 Fixed pipes (steel hot galvanized) for routing the electrical cables shall be provided on the support beams of the roller batteries. Cable covers shall be UV-resistant

8.0 ELECTRIC LINE SYSTEMS

- 8.1 This shall comprise but not limited to the of followings:

- I. **Wind Warning System:** Wind warning devices on any support with transducer for wind direction, speed including evaluation and display in the drive station shall be provided. Wind Warning speed shall be 18 m/s and shutdown speed shall be 22 m/s.
- II. Limit Switch
- III. Electronic rope position monitoring mechanical part.
- IV. The system must detect the exact position of the Haul rope and selectively detect the leaving of the groove for each sheave assembly and issue it as a warning.
- V. In the event of failure of one or more breaking rods on the line, it shall be possible to operate the system at full driving speed only with the electronic rope position monitoring function. The system shall be designed to handle local lightning strikes without loss of function.
- VI. Electronic rope position monitoring system on the sheave assemblies (uphill and downhill side) including the necessary wiring per prop.
- VII. A test gauge for functional testing of the system on the support shall be supplied. The necessary empty tubes and brackets are to be included.
- VIII. Circuit breaker, overvoltage protection and the outlets for any station:
 - a) Auxiliary drives, station
 - b) Haul rope tensioning device

- 8.2 All safeties must be actuated in the event of failure of regular power supply and when the system runs on DG set or with Emergency drive.

9.0 Control Devices

- 9.1 The control devices shall comply with applicable CEN standards. The control devices shall be capable of processing minimum following data.
 1. Max Motor speed.
 2. Error messages of the safety circuits (stop, emergency stop, emergency stop-BB, emergency stop-SB).
 3. Initial error display.

4. General operating data such as starting conditions, driving speed, condition of the safety and service brakes.
5. Wind speed and direction.
6. Data of the pass-through protection (all counter values, limit values min./max.).
7. Recording of the braking curves (print, save).
8. Selective rope position monitoring.
9. Grip positioning
10. Operation and visualization via OPC panel or own PC
 - a) Display of fault messages in plain text, overview images with up-to-date display of operating states, vehicle marking on any vehicle.
 - b) All data necessary for the operation of the system must be displayed in both stations via this visualization.
11. Furthermore, the test functions such as for the drive-through protection or the drive are carried out via the touch screen control panel.
12. **Drive Station control for Controlling and Monitoring the Main Drive shall include.**
 - a) Programmable logic controller for master control and set point preparation
 - b) Programmable logic controller for control and monitoring of the auxiliary drives
 - c) Programmable logic controller for entry, passage and exit monitoring station as well as for distance regulation
 - d) The control cabinet shall be spatially separated from the low-voltage room in the control room incl. the necessary equipment for driving with unoccupied remote station
 - e) It must be possible to set the control to at least 3 freely selectable vehicle distances.
 - f) PLC system should have provision to make necessary changes in rope speed, cabin spacing and cabin handling system in the stations, so that, during transportation of materials, there should not be any inconvenience in loading and unloading of the local commodities.
 - g) Brake control
 - h) Brake simulation
 - i) Safety system track
 - j) Integration of the emergency drive control into the contouring control system
 - k) Integration of the gripping force test into the web control system
 - l) Integration of the monitoring for the opening and closing of the Cabins into the railway control system
 - m) Integration of the hydraulic tensioning control into the web control system

- n) Zoning for anti-collision
- o) Scope of delivery incl. all required operating switches, Beros, measuring instruments, intermediate terminal, etc.

13. Return Station / Intermediate Station Control shall include.

- a) Programmable logic controller for master control and set point preparation
- b) Programmable logic controller for control and monitoring of the auxiliary drives
- c) Programmable logic controller for entry, passage and exit monitoring station as well as for distance regulation
- d) The control cabinet shall be placed in the duty room incl. the necessary equipment for driving with unmanned drive station
- e) Integration of the hydraulic tensioning control into the web control system
- f) Integration of the monitoring for the opening and closing of the Cabins into the ropeway control system
- g) Integration of the station control system (station garaging) incl. lifting platform into the ropeway control system
- h) Zoning for anti-collision
- i) Scope of delivery incl. all required operating switches, Beros, measuring instruments, intermediate terminal boxes, etc.

10.0 STANDBY DG AT DRIVE STATION, RETURN STATIONS, AND ANGULAR STATIONS

- 10.1 DG set of requisite capacity commensurate with the location and its altitude with suitable change over arrangement from grid shall be provided. The system performance must be sufficiently dimensioned to ensure the supply of the ropeway system including garage and the power supply of the station buildings. If tyre conveyors are run electrically, DG must also provide energy to run the conveyors during evacuation/emergency operations.

11.0 OTHER FACILITIES AT STATIONS

- 11.1 The following electrical equipments shall be provided at stations including power supply and wiring:
- a. Emergency drive control
 - b. Grip force test
 - c. Hydraulic tensioning
 - d. Garaging including manual charging of cabins
 - e. Communication system cabin – station equipment

12.0 OPERATOR'S CABIN AT STATION

- 12.1 The operator's cabin shall be provided within the station platform area. It should be designed to provide an unimpeded view of operations.

13.0 Earthing and Other Material

- i. Earthing and lightning protection systems for the Towers and transition stations shall be provided as per relevant CEN standard.
- ii. Earthing and lightning protection system for the ropeway equipment of the drive and counter stations, foundations, building structures, roof shall be provided.

14.0 Remote Control at Stations

- 14.1 Supply of one remote control unit per station shall be provided to enables the shutdown of the system from any point within the starting area.

15.0 Speech Memory 2 Languages (English and Local Language)

- 15.1 Speech memory for playing back 8 ready-made messages in 2 languages via the trackside loudspeakers or via WLAN and intercom system including all necessary hardware and software shall be provided.

16.0 Electrical Devices

- 16.1 Following equipments shall be installed in the Station areas.

A. Batteries and Charging Equipment

- i. Batteries and charging equipment Control of lower and upper station, as necessary, deflection angle station. The 24V/DC supply of the control shall be done via the station batteries.
- ii. The station batteries should be of adequate capacity, so that the system can be operated with the emergency drive for at least 1.5 hours in the event of a power failure.
- iii. A trickle charger shall be installed for the battery of the emergency DG sets.

B. Station Panels

1. Station panels for drive and tensioning stations shall consist of the following functions.
 - i. Stop, Emergency Stop, Emergency Stop SB, Start, Ready, Slow, Telephone Socket, Free Lamp, Ready Lamp, Loudspeaker System with Intercom Unit for Station and Line Speakers.
2. Platform boxes shall require the following functions:
 - i. Stop, Emergency Stop, Emergency Stop SB, Start, Departure, Slow, Telephone Socket, Free Lamp, Ready Lamp
 - ii. Safety switch
 - iii. Telephone sockets
 - iv. Earthing rod
 - v. Trackside spotlight
 - vi. Rotating beacons, signaling devices and horns

vii. Modem for remote maintenance

C. Telephone and Signaling System Consist of:

- i. Signaling system Drive station
- ii. Signal system tensioning station
- iii. Signal system Deflection angle station,
- iv. Telephone sets to the extent necessary
- v. Secondary alarm clock to the extent necessary

D. Station Wiring

All cables for the necessary connections within the scope of the wiring as under.

- i. Between drive and switching device
- ii. Between low-voltage main distribution board and main ropeway distribution board Distance according to planning documents
- iii. Between low-voltage and transformer equipment Distance according to planning documents
- iv. Between converter and drive motor Distance according to plan documents
- v. Connection to the control and monitoring equipment
- vi. Complete wiring of the scope of delivery in the drive and counter station and the deflection angle station
- vii. Execution of the cabling in the transition to the station building rodent protected.

17.0 Line Facility

- 17.1 Electrical line cabling to be designed as self-supporting cable system stretched from station to tower to tower to station including suspension cable, cable shoe and bracing:

A. Station and Tower Connection

Connection to station and tower construction, consisting of:

- i. Surge protection devices for high tension cables
- ii. Terminal boxes for Towers, Assembly at least 1.5 m above the top edge of the foundation
- iii. Cable connection from the terminal boxes to the switches of the monitoring devices on the full as well as the empty cable side.
- iv. Fixed pipes along the column shaft as well as the column yoke are provided by the ropeway manufacturer.
- v. Loudspeaker system for track, designed as weatherproof loudspeakers with amplifier system and microphone.
- vi. Wind warning devices on any support with transducer for wind direction and speed, incl. evaluation and display in the drive station.
- vii. Air traffic warning lights or similar systems

B. Control Cable or Fibre Optic Cable

Control cable or fibre optic cable for control including signal transmission between the stations as well as from all trestles and also for a video surveillance system in the stations shall be provided.

C. Line Cable

Cable for the loudspeaker functions and energy Supply Lighting Towers Cable for the energy supply for lighting on the separate supports shall be provided.

D. Electronic Rope Position Monitoring Electrical Part

The electrotechnical part of the electronic rope position monitoring system shall include:

- i. Cable for electronic rope position monitoring
- ii. Wiring and installation of the equipment provided by the ropeway manufacturer on the sheave assemblies and Towers.
- iii. Integration into the control system.

E. Support Rope System for Line Cabling

Support rope system for track cabling from station via all supports to station shall include:

- i. Support rope
- ii. Tensioning equipment at each station including remaining rope reel
- iii. Rope shoes on each tower
- iv. Electrical equipment

18.0 Haul Rope

18.1 The requirements of the Haul Rope shall be as under.

- i. Round strand rope.
- ii. 6x36 WS / 8-stranded optional.
- iii. Compacted construction,
- iv. Special design "Performa" or comparable.
- v. Bright,
- vi. Service life preferably 10 years and reduction of the running noise by approx. 3 - 5 dB compared to standard compacted rope.

19.0 Installation of Vertical Rescue System

Annexture - I

Stations	Max. acceleration [kW]			Additional [kW]		Rope Loop	Explanation	TOTAL [kW]
	Red Line	Green Line	Blue Line	drive	intermediate return			
Taradevi	306			40		Taradevi - ZPTH	Taradevi + Chakkar + ZPTH + drive	792
Chakkar	446				25			25
ZPTH		280		40		ZPTH - Old Bus Stand	ZPTH + ISBT + Railway + drive + return	1110
ISBT		503	486	40	25	ISBT - ICR	ISBT + 103 Tunnel + Victory Tunnel + drive + intermediate	1355
Railway Station		272			25			25
Old Bus Stand		350			25			25
Lift Point 2		746			25			25
103 Tunnel		298			25			25
Victory Tunnel		506			25			25
ICR		339			30			30
IGMC		552			25			25
Sanjauli		570		40		Sanjauli - ICR	ICR + IGMC + Sanjauli + Navabhar + drive + intermediate	1928
Navabhar		412			25			25
Secretariat		295		40	25	Secretariat - Kasumpti secretariat - Old Bus Stand	Old Bus + Lift Point 2 + Secretariat + drive + Kasumpti	1456
Kasumpti					15			15

List of preferred manufactured and suppliers

Electromechanical works

- Ropeway engineering
 - Bartholet
 - Doppelmayr
 - Garaventa
 - Leitner
 - POMA
- Carriers
 - Bartholet
 - Carvatech
 - CWA
 - Sigma
- Rope
 - Fatzer
 - Teufelberger
 - Arcelormitter
- Electrical/control equipment
 - Bartholet
 - Doppelmayr
 - Frey Austria
 - Frey Stans (Switzerland)
 - Leitner
 - POMA
 - SisAG



Ropeways and Rapid Transport System Development Corporation HP Ltd.

प्रदूषण मुक्त यातायात के लिए हिमाचल की पहल



“Design, Supply, Construction, Installation, Testing, Commissioning and Operation & Maintenance for 5 (five) years of Seamless Innovative Urban Transportation (Ropeways, Lifts & Escalators Etc.) Network in Shimla City (Himachal Pradesh) on Engineering Procurement and Construction (EPC) Mode.”

OPERATION AND MAINTENANCE

Volume - V

October - 2024

Externally Aided Project

(Under Consideration for funding by New Development Bank)

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SECTION – S.01

1.1 GENERAL:

- 1.1.1 These Specifications contained herein shall be read in conjunction with other tender documents.
- 1.1.2 The Work shall be carried out in accordance with the standards and specifications issued to the Contractor by the Authority/Engineer.
- 1.1.3 Absence of terms such as providing, supplying, laying, installing, fixing etc. in the descriptions in connection with the operation and maintenance does not even remotely suggest that the Contractor is absolved of such providing, supplying etc. unless an explicit stipulation is made in this contract. The Authority shall bear no costs of materials, labour, equipment, duties, taxes, royalties etc.
- 1.1.4 The specifications may have been divided into different sections / sub-heads for convenience only. They do not restrict any cross-references. The Contractor shall take into account inter-relations between various parts of works/trades. No claim shall be entertained on the basis of compartmental interpretations.
- 1.1.5 Alternative or additional codes and standards proposed by the contractor shall be internationally recognized codes and shall be equivalent to or better than, Indian Standards issued by the Bureau of Indian Standards or any other Indian professional body or organization, subject to being, in the opinion of the Authority's Representative, suitable for incorporation or reference into the specifications.
- 1.1.6 The Contractor shall get final approval along with system safety certification as per CEN standards before the commercial operation. The operation of the ropeway system has to be carried out as per the relevant standards and safety standards rules/acts approved by the State Government. from time to time for entire period of his Contract. The Contractor is hereby informed that before the project can commence commercial operations, the Independent Engineer appointed by the Authority must inspect the entire ropeway system in accordance with the Himachal Pradesh Aerial Ropeways Act, 1968, as amended from time to time. The Contractor shall provide full assistance to the Independent Engineer during the inspection in every possible way.
- 1.1.7 The stations developed at all locations will be maintained properly to meet the needs of passengers/tourists as per the prevailing laws and regulations of the State Government.
- 1.1.8 The maintenance of entire ropeway system will be carried out as per the CEN- Standards and prevailing rules/acts for safety and security laid down by the government time to time for entire period of his Contract.
- 1.1.9 The Contractor shall maintain best in class safety mechanism (as per CEN Standards) in the entire ropeway system to prevent any accident and mishaps during operation for entire period of his Contract. Accordingly, the Contractor will submit the safety plan to RTDC, the Authority in advance prior to start of operation and obtain Approval from Authority.

- 1.1.10 The Contractor shall maintain necessary public announcement and security system (as per CEN Standards) along the alignment to alert passengers and prevent any breach in the security. To achieve this the Contractor shall maintain security mechanisms such as, deployment of specialised personal at vantage points, CCTV security system, PA system, alarm system or any other system.
- 1.1.11 The Contractor shall ensure and maintain suitable evacuation system as per CEN standard in case of emergency stoppage of ropeway in midway, any failure in the tower, failure in machinery or any other problems in the cable car, etc. during the operation of ropeway.
- 1.1.14 The Contractor shall take accident insurance for the entire ropeway systems, passengers, equipment, other machinery, civil structures, lifts, escalators etc during the entire period of contract as per prevalent laws and approval by the Authority.
- 1.1.15 The Contractor shall ensure maintenance of efficient fire detection and suppression system for the entire ropeway including stations.
- 1.1.16 The Contractor shall submit operation & maintenance manuals along with standard operating procedures issued E&M supplier and prepare plan, and submit for overhauling of ropeway system, traffic dispersal system, evacuation plan of people for all the stations, fire-fighting system, medical aid system, security system, etc. for the approval of RTDC, the Authority before the operation.
- 1.1.17 The Contractor shall monitor weather (wind speed, rainfall, etc.) to ensure safe services.
- 1.1.18 Safety & Security: The safety and security of the ropeway system and operation rests with the Contractor. The Contractor shall maintain security personnel, gadgets as required, as part of the maintenance services.
- 1.1.19 Electricity Supply: The Contractor shall ensure proper lighting of the ropeway stations and facilities including regular maintenance as well as maintenance of rooftop grid connected solar power at all stations. RTDC shall only facilitate the Contractor for getting an electricity connection, however the payment of the electricity bills shall be made by RTDC.
- 1.1.20 Water Supply Arrangement: The Contractor shall arrange adequate water for drinking & general cleanliness of the ropeway facilities.
- 1.1.21 Landscaping: The Contractor shall put flowering plants and other shrubs around entire building and open areas of Entire Ropeway Project Area as per the approval of the RTDC and maintain the same in good condition at all times.
- 1.1.22 Cleaning of the ropeway gondolas and stations: The Contractor shall keep close watch on graffiti and also ensure regular cleaning of the station areas and gondola cabins.

- 1.1.23 Garbage Disposal: The Contractor shall install segregated litterbins as specified at all station locations and disposal of the collected waste shall be the responsibility of the Contractor as per requirement of Municipal Corporation of Shimla.
- 1.1.24 Operation of a CCTV surveillance including maintaining of all record, safety of the program for the facility & the users. The personnel engaged in the provision of any such services under any of the Agreements/SOPs including correction of safety violations and deficiencies shall take all actions necessary to provide a safe environment in accordance with Applicable Laws and Good Industry Practice.
- 1.1.25 Contractor shall take all reasonable precautions for the prevention of accidents on or about the Ropeway Facility and provide all reasonable assistance and emergency medical aid to accident victims. The Contractor shall ensure and maintain first-aid medical system at all stations by deploying first aid units. The Contractor may also tie up with local ambulance services/Hospital wherever possible. There should be first aid kits in every carriage in case of unforeseen stoppage.
- 1.1.26 The Contractor shall ensure that number of passengers in Gondolas shall not exceed the design capacity of the cabin.
- 1.1.27 The Contractor shall provide and maintain at site throughout the period of works the following at his own cost and without extra charge:
- a) All labour, materials, plant, equipment and temporary works, Overhead charges as well as general liabilities, obligations, insurance and risks, required to complete and maintain the works to the satisfaction of the Authority/Engineer.
 - b) Cost of Preparation and compliance with provision of a quality assurance control program.
 - c) Cost of safeguarding the environment.
- 1.2.28 It is envisaged that Ropeway Network shall be Commissioned in phased manner. If Authority wishes to operate any one line before completion of entire network, the payment to the Contractor shall be made on prodata basis on mutually agreed terms.
- 1.2.29 The Contractor has to provide breakup of Operation and Maintenance Cost Component wise, Line wise and Station wise as and when sought by the Authority post opening of the bid.
- 1.2.30 Taking-Over Certificate: The Contractor may request a Taking-Over Certificate by notifying the Authority/Engineer no more than 14 days before they believe the Works are complete and ready for takeover. If the Works are divided into Sections, the Contractor can apply for a Taking-Over Certificate for each Section. Once the Works have been completed per the Contract requirements, including passing any relevant Tests, the Authority will issue the certificate. Furthermore, the RTDC will initiate discussions with the Contractor and begin commercial operations for that section in advance for that particular section.

1.2 SCOPE OF WORKS:

The detailed scope of services required to be undertaken under operation and maintenance of ropeway is as below:

- 1.2.1 The contractor shall operate & maintain the Ropeway to ensure safety, steady & smooth operation under the supervision of the RTDC authorized official. The contractor shall abide by the prevailing laws and regulation of the Government/ CEN standards and the prevailing rules for safety and security as laid down by the Government from time to time for entire operation & maintenance period.
- 1.2.2 The Ropeway shall be under operation in a normal day for 16 hours.
- 1.2.3 The Daily/weekly/fortnightly/monthly/Quarterly/annually maintenance of the Ropeway shall be carried out as per the Standard Operating & Maintenance procedure of the manufacturer.
- 1.2.4 The contractor shall engage his own man power to carry out the maintenance activity and shall take care of PF, ESI coverage, minimum wages to them duly complying with the labour laws. The Contractor shall provide the list of required manpower to be used and got approved by the Authority.
- 1.2.5 The operation & maintenance of the entire project is to be carried out in conformity with BIS (Bureau of Indian Standards) /CEN Standards as applicable.
- 1.2.6 The Contractor shall maintain necessary maintenance records, logbooks and history sheets concerning various equipment, replacement of spares and consumables details etc.
- 1.2.7 The contractor agrees to comply with any reasonable suggestions or instructions issued by the officials of the Authority without fail duly submitting a compliance report.
- 1.2.8 If any act such as earthquake, flood, land slide, civil war, external aggression etc. occurs, the obligation enjoined upon the parties under agreement conditions get suspended except security of the premises and installation.
- 1.2.9 RTDC reserve the right for advertisement at the space within the entire ropeway premises including the cabins.
- 1.2.10 The contractor shall adhere to the SOP of the Manufacturer and the Himachal Pradesh Aerial Ropeways Act, 1968, as amended from time to time, regarding ropeway safety mechanism in order to prevent any accident and mishaps during operation for entire operation & Maintenance period. Accordingly, the contractor shall train his technical staff as per the SOP for carrying out evacuation and mock exercises.
- 1.2.11 The expenditure on account of fuel expenses for running of DG set in the eventuality or power failure for evacuation of passengers shall be in the scope of the contractor.
- 1.2.12 The Contractor shall maintain an Inspection Schedule which shall be updated in accordance with the Himachal Pradesh Aerial Ropeways Act, 1968, as amended from time to time, also assist the Ropeway Inspector or Ropeway Regulator and Expert Committee for inspection of entire ropeway system on Daily/weekly/Fortnightly/Monthly/Quarterly/Annual basis and maintain proper record of relevant documents.

- 1.2.13 The Contractor shall provide detailed list of activities for each project component to be taken up during Operation Period including details of its staff which shall include but limited to “the minimum list of manpower to be provided at each station” as given in Appendix-4. Also, it is Contractor’s responsibility to provide adequate manpower at all stations so that Operation of Ropeway is always smooth and efficient.
- 1.2.14 Electricity bills will be paid directly by RTDC to Power Supply Company as applicable and is not in scope of the Contractor.
- 1.2.15 Collecting and appropriating the Fee: The Contractor shall deploy sufficient personnel to collect fees from passengers for the use of the ropeway and ensure that these fees are deposited with the Authority along with its details on a daily basis. The Contractor shall also maintain accurate records of all transactions.
- 1.2.16 Spare Parts/Consumables: The Contractor shall submit a list of spare parts and consumables required for the annual operation in advance and get these approved by the Authority. Additionally, the Contractor must ensure that the minimum stock of these items, as specified in the approved list, is maintained at all times throughout the entire Operation and Maintenance Period for minimising break down period.
- 1.2.17 The payment of water bills, sewerage bills & garbage bills shall be in the scope of the contractor.
- 1.3 OBLIGATIONS RELATING TO OPERATION AND MAINTENANCE OF THE ROPEWAY
 - 1.3.1 The Contractor agrees to ensure that the training is provided to its manpower by the Associate partner (Technical tie up Partner) for Operation and Maintenance of the system. In the entire period of Five (5) years after the commissioning of the project, the Associate partner will ensure periodic handholding in the training of the manpower and will also certify the competence of the trained manpower. The Contractor will ensure the continuity of this trained manpower during the entire period of contract and in extraordinary circumstances ensure the training of replacement with the prior approval of Authority.
 - 1.3.2 At the end of the 5 (five) year’s period, an independent CEN certified inspection body shall determine the state of the ropeway. Any costs related to shortcomings in preventive maintenance or damage due to lack of maintenance shall be attributed to the Contractor.

1.4 DELIVERABLES, TIMELINES AND TERMS OF PAYMENT & SCHEDULE:

The contractor will provide a Training certificate of training imparted to his/her/its technical staff from the Associate Partner (Technical Tie-up Partner).

The Contractor shall operate and maintain the project for a period of 5 (five) years commencing from the date of issue of completion certificate.

For the performance of its Operation and Maintenance obligations, the Contractor shall be paid on quarterly basis on satisfactorily completion of that quarter. The Contractor shall quote for Annual Operation and Maintenance Cost for each year separately. The quarterly lumpsum amount of Operation and Maintenance shall be 1/4th (one-fourth) of the annual cost of operation & maintenance and will be paid after satisfactory performance on completion of every quarter.

The amount (Quoted by the Contractor) as per the terms & conditions of the Contract Agreement subject to the mandatory payments /deductions as per applicable law, shall be paid by RTDC on quarterly basis. The payment shall be disbursed with in 15 days of the receipt of the bills.

1.5 SUPPLY OF VIDEO CDS:

The work consists of taking video films of important activities of the works as directed by the Authority/Engineer during the currency of the Project and editing them to a video film of playing time not less than 60 minutes. It shall contain narration of the activities in English/Hindi by a competent narrator. The edition of the film and script of the narration shall be approved by the Authority/Engineer.

Robotic Inspection

The contractor shall deploy drones for inspection and monitoring of structures as well as ropeway lines & towers. The record of photographs and videos shall be submitted to the Authority/Engineer on monthly basis or as directed by Authority/Engineer.

SECTION – S.02

OPERATION AND MAINTENANCE (O&M)

2.1 O&M Obligations of the Contractor

2.1.1 During the Operation Period, the Contractor shall operate and maintain the Ropeway in accordance with CEN Standards, this Agreement and if required, modify, repair or otherwise make improvements to the Ropeway to comply with the provisions of this Agreement, Applicable Laws and Applicable Permits, and conform to Specifications and Standards and Good Industry Practice after approval of Authority. The Contractor shall bear all costs and expenses what so ever for operation & maintenance of the ropeway during the entire O&M Period except for payment of electricity bills to the power supply Agency. The obligations of the Contractor hereunder shall include:

- a) permitting safe, smooth and uninterrupted flow of passengers on the Ropeway during normal operating conditions (minimum availability of 95%).
- b) collecting and appropriating the Fee for the Authority.
- c) minimising disruption to traffic in the event of accidents or other incidents affecting the safety and use of the Ropeway by providing a rapid and effective response and maintaining liaison with emergency services of the State.
- d) carrying out periodic preventive maintenance of the Ropeway.
- e) undertaking routine maintenance of the Ropeway.
- f) undertaking major maintenance of the Ropeway.
- g) Preventing any unauthorised use and encroachments of the Ropeway, with the assistance of concerned law enforcement agencies.
- h) protection of the environment and provision of equipment and materials, therefore.
- i) operation and maintenance of all communication, control and administrative systems necessary for the efficient operation of the Ropeway.
- j) maintaining a public relations unit to interface with and attend to suggestions from the Users, Government Agencies, Media and other agencies.
- k) complying with all Safety Requirements.

2.1.2 The Contractor shall remove all surplus construction machinery and materials, waste materials (including hazardous materials and wastewater), rubbish and other debris promptly from the Project Site, and keep the Project Site in a clean, tidy and orderly condition, and in conformity with the Applicable Laws, Applicable Permits and Good Industry Practice.

2.1.3 The Contractor shall also maintain all access roads/overpasses/under-passes or other structures leading to the ropeway building from the main road.

2.2 Maintenance Requirements

2.2.1 The Contractor shall always ensure that during the Operation Period, the Ropeway conforms to the maintenance requirements set forth in Appendix-1 (the “Maintenance Requirements”).

2.3 Maintenance Manual

2.3.1 No later than 180 (one hundred and eighty) days prior to the Scheduled Operation Date, the Contractor shall submit the authorised repair and maintenance manual (the “Maintenance Manual”) of the technology and equipment supplier which shall follow Specifications and Standards for the regular and preventive maintenance of the Ropeway in conformity with the Maintenance Requirements, Safety Requirements and Good Industry Practice.

2.3.2 The Maintenance Manual shall include provisions for maintenance of Project Assets and shall provide for life cycle maintenance, routine maintenance and reactive maintenance which may be reasonably necessary for maintenance and repair of the Project Assets, including replacement thereof, such that their overall condition conforms to Good Industry Practice.

2.3.3 The Maintenance Manual shall be revised and updated from time to time as per requirement of the Original equipment Manufacturer (OEM) but with the prior approval of the Authority.

SECTION – S.03

MAINTENANCE PROGRAM

- 3.1 On or before Commercial Operation Date and no later than 45 (forty-five) days prior to the beginning of each Accounting Year during the Operation Period, as the case may be, the Contractor shall provide to the Authority/Engineer, its proposed annual programme of preventive, urgent and other scheduled maintenance (the “Maintenance Programme”) to comply with the Maintenance Requirements, Maintenance Manual and Safety Requirements as per Specifications and Standards. The Maintenance Programme shall include the following:
- a) the proposed maintenance works and its schedule.
 - b) deployment of resources for the maintenance works.
 - c) arrangements and procedures for carrying out repairs.
 - d) criteria to be adopted for deciding maintenance needs.
 - e) intervals and procedures for carrying out inspection of all elements of the Ropeway.
 - f) intervals at which the Contractor shall carry out periodic maintenance.
 - g) details related to inspection tests, routine tests and periodic tests.
 - h) arrangements and procedures for carrying out safety related measures; and
 - i) intervals for major maintenance works and the scope thereof.
- 3.2 Within 15 (fifteen) days of receipt of the Maintenance Programme, the Authority/Engineer shall review the same and convey its comments and approval to the Contractor with reference to its conformity with the Maintenance Requirements, Maintenance Manual and Safety Requirements.
- 3.3 The Contractor may modify the Maintenance Programme as may be reasonable in the circumstances after approval or as directed by the Authority.

SECTION – S.04

SAFETY, BREAKDOWNS AND ACCIDENTS

- 4.1 The Contractor shall ensure safe conditions for the Users, and in the event of unsafe conditions, it shall follow the relevant operating procedures as per CEN Specifications and Standards, and removal of obstruction and debris without delay. Such procedures shall conform to the provisions of this Agreement, Applicable Laws, Applicable Permits and Good Industry Practice.
- 4.2 The Contractor's responsibility for rescue operations on the Ropeway shall be limited to getting the passengers to the nearest Station for disembarkation. The technology provider shall define procedure/ capability under such circumstances. Alternatively, rescue operations procedure to be followed as per CEN Specifications and Standards with the responsibility of the Contractor to get people safely on the ground.

SECTION S.05

DE-COMMISSIONING DUE TO REPAIR & EMERGENCY

- 5.1 If, in the reasonable opinion of the Contractor, there exists a repair or an Emergency which warrants de-commissioning and closure to traffic of the whole or any part of the Ropeway, the Contractor shall be entitled to de-commission and close the whole or any part of the Ropeway to traffic for so long as such Emergency and the consequences thereof warrant; provided that such decommissioning and particulars thereof shall be notified by the Contractor to the Authority well in advance for repairs and without any delay in case of emergency, and the Contractor shall diligently carryout and abide by any reasonable directions that the Authority may give for dealing with such Emergency.
- 5.2 The Contractor shall re-commission the Ropeway or the affected part thereof as quickly as practicable after the circumstances leading to its decommissioning and closure have ceased to exist or have so abated as to enable the Contractor to re-commission the Ropeway and shall notify the Authority of the same without any delay.
- 5.3 Any decommissioning or closure of any part of the Ropeway and the re-commissioning thereof shall, as soon as practicable, be brought to the notice of affected persons by means of public announcements/notice.

SECTION – S.06

DAMAGES FOR BREACH OF MAINTENANCE OBLIGATIONS

- 6.1 In the event that the Contractor fails to repair or rectify any defect or deficiency set forth in the Maintenance Requirements within the period specified therein, it shall be deemed to be in breach of this Agreement and the Authority shall be entitled to recover Damages, to be calculated and paid for each day of delay until the breach is cured, for an amount equal to Average Daily Fee in addition to recovery of cost as per clause 7.1. Recovery of such Damages shall be without prejudice to the rights of the Authority under this Agreement, including the right of Termination thereof.
- 6.2 The Damages set forth in Clause 7.1 may be assessed and specified forthwith by the Engineer; provided that the Authority may, in its discretion, demand a smaller sums Damages, if in its opinion, the breach has been cured promptly and the Contractor is otherwise in compliance with its obligations hereunder. The Contractor shall pay such Damages forthwith and, in the event, that it contests such Damages, the Dispute Resolution Procedure shall apply.

SECTION – S.07

AUTHORITY’S RIGHT TO TAKE REMEDIAL MEASURES

- 7.1 In the event the Contractor does not maintain and/or repair the Ropeway or any part thereof in conformity with the Maintenance Requirements, the Maintenance Manual or the Maintenance Programme, as the case may be, and fails to commence remedial works within 15(fifteen) days of receipt of the O&M Inspection Report or a notice in this behalf from the Authority/Engineer, as the case may be, the Authority shall, without prejudice to its rights under this Agreement including Termination thereof, be entitled to undertake such remedial measures at the risk and cost of the Contractor, and to recover its cost from the Contractor. In addition to recovery of the aforesaid cost, a sum equal to 20% (twenty per cent) of such cost shall be paid by the Contractor to the Authority as Damages. For the avoidance of doubt, the rights of the Authority under this Clause 8.1 shall be without prejudice to its rights and remedies provided under SECTION – S.07.

SECTION - S.08

OVERRIDING POWERS OF THE AUTHORITY

- 8.1 If in the reasonable opinion of the Authority, the Contractor is in material breach of its obligations under this Agreement and, in particular, the Maintenance Requirements, and such breach is causing or likely to cause material hardship or danger to the Users, the Authority may, without prejudice to any of its rights under this Agreement including Termination thereof, by notice require the Contractor to take reasonable measures immediately for rectifying or removing such hardship or danger, as the case may be.
- 8.2 In the event that the Contractor, upon notice under Clause 8.1, fails to rectify or remove any hardship or danger within a reasonable period, the Authority may exercise overriding powers under this Clause 8.2 and take over the performance of any or all the obligations of the Contractor to the extent deemed necessary by it for rectifying or removing such hardship or danger; provided that the exercise of such overriding powers by the Authority shall be of no greater scope and of no longer duration than is reasonably required hereunder; provided further that any costs and expenses incurred by the Authority in discharge of its obligations hereunder shall be deemed to be O&M Expenses, and the Authority shall be entitled to recover them from the Contractor in accordance with the provisions of SECTION - S.08 along with the Damages specified therein.

In the event of a national emergency, civil commotion or any other act, the Authority may take over the performance of any or all the obligations of the Contractor to the extent deemed necessary by it or as directed by the Government, and exercise such control over the Ropeway or give such directions to the Contractor as may be deemed necessary; provided that the exercise of such overriding powers by the Authority shall be of no greater scope and of no longer duration than is reasonably required in the circumstances which caused the exercise of such overriding power by the Authority. It is also agreed that the Contractor shall comply with such instructions as the Authority may issue in pursuance of the provisions of SECTION - S.08, and shall aid and cooperation to the Authority, on a best effort basis, for performance of its obligations hereunder.

SECTION - S.09

RESTORATION OF LOSS OR DAMAGE TO ROPEWAY

Save and except as otherwise expressly provided in this Agreement, if the Ropeway or any part thereof suffers any loss or damage during the period of Contract from any cause whatsoever, the Contractor shall, at its cost and expense, rectify and remedy such loss or damage forthwith so that the Ropeway conforms to the provisions of this Agreement.

SECTION S.10

MODIFICATIONS TO THE ROPEWAY

The Contractor shall not carry out any material modifications to the Ropeway except where such modifications are necessary for the Ropeway to operate in conformity with the Specifications and Standards, Maintenance Requirements, Good Industry Practice and Applicable Laws without approval of Authority.

The Contractor shall notify the Authority/Engineer of the proposed modifications along with particulars and shall commence the work on such modifications only after the approval of the Authority.

For the avoidance of doubt, if any modification to the Ropeway or part thereof has a material effect on the safety of Users, the same shall be subject to safety related certification in accordance with Applicable Laws and the procedure.

For the avoidance of doubt, all modifications made hereunder shall comply with Specifications and Standards, Applicable Laws and the provisions of this Agreement.

SECTION – S.11

EXCUSE FROM PERFORMANCE OF OBLIGATIONS

The Contractor shall not be considered in breach of its obligations under this Agreement if any part of the Ropeway is not available to traffic on account of any of the following for the duration thereof:

- a) an event of Force Majeure.
- b) measures taken to ensure the safe use of the Ropeway except when unsafe conditions occurred because of failure of the Contractor to perform its obligations under this Agreement; or
- c) compliance with a request from the Authority or the directions of any Government Instrumentality, the effect of which is to close all or any part of the Ropeway.
- d) Notwithstanding the above, the Contractor shall keep all unaffected parts of the Ropeway open to traffic provided they can be operated safely.

SECTION – S.12

BARRIERS and DIVERSIONS

The Authority shall ensure that during the Operation Period, no barriers are erected or placed by any Government Instrumentality on the Ropeway except for reasons of Emergency, national security, law and order or collection of inter-state taxes.

The Authority shall also make best endeavours to procure that no Government Instrumentality shall undertake or cause to be undertaken, except for reasons of Emergency, national security or law and order, any diversions of traffic from, or closing down of approach roads to the Ropeway that may cause a material adverse effect on the flow of traffic to and from the Ropeway.

SECTION – S.13

MONITORING OF OPERATION AND MAINTENANCE

13.1 Monthly status reports

During Operation Period, the Contractor shall, no later than 7 (seven) days after the close of each month, furnish to the Authority/Engineer, a monthly report stating in reasonable detail the condition of the Ropeway including its compliance or otherwise with the Maintenance Requirements, Maintenance Manual, Maintenance Programme and Safety Requirements, and shall promptly give such other relevant information as may be required by the Authority/Engineer. In particular, such report shall separately identify and state in reasonable detail the defects and deficiencies that require rectification.

13.2 Reports of unusual occurrence

The Contractor shall, prior to the close of each day, send to the Authority/Engineer, by facsimile or e-mail, a report stating accidents and unusual occurrences on the Ropeway relating to the safety and security of the Users and Ropeway. A weekly and monthly summary of such reports shall also be sent within 3 (three) days of the closing of each week and month, as the case may be. For the purposes of this Clause 13.2, accidents and unusual occurrences on the Ropeway shall include:

- a) death or injury to any person.
- b) damaged or dislodged fixed equipment.
- c) obstruction in opening/closing of doors of a coach.
- d) any obstruction on the Ropeway, which results in slow down of the services being provided by the Contractor.
- e) disablement of any cabin during operation.
- f) communication failure affecting the operation of Ropeway.
- g) smoke or fire; and
- h) other relevant information as may be required by the Authority or the Engineer.

In case of death or Injury, the contractor shall immediately intimate the same to the Station House Officer(SHO) Police Station of the area concerned in addition to the Authority.

13.3 Inspection

The Authority/Engineer shall inspect the Ropeway at any time but at least once a month. It shall make a report of such inspection (the “O&M Inspection Report”) stating in reasonable detail the defects or deficiencies, if any, with reference to the Maintenance

Requirements, Maintenance Manual, the Maintenance Programme and Safety Requirements, and send a copy thereof to the Contractor within 7 (seven) days of such inspection. The contractor shall facilitate the inspections by the Authority as well as by the Regulator as per HP Aerial ropeway Act 1968 amended from time to time.

13.4 Tests

For determining that the Ropeway conforms to the Maintenance Requirements, the Authority/Engineer shall require the Contractor to carry it, or cause to be carried out, tests specified by it in accordance with Good Industry Practice and as per **Appendix-3**. The Contractor shall, with due diligence, carry out or cause to be carried out all such tests in accordance with the instructions of the Authority/Engineer and furnish the results of such tests forthwith to the Authority/Engineer.

13.5 Remedial measures

The Contractor shall repair or rectify the defects or deficiencies, if any, set forth in the O&M Inspection Report or in the Test results referred to in Clause 13.4 and furnish a report in respect thereof to the Authority/Engineer and the Authority within 15 (fifteen) days of receiving the O&M Inspection Report or the Test results, as the case may be; provided that where the remedying of such defects or deficiencies is likely to take more than 15 (fifteen) days, the Contractor shall submit progress reports of the repair works once every week until such works are completed in conformity with this Agreement.

The Authority/Engineer shall require the Contractor to carry out or cause to be carried out Tests, at its own cost, to determine that such remedial measures have brought the Ropeway into compliance with the Maintenance Requirements and the procedure set forth in this Clause 13.5 shall be repeated until the Ropeway conforms to the Maintenance Requirements. In the event that remedial measures are not completed by the Contractor in conformity with the provisions of this Agreement, the Authority shall be entitled to recover Damages from the Contractor under and in accordance with the provisions of SECTION-S07.

At any time during the Maintenance Period, the Authority may appoint an external technical auditor to conduct an audit of the quality of the Works. The Auditor in the presence of the representative of the Contractor and the Authority's Engineer shall carry out the Tests. The findings of the Audit shall be notified to the Contractor for taking remedial measures. After completion of remedial measures by the Contractor, the Auditor shall undertake closure audit, and this process will continue till the remedial measures have brought the maintenance works into compliance with the specifications and standards. The Contractor shall provide all assistance as may be required by the auditor in the conduct of its audit.

13.6 Quarterly Fee Statement

During the Operation Period, the Contractor shall furnish to the Authority, within 7 (seven) days of completion of each quarter, a statement of Fee (the "Quarterly Fee Statement"). The Contractor shall also furnish to the Authority such other information as the Authority may reasonably require, at specified intervals, in discharge of its statutory functions

SECTION – S.14

TRAFFIC REGULATION AND SECURITY

14.1 Traffic regulation by the Contractor

- 14.1.1 The Contractor shall regulate the traffic on the Ropeway in accordance with Applicable Laws and subject to the supervision and control of the Authority [or a substitute thereof empowered in this behalf under the Applicable Laws].
- 14.1.2 The Contractor shall, in consultation with the Authority and representatives of Users, evolve and publicise a system based on Good Industry Practice such that no User or category of Users is discriminated against or unduly favoured, as the case may be, in the use of the Ropeway.
- 14.1.3 The Contractor shall have the obligation to manage, operate and regulate the Ropeway on a common carrier basis providing non-discriminatory services to all persons.

14.2 Security

- 14.2.1 The Contractor shall be responsible for the security arrangements within Ropeway in order to maintain the orderly conduct of its business and the security thereof.
- 14.2.2 The Contractor shall abide by and implement any instructions of the Authority for enhancing the security within and around the Ropeway. The Contractor shall not be entitled to any compensation for disruption of its operations or loss or damage resulting from the Authority's actions, or the actions of any organisation authorised by the Authority other than those resulting from wilful or grossly negligent acts or omissions of such organisation. The Authority agrees that it shall cause the relevant organisations to take such actions as reasonably deemed necessary by them, without unduly or unreasonably disrupting the operations of the Ropeway or interfering with the exercise of rights or fulfilment of obligations by the Contractor under this Agreement. The Contractor agrees that it shall extend its full support and cooperation to the Authority and to the other organisations authorised by the Authority in the discharge of their obligations thereunder.
- 14.2.4 Subject to the rights of the Contractor, the Authority or any agency duly authorised by it shall be entitled to inspect and search the Ropeway or part thereof and to search any person or vehicle entering the Site or departing there from, without unduly or unreasonably disrupting the operations of the Ropeway.
- 14.2.5 The Authority shall ensure and procure that the personnel of the Contractor and all its contractors, suppliers, sub-contractors and agents and the Users of the Ropeway are allowed free ingress and egress from the limits of the Ropeway without any unreasonable interference by the personnel of the Authority.
- 14.2.7 The Authority and the Contractor shall jointly make best endeavours to ensure that the security of the Ropeway is maintained such that the level of risk premium under insurance covers (if any) that is to be borne by the Contractor shall be at the lowest possible rate.

SECTION – S.15

KEY PERFORMANCE INDICATORS

15.1 Key Performance Indicators

Without prejudice to the obligations specified in this Agreement, the Contractor shall operate the Ropeways such that it achieves or exceeds the performance indicators specified in this Section– S.15.

15.2 Operation of Ropeway Carriers

15.2.1 The Ropeways shall be operated such that the service shall operate between 6:00 AM to 10:00 PM or as specified by the Authority for a duration of 16 hours.

15.2.2 The Contractor shall at all times ensure that:

- a) the ropeway carriers are clean, hygienic and free of odour; and
- b) there is adequate lighting within the carrier and Station in conformity with the Specifications and Standards.
- c) the hygiene and cleanliness in common areas within the Station is maintained properly in accordance with Maintenance Requirements.
- d) all entry and exit points, passages, circulation areas and vehicular traffic are so managed that they do not have a queue with a waiting time exceeding [5 (five)] minutes.
- e) all lifts, public address systems and lighting systems function efficiently, and their availability is no less than 95% (ninety-five per cent) during the operation and Maintenance period.
- f) 50% (fifty) percent of all phone calls relating to the Ropeway are answered within 30 (thirty) seconds.

15.3 Provisions of Carriers

The number of passengers shall not exceed the design capacity of the carriers.

15.4 Operation of Terminal Stations

15.4.1 The Parties hereto agree that the primary purpose of the Station is to provide space for the Users who normally stay at a Station for a period of time no longer than necessary, to wait for and enter the carriers or to exit the Station or after exiting from the carriers.

15.4.2 The design, construction, operation and maintenance of the Stations shall be such that:

- a) a user alighting at the platform should be able to reach a point outside the Station in not more than [3 (three)] minutes of brisk walking and a User crossing the fee collection point should be able to reach the platform in not more than [2 (two)] minutes of brisk walking; and

- b) in case of Emergency, evacuation from any point on the platform to a point of safety in an open space within or outside the Station shall not exceed [100 (one hundred)] meters.

15.4.3 The entry and exit gates, including the automatic ticket verification machines, shall be so designed and operated that the waiting time for the Users shall not exceed [2 (two)] minutes.

15.4.4 The Contractor shall provide an adequate number of ticket vending machines and ticket counters such that waiting time for the Users shall not exceed [2 (two)] minutes.

15.5 Monthly status report

During Operation Period, the Contractor shall, no later than 7 (Seven) days after the close of each month, furnish a monthly report stating in detail the compliance with all the Key Performance Indicators along with an analysis of the reasons for failures, if any, and the strategies for addressing the same and for otherwise improving the operational performance of the Ropeway.

15.6 Penalty for shortfall in performance

The Contractor shall ensure and procure compliance of each of the Key Performance Indicators and for any shortfall in average performance during a quarter, it shall pay Damages within 30 (thirty) days of the quarter in which the shortfall occurred. The Damages due and payable under this Clause 15.6 shall be in accordance with the Appendix-2. However, the Authority may waive the Damages, in part or full, if it is satisfied that the Contractor has been carrying out its obligations diligently and efficiently and that the shortfall to be waived was on account of reasons beyond the control of the Contractor.

15.7 CEN certification

The Contractor shall commercially operate the ropeway only after the issue of certificate of completion for compliance as per Standards from the CEN Electro-Mechanical Equipment Supplier.

15.8 Passenger Charter

The Contractor shall display and implement Bye-laws of this ropeway approved and notified by the State Govt. The Contractor shall at all times be accountable and liable to Users in accordance with the provisions of the above bye-laws.

Appendix-1

Maintenance Requirement

1. Introduction

This Schedule outlines the maintenance requirements for the ropeway project as per the Engineering, Procurement, and Construction (EPC) agreement. The purpose is to ensure the safety, reliability, and efficiency of the ropeway system throughout its operational lifespan.

2. Scope of Maintenance

The maintenance activities covered under this Schedule include but are not limited to:

- Routine inspections (Daily, Fortnightly, Monthly, Quarterly, Bi-annual, Annual)
- Preventive maintenance
- Corrective maintenance
- Lubrication
- Safety checks
- Emergency repairs
- Component replacements
- Software updates (if applicable)

3. Maintenance Responsibilities

3.1. Contractor Responsibilities:

The Contractor shall be responsible for:

- Performing routine inspections (Daily, Fortnightly, Monthly, Quarterly, Bi-Annual, Annual) as per the manufacturer's recommendations.
- Carrying out preventive maintenance activities to minimize downtime and ensure optimal performance.
- Responding promptly to any reported faults or malfunctions.
- Keeping detailed records of all maintenance activities, including dates, findings, and actions taken.
- Providing qualified personnel and equipment for maintenance tasks.

3.2. Authority Responsibilities:

The Authority shall be responsible for:

- Providing access to the ropeway system for maintenance purposes.

- Collaborating with the Contractor to schedule maintenance activities during off-peak hours whenever possible.
- Notifying the Contractor of any observed abnormalities or issues with the ropeway system.
- Reviewing and approving maintenance schedules and procedures proposed by the Contractor.

4. Maintenance Schedule

The maintenance schedule shall be developed based on the manufacturer's recommendations, operational requirements, and regulatory standards. It shall include:

- Frequency of routine inspections
- Interval for preventive maintenance tasks
- Emergency response procedures
- Scheduled downtime for major maintenance activities
- Seasonal adjustments for environmental factors (e.g., winterization)

5. Maintenance Standards

All maintenance activities shall adhere to the following standards:

- Manufacturer's recommendations and guidelines
- Applicable industry standards and regulations
- Best practices for ropeway maintenance and operation
- Safety protocols to minimize risks to personnel and the public

6. Documentation and Reporting

The Contractor shall maintain comprehensive documentation of all maintenance activities, including:

- Maintenance logs
- Inspection reports
- Work orders
- Spare parts inventory
- Incident reports (if any)

Regular reports shall be submitted to the Owner detailing the status of maintenance activities, any identified issues, and proposed solutions.

7. Compliance and Review

The maintenance requirements outlined in this Schedule shall be subject to review and audit to ensure compliance with contractual obligations and regulatory requirements. Any deviations or deficiencies shall be promptly addressed by the Contractor.

Annex – I (Appendix-1)

REPAIR/RECTIFICATION OF DEFECTS AND DEFICIENCIES - ROPEWAY PROJECT

The Contractor shall promptly address the defects and deficiencies specific to the Ropeway Project as outlined in this Annex-I of Appendix-1 within the specified timeframes:

Nature of Defect or Deficiency	Time Limit for Repair/Rectification
ROPEWAY COMPONENTS	
(a) Rope Carriages and Supports	
(i) Rope Blockage or Malfunction	Immediate suspension of service; Permanent restoration within 24 hours
(ii) Excessive Swinging or Vibrations	Immediate suspension of service; Permanent restoration within 24 hours
(iii) Rope Tension Irregularities	Immediate suspension of service; Permanent restoration within 24 hours
(iv) Any Structural Damage or Cracks	24 hours
(v) Any Other Operational Defects	24 hours
(b) Passenger Platforms and Stations	
(i) Malfunction of Passenger Loading/Unloading Mechanism	4 hours
(ii) Platform Structural Integrity Issues	7 (seven) days
(iii) Facility Cleanliness and Hygiene	2 hours
(c) Electrical and Mechanical Systems	
(i) Power Supply Failure	4 hours
(ii) Equipment Faults or Malfunctions	24 hours
(iii) Emergency Stop Mechanism Failure	Immediate suspension of service; Permanent restoration within 12 hours
(iv) Safety System Alarms or Alerts	2 hours

Nature of Defect or Deficiency	Time Limit for Repair/Rectification
(v) Any Other Electrical or Mechanical Issues	24 hours
(d) Passenger Safety and Comfort	
(i) Emergency Evacuation Readiness	Ongoing readiness: Immediate action as required
(ii) Passenger Comfort Amenities	2 hours
(iii) Emergency Response Accessibility	2 hours
(e) Environmental and Aesthetic Concerns	
(i) Waste Management	4 hours
(ii) Vegetation Maintenance	7 (seven) days
(iii) Aesthetic Damage Repair	24 hours
(f) Miscellaneous Items	
(i) Removal of Obstacles on Rope Path	Immediate
(ii) Reporting and Documentation of Incidents	Immediate
(iii) Any Other Defects as per Project Requirements	As determined by the competent authority

Note: The timeframes for repair/rectification may be subject to modification by the Authority as per project exigencies and with the approval of the competent authority.

Appendix-2

Payment Reduction for Non-Compliance

Payment reduction for non-compliance with the Maintenance Requirements

- (i) Monthly lump sum payments for maintenance shall be reduced in the case of non-compliance with the Maintenance Requirements set forth in Appendix-1.
- (ii) Any deduction made on account of non-compliance with the Maintenance Requirements shall not be paid even after compliance subsequently. The deductions shall continue to be made every month until compliance is done.

Percentage reductions in lump sum payments on monthly basis

The amount to be deducted from monthly lump-sum payment for non-compliance of particular item shall be calculated as under:

$$R = \frac{P}{100} \times (M1 \text{ or } M2) \times \frac{L1}{L}$$

Where,

P= Percentage of particular item/Defect/deficiency for deduction

M1 or M2 = Monthly Lump-Sum Payment

L1= Non-Complying Length of Ropeway

L = Total Length of the Ropeway

R= Reduction (the amount to be deducted for non-compliance for a particular item/Defect/deficiency)

The total amount of reduction shall be arrived at by summation of reductions for such items/Defects/deficiency or non-compliance.

For any Defect in a part of One Kilometre, the Non-Conforming Length shall be taken as One Kilometre.

Appendix-3

Tests on Completion of Operation and Maintenance Period

On completion of the Operation and Maintenance period, the Contractor shall get the installed Ropeway system inspected by the Certified Safety Auditor for the CEN Standards which shall be an accredited notified body according to EU regulation (EC) 2016/24, certified inspection body and testing body according to EN ISO/IEC 17020 (inspection) and EN ISO/IEC17025 (testing) respectively. The contractor shall submit the certificate of inspection from the above Certified Safety Auditor including but not limited to following: -

1. Visual Inspection: A visual inspection is carried out to check for any obvious signs of damage, wear, or deterioration in the ropeway components such as cables, sheaves, grips, towers, and terminals.
2. Functional Testing: Functional tests are conducted to ensure that all mechanical and electrical components of the ropeway system are operating as intended. This includes testing the operation of the drive system, brakes, emergency stops, and control mechanisms.
3. Load Testing: Load testing involves subjecting the ropeway to its maximum designed load capacity to ensure that it can safely transport passengers or cargo without exceeding its load limits.
4. Speed and Performance Testing: Speed and performance tests are conducted to verify that the ropeway can operate at the specified speeds and meet the required performance criteria under normal operating conditions.
5. Safety Systems Testing: Testing of safety systems such as emergency braking, anti-rollback mechanisms, and overload protection systems is essential to ensure that they function correctly in case of an emergency.
6. Environmental Testing: Environmental testing involves evaluating the ropeway's performance under various environmental conditions such as temperature extremes, wind, rain, and snow to ensure that it can operate safely and reliably in all weather conditions.
7. Documentation Review: Reviewing all documentation related to the maintenance period, including maintenance logs, inspection reports, and any repairs or modifications performed during the maintenance period, is crucial to ensure that all necessary tasks have been completed according to the manufacturer's recommendations and regulatory requirements.
8. Certification and Regulatory Compliance: Finally, the ropeway must undergo certification and regulatory compliance checks at contractor's costs to ensure that it meets all applicable safety standards and regulations set forth by relevant authorities

Appendix-4

LIST OF MINIMUM MANPOWER REQUIRED FOR OPERATION OF ROPEWAY

Description	for Sections/ Stations	shifts	No. of Staff
Administrative			
Accountant	1 per 2 sections	1	3
Storekeeper	1 per section	1	6
Assistant Storekeeper	1 per section	2	12
Record sorter cum clerk	1 per section	1	6
Housekeeping staff	2 per station	2	60
Security Guards	4 per station	3	130
Booking Clerk	4 per station	2	120
Technical			
Resident Manager	One for entire network		1
Mechanical Engineer	One per section and one for Turning station	2	14
Electrical Engineer	One per two sections	2	6
Mechanical Fitter	One per section	2	12
Electrician	One per 2 sections	2	6
Welder	One for 2 sections	1	3
Helpers	One per station	2	30
Cabin attendants/ technician/Ushers (including one reliever) for 1 station	Four per Station	2	120
Ropeway Operators	One per section	2	12

Note: The Minimum Manpower Requirement may be subject to modification by the Authority as per project exigencies.



“Design, Supply, Construction, Installation, Testing, Commissioning and Operation & Maintenance for 5 (five) years of Seamless Innovative Urban Transportation (Ropeways, Lifts & Escalators Etc.) Network in Shimla City (Himachal Pradesh) on Engineering Procurement and Construction (EPC) Mode.”

ENVIRONMENT AND SOCIAL MANAGEMENT PLAN

Volume - VI

October - 2024

Externally Aided Project

(Under Consideration for funding by New Development Bank)

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1. Environment and Social Management Plan

1.1 Introduction

The Environmental and Social Management Plan (ESMP) for the Project is a comprehensive document that outlines the anticipated environmental and social impacts, mitigation measures, and monitoring activities to ensure the project's sustainable implementation. The ESMP aims to:

- **Identify and address** potential Environmental and Social risks associated with the project.
- **Develop and implement** effective mitigation measures to minimize these risks.
- **Monitor and evaluate** the effectiveness of mitigation measures.
- **Ensure compliance** with applicable Environmental and Social regulations.

The ESMP covers all the phases of the project. It addresses potential impacts on land use, biodiversity, air quality, water quality, soil management, social aspects, and cultural heritage.

1.2 Objectives of the Environmental and Social Management Plan

The primary objectives of the ESMP are to:

- **Integrate** environmental and social considerations into project planning, design, and implementation.
- **Minimize** negative environmental and social impacts.
- **Maximize** positive environmental and social benefits.
- **Ensure** compliance with local, national, and international laws, regulations, and best practices.
- **Promote community engagement** and ensure the project's benefits extend to local stakeholders.
- **Protect human health and safety** and ensure a safe working environment for all personnel involved.

1.3 ESMP Development and Implementation

The ESMP has been developed using insights from the Environmental and Social Impact Assessment (ESIA) studies conducted for the project. The **Contractor** will be responsible for updating the ESMP, if necessary, after final design approval, and must seek final approval from the Engineer and Authority.

The Contractor will ensure full compliance with the ESMP throughout the project lifecycle. This includes:

- Allocating the necessary resources, including financial, technical, and human capital, for effective implementation.
- Establishing an Environmental, Health, and Safety (EHS) cell with qualified personnel to oversee implementation and reporting.
- Regularly monitoring and reporting on ESMP compliance to the Engineer, Authority, and relevant stakeholders.

2. Clearances and Permissions Required Project

2.1 Table Clearance/permits required prior to Construction of the project

Permit/License	Issuing Authority	Responsible Party for Application	Expected submission
Forest Clearance (FC)	State Forest Department	Authority	submitted
Aerial Ropeway Act Clearance	Principal Secretary (PWD), Himachal Pradesh	Authority	Post tender award
Tree Felling Permit	State Forest Department	Authority	Submitted along with Forest clearance case
No Objection Certificate (NOC) from AAI	Airport Authority of India (AAI)	Authority	Post tender award
Building Plan Approval	Local Municipal Corporation	Authority	Upon completion of the design
Environmental and Social Impact Clearance	Ministry of Environment, Forest and Climate Change (MoEFCC)	Authority	N/A
Construction Noise permit	State Pollution Control Board	Contractor	Post Contractor engagement (only if noise levels that exceed permissible limits)
Water Use Permission during construction	Local Municipal Corporation /water Authority	Contractor	Post Contractor engagement
Electricity Connection for construction purposes	HP State Electricity Board, Shimla	Contractor	Post Contractor engagement
Compliance under Employees' Provident Funds Act, 1952	Employee's Provident Fund Organization (EPFO)	Contractor	Post Contractor engagement
Compliance under Building and Other Construction Workers Act, 1996	Labour Department, GoHP	Contractor	Post Contractor engagement

Permit/License	Issuing Authority	Responsible Party for Application	Expected submission
Public Works Department (PWD) NoC	Public Works Department (PWD), GoHP	Contractor	Post Contractor engagement
Consent to Establish/operate for Crusher and any other plants etc.	Himachal Pradesh State Pollution Control Board	Contractor	Post Contractor engagement (if required) ¹
Record under Equal Remuneration Act, 1976	Labour Department, GoHP	Contractor	Post Contractor engagement
Registration under Inter-State Migrant Workmen Act, 1979	Labour Department, GoHP	Contractor	Post Contractor engagement
Compliance under Central Motor Vehicle Act, 1988	Regional Transport Office (RTO), GoHP	Contractor	Post Contractor engagement
Public Liability Insurance under Public Liability Insurance Act, 1991	Insurance Companies	Contractor	Post Contractor engagement

Note: The contractor shall conduct a thorough review of all applicable laws, regulations, and guidelines to identify any additional clearances or permits that may be required.

2.2 Table Clearance/permits required prior to operation of the project

S. No.	Clearances/Permissions Required	Competent Authority to Accord Clearances	Responsibility to Obtain Clearance
1	Water Connections	Irrigation and Public Health Department, GoHP/ MC Shimla	Authority
2	Electricity Connection	Himachal Pradesh State Electricity Board (HPSEB)	Authority
3	Sewer Connections	Local Municipal Corporation	Authority
4	Lift NoC	Department is HPPWD; Electrical Division	Authority
5	Water Connections	Irrigation and Public Health Department, GoHP/ MC Shimla	Authority

¹ It is essential that contractors procure materials from **authorized and approved sources**

S. No.	Clearances/Permissions Required	Competent Authority to Accord Clearances	Responsibility to Obtain Clearance
6	Electricity Connection	Himachal Pradesh State Electricity Board (HPSEB)	Authority

3. The Environmental Management Action Plan

3.1 Introduction

Based on the environmental assessment of the project activities, an **Environmental Management Plan (EMP)** has been developed to address potential adverse environmental impacts. The EMP outlines the anticipated impacts, corresponding mitigation measures, monitoring requirements, and assigns responsibilities for implementing these actions at different stages of the project.

A detailed and site-specific **Environment Management Action Plan (EMAP)** has been designed for the construction and implementation phases of the project. This plan outlines feasible and cost-effective mitigation measures aimed at minimizing significant environmental impacts to acceptable levels. The EMAP also identifies the responsible parties for implementing and supervising these mitigation measures.

Monitoring of the project's environmental aspects will be conducted by **Environmental Safeguard Specialists** from **Authority/Engineer**. Key activities to be monitored include:

- Planning, coordination, and management related to environmental safeguards.
- Identification of corrective and preventive actions.
- Recording health and safety incidents, including worker and community accidents (minor, severe, or fatal) and near-misses.
- Engaging with project-affected communities for consultations, feedback, and grievance redressal during implementation.
- Preparation of progress reports and monitoring compliance with environmental safeguard measures.

Additional good environmental practices will be observed, such as:

- Sanitary waste management, noise control, and hygiene maintenance.
- Proper maintenance of fire and safety equipment.
- Compliance by contractors with all EMAP measures, supervised by Authority and Engineer.

3.2 Environmental Monitoring:

To ensure the project does not negatively impact environmental quality, the contractor is responsible for monitoring key environmental parameters such as water, soil, air, and noise, both before construction (to establish baseline) and during construction. These activities will be conducted in accordance with Central Pollution Control Board (CPCB) guidelines.

The contractor is also required to appoint a **Senior Health, Safety, and Environmental Expert** to oversee the environmental management requirements throughout the project. The monitoring schedule and periodicity of the environmental parameters are detailed in table and follows the EMAP table.

All environmental management and mitigation measures must be implemented in accordance with the recommendations, procedures and guidelines provided in the respective annexures.

3.3 Environmental Management Action Plan (EMAP) during Construction

Activities/ Concerns	Potential impacts	Assessed Risk level	Mitigation measures	Monitoring Indicators	Institutional Responsibilities	
					Implementatio n	Supervision
Submission of C-ESMP (Contractor Environmental and Social Management Plan)	-		Contractor will prepare and submit a Contractor Environmental and Social Management Plan (C-ESMP) as per project guidelines. Refer all the Annexures for detailed plan requirements.	Submission of C-ESMP on time	Contractor	Safeguard Team of Authority / Engineer
Labour management risk	Delayed wages, inadequate worker facilities	Medium	Contractor will provide labour management facilities in accordance with Annexures 1, 2, and 3 , including solid waste management and camp facilities.	Regular checks on wage payments, compliance with facilities as per labour laws	Contractor	Safeguard Team of Authority / Engineer
Safety hazards due to increased traffic	Accident risk	Medium	Contractor to prepare and implement a Traffic Management Plan (TMP), with safety protocols and public safety measures. Refer Annexure 4 for Traffic Management Plan.	Ensure the TMP is prepared and available at the project site	Contractor	Safeguard Team of Authority / Engineer
Workplace injury and hazard	Workforce injury risk	Medium	Contractor to adhere to health and safety protocols. Training on occupational safety as per laws (refer Annexure 4 ; Safety Management Plan).	Occupational Health and Safety Plan Training completion	Contractor	Safeguard Team of Authority / Engineer
Community Health and Safety	Community risks due to project	Low	Contractor to ensure health and safety of community; conduct stakeholder consultations; refer	Monitoring of community	Contractor	Safeguard Team of Authority /

Activities/ Concerns	Potential impacts	Assessed Risk level	Mitigation measures	Monitoring Indicators	Institutional Responsibilities	
					Implementatio n	Supervision
	activities		Annexures 5 and 10 for public health and landslide management plans.	complaints and incidents		Engineer
Sexual Exploitation and Abuse (SEA)/ Sexual Harassment (SH)	Sexual harassment or exploitation	Low	Contractor to establish Internal Complaints Committee (ICC) as per Sexual Harassment Act 2013. Refer Annexure 4 for more details on safety management.	ICC setup and complaints redressal process	Contractor	Safeguard Team of Authority / Engineer
Public Health Delivery and Management	Health risks to workers and surrounding community	Medium	Contractor to establish healthcare facilities at labor camps, including dispensaries and first-aid posts. Refer Annexure 10 for Public Health Management Plan.	Monitoring of healthcare facilities, availability of medical staff and first-aid	Contractor	Safeguard Team of Authority / Engineer
Accidental Oil Leakage or Spills	Risk to workers and environment	High	Upgrading equipment and preventing spills. Contractor will prepare an Oil Spill Management Plan as part of the Health and Safety protocol, as outlined in the annexures.	Record of spill incidents, maintenance of equipment	Contractor	Safeguard Team of Authority / Engineer
Chance finds	Loss of cultural, historical items	Medium	Contractor to follow the cultural and heritage management rule strictly	Strict monitoring reporting to Authority and construction activities	Contractor	Safeguard Team of Authority / Engineer
Water logging	Health and Community	Low	Monitor site for potential waterlogging issues, with periodic	Monitoring at site	Contractor	Safeguard Team of Authority /

Activities/ Concerns	Potential impacts	Assessed Risk level	Mitigation measures	Monitoring Indicators	Institutional Responsibilities	
					Implementatio n	Supervision
	health risks		drainage checks.			Engineer
Wastewater Management	Water pollution due to construction wastewater	Medium	Contractor to implement wastewater treatment measures including mobile sewage treatment plants at labor camps. Refer Annexure 7.	Regular water quality monitoring and maintenance of sewage treatment plants	Contractor	Safeguard Team of Authority / Engineer
Quarry Restoration and Rehabilitation	Land degradation after quarrying activities	High	Contractor to follow the Quarry Restoration Plan, including topsoil conservation, backfilling, and re- vegetation. Refer Annexure 6.	Post-quarrying site inspections, re- vegetation success, and topsoil management	Contractor	Safeguard Team of Authority / Engineer
Landslide Mitigation	Risk of landslides affecting construction sites	High	Contractor to implement landslide control measures including slope stabilization, drainage, and afforestation. Refer Annexure 5.	Regular monitoring of vulnerable areas, drainage systems, and slope stability	Contractor / Engineer	Safeguard Team of Authority / Engineer
Topsoil Conservation	Erosion and land degradation	High	Refer Annexure 6 for Quarry Restoration and Rehabilitation Management Plan for measures on topsoil conservation.	Topsoil usage monitoring	Contractor	Safeguard Team of Authority / Engineer
C&D waste (Debris disposal)	Impacts at working place, neighboring people, water channels and biodiversity	Medium	Disposal should be as per C&D Rules 2016. Segregation of C&D waste and deposit at collection centers or handover to authorized processing facilities. Ensure no littering or deposition to prevent obstruction to traffic,	Monitoring at site	Contractor	Safeguard Team of Authority / Engineer

Activities/ Concerns	Potential impacts	Assessed Risk level	Mitigation measures	Monitoring Indicators	Institutional Responsibilities	
					Implementatio n	Supervision
			public, or drains. Removal of all C&D waste in consultation with the concerned local authority. All wastes will be disposed of at designated sites by the Contractor.			
Air Quality	Air pollution and dust emissions	High	Contractor to manage air quality by controlling dust and ensuring all equipment is functional. Refer Annexure 8 for Air Quality Management Plan. Air quality monitoring as per the schedule and frequency given in table 3.5.	Air quality reports and site inspections	Contractor	Safeguard Team of Authority / Engineer
Noise and vibration	Noise pollution	Low to medium	Annexure 9 outlines noise control measures. The contractor will limit noisy operations to daytime hours, use noise suppression equipment, and notify residents. Noise monitoring as per the schedule and frequency given in table 3.5	Noise level and monitoring community feedback	Contractor	Safeguard Team of Authority / Engineer
Water quality	Contamination of local water sources	Low	The contractor will ensure wastewater management systems are in place. Refer Annexure 7 for wastewater treatment details. Water quality monitoring as per the schedule and frequency given in	Regular water quality monitoring	Contractor	Safeguard Team of Authority / Engineer

Activities/ Concerns	Potential impacts	Assessed Risk level	Mitigation measures	Monitoring Indicators	Institutional Responsibilities	
					Implementatio n	Supervision
			table 3.5.			
Biodiversity Management	Impact on local flora and fauna	Medium	Implement biodiversity conservation measures. Refer Annexure 12 for Biodiversity Management and Conservation Plan.	Flora and fauna monitoring	Contractor	Safeguard Team of Authority / Engineer
Solid Waste disposal	Soil, water and air pollution from improper waste disposal	High	Annexure 3 provides detailed guidelines on solid waste management. Contractor to follow the plan for proper waste disposal and segregation. Soil quality monitoring as per the schedule and frequency given in table 3.5.	Regular waste management monitoring	Contractor	Safeguard Team of Authority / Engineer
Hazardous Waste Management	Improper disposal of hazardous materials	High	Contractor to ensure safe collection, storage, and disposal of hazardous waste such as used oils and chemicals. Refer Annexure 3 for solid and hazardous waste management guidelines.	Regular inspections, hazardous waste records, and compliance with disposal regulations	Contractor	Safeguard Team of Authority / Engineer
Energy conservation measures	High fuel consumption during construction	Medium	Contractors to ensure efficient use of equipment, reduce idling, and promote energy-saving measures. Refer Annexure 11.	Fuel consumption records, maintenance of equipment, and energy-saving measures	Contractor	Safeguard Team of Authority / Engineer

3.4 EMAP during Operation Phase of the project

Activities/ Concerns	Potential Impacts	Assessed Risk level	Mitigation measures	Monitoring Indicators	Institutional Responsibilit es
					Implementati on and Supervision
Operation of the Ropeway	Risk of injury and health issues	Medium	Compliance with health and safety regulations applicable in the state and ropeway sector. Ensure all staff receive training on safety and health issues.	Number of staff trained on safety and health issues. performance on safety and health issues regularly monitored.	Official in charge of O&M / Authority
Gender & GRM	SEA/SH risks	Medium	Setup an Internal Complaints Committee (ICC) for terminal staff and provide training as per the Sexual Harassment at the Workplace (Prevention, Prohibition, and Redressal) Act, 2013. Deploy security personnel for passenger safety, particularly women. Advertise helpline numbers and hotlines for women's safety. Training staff on GRM, RTI, labour standards, gender sensitization, and services for women, differently-abled, and senior citizens.	ICC setup and number of complaints redressed. Number of SEA/SH trainings and awareness camps held. Number of trainings on employees' Code of Conduct. Number of complaints addressed by GBV organizations.	Official in charge of O&M / Authority / Engineer
Employment opportunities	Limited employmen t opportuniti es for women	Medium	Comply with the requirements of policies of Authority and Government of H.P.	Ensure reservation for women in vacancies at the	Officials in charge of O&M
Employment Opportunities	Limited employmen t	Medium	Ensure compliance with policies of the Authority and Government of H.P. regarding employment opportunities.	Number of women employed in compliance with reservation policies, if any.	Officials in charge of O&M / Authority

Activities/ Concerns	Potential Impacts	Assessed Risk level	Mitigation measures	Monitoring Indicators	Institutional Responsibiliti es
					Implementati on and Supervision
	opportuniti es for women				
Biodiversity Conservation	Impact on local flora and fauna	Medium	Ensuring implementing biodiversity conservation measures post-construction. Refer Annexure 12 for the Biodiversity Management Plan.	Monitoring of flora and fauna within the project vicinity	Officials in charge of O&M / Authority
Solid Waste Management in Operation	Improper waste disposal by staff	Medium	Contractor to follow solid waste disposal guidelines, ensuring collection and segregation during operation. Refer Annexure 3.	Waste management monitoring and audits	Officials in charge of O&M / Authority
Noise and Vibration Control	Noise pollution during operation	Low to Medium	Noise control measures to be maintained, including regular equipment maintenance and public notifications. Refer Annexure 9.	Noise level monitoring during operation	Officials in charge of O&M / Authority

3.5 Monitoring plan for Environmental receptors/attributes

Project Stage	Parameters	Location	Frequency	Standards	Implementation by	Supervision
Pre-Construction Phase						
Air Quality	PM10, PM2.5, SO2, NO2	8 stations	Once	National Ambient Air Quality Standards (NAAQS)	Contractor by CPCB approved laboratory	Authority and Engineer

Project Stage	Parameters	Location	Frequency	Standards	Implementation by	Supervision
Water Quality	pH, electrical conductivity, turbidity, total dissolved solids, total hardness, chlorides, sulfates, nitrates, fecal coliform	10 samples at different locations along the ropeway alignment	Once	Central Pollution Control Board (CPCB) standards	Contractor by CPCB approved laboratory	Authority and Engineer
Noise Quality	Noise levels	Major construction sites and traffic junctions	Once, during peak hours	CPCB noise standards	Contractor by Noise meter (purchased for the project)	Authority and Engineer
Soil Quality	N, P, K, heavy metals	1 sample at construction site, 1 sample at labor camp	Once, either pre-monsoon or post-monsoon	CPCB standards	Contractor by CPCB approved laboratory	Authority and Engineer
Construction Phase						
Air Quality	PM10, PM2.5, SO2, NO2	8 stations	Twice a week for four consecutive weeks in each season (winter, pre-monsoon, post-monsoon)	National Ambient Air Quality Standards (NAAQS)	Contractor by CPCB approved laboratory	Authority and Engineer
Water Quality	pH, electrical conductivity, turbidity, total dissolved solids, total hardness, chlorides, sulfates, nitrates, fecal coliform	10 samples at different locations along the ropeway alignment	Thrice a year (pre-monsoon, monsoon, post-monsoon)	Central Pollution Control Board (CPCB) standards	Contractor by CPCB approved laboratory	Authority and Engineer
Noise Quality	Noise levels	Major construction sites and traffic	During peak construction activities	CPCB noise standards	Contractor by Noise meter (purchased for the project)	Authority and Engineer

Project Stage	Parameters	Location	Frequency	Standards	Implementation by	Supervision
		junctions				
Soil Quality	N, P, K, heavy metals	1 sample at construction site, 1 sample at labor camp	Twice a year (pre-monsoon, post-monsoon)	CPCB standards	Contractor by CPCB approved laboratory	Authority and Engineer
Operation Phase						
Air Quality	PM10, PM2.5, SO2, NO2	8 stations	Twice a week for four consecutive weeks in each season (winter, pre-monsoon, post-monsoon)	National Ambient Air Quality Standards (NAAQS)	RTDC Ltd. by CPCB approved lab	Authority
Water Quality	pH, electrical conductivity, turbidity, total dissolved solids, total hardness, chlorides, sulfates, nitrates, fecal coliform	10 samples at different locations along the ropeway alignment	Twice a year	Central Pollution Control Board (CPCB) standards	RTDC Ltd. by CPCB approved lab	Authority
Soil Quality	N, P, K, heavy metals	2 samples along ropeway alignment	Once a year	CPCB standards	RTDC Ltd. by CPCB approved lab	Authority

4. Implementation of Environmental and Social Management Plan (ESMP)

4.1 Introduction

The implementation of the Environmental and Social Management Plan (ESMP) by the contractor will be achieved through the following key actions:

- **Contractor's Environmental and Social Management Plan (C-ESMP):** The Contractor is required to incorporate C-ESMP into the bid document, and the contractor will establish a comprehensive Environment, Health, and Safety (EHS) cell. This cell will ensure the effective implementation of the EMP and Safety, Health, and Environment (SHE) policies on site.
- **EHS Expertise:** The contractor's EHS cell must have the necessary expertise and experience in the fields of environment, health, and safety to manage on-site risks and mitigation measures effectively.
- **Adherence to ECoPs:** The contractor must comply with the Environmental Code of Practices (ECoPs) designed specifically for the project to ensure compliance with environmental standards.
- **Coordination with RTDC and General Consultant (GC):** The contractor's EHS cell will work in close collaboration with the General Consultant (Engineer) and Authority to ensure smooth coordination during implementation.
- **Monthly Compliance Reporting:** The contractor's EHS cell will submit monthly reports on the compliance of the EMP, relevant regulatory requirements, and RTDC Ltd's E&S systems.
- **Environmental Expert Deployment:** Contractors are required to have an environmental and social expert on-site at all times to oversee compliance. Payments to the contractor will be linked to their environmental performance, with penalties imposed for inadequate implementation of environmental safeguards.
- **Monitoring by PMC:** A Project Monitoring Consultant (Engineer) will monitor the contractor's performance and ensure compliance with the ESMP. The Engineer will communicate compliance status and recommend corrective actions for any gaps or non-compliance issues.

The responsibilities of the various units involved in the implementation of the ESMP are outlined in following table.

4.2 Responsibility of Different Units in ESMP Implementation

Organization	Responsibilities
Authority	• Overall monitoring and supporting smooth project execution. • Recruitment and supervision of external monitors and experts.
Environmental and Social Experts (Engineer)	• Ensuring ESMP inclusion in bidding documents. • Coordinating with agencies, local authorities, and communities. • Preparing progress reports and ensuring effective ESMP implementation. • Overseeing consultant reports and providing guidance. • Securing statutory clearances. • Conducting site inspections and monitoring.

Organization	Responsibilities
	- Documenting best practices. - Preparing compliance reports for RTDC and New Development Bank.
Contractor	- Submitting and approving C-ESMP. - Implementing mitigation measures and monitoring actions outlined in the ESMP. - Appointing an EHS Manager and adequate staff to ensure compliance with environmental and safety responsibilities. - Providing monthly compliance reports.

4.3 Emergency Response Plan (ERP)

The Environmental and Social Risks, including natural disasters, will be managed through an **Emergency Response Plan (ERP)**. The contractor will prepare a site-specific emergency response plan to address different emergencies like fires, accidents, spills, natural disasters, and medical emergencies etc. Contractors will be responsible for:

- Ensuring the safety and evacuation of the workforce during natural disasters or emergencies.
- Establishing regular coordination with disaster management authorities at the district and state levels.
- Designating an Incident Controller (IC), Emergency Controller (EC), and other required personnel to manage emergencies.
- Conducting regular training and mock drills for all workers to prepare for emergencies.

This ERP will be a mandatory part of the contractor's ESMP and will be reviewed and approved by the Engineers.

4.4 Contractor's ESMP

Before construction begins, the contractor will prepare and submit a Contractor's ESMP (C-ESMP), which will be site specific and will include the detailed management plans/procedures as outlined in Annexures 1 to 12 of the Environmental and Social Management Plan (ESMP). The C-ESMP must incorporate all the specific mitigation measures, monitoring protocols, and execution strategies related to the following key areas:

- Biodiversity Management**, including protection of species and habitats.
- Avi-fauna Management Plan**, ensuring all specific actions.
- Waste Management**, ensuring proper disposal of solid and hazardous waste.
- Occupational Health and Safety (OHS)** measures for workers' safety.
- Water, Soil, Air, and Noise Quality Monitoring** protocols.
- Traffic and Road Safety Management** for minimizing impacts on the surrounding community.
- Traffic Deviation Plan** that includes temporary road diversions, signage, and lighting for public safety

In addition, the contractor will be contractually obligated to implement work zone safety arrangements which include provision of PPEs, fixed/ mobile barricades between work area

and pedestrian/ traffic and required measures for ensuring community safety during construction activities. The requirements also include site specific traffic management plan for all types of work along with a work zone safety check list.

All measures recommended in these management plans must be fully implemented by the contractor during the construction phase, with regular compliance reporting to the Project Management Unit (PMU) and monitoring authorities.

The C-ESMP will be approved by the Engineer and periodically reviewed to ensure it aligns with safety and environmental requirements.

4.5 Contractor's Code of Conduct

The contractor will conduct their work in accordance with a Code of Conduct (CoC) that addresses risks related to sexual exploitation, abuse, and harassment. This CoC applies to all staff, laborers, and employees at the worksite, including sub-contractors, suppliers, and any personnel involved in the project. All such individuals are referred to as "Contractor's Personnel" and are required to comply with the CoC.

The project environment must be free from unsafe, offensive, abusive, or violent behavior, ensuring that all individuals feel safe to raise concerns without fear of retaliation.

The contractor is responsible for ensuring that each Contractor's Personnel receives a copy of the CoC, written in a language they understand, and that they sign or provide a fingerprint to acknowledge receipt. The CoC must also be visibly displayed at multiple locations on-site and in areas accessible to the local community and project-affected individuals. The CoC will be provided in languages comprehensible to all relevant parties, and training sessions will be conducted to ensure all personnel, including laborers and staff, fully understand and adhere to the Code's requirements.

5. Grievance Redressal Mechanism

5.1 Introduction

A **Grievance Redressal Mechanism (GRM)** will be established by Authority to address any grievances or complaints from stakeholders.

5.2 Multiple Channels:

Stakeholders will be allowed to file grievances through various channels, including written submissions, emails, phone calls, and in-person meetings.

The GRM will have multiple levels to ensure efficient dispute resolution.

1. **Site-Level Grievance Committee:** Handles day-to-day issues.
2. **Project-Level Grievance Redress Committee:** Escalates unresolved grievances.

5.3 Timely Response:

The project team will respond to grievances in a timely and effective manner.

5.4 Regular Monitoring:

The project team will regularly monitor the number of grievances received and resolved to identify any trends or patterns.

5.5 Grievance register:

Grievance register will be maintained in the format as given overleaf.

Format of Grievance Record Register

Location of the Project: _____

Date: _____

Sl. No	Date of Receipt	Particulars of the Complainant				Particulars of Grievance			Status		
		Name	Addresses	Contact no.	Whether acknowledgment given at the time of receipt	Subject of the Grievance	Description of Grievance	Date of acknowledgment	Current status	Description of action taken on grievance	Justification/ remarks
1											
2											
3											
4											
5											
6											
7											
8											

Signature of the Community Liaison Officer / Grievance Officer

5.6 Worker's grievance redressal System

The Contractor will establish an effective internal grievance addressal system to provide a platform for employees to raise concerns, complaints, or grievances related to their employment conditions.

5.7 Grievance Procedure

5.7.1 Informal Resolution:

- Employees will attempt to resolve grievances informally by discussing the issue with their immediate supervisor.
- Supervisors will listen to employee concerns and try to find a mutually satisfactory solution.

5.7.2 Formal Grievance Filing:

- If the issue cannot be resolved informally, employees will file a formal grievance in writing to the designated grievance officer.
- The grievance form should include;
 - ✓ Employee's name, designation, and department.
 - ✓ Date of the grievance.
 - ✓ Detailed description of the grievance.
 - ✓ Relevant supporting documents (if any).
- The grievance officer will acknowledge receipt of the grievance and maintain a record (refer table overleaf for maintaining worker's grievance register).

5.7.3 Investigation and Resolution:

- The grievance officer will investigate the grievance, gather information, interview relevant parties, and review documentation.
- A decision will be made based on the findings of the investigation and applicable policies and procedures and will be communicated to employee in writing.

5.7.4 Appeal Mechanism:

- Employees may appeal the decision to a higher authority within the organization if they are dissatisfied. The appeal process will be clearly defined and documented.

Worker's Grievance register format

No.	Date Received	Complainant's Name	Designation	Department	Nature of Grievance	Action Taken	Date of Resolution	Outcome
1								
2								
3								
....								

6. Capacity Building / Training Requirements

6.1 Introduction

Capacity building is an essential component for the successful implementation of the Environmental and Social Management Plan (ESMP). It ensures that all stakeholders are well-equipped with the necessary knowledge and skills to effectively address environmental, social, and health-related challenges during the construction and operation phases of the project. The aim of the training is to enhance the understanding of environmental, social safeguards, occupational health and safety (OHS) standards, and community relations.

6.2 Objectives of Capacity Building

The key objectives of the capacity-building program are to:

- Ensure all project stakeholders are aware of the environmental and social sensitivities associated with the project.
- Equip staff and contractors with the skills necessary to implement mitigation measures effectively.
- Build the capacity of staff and workers on the importance of adhering to environmental, social, and cultural standards.
- Promote a culture of safety, inclusiveness, and awareness of community values in and around the project area.
- Comply with NDB's and national requirements regarding environmental and social safeguards.

6.3 Stakeholders Involved in Capacity Building

Capacity building will target various levels of stakeholders involved in the project. These include:

- **Project Management Unit (PMU) and Project Management Consultant (Engineer):** Key personnel responsible for overseeing the implementation of the ESMP.
- **Contractors and Supervisors:** On-the-ground teams responsible for daily construction activities.
- **Grievance Redress Mechanism (GRM) Committees:** Members responsible for handling and resolving community grievances.
- **Camp and Field Staff:** Personnel working on specific aspects of the project (construction, camp management, restoration).

6.4 Capacity Building Structure and Responsibilities

The Project Implementation Agency (PIA), in coordination with contractors and external consultants (if required), will be responsible for organizing and conducting the training sessions. Supervisors at construction sites will play a key role in the day-to-day capacity-

building activities for their teams. Regular workshops, seminars, and on-site practical training will be conducted.

Training Providers:

- Environmental and Social (E&S) Specialists from the Supervision Consultant team.
- Contractor's Environmental, Social, Occupational, Health, and Safety (ESOHS) Officers.
- External experts for specialized topics.

Training Frequency:

- Prior to the commencement of any construction activities.
- During construction, with periodic refreshers as needed.
- During the operation phase for relevant stakeholders.

6.5 Key Training Topics

The training will cover a wide range of topics essential for the successful implementation of the ESMP, focusing on practical issues, mitigation measures, and regulatory compliance.

Training Topic	Target Audience	Responsibility	Schedule
General Environmental and Social Awareness	Authority staff, Contractors	Authority, Contractor	Prior to project activities; refreshers as needed
Mitigation Measures (ESMP Overview)	Authority staff, Contractors	Authority, Contractor	Before construction begins; regular intervals
Waste Management and Disposal	Construction Workers, Camp Staff	Contractors	Before and during construction operations
Occupational Health and Safety (OHS) Protocols	All construction and camp staff	Contractor's ESOHS Officers	Prior to construction and ongoing
Community Engagement and Cultural Sensitivity	All project staff and contractors	RTDC Ltd, Contractor	Prior to engaging with communities
Gender Sensitivity and Inclusiveness	All staff, Contractors	RTDC Ltd, External Experts (if required)	At start of construction and as required
Defensive Driving and Transportation Safety	Drivers/Operators	Contractor	Prior to vehicle operations
Prevention of Sexual Exploitation and Abuse (SEA/SH)	All project and contractor staff	External Experts/ Contractor's ESOHS	Before and during construction
Grievance Redress Mechanism (GRM) Management	GRM Committee Members	External Experts/GRM Officer	Prior to and during project implementation
Flora and Fauna Conservation Awareness	Restoration Teams, Environmental Officers	Contractors, E&S Cell of RTDC Ltd	Before restoration activities begin

6.6 Monitoring and Evaluation

The effectiveness of the capacity-building and training programs will be monitored through:

- **Pre- and post-training assessments** to gauge the improvement in knowledge and skills.
- **Regular audits** by environmental and social specialists to ensure training effectiveness.
- **Feedback mechanisms** where participants can share their experiences and suggest improvements.
- **Field observations** to ensure that trained personnel apply the knowledge in their daily tasks.

7. Annexure – I: - Labor Camp Facilities for the workers

7.1 Introduction

These management procedures for the Contractor outline the essential requirements for providing adequate facilities in labor camps to ensure the well-being of workers and minimize environmental impacts.

7.2 Key Considerations by the Contractor

- **Housing:** Provide suitable housing units that meet basic needs and ensure a comfortable living environment.
- **Water Supply:** Ensure access to clean potable water through a reliable source and proper treatment facilities.
- **Sanitation:** Provide adequate sanitation facilities, including toilets, bathrooms, and waste disposal systems.
- **Solid Waste Management:** Implement a proper solid waste management plan to prevent accumulation and potential health hazards.
- **Health and Safety:** Ensure compliance with health and safety regulations and provide necessary medical facilities.

7.3 Specific Requirements

- **Housing:**
 - ✓ Provide housing units of at least 30-40 square meters per family.
 - ✓ Ensure proper ventilation and adequate lighting.
 - ✓ Maintain cleanliness and sanitation within the housing units.
- **Water Supply:**
 - ✓ Provide access to clean potable water through a centralized system or individual connections.
 - ✓ Install water filtration or treatment units if necessary to ensure water quality.
 - ✓ Monitor water quality regularly.
- **Sanitation:**
 - ✓ Provide a sufficient number of toilets and bathrooms based on the number of workers.
 - ✓ Ensure proper maintenance and cleaning of sanitation facilities.

- ✓ Implement a system for the safe disposal of wastewater.
- **Solid Waste Management:**
 - ✓ Implement a waste segregation system to separate biodegradable and non-biodegradable waste.
 - ✓ Provide proper storage facilities for waste.
 - ✓ Arrange for regular collection and disposal of waste through authorized agencies.
 - ✓ Promote recycling and waste reduction practices.
- **Health and Safety:**
 - ✓ Develop and implement a health and safety plan that complies with relevant regulations.
 - ✓ Provide access to basic medical facilities, including a first-aid post and a dispensary.
 - ✓ Conduct regular health checkups for workers.
 - ✓ Ensure compliance with occupational health and safety standards.

7.4 Additional Considerations

- **Community Facilities:** Consider providing community facilities such as a canteen, recreational areas, and childcare facilities, if applicable.
- **Accessibility:** Ensure that the labor camp facilities are accessible to all workers, including those with disabilities.
- **Environmental Impact:** Minimize the environmental impact of the labor camp by implementing sustainable practices and reducing waste generation.

7.5 Monitoring and Evaluation

- Regularly monitor the conditions of the labor camp, including housing, sanitation, water supply, and waste management.
- Assess the health and well-being of workers through health checkups and surveys.
- Address any issues or concerns that arise promptly.

7.6 Compliance with Regulations

- Ensure compliance with all applicable environmental, health, and safety regulations.
- Obtain necessary permits and approvals from relevant authorities.
- Maintain records of compliance and monitoring activities.

8. Annexure-II: Labor Management Plan for the Project

8.1 Introduction

These management procedures outline the essential requirements for the Labor Management Plan (LMP) in the r project. The LMP aims to ensure the safe, fair, and efficient management of the workforce involved in the project.

8.2 Key Considerations

- **Recruitment and Selection:**
 - ✓ Establish clear recruitment procedures and selection criteria based on qualifications, experience, and skills.
 - ✓ Ensure fair and transparent recruitment practices.
- **Employment Contracts:**
 - ✓ Prepare clear and comprehensive employment contracts that outline the terms and conditions of employment.
 - ✓ Include clauses related to wages, benefits, working hours, safety, and disciplinary procedures.
- **Wages and Benefits:**
 - ✓ Pay competitive wages that comply with applicable labor laws and industry standards.
 - ✓ Provide appropriate benefits, such as health insurance, provident fund, and gratuity, as required by law.
- **Working Hours and Conditions:**
 - ✓ Adhere to legal working hours and provide rest breaks.
 - ✓ Ensure safe and healthy working conditions.
 - ✓ Implement measures to prevent fatigue and stress.
- **Health and Safety:**
 - ✓ Develop and implement a comprehensive health and safety plan.
 - ✓ Provide necessary personal protective equipment (PPE).
 - ✓ Conduct regular safety training and awareness programs.
 - ✓ Investigate accidents and incidents promptly.
- **Training and Development:**
 - ✓ Provide relevant training and skill development opportunities to enhance the capabilities of workers.
 - ✓ Identify training needs and develop a training plan.
 - ✓ Ensure that workers receive necessary certifications and licenses.
- **Grievance Redressal:**

- ✓ Establish a grievance redressal mechanism to address complaints and concerns of workers.
- ✓ Ensure timely and fair resolution of grievances.
- **Welfare Measures:**
 - ✓ Provide basic welfare facilities, such as medical care, transportation, and accommodation.
 - ✓ Implement measures to promote the well-being of workers.
- **Community Relations:**
 - ✓ Foster positive relationships with the local community.
 - ✓ Address any concerns or grievances raised by the community.

8.3 Specific Requirements

- **Recruitment and Selection:**
 - ✓ Develop clear job descriptions and qualifications.
 - ✓ Use fair and transparent selection methods, such as interviews and assessments.
 - ✓ Prioritize the recruitment of local residents.
- **Employment Contracts:**
 - ✓ Ensure that employment contracts are compliant with labor laws.
 - ✓ Clearly define the scope of work, wages, benefits, and working hours.
 - ✓ Include clauses related to disciplinary procedures and termination of employment.
- **Wages and Benefits:**
 - ✓ Pay wages that are competitive with industry standards and comply with minimum wage laws.
 - ✓ Provide legally mandated benefits, such as provident fund and gratuity.
 - ✓ Consider providing additional benefits, such as health insurance and transportation allowances.
- **Working Hours and Conditions:**
 - ✓ Adhere to legal working hours and provide rest breaks as required.
 - ✓ Ensure safe and healthy working conditions, including adequate lighting, ventilation, and temperature control.
 - ✓ Implement measures to prevent fatigue and stress, such as rotating shifts and providing adequate rest periods.
- **Health and Safety:**
 - ✓ Develop and implement a comprehensive health and safety plan that includes hazard identification, risk assessment, and control measures.
 - ✓ Provide necessary PPE to workers.
 - ✓ Conduct regular safety training and awareness programs.

- ✓ Investigate accidents and incidents promptly and take corrective actions.
- **Training and Development:**
 - ✓ Identify training needs based on job requirements and skill gaps.
 - ✓ Develop a training plan that includes on-the-job training, workshops, and external courses.
 - ✓ Ensure that workers receive necessary certifications and licenses.
- **Grievance Redressal:**
 - ✓ Establish a grievance redressal mechanism, such as an internal complaints committee.
 - ✓ Provide clear procedures for filing and resolving grievances.
 - ✓ Ensure that grievances are addressed in a timely and fair manner.
- **Welfare Measures:**
 - ✓ Provide basic welfare facilities, such as medical care, transportation, and accommodation.
 - ✓ Implement measures to promote the well-being of workers, such as counseling services and recreational activities.

8.4 Monitoring and Evaluation

- Regularly monitor compliance with labor laws and regulations.
- Conduct regular safety inspections and audits.
- Evaluate the effectiveness of training programs and grievance redressal mechanisms.
- Address any issues or concerns that arise promptly.

8.5 Compliance with Regulations

- Ensure compliance with all applicable labor laws and regulations.
- Maintain records of employment contracts, wages, benefits, and working hours.
- Conduct regular audits to assess compliance.

9. Annexure-III: Solid Waste Management Plan

9.1 Introduction

This Solid Waste Management Plan (SWMP) outlines the strategies for managing solid waste generated during the construction and operation phases of the Ropeway Project. The SWMP aims to minimize environmental impacts, promote sustainability, and ensure proper waste disposal.

9.2 Key Considerations

- **Waste Generation:** Assess the types and quantities of solid waste that will be generated during the project.
- **Segregation:** Implement a system for segregating solid waste at source to facilitate recycling and composting.
- **Collection:** Establish efficient collection systems for different types of waste.
- **Transportation:** Arrange for safe and timely transportation of waste to appropriate disposal sites.
- **Disposal:** Utilize appropriate disposal methods, such as landfills, composting, and recycling.
- **Environmental Impacts:** Minimize negative environmental impacts associated with solid waste management.

9.3 Specific Requirements

Waste Segregation:

- Educate workers and local communities about the importance of waste segregation.
- Provide clear guidelines and signage for different types of waste.
- Implement a system for collecting segregated waste at source.

Collection:

- Provide suitable waste bins or containers at strategic locations.
- Ensure regular collection of waste to prevent accumulation and potential health hazards.
- Consider using covered bins or containers to prevent littering and odor issues.

Transportation:

- Use appropriate vehicles for transporting solid waste, ensuring proper containment and prevention of leakage.
- Comply with transportation regulations and guidelines.

Disposal:

- Identify suitable disposal sites for different types of waste.
- Prioritize recycling and composting for recyclable and biodegradable waste.
- Ensure proper disposal of hazardous waste in accordance with regulations.
- Explore opportunities for waste-to-energy initiatives.

Hazardous Waste Management:

- Identify and manage hazardous waste generated during the project, such as burnt mobile oil, batteries, and other items specified in Schedule-I of the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.
- Store hazardous waste in designated areas prior to collection by an authorized vendor.
- Dispose of hazardous waste through authorized channels, such as recycling vendors approved by the CPCB or State Pollution Control Board².
- Ensure compliance with all relevant regulations regarding hazardous waste management.

E-Waste Management:

- Manage e-waste generated during the project in accordance with the E-Waste (Management) Rules, 2016.
- Collect, store, transport, segregate, refurbish, dismantle, recycle, or dispose of e-waste as per prescribed procedures.
- Ensure proper storage of e-waste before disposal.

Environmental Impacts:

- Minimize the generation of waste through waste reduction and reuse practices.
- Avoid open burning of waste, as it can contribute to air pollution.
- Monitor and mitigate any negative impacts on water bodies and soil.

Monitoring and Evaluation

- Regularly monitor the quantity and quality of solid waste generated.
- Track the efficiency of waste collection and disposal systems.
- Assess the effectiveness of waste reduction, reuse, and recycling initiatives.
- Evaluate compliance with environmental regulations.

Additional Considerations

- **Community Engagement:** Involve local communities in waste management activities and raise awareness about proper waste disposal practices.
- **Capacity Building:** Provide training and capacity building for workers involved in waste management.
- **Emergency Response:** Develop an emergency response plan to address spills or accidents related to waste management.

² Follow the link to find the list; <https://hppcb.nic.in/pdf/recycler.pdf>

10. Annexure-IV: - Safety Management Plan

10.1 Safety Issues

Construction and operation of the aerial ropeway involve several hazards and potential accidents. Therefore, a comprehensive risk assessment is essential. The risk assessment will focus on various site-specific factors such as seismicity, slope stability, and soil erodibility. Specialists will be involved in conducting the assessment, and the findings will form the basis for the Disaster Management Plan.

10.2 Key components of the Disaster Management Plan include:

- **Emergency Planning:** Pre-defined response strategies for different types of emergencies.
- **Emergency Procedures:** Detailed steps for immediate action during emergencies.
- **Safety Measures for the Ropeway:** Specific safety protocols for operating and maintaining the ropeway system.

Regular Maintenance of the ropeway's structural, mechanical, and electrical components is crucial to prevent hazards and ensure safety. A systematic maintenance plan will be implemented that covers:

- **Lubrication, Inspection, and Adjustment:** Procedures for routine maintenance of all components.
- **Maintenance Frequency:** As specified by the ropeway designer or the manufacturer, especially for critical components like wire ropes, strands, and belts.

The following components will be included in the maintenance plan:

- Conveyor Belting
- Drums and Rollers
- Conveyor Belt Tensioning System
- Braking Systems
- Electrical Control Systems
- Communication Systems
- Structural Integrity

10.3 Fire Safety

Fire Protection Equipment

All facilities to be constructed as part of the project shall be fully equipped with fire protection systems adhering to the Indian Standards (IS) for fire safety. The fire hazards, particularly in labor camps, colonies, and other temporary structures, will be analyzed and addressed with appropriate fire safety measures. These measures will ensure that the construction phase remains safe for all personnel involved.

Maintenance of Fire Protection Equipment

During construction, RTDC will oversee the adequacy of fire safety systems by the Contractor. The EHS representatives of the department will report to the Head of Project and will ensure that fire protection systems comply with all required standards. Regular inspections and

maintenance will be conducted to verify the operational efficiency of fire safety systems across all facilities.

Machine Safety at Project Site

The machinery deployed at the site, such as excavators, JCBs, and backhoes, must be operated safely under the supervision of trained personnel. Key safety practices will be implemented to ensure safe operation of equipment.

- **Routine Checks:** Daily inspections of machinery, focusing on hydraulic systems, mechanical conditions, and other essential operating systems.
- **Vehicle Movement:** A trained supervisor will regulate the movement of trucks and other vehicles within the project area to prevent accidents.
- **Safety Training:** All personnel working with construction machinery will receive safety training, including first-aid and emergency response protocols.

Work Zone Safety and Community Risks

Construction activities may pose risks to both the workforce and the surrounding community. The following measures are essential to ensure safety within the work zone and the nearby community:

- **Mud Slips and Erosion:** Safety risks due to mud slips and soil erosion during excavation will be mitigated with appropriate protection measures.
- **Equipment and Vehicle Movement:** Safe zones and pathways will be established to prevent accidents related to moving construction equipment and debris disposal vehicles.
- **Noise and Dust Pollution:** Measures such as noise barriers and dust control systems will be implemented to minimize impacts on the local community.
- **Community Engagement:** The influx of migrant workers will be managed by maintaining a clear communication channel with local communities to avoid conflicts and discomfort.

10.4 Safety Practices During Construction

Personal Safety Equipment

- All personnel, including visitors, will be required to wear appropriate personal safety gear before entering the work zone.
- **Foot Protection:** Safety boots with steel caps will be mandatory for all workers.
- **Hearing and Eye Protection:** Ear protectors will be provided for workers exposed to high noise levels, and protective eyewear will be required in hazardous zones.
- **Fall Protection:** Workers on steep slopes or unprotected levels will use construction safety belts and lifelines.

10.5 Traffic Safety on Public Roads

All construction activities near public roads will include the following safety precautions:

- **Traffic Control:** Barricades, flagmen, and warning signs will be used to manage traffic flow and protect the public.

- **Detours:** Temporary detours will be provided where necessary, and they will be maintained in a safe and accessible condition.
- **Barricades and Lighting:** Roads closed for construction will be protected with barricades, warning lights, and signs. Barricades will remain illuminated from sunset to sunrise.

10.6 Occupational Health & Safety (OHS)

The Contractor will implement a comprehensive Occupational Health & Safety (OHS) program to safeguard workers during excavation and construction activities. Key elements include:

- **Dust Control:** Dust generated during excavation and transportation of materials will be controlled through water sprays and other measures.
- **Medical Examinations:** Workers will undergo initial and periodic medical examinations to monitor their health.
- **Heat Stress:** Workers exposed to extreme heat will receive appropriate safety gear and will have access to hydration stations.

10.7 Noise Induced Hearing Loss (NIHL)

Noise from construction equipment such as compressors, drills, and rock breakers will be monitored and controlled. The Hearing Conservation Program includes:

- Provision of Hearing Protection Devices (HPDs) for all workers.
- Annual audiometry examinations to assess hearing loss risks.
- Noise Suppression Engineering: Equipment will be fitted with noise suppression devices to minimize noise exposure.

10.8 Occupational Lung Diseases (OLD)

Health camps will be conducted regularly to screen workers for occupational lung diseases, particularly those working in dusty environments. Protective devices and training programs will be provided to mitigate these risks.

10.9 Public Awareness Program for HIV/AIDS & COVID-19

A public awareness campaign will be implemented to control the spread of HIV/AIDS and COVID-19 among workers and the local community. Key activities include:

- **Ensuring Blood Safety:** Training programs for doctors and blood bank staff in consultation with the National/State AIDS Control Organization.
- **Control of Sexually Transmitted Diseases (STDs):** STD control measures will be implemented in labor camps, including awareness programs and access to medical facilities.
- **Public Awareness Campaign:** A wide-reaching campaign will use media and community engagement to raise awareness about HIV/AIDS and COVID-19.

10.10 Measures for AIDS Control

The project will adopt the following measures to control AIDS:

- **Prevention:** Awareness programs educating people about the risks and preventive measures.
- **Anti-retroviral Treatment:** While no cure exists, treatments to suppress HIV infection will be available.
- **Primary Health Care:** The AIDS control program will be integrated with primary healthcare initiatives to address all related health issues.

10.11 Accident, Dangerous Occurrence, and Near Miss Record Keeping and Reporting

The contractor will maintain a detailed record of all accidents, near misses, and other safety incidents in the following format:

Date of Incident	Type of Incident (Near Miss, First Aid, Minor Injury, Major Accident, Severe, Fatal)	Location	Description of Incident/ Accident	Injured Person Details (Name, Job Title)	Injury Type/ Severity	Cause of Incident (Immediate & Underlying)	Corrective & Preventive Action Taken	Reported By	Involved Team
1									
2									
3									
4									
5									
.....									

The Preliminary Accident / Dangerous Occurrence / Near Miss Report is a crucial document for tracking and addressing any incidents on the project site. This report serves as an initial record of accidents, dangerous occurrences, or near-miss events, helping to identify potential hazards and implement corrective measures to prevent future incidents.

The report will capture essential details such as the date, time, location, type of incident, individuals involved, and the actions taken immediately afterward. It also includes a section for identifying the causes of the incident and outlining preventive actions to be implemented. The information collected will be reviewed by the Environmental, Health, and Safety (EHS) Expert and is crucial for improving safety protocols on-site.

The Preliminary Accident / Dangerous Occurrence / Near Miss Report format is given below for reference and will be used by the contractor for incident reporting.

Preliminary Accident / Dangerous Occurrence / Near Miss Report

Section	Details
Job Site Name / Job No.	

Name of Injured	
Age	
Sex	
Designation	
Contractor / Department Name	
Date & Time of Accident / Incident	
Location of Accident / Incident	
Brief Description of Accident / Incident	
Photos / Sketches (if applicable)	
Action Taken Immediately After Event	
Nature of Injury	☐ Major ☐ Minor
Type of Injury	☐ Fractures ☐ Superficial Injuries ☐ Burns ☐ Electric Shock ☐ Multiple Injuries ☐ Other (Specify)
Unsafe Acts / Conditions Leading to Event	
Safety Appliances Used	
Remedial Measures to Prevent Reoccurrence	
Other Relevant Information	
Witness Name	

**Site Engineer / Site Supervisor /
Safety Personnel**

Site In Charge / DTL / TL

11. Annexure-V: - Landslide Control and Mitigation Management Plan

11.1 Introduction

As part of the Environmental and Social Management Plan (ESMP), this Landslide Control and Mitigation Management Plan has been developed to ensure the stability of embankments and slopes in the project area, particularly around the proposed ropeway stations and related infrastructure. The aim is to protect the project area from landslides and improve the stability of vulnerable areas through engineering and ecological measures.

11.2 Landslide Control Measures

The following control measures are proposed to mitigate the risk of landslides:

- **Vulnerability Assessment:** Identify and assess areas prone to landslides based on site-specific conditions such as slope angle, soil type, and rainfall patterns.
- **Surface Water Drainage:** Manage and redirect surface water flowing into landslide-prone areas or areas where water emerges in the head scarp. Proper drainage systems will be installed to prevent water accumulation.
- **Filling and Compaction:** Open cracks that could allow water infiltration will be filled and compacted to prevent further weakening of the slope. This will help reduce the likelihood of landslides caused by water ingress.
- **Slope Stabilization:** In cases where there are slow, creep-like movements of the slope, filling cracks can impede further deformation and prevent the landslide from propagating upslope.

11.3 Mitigation Measures

Several mitigation measures have been suggested for managing landslide risks in the project area:

- **Rock Anchoring and Slope Carving:** Anchoring rocks into the slope and carving out unstable portions will provide structural stability to slopes that are at risk of failure.
- **Shotcreting:** A protective layer of shotcrete will be applied to stabilize steep slopes where rockfalls or landslides are likely.
- **Afforestation:** Trees and shrubs will be planted to stabilize the soil. Afforestation using native species will help bind the soil and reduce the risk of landslides.

11.4 Landslide Control with Coir-Geotextile

A coir-geotextile solution will be employed for areas with significant landslide risk. This method involves using natural coir matting to stabilize the slope surface. Below is a description of the steps involved:

- **Area Selection:** A 20 m x 30 m area along the slope will be selected, and two unbounded stone masonry walls, each 22 meters long and 1.2 meters high, will be constructed at the base of the steep slopes. These walls will help prevent debris movement and improve drainage.
- **Grading the Slope:** The surface of the slope will be graded to eliminate unevenness, and exposed rocks or boulders will be treated. Trenches of 30 cm x 30 cm will be dug at the top and bottom of the slope to anchor coir nets.

- **Seeding and Vegetation:** Limited quantities of quick-growing grasses such as Pennisetum sp. or Vetiveria sp. will be seeded to promote root growth, which will further stabilize the soil. These grasses have roots extending 40 to 50 cm, providing additional stability.
- **Coir Matting Installation:** Coir matting rolls will be anchored in the top trench and unrolled down the slope. Each section of matting will overlap by 15 cm and will be anchored into the soil with mild steel staples forming a grid pattern of 2 meters. Coir ropes (20 mm in diameter) will be tied to the matting and anchored in a crisscross pattern to form a grid of 1 meter. The matting will be used on both the upper and lower halves of the slope, with a slope angle of 60° for the upper half and 40° for the lower half.
- **Bamboo Anchoring:** Locally grown bamboo culms may be used to further anchor the coir matting and geo-textile, which will promote long-term slope stability. Over time, the bamboo roots will develop and provide additional structural integrity to the slope.

11.5 Monitoring and Maintenance

Regular monitoring and maintenance of the landslide control measures will be carried out to ensure their effectiveness. Monitoring will include:

- **Inspections:** Periodic inspections of vulnerable areas, especially during and after the rainy season, to assess any new risks or signs of slope failure.
- **Maintenance:** Routine maintenance of drainage systems, retaining walls, and coir matting to prevent blockages and ensure continued functionality.
- **Reporting:** Any changes in slope stability or early warning signs of potential landslides will be reported immediately to the project management team for further action.

12. Annexure-VI:- Quarry Restoration and Rehabilitation Management Plan

12.1 Introduction

This Quarry Restoration and Rehabilitation Management Plan is developed as part of the Environmental and Social Management Plan (ESMP) to ensure that quarrying activities, including mining of minor minerals, are conducted in an environmentally sustainable manner. The plan outlines restoration strategies post-quarrying, emphasizing eco-friendly practices such as backfilling, re-vegetation, and landscape restoration. It aims to restore ecological balance while minimizing environmental degradation caused by quarrying activities.

12.2 Measures to be Adopted Before Quarrying

Before commencing quarrying activities, the following measures will be implemented to ensure site restoration:

- **Topsoil Removal and Storage:** The top 6-12 inches of soil will be removed and stored separately before any quarrying or surface disturbance begins. This topsoil will be stockpiled in a designated area and will later be used for rehabilitation after quarrying activities have ceased.
- **Safety Buffer:** A 7.5-meter safety barrier around the quarry area will be maintained and vegetated to prevent soil erosion and enhance the environmental aesthetics of the quarry site.

12.3 Measures to be Adopted After Quarrying

Once quarrying activities have concluded, the following restoration measures will be undertaken:

- **Diversion of Runoff:** Effective drainage systems, including garland drains around the quarry site, will be constructed to prevent surface runoff from infiltrating the quarry site. These drains will capture the runoff and divert it to nearby natural drains, preventing erosion and soil degradation.
- **Filling of Depressions:** Quarries often result in the formation of depressions and craters due to the removal of rocks and other materials. These depressions will be filled with boulders, rocks, gravel, and soil sourced from nearby construction sites. This will restore the natural topography and prevent further erosion.
- **Construction of Retaining Walls:** In areas with moderately steep slopes, retaining walls will be constructed around filled depressions to provide additional stability. These walls will help prevent landslides and erosion, especially in vulnerable areas.
- **Use of Rocks for Landscaping:** Rocks and boulders left over from the quarrying process will be strategically placed to support the growth of mosses and lichens. These species will serve as ecological pioneers, aiding in natural succession and vegetation growth. Moderately sized boulders will also be used to line pathways and delineate natural boundaries.
- **Laying of Topsoil:** The depressions filled with rock aggregates will be covered with the previously stockpiled topsoil. The natural fungal spores in the topsoil, along with the use of organic manure and Vesicular-Arbuscular Mycorrhizal (VAM) fungi, will promote plant growth and initiate natural vegetation succession. This process will help in the reclamation of soil and facilitate the establishment of young seedlings.

- **Barbed Wire Fencing:** The perimeter of the restored quarry site will be fenced with barbed wire to prevent the entry of animals and unauthorized persons. This will also protect newly planted vegetation from grazing, promoting natural regeneration and enhancing the success of re-vegetation efforts.

12.4 Re-vegetation Plan

The re-vegetation of the quarry sites will be based on an Integrated Biological and Biotechnological Approach. The following steps will be undertaken:

- **Evaluation of Rock Material:** The rock material will be evaluated for its physical and chemical properties to assess its ability to support vegetation. This will help determine the appropriate vegetation types and soil amendments required for successful re-vegetation.
- **Soil and Organic Waste Blends:** Blends of organic waste and soil will be formulated to enhance the nutrient content of the soil and improve the rhizosphere for plant growth.
- **Bio-fertilizers and Mycorrhizal Fungi:** Specialized strains of mycorrhizal fungi, rhizobium, azotobacter, and phosphate solubilizers will be isolated and screened for suitability in rehabilitating mined-out sites. These bio-fertilizers will improve soil health and boost plant growth.
- **Mass Culture of Bio-fertilizers:** Bio-fertilizers and mycorrhizal fungi will be procured from institutions specializing in phyto-remediation to accelerate soil reclamation and plant establishment.
- **Plantation:** The final stage will involve the plantation of native species at the quarry sites. The selected species will be combined with bio-fertilizers and VAM fungi to ensure robust growth and successful re-vegetation of the site.

12.5 Monitoring and Maintenance

- **Regular Inspections:** The restoration site will be monitored regularly to ensure that the implemented measures are effective. Inspections will focus on drainage efficiency, vegetation growth, and soil stability.
- **Maintenance of Structures:** Retaining walls, drainage systems, and fencing will be maintained to ensure long-term site stability.
- **Re-vegetation Monitoring:** The growth of planted species will be periodically assessed to ensure successful re-establishment of vegetation.

13. Annexure-VII: - Wastewater Management and Effluent Treatment Plan

13.1 Introduction

This Wastewater Management and Effluent Treatment Plan, a part of the Environmental and Social Management Plan (ESMP), is designed to manage and mitigate the environmental impacts associated with wastewater generated during the construction phase of the project. The plan addresses the treatment of sewage from labor camps, effluents from construction workshops, and ensures the protection of nearby water bodies and the surrounding environment.

13.2 Sewage Treatment Plan

During the peak construction phase, an additional population of 800 workers is expected, necessitating the installation of proper sanitation and wastewater management facilities. To handle the sewage generated from the construction labor camps, the following measures will be implemented:

- **Community Toilets:** One community toilet will be provided for every 20 people, ensuring adequate sanitation facilities.
- **Mobile Sewage Treatment Plants (STP):** For every 500 workers, one mobile sewage treatment plant will be provided. These STPs will treat sewage from the community toilets, and the treated effluent will be disposed of through absorption trenches, ensuring that wastewater does not contaminate drinking water sources or the surrounding environment. Drinking water facilities and waste disposal sites will be strategically located away from each other to prevent cross-contamination.
- **Sanitary Facilities for Labor Camps:** A total of 20 community latrines and two mobile STPs will be installed to manage sewage generated from the labor camps.

13.3 Effluent Treatment from Workshops

The construction phase will require several workshops to maintain and service construction machinery and vehicles, such as:

- **Earth-moving machinery** (e.g., shovels, dozers, dumpers, loaders, graders)
- **Pneumatic and concreting equipment** (e.g., boomers, wet shotcrete machines, concrete pumps)
- **Transport equipment** (e.g., buses, trucks, transit mixers, ambulances)

These workshops will generate effluents containing high levels of oil & grease and suspended solids. If not treated properly, this wastewater can significantly degrade the quality of receiving water bodies by increasing turbidity and introducing pollutants. To address this, the following measure is proposed:

- **Oil Separator Units:** An oil separator unit will be installed to treat effluents from the workshops. This system will remove oil, grease, and suspended solids, ensuring that the treated water meets environmental standards before being discharged.

13.4 Monitoring and Maintenance

Regular monitoring and maintenance of the wastewater treatment systems will be conducted to ensure they function effectively:

- **Sewage Treatment:** The mobile STPs will be inspected regularly to ensure proper treatment of sewage and adherence to environmental standards.
- **Oil Separator Units:** Workshop effluents will be continuously monitored for oil & grease content and turbidity levels. The separator units will be maintained to prevent system failures and ensure compliance with discharge standards.

14. Annexure-VIII: - Air Quality Management Plan

14.1 Introduction

The Air Quality Management Plan forms part of the Environmental and Social Management Plan (ESMP) and outlines measures to manage and mitigate air pollution during the construction and operation phases of the project. The plan addresses emissions control, air pollution management for DG sets, and dust control measures to ensure compliance with national air quality standards.

14.2 Control of Emissions

Construction activities, including the use of vehicles, equipment, and Diesel Generator (DG) sets, will generate minor air pollutants, primarily from exhaust emissions. Additional emissions will result from the transportation of materials and excavated debris. The following measures will be adopted to control air pollution from these sources:

- **Maintenance of Construction Equipment:** The contractor will ensure that all construction vehicles and equipment are properly maintained and regularly serviced to minimize exhaust emissions.
- **Limiting Idle Time:** Construction vehicles and equipment will be turned off when not in use for extended periods. Unnecessary idling of vehicles will be strictly prohibited to reduce fuel consumption and emissions.
- **Traffic Management:** Effective traffic management will be implemented to avoid traffic congestion and delays, minimizing emissions from transportation in and around the project site.
- **Road Repair and Maintenance:** Any road damage caused by construction activities will be promptly repaired to prevent dust and emissions from degraded road surfaces.

14.3 Air Pollution Control for DG Sets

Diesel Generator (DG) sets are essential for power supply during construction, but their operation can result in elevated SO₂ levels, potentially exceeding the permissible limit of 60 µg/m³. To mitigate air pollution from DG sets:

- DG sets will be installed and operated according to Central Pollution Control Board (CPCB) guidelines.
- Adequate ventilation and stack height will be provided to disperse emissions and minimize their impact on ambient air quality.

14.4 Dust Control Measures

Dust generation from excavation, material handling, and transportation is a significant concern during construction. The following dust control measures will be implemented.

- **Water Spraying:** Regular spraying of water on exposed surfaces, such as roads and construction sites, will be conducted to suppress dust.
- **Covered Transportation:** Trucks transporting materials will be covered with tarpaulins to prevent dust from becoming airborne during transit.

- **Speed Limits:** Speed limits will be enforced within the construction zone to minimize dust generation from vehicle movement.
- **Windbreaks and Barriers:** Windbreaks or temporary barriers will be installed where necessary to prevent the dispersion of dust into nearby areas.

14.5 Monitoring and Compliance

Regular monitoring of air quality will be conducted to ensure that emission levels comply with national standards. If any deviations are detected, corrective actions will be implemented immediately. The contractor will maintain records of equipment maintenance and ensure compliance with the prescribed emission control measures.

15. Annexure-IX: - Noise Control and Mitigation Management Plan

15.1 Introduction

This Noise Control and Mitigation Management Plan, part of the Environmental and Social Management Plan (ESMP), outlines the measures necessary to manage and minimize noise pollution during the construction phase of the project. It includes strategies for controlling noise generated by construction equipment, vehicles, and Diesel Generator (DG) sets, while ensuring compliance with national noise standards and protecting workers and nearby residents.

15.2 General Noise Control Measures

The contractors will be responsible for ensuring that all construction equipment and vehicles are maintained in proper working order and meet Occupational Safety and Health Administration (OSHA) noise standards. The following control measures will be implemented to mitigate noise pollution:

- **Equipment Maintenance:** All construction equipment will be fitted with noise suppression devices, and vehicles will be equipped with mufflers as recommended by the manufacturer.
- **Idling Reduction:** Construction equipment will not be allowed to idle unnecessarily, particularly in noise-sensitive areas. Staging of noisy equipment will be avoided in such areas whenever possible.
- **Sound Barriers:** The use of temporary sound fences or barriers around high-noise areas will be evaluated and implemented where necessary.
- **Public Notification:** Residents within a 300-foot radius (approximately 90 meters) of major noise-generating activities will be notified in advance. The notification will outline the noise control measures being implemented.
- **Noise Monitoring:** Regular monitoring of noise levels will be conducted during construction. If noise levels exceed acceptable limits, the contractor will be required to stop work and take corrective action before resuming.
- **Personal Protective Equipment (PPE):** Workers exposed to high noise levels, especially near crushers, will be provided with earmuffs or plugs, capable of reducing noise levels by at least 15 dB(A).
- **Work Hours:** Working hours will be planned in line with OSHA guidelines to minimize noise exposure to both workers and the surrounding community.
- **Limiting Exposure:** The exposure time for workers subjected to high noise levels will be limited according to OSHA recommendations to prevent psychological and physiological effects.

15.3 Noise Control Measures for DG Sets

Diesel Generator (DG) sets are a significant source of noise during construction. The following standards and measures will be implemented to control noise from DG sets:

- **Noise Standards:** The maximum permissible sound pressure level for DG sets with a capacity of up to 1000 kVA will be 75 dB(A) at 1 meter from the enclosure surface.

- **Acoustic Enclosures:** DG sets will be fitted with acoustic enclosures made from CRCA sheets and insulated with fire-retardant foam. These enclosures will be designed to meet the 75 dB(A) noise limit of 1 meter, as specified by the Central Pollution Control Board (CPCB), Ministry of Environment & Forests.
- **Insertion Loss:** The acoustic enclosure or room treatment will be designed for a minimum 25 dB(A) insertion loss, or to meet ambient noise standards, whichever is stricter.
- **Exhaust Mufflers:** DG sets will be equipped with exhaust mufflers capable of providing a minimum 25 dB(A) insertion loss.
- **Siting and Control:** Efforts will be made to site DG sets appropriately and implement control measures to ensure that noise levels outside the DG set premises meet ambient noise standards.
- **Maintenance:** A routine and preventive maintenance program will be implemented in consultation with the DG set manufacturer to prevent noise levels from deteriorating over time.

15.4 Monitoring and Compliance

Regular noise monitoring will be carried out during construction to ensure compliance with established noise standards. If noise levels exceed permissible limits, corrective actions will be taken immediately. Contractors will be required to maintain logs of equipment maintenance and PPE distribution to workers.

16. Annexure-X: - Public Health Delivery and Management Plan

16.1 Introduction

This Public Health Delivery and Management Plan is designed to ensure the provision of adequate healthcare, sanitation, and hygiene for the labor population and surrounding communities during the construction phase of the project. The plan addresses medical facilities, sanitation measures, immunization programs, and health awareness activities, ensuring a safe and healthy working environment. It forms part of the Environmental and Social Management Plan (ESMP) and aims to minimize public health risks associated with the influx of labor during construction.

16.2 General Measures

The following general public health measures will be implemented to safeguard the labor population and their families:

- **Provision of Sanitation Facilities:** Adequate drinking water and sanitation facilities, including mobile toilets and sewage treatment, will be provided as part of the Environmental Management Plan (EMP).
- **Potable Water Supply:** Potable water will be supplied to the labor population, and drinking water sources will be regularly tested for quality.
- **Surveillance and Immunization:** A proper surveillance system will be established, and a comprehensive immunization schedule will be implemented for the labor population to prevent the spread of communicable diseases.

16.3 Development of Medical Facilities

To handle potential injuries and illnesses at the project site, the following medical facilities will be established:

- **Dispensary:** A well-equipped dispensary will be constructed to provide medical care for injuries and diseases likely to occur at a large-scale construction site.
- **First-Aid Posts:** First-aid posts will be established at major construction sites. These posts will provide immediate care to workers in the event of injury or accident and will be equipped with:
 - ✓ A first-aid box containing essential medicines (including ORS packets).
 - ✓ First-aid appliances such as splints, dressing materials, stretchers, and wheelchairs.

The first-aid post will be housed in a temporary structure and managed by a Health Assistant and a First Aid Attendant. Doctors from the main dispensary will visit the first-aid post daily to attend to workers. Communication links between the dispensary, first-aid posts, and nearby hospitals will be established for emergencies. The post will be equipped with fire-fighting equipment, telephones, and an ambulance van.

16.4 Health Extension Activities

Health extension activities will be carried out in the villages around the project area to improve hygiene and sanitation. These activities will involve:

- **Promoting Environmental Sanitation:** Educating the community about proper sanitation, particularly with respect to water pollution from domestic waste.
- **Monitoring Water Potability:** Health functionaries will collect water samples from different sources to ensure regular disinfection of drinking water supplies.
- **Disease Surveillance:** Close monitoring of the spread of communicable diseases due to the migration of laborers into the area will be carried out, with immediate action taken in case of any outbreaks.
- **Community Engagement:** Health extension activities will be conducted with the help of local leaders, NGOs, and health workers to raise awareness about public health issues. Regular health promotion campaigns will be organized in collaboration with the state government's health department.

16.5 Disposal of Bio-Medical Waste

All bio-medical waste generated at the dispensary and first-aid posts will be handled and disposed of in a scientific manner. Special collection containers will be placed at medical facilities for the proper disposal of bio-medical waste. These containers will be regularly collected and transported to authorized treatment facilities for safe disposal.

16.6 Infrastructure

- **Mobile Dispensary:** Due to land constraints, a mobile dispensary will be established to ensure easy access to medical facilities at different construction sites.
- **First-Aid Posts:** Temporary first-aid posts, constructed from MS/GI sheets and bamboo, will be set up at major construction areas.

16.7 Health Awareness and Vaccination Camps

Regular health awareness and vaccination camps will be organized for laborers and the local population. These camps will focus on promoting hygiene, disease prevention, and the importance of vaccinations to prevent the spread of communicable diseases.

16.8 Traffic and Logistics Management

As part of the project's health and safety plan, a Traffic Management Plan will be developed to manage vehicle and pedestrian traffic at the project site. This plan will include:

- Segregation of pedestrian and vehicle traffic.
- Project-specific traffic rules such as speed limits and one-way traffic flows.
- The use of traffic control devices such as road humps, convex mirrors, delineators, traffic signals, and barriers.
- Deployment of traffic marshals and flagmen at critical areas to regulate traffic flow and ensure safety.

This Public Health Delivery and Management Plan ensures that the labor population and surrounding communities are provided with adequate healthcare and sanitation facilities during the project's construction phase.

17. Annexure-XI: - Energy Conservation and Management Plan

17.1 Introduction

The Energy Conservation and Management Plan, a key component of the Environmental and Social Management Plan (ESMP), outlines measures to optimize energy use during both the construction and operation phases of the project. The plan focuses on reducing energy consumption, improving fuel efficiency, and promoting the use of renewable energy sources to ensure environmental sustainability throughout the project lifecycle.

17.2 Construction Phase

Provisions of Free Fuel

To minimize the environmental impact of labor migration, RTDC Ltd., in coordination with the district administration, will make necessary arrangements for the supply of fuel to the labor and technical workforce during the construction phase.

- **Community Kitchens:** The contractor will be responsible for operating community kitchens in the labor camps, using LPG as fuel.

Other Energy Conservation Measures

The following energy conservation practices will be implemented during construction to reduce fuel consumption and optimize energy use:

- **Efficient Work Scheduling:** Work schedules will be designed to minimize equipment idle time and avoid double handling of materials.
- **Throttling and Switching Off Equipment:** Construction equipment will be throttled down or turned off when not in use.
- **Truck Idle Reduction:** Truck engines will be switched off while waiting to access the site or while being loaded/unloaded to reduce fuel consumption.
- **Energy Efficient Lighting:** Site office equipment and lights will be turned off when not in use, and optimal lighting intensity will be used for security and safety.
- **Temporary Road Design:** Temporary roads will be carefully designed to minimize transportation distances within the project area.
- **Equipment Maintenance:** Regular maintenance of construction equipment will ensure optimal performance and fuel efficiency.
- **Energy Efficient Equipment:** Ensure that construction equipment meets or exceeds energy-efficiency specifications.

Provisions for Electricity

The following provisions will be made to supply electricity to the labor colony during construction:

- **Lighting:** Two 100W bulbs will be provided per family for lighting purposes.
- **Electricity for Heating:** One (01) unit of electricity per day will be provided to each worker residing in the project camps/colonies for heating purposes.
- **Solar Streetlights:** Solar streetlights will be installed throughout the labor colony to reduce reliance on conventional energy sources.

- **Solar Water Heaters:** Solar water heaters will be installed to provide hot water in the labor colony, promoting the use of renewable energy.

17.3 Operation Phase

During the operation phase, the following energy conservation measures will be implemented to ensure long-term sustainability:

- **Use of CFL Lights: Compact Fluorescent Lamps (CFLs)** will be used extensively for lighting purposes to reduce energy consumption.
- **Awareness Campaigns:** Awareness programs will be conducted to educate the local population about the benefits of using CFL lights and other energy-efficient practices.
- **Climate-Responsive Design:** Heating, cooling, and lighting systems in buildings will be designed based on climate-responsive principles to reduce energy consumption.
- **Renewable Energy Sources:** Renewable energy technologies such as **daylighting** and **passive solar heating** will be employed to optimize energy use in buildings.
- **System Control Strategies:** Building performance will be optimized by employing system control strategies such as **occupancy sensors** for lighting and temperature control systems to improve comfort while minimizing energy use.
- **Solar Power Utilization:** Solar energy will be maximized for **signage and pedestrian lighting**, reducing reliance on conventional power sources.
- **Transportation Efficiency:** Roads within the project area will be designed to reduce transportation distances, minimizing fuel consumption and associated emissions.

17.4 Monitoring and Maintenance

Regular monitoring of energy usage during both the construction and operation phases will be conducted to ensure the effectiveness of energy conservation measures. Maintenance of solar installations and energy-efficient equipment will be carried out periodically to ensure continued optimal performance.

This **Energy Conservation and Management Plan** promotes efficient energy use and encourages the adoption of renewable energy technologies during the construction and operation phases of the project.

18. Annexure-XII: - Biodiversity Management and Conservation Plan

18.1 Introduction

The Biodiversity Management and Conservation Plan (BMP) is designed to conserve and enhance biodiversity within the project area. It focuses on protecting threatened species and habitats, restoring ecological value, and involving local communities in conservation efforts. The BMP outlines specific, measurable, achievable, and time-bound actions to mitigate the impact of the project on biodiversity, particularly in relation to Schedule-I faunal species.

The key strategies for biodiversity conservation in the BMP include:

- Screening project sites to avoid critical natural habitats.
- Promoting the use of indigenous species in plantations and nurseries while avoiding exotic and invasive species.
- Involving local communities and panchayats in conservation activities.
- Implementing measures to prevent forest fires, habitat fragmentation, and illegal tree felling.

18.2 Ecological Sensitivities in the Project Area

The Shimla Water Catchment Sanctuary, located within a 10 km radius of the project site, is rich in biodiversity, home to numerous plant, bird, and animal species, and primarily covered by dense Deodar forests. Despite the project's proximity to this sanctuary, the project is designed to minimize impacts on flora and fauna, with no loss of trees or hindrance to wildlife movement. A detailed plan to address any potential ecological sensitivities has been developed, with special attention to rare, endangered, or threatened (RET) species.

18.3 Species of Conservation Significance

Flora

No RET plant species have been recorded within the project area. However, dust deposition during the construction phase may temporarily affect plant growth. Afforestation will compensate for the minimal forest loss, with native species planted at a 1:5 ratio.

Avifauna

Bird species such as spotted doves, swifts, pigeons, sparrows, and house crows are commonly observed. No migratory birds or Important Bird Areas (IBAs) were found within the 10 km radius. To mitigate any habitat disturbance during construction, bird diverters will be installed, and nesting sites (if found, any) will be avoided whenever possible.

Mammals

No Schedule-I mammal species were observed along the project alignment. Small mammal species may temporarily vacate the area during construction but are expected to return once the habitat is restored.

18.4 Impacts and Mitigation Measures

The Biodiversity Management Plan (BMP) addresses potential impacts during construction and operation phases with targeted mitigation strategies.

Table: Biodiversity Management Plan

Activity	Impact	Phase	Mitigation Measures
Route Survey and Planning	Habitat disturbance due to bush clearance	Construction	- Minimize habitat disturbance by using existing trails. - Limit vegetation clearance to the minimum area required. Consider alternative transportation modes such as ropeways.
Vegetation Clearance for Towers	Habitat loss for flora and fauna	Construction	- Restrict clearance to designated areas. - Afforestation at a 1:5 ratio. - Avoid night work in sensitive areas.
Stringing of Conductors	Habitat disturbance for fauna	Construction	- Avoid nesting sites. - Conduct pre-surveys to identify and relocate nests. - Minimize tree pruning.
Clearing for Approach Roads and RoW	Habitat loss and disturbance, potential tree felling	Construction	- Tree felling only when necessary. - Ensure tree removal is supervised by trained personnel. - Relocate nests if required.
Transportation of Materials	Disturbance to fauna and flora	Construction	- Use trucks and ropeways where feasible. - Avoid unnecessary damage to flora and fauna. - Enforce strict rules against hunting or poaching.
Risk of Electrocution and Collision	Mortality of birds and arboreal mammals	Operation	- Install bird diverters and perch rejecters. - Use canopy bridges to facilitate arboreal species movement. - Conduct routine maintenance in coordination with the forest department.

18.5 Avi-Faunal Management Plan

Forests are crucial for the survival of avifauna, providing nesting, foraging, and breeding habitats. The Avi-Faunal Management Plan aims to protect bird habitats and avoid nest predation. Key measures include:

- **Installation of Artificial Nest Boxes:** These will be placed in strategic areas to attract hole-nesting birds. The design will include untreated wood, grooved interiors, and adequate ventilation. Nest boxes will be installed at heights of 10-12 feet on trees along the project corridor.
- **Avoiding Nest Predation:** Efforts will be made to protect large forest tracts to support interior forest birds.

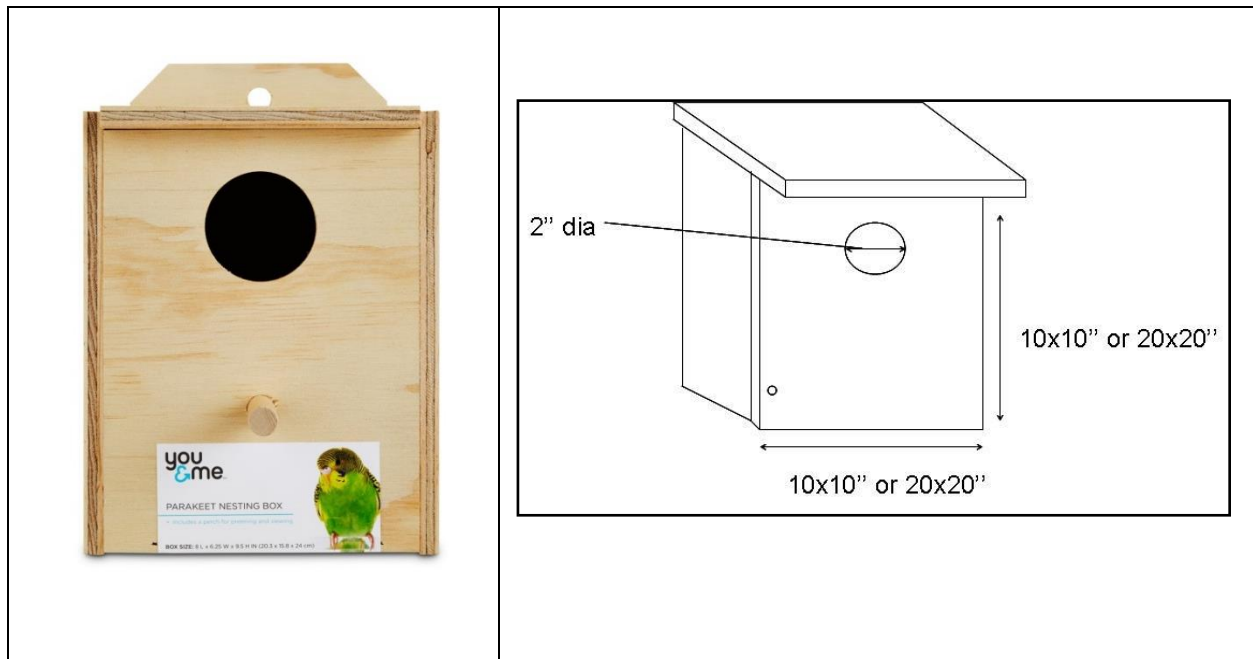


Figure: Net Box Design

This Biodiversity Management and Conservation Plan outlines essential measures to mitigate the environmental impact of the project, protect species of conservation significance, and promote biodiversity conservation.

19. List of Environmental and Social Management Items for Cost Estimation

19.1 ESMP Cost Estimation

The following table outlines the key environmental and social management items that need to be considered for cost estimation in the project. These items ensure compliance with the Environmental and Social Management Plan (ESMP) and cover essential aspects such as biodiversity conservation, waste management, health and safety, and community engagement.

S. No.	Management/ Mitigation Measure	Description
1	Solid Waste Management	One covered truck for solid waste conveyance
		Manpower for waste collection (4 persons)
		Waste collection hand carts (10 units)
		Total for Solid Waste Management
2	Hazardous Waste Management	Storage, handling, and disposal of hazardous waste
		Total for Hazardous Waste Management
3	E-Waste Management	Proper storage and handling of e-waste
		Total for E-Waste Management
4	Landslide Control Measures	Construction of retaining wall
		Geo-textile measures
		Turfing
		Coir matting
		Contingencies
		Total for Landslide Control Measures
5	Quarry Restoration Plan	Re-vegetation of quarry sites
		Total for Quarry Restoration Plan
6	Waste Water Management Plan	Community toilets (20 units)
		Sewage treatment plant
		Oil separator unit for workshop effluents
		Monitoring of Water Quality
		Total for Waste Water Management Plan
7	Air Quality Management Plan	Air pollution control measures
		Total for Air Quality Management Plan
8	Implementation of Environmental Monitoring Programme during construction stage	Soil quality monitoring
		Total for soil quality monitoring
9	Noise Control Measures	Acoustic enclosure for DG sets
		DG sets maintenance
		PPE distribution to workers
		Total for Noise Control Measures
10	Public Health Delivery System	Recurring Expenditure
		Salaries:
		- Doctor (1 no.)
		- Nurse (1 no.)
		- Male multi-purpose health worker (1 no.)

S. No.	Management/ Mitigation Measure	Description
		- Attendant (1 no)
		- Driver (1 no.)
		First-Aid Post (Health Assistants & Dressers)
		Subtotal Recurring Salaries
		Non-Recurring Expenditure
		Mobile dispensary setup
		Miscellaneous medical supplies
		Drugs and medicines
		Contingencies
		2 First-Aid Posts (construction with MS/GI sheets, bamboo)
		Free medicines for laborers
		Health awareness/vaccination camps
		Bio-medical waste collection, transport, storage, and treatment
		Chlorination of drinking water in project-affected villages
		Subtotal Non-Recurring Expenditure
		Total for Public Health Delivery System
11	Biodiversity Management Plan	Forest Dept. support for vegetation clearance and monitoring
		Biodiversity monitoring during construction and operation
		Bird diverters and water holes
		Total for Biodiversity Management Plan
12	Avi-Faunal Management Plan	Installation of 500 nest boxes
		Repair and maintenance of nests
		Skilled person salary for 5.5 years
		Awareness programs and contingencies
		Total for Avi-Faunal Management Plan
13	Health and Safety (First Aid, Mobile Dispensaries)	Mobile dispensary and health materials
		Total for Health and Safety

Signature Not Verified

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