



ODISHA HYDRO POWER CORPORATION LTD
(A GOVT. OF ODISHA UNDERTAKING)

CIN: U40101OR1995SGC003963

REGD. OFFICE: OHPC Corporate Office, Bhoi Nagar, Janpath, Bhubaneswar-751022

Phone: 91 -0674-2542983, 2542802, 2545526, 2542826

E-mail: ohpc.co@gmail.com, website: www.ohpcltd.com

VOLUME-I
(Conditions for EPC Contract with Price Proposal, Cover-I)
(EPC Contract)

NAME OF WORK

*Repair and Rehabilitation of Power channel from HHEP, Burla to
CHEP, Chiplima, Sambalpur, Odisha.*

-sd-
C&P(Head)

TENDER DOCUMENT FOR EPC CONTRACT FOR

**Repair and Rehabilitation of Power channel from HHEP, Burla to CHEP, Chiplima,
Sambalpur, Odisha.**

STANDARD TENDER DOCUMENT CONTAINS FOLLOWING VOLUMES

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- 2. VOLUME – II TECHNICAL SPECIFICATIONS**
- 3. VOLUME – III MAPS & DRAWINGS**

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CHECK LIST

CHECK LIST

DOCUMENTS TO BE FURNISHED BY THE BIDDER

The check list has been prepared to facilitate submission of information sheets by the bidders. Other information required for the bid, but not mentioned in the check list shall also be submitted.

Sl. No.	Particulars of Submitted	BID document Reference: (Section/Volume))	Whether furnished		Reference to uploaded document Page No.
			Yes	No	
	Cover – I				
	FILE-I				
1	Qualification criteria (i) Execution of similar work (ii) Annual Turnover (iii) Credit Facilities	As per Instructions to Bidders (Section-II), Vol-I			
	FILE-II				
1	Letter of submission of Bid in Form A	Section-III- Vol-I			
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3	EMD	Section-III-Vol-I			
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7	PAN	As per Instructions to Bidders (Section-II), Vol-I			
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19	Litigation History in Annexure-V	Section-III, Vol-I			
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2	Construction Program for 36 Months	As per Instructions to Bidders (Section-II), Vol-I			
3	Milestones for execution of work.	Appendix-F1 & F2, Vol-I.			
	Cover – II				
	Financial Bid				
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1	Financial bid	Appendix-F of Financial Bid, (Cover-II) in Intelligent BoQ (.excel)			

e-Procurement Notice



ODISHA HYDRO POWER CORPORATION LTD

(A GOVT. OF ODISHA UNDERTAKING)

CIN: U40101OR1995SGC003963

REGD. OFFICE: OHPC Corporate Office, Bhoi Nagar, Janpath, Bhubaneswar-751022

Phone: 91 -0674-2542983, 2542802, 2545526, 2542826

E-mail: ohpc.co@gmail.com, website: www.ohpcltd.com

e-Procurement Notice No. 01/2026-27/3780

INVITATION FOR BID (IFB)

OHPC Ltd., Bhubaneswar invites bids on EPC rate in double cover system (Cover-I Technical Bid and Cover-II Price bid) for the below mentioned work through 'e'-procurement as detailed in the table below. The bids should be submitted 'online' in <https://tendersodisha.gov.in> by the "Super Class" contractors registered with the State Government or contractors of equivalent grade/class registered with Central Government / Railways / MES having registration for execution of civil works on production of definite proof from the appropriate authority. The bidders should have necessary portal enrolment with their own Digital Signature Certificate. The bidder must possess compatible Digital Signature Certificate (DSC) of Class – II or Class-III.

Name of the work	E.M.D. (in ₹) (Online / Offline)	Cost of bid document (Online)	Class of Bidder	Period of completion (in calendar month)
"Repair and Rehabilitation of Power channel from HHEP, Burla to CHEP, Chiplima, Sambalpur, Odisha"	1,40,75,985/-	11,800/- (Rs.10,000+18% GST)	"Super Class"	36 months

Date & Time of availability of bid documents in the portal: From 11:00 Hrs. of Dt.04.05.26 to 12:00 Hrs. of dt.02.06.2026

Last date of submission of Pre-bid queries: Up to Dt.13.05.2026 (01:00 PM)
 Pre-Bid meeting : Dt.18.05.2026 at 11.30 AM, OHPC Conference Hall, BBSR through VC
 Pre-Bid Compliance : Dt.25.05.2026
 Last date & Time of submission of bids: Up to 12:00 Hrs. of Dt.02.06.2026
 Date of Opening of the Technical Bid: Dt.03.06.2026 at 11:30 AM
 Further details can be availed from the e-procurement portal <https://tendersodisha.gov.in>.

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Contract & Procurement Head,
CO, BBSR, OHPC Ltd.

Memo No. 3781**Dated. 20.04.2026**

Copy to Sr. General Manager (Fin.), Corporate Office, OHPC Ltd., for information and necessary action.

-sd-**Contract & Procurement Head,****Memo No. 3782****Dated. 20.04.2026**

Copy along with soft copy of the advertisement forwarded to the Asst. Manager (PR), OHPC Corporate Office, Bhubaneswar for information and necessary action. He is requested to arrange for publication of e-Procurement Notice No.OHPC/Tech/C&P-01/26-27 in one English National News Paper and one Odia Daily News Paper in one edition only on or before Dt.04.05.26 for wide circulation. This has been approved by the Competent Authority.

-sd-**Contract & Procurement Head,****Memo No. 3783****Dated. 20.04.2026**

Copy along with soft copy of the e-Procurement Notice forwarded to the GM (IT), OHPC Corporate Office, Bhubaneswar for uploading of the same in the OHPC website on or before dt.04.05.26 for wide circulation.

-sd-**Contract & Procurement Head,****Memo No. 3784****Dated. 20.04.2026**

Copy to SGM (Civil), Corporate Office for information & necessary action.

-sd-**Contract & Procurement Head,****Memo No. 3785****Dated. 20.04.2026**

Copy to the Unit Head, HHEP, Burla / Unit Head, CHEP, Chiplima for information and necessary action.

-sd-**Contract & Procurement Head,**

ODISHA HYDRO POWER CORPORATION LTD.

(A Govt. of Odisha Undertaking)

Bhoi Nagar, Unit-IX, Bhubaneswar.

DIST-Khordha-751022, Tel-(0674)-2542983/ 2542802/ 2545526/ 2542826,

e-mail:ohpc.co@gmail.com

(GSTIN-21AAACO2575P1Z9)

NOTICE INVITING TENDER

e-procurement Notice No -**01/2026-27/3780** (on-line)

Online tenders are invited on EPC-Turn-Key Basis from the qualified short-listed bidders for execution of the following works;

Name of Work	Class/EMD /Tender Fee /Period of completion
<p>(1) “Repair and Rehabilitation of Power channel from HHEP, Burla to CHEP, Chiplima, Sambalpur, Odisha” Including renovation of Surplus Escape, Head Regulator, Cross Regulator along with execution of ancillary works of drain, service road, Beautification etc..</p>	<p>(1) The Bidder should be an Individual / Single Proprietary firm/ Company having valid Contract Registration Certificate of category ‘<i>Super class</i>’ issued by Odisha PWD duly registered in CDMS portal or Contract Registration Certificate of equivalent rank issued by CPWD/ Railways/ MES/other State Governments. In that case the bidder needs to register in CDMS portal before participating in tender / before issue of work order. The certified copy of the same along with corresponding work value limitation of class of Contract Registration (except OPWD) is to be submitted with the tender. However, the successful Bidder, if not registered under OPWD, has to register under OPWD before signing the agreement for execution of the work. Accordingly, the bidder has to submit a declaration.</p> <p>(2) Bidder in a JV (Joint Venture)/ Partnership firm are not allowed.</p> <p>(3) Statutory requirements- The Bidder should possess EPF Regn., PAN, GSTIN etc. against its / their establishment and the bidder should have registered in CDMS portal to participate in the tender.</p> <p>(4) EMD- The EMD cost to be submitted online/offline.</p> <p>Tender Fee-Rs 11,800/- (Rs. 10,000 + 18% GST) to be transferred online (Non-Refundable)</p> <p>(5) Period of Completion –36 (Thirty-Six) Consecutive calendar months.</p>
<p>A. PERIOD OF AVAILABILITY OF TENDER DOCUMENT.</p>	<p>Dt. 04.05.2026 from 11.00 AM to Dt. 02.06.2026 up to 12.00 PM</p>

B.	DATE, TIME& PLACE OF PRE-BID CONFERENCE	18.05.2026 at 11.30 A.M through VC. The link of VC shall be shared with the requested email Id.
C.	LAST DATE AND TIME FOR RECEIPT OF BIDS	02.06.2026 up to 12.00 PM
D.	PLACE OF SALE, RECEIPT OF BIDS	Online through e-procurement.
E.	TIME AND DATE OF OPENING OF TECHNICAL BID	03.06.2026 at 11.30 AM.
F.	PLACE OF OPENING OF BIDS	Odisha Hydro Power Corporation Limited, Bhoi Nagar, Unit-IX, Bhubaneswar-22
G.	Further details can be seen from e-procurement portal “ https://tendersodisha.gov.in ”	

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C&P HEAD

SECTION – I
DETAILED NOTICE INVITING TENDER
(DNIT)

Section-I

1.0 INTRODUCTION:

Chiplima HEP is located 24 km southeast of the Hirakud dam. The installed capacity of Chiplima Powerhouse is 72 MW (3 units of 24 MW). Chiplima Hydroelectric Project utilizes the tail water of Hirakud HEP. The power plant has been in operation since 1962. The 83,617.75 ft (25,487 m) long power channel conveys the water from Burla powerhouse downstream to Chiplima powerhouse. In overall length of channel, 4 Nos. of water regulating structures i.e., Surplus escape, Head regulator, Syphon spillway and cross regulator are already existing at different chainage of channel. The objective of the present work is to repair the damaged water conductor channel from HHEP, Burla to CHEP Chiplima including the repair modification of the regulating structures in the system. The repair of Service Road, drain, installation of STP etc. is also in the scope of the work.

2.0 INVITATION:

- 2.1** Online tender for the following work is invited on EPC contract basis by the C&P Head, ODISHA HYDRO POWER CORPORATION LIMITED, Unit-IX, Bhoi Nagar, Bhubaneswar-22 from the eligible perspective bidders
- 2.2** The concerned Bidder shall submit the certificate of registration with concerned State / Government bodies / Authority along with the tender as mentioned in NIT (Notice Inviting Tender).
- 2.3** The Bidder should be an Individual / Single Proprietary firm/ Company having valid Contract Registration Certificate issued by Odisha PWD duly registered in CDMS portal or Contract Registration Certificate of equivalent rank issued by CPWD/ Railways/ MES/other State Governments.
- 2.4** Failure of taking action specified in Para 2.2 and 2.3 above, the concerned bidder shall be disqualified and they will be suspended for three years.

3.0 PARTICULARS OF TENDER

- | | | | |
|----|----------------------|---|---|
| a) | Name of Department | : | Odisha Hydro Power Corporation Ltd. Under the administrative control of Department of Energy. |
| b) | Tender Notice Number | : | “e” Procurement Notice No. 01/2026-27 (on-line) |
| c) | Period of Contract | : | 36 (Thirty-six) consecutive calendar months |
| d) | Form of Contract | : | EPC contract |
| e) | Tender Type | : | Online e-procurement. |
| f) | Tender category | : | Works. |
| g) | EMD | : | <u>Rs.1,40,75,985/-</u> in shape of Insurance Surety Bond/ account payee demand draft/fixed deposit receipt/ bank guarantee including e-Bank Guarantee from any of the scheduled commercial banks or payment online in an acceptable form, |

failing which the tender will be non-responsive.

- h) Cost of Tender Document : **Rs.11,800.00** to be transferred online (including 18% GST & Non-refundable)
- i) Bid Submission : Technical (Cover-I) and Price bid (Cover-II) through Online mode only.
- j) Bid Validity : 180 days from last date of submission of bid.
- k) **Pre-Bid meeting** : **18.05.2026 at 11.30 A.M in VC.**
- l) **Technical Bid opening date** : **03.06.2026 at 11.30 AM** onwards.
Place of Technical Bid opening: Odisha Hydro Power Corporation Limited, Unit-IX, Bhoi Nagar, Bhubaneswar-22
- m) Price Bid opening Date : Date & place of opening of price bid shall be notified by the Tender Inviting Authority.
- n) Initial Security Deposit (ISD) : Total 5% of the agreement value in shape of Demand Draft from nationalized bank/Banker's cheque/N.S.C./Post Office Savings Bank Account/Post Office Time Deposit Account/ Kisan Vikash Patra/Bank Guarantee/ Insurance Surety Bond in favour of **OHPC** from any **Nationalized Bank/ Scheduled Commercial Bank in India duly counter guaranteed by its Regional Branch at Bhubaneswar.**
- o) Performance Security : 5% of the gross amount of each running bills will be deducted.
- p) Authority Inviting Bids. : **C&P HEAD, OHPC Ltd.**
Address: Odisha Hydro Power Corporation Limited, Unit-IX, Bhoi Nagar, Bhubaneswar-22
Contact Details : Phone No: 7328840352
email: ohpc.co@gmail.com

4.0 DOWNLOAD OF TENDER DOCUMENTS

The tender documents are available in electronic form from **11.00 AM of 04.05.2026 up to 12 PM of 02.06.2026** in the website **www.tendersodisha.gov.in**. Interested qualified shortlisted bidders can view these tender documents online, and can download tender documents. Bidders who wish to submit their offer shall deposit specified tender document fees through online mode only.

5.0 PRE-BID CONFERENCE

- 5.1 A Pre-Bid Meeting, open to all prospective bidders, will be convened by the C&P Head, OHPC Ltd on **18.05.2026 at 11.30 A.M.** onwards which will be held through VC only.
- 5.2 The purpose of this meeting will be to discuss and answer to the queries on any matter that may be raised by the bidder at that stage. The answers/reply to the

queries shall be uploaded in the e-procurement portal.

- 5.3 The bidders are requested to submit any query in writing, on-line in e-procurement portal or e-mail (ohpc.co@gmail.com) to reach the office of C&P Head, OHPC Ltd. during the clarification seeking period as mentioned in NIT by **1:00 PM of 13.05.2026**.
- 5.4 Any modification of the bid documents that may become necessary as a result of the Pre-Bid Meeting shall be made by the Employer, by issuing an addendum to Bid Documents, which eventually become a part of the Agreement.
- 5.5 The proceedings of the pre-bid Meeting will be uploaded in the designated location of website and shall be treated as a part of bid document. No further information relating to pre-bid shall be provided to the bidder.
- 5.6 Non-attendance at the pre-bid meeting shall not be a cause for disqualification of the bidder. However, no claim/ query will be entertained after the scheduled pre-bid meeting on the plea of such non-attendance.

SUBMISSION OF TENDER:

- 5.7 The bidders shall submit their tender online only. In case of any failure, malfunction or breakdown of electronic system used during the e-procurement process, the tender inviting authority shall not be responsible for failure or breakdown other than in those systems strictly within his own control.
- 5.8 The e-procurement applications are PKI (Public Key Infrastructure) enabled and supports the digital Signature certificates (DSC) of appropriate class (Class-II or Class-III) issued from a registered Certifying Authority (CA) as stipulated by Controller of Certifying Authorities (CCA), Government of India such as n-code, Sify, TCS, e-Mudhra etc., for signing the bids at the time of submission by contractor. The contractor has to procure digital Signature certificates issued by above authority as per the procedure. Digitally signed bids are to be submitted electronically through e-procurement, without which the tender will not be considered for opening the price Bid.

State Procurement Cell, Nirman Soudh, Bhubaneswar may be contacted to know the procedure of bid submission on e-procurement platform. The telephone No is 18003456765 (Toll free), 0674- 2530998.
- 5.9 The bidders would be required to register on the e-procurement market place www.tendersodisha.gov.in and submit their bid online. OHPC Ltd will not accept any bid submitted in the paper form. The bidders should quote their Tender contract price at the prescribed field / place provided in the e-market place.
- 5.10 The bidder may ask question online in the e-procurement portal using his/her DSC, provided the questions are raised within the period of seeking clarification as mentioned in the particular of tender. The officer inviting tender will clarify queries related to the tender during the pre-Bid meeting.
- 5.11 Intending bidders can contact the C&P Head, OHPC Ltd. for any clarification, and information on any working day during working hours. No clarification will be entertained after the pre-bid meeting.
- 5.12 The bidders are requested to submit the bids in single stage with two covers.

Cover-1: Qualification criteria and Technical bid and Cover-2 : Financial bid in separate.

6 OPENING OF TENDER

The Technical Bid will be opened on **03.06.2026 at 11.30 AM** on website **www.tendersodisha.gov.in** . Intending bidders or their representative who wish to participate in online tender opening can log on to **www.tendersodisha.gov.in** on the due date and time after online opening of the bid by the authorized officer. The price bid will be opened after evaluation of the technical bid of tender.

7 GENERAL INSTRUCTIONS

- 7.1 The cost of tender document will not be refunded under any circumstances.
- 7.2 EMD in the form specified in tender document only shall be accepted failing which the tender will be non-responsive.
- 7.3 The bid shall be valid for One hundred eighty (180) days from the last date of submission of bid on line.
- 7.4 Tenders without the cost of Tender Document and EMD and which do not fulfill all or any of the conditions or submitted incomplete in any respect will be rejected.
- 7.5 Conditional tender shall not be accepted.
- 7.6 Corporation reserves the right to accept or reject any or all tenders without assigning any reason thereof.
- 7.7 The bid document shall form a part of contract and only required documents need to be uploaded during online bid submission for evaluation of bid.
- 7.8 The bidders are advised to read carefully the “Instruction to Bidders” contained in the tender documents at section-II.
- 7.9 The website address for e -Tendering is www.tendersodisha.gov.in
- 7.10 The details of the above notice will be available on www.tendersodisha.gov.in .
- 7.11 **Defect liability period: 2(two) years** from the date of completion of the project.
- 7.12 The dates stipulated in the NIT are firm and under no circumstances they will be relaxed unless officially extended/modified.
- 7.13 Other terms and conditions shall be applied as per terms and condition of the tender documents.

Further details can be seen from e-procurement portal www.tendersodisha.gov.in.

C&P HEAD

SECTION – II

INSTRUCTION TO BIDDERS

SECTION – II

INSTRUCTION TO BIDDERS

1.0 SPECIAL ATTENTION:

- 1.1 The Bidder should be an Individual / Single Proprietary firm/ Company having valid Contract Registration Certificate issued by Odisha PWD duly registered in CDMS portal or Contract Registration Certificate of equivalent rank issued by CPWD/ Railways/ MES/other State Governments.
- 1.2 All bidders are urged to submit a written/ online request immediately upon receipt of the tender documents for the matter where clarification and/ or additional information are desired, along with the details of work. All such request should reach the authority inviting tender through e-mail on or before **dt. 13.05.2026 up to 1.00 PM.**
- 1.3 **The design, data & drawings are attached at volume-III of tender document. it may be noted that technical details & drawings of the project described in the tender are purely for reference purpose only and therefore, it is the primary responsibility of the prospective bidders to conduct site visit at their own cost for acquaintance, assessment of work involved, development of fresh designing of the technical parameters, preparation of detailed engineering drawings, formulation of all technical parameters, material requirement.**
- 1.4 **THE BIDDERS ARE ADVISED TO VISIT THE SITE BEFORE QUOTING THE BID. THEY SHOULD ASCERTAIN ALL THE REQUIRED DATA FOR COMPLETION OF THE WORK IN EPC MODE.**
- 1.5 The tender document shall be submitted as per procedure laid down in Section -II, Para No. 15, for submission of tender.
- 1.6 Tender shall be opened as per procedure laid down in Section – II, Para 16.
- 1.7 All bidders are cautioned that bid containing any deviation from the contractual terms and conditions, specifications or requirements shall be rejected as non-responsive.
- 1.8 Conditional bid will be rejected outright. No condition shall be included in tender.
- 1.9 Alternative bids are not acceptable.
- 1.10 Evaluation of bid will be done when tender is considered responsive as per tender condition.
- 1.11 Bidder shall have to declare regarding correctness of the tenders submitted in the prescribed format.
- 1.12 The Owner/Employer reserve the right to qualify /disqualify any bidder without assigning any reason thereof.
- 1.13 Bidders shall be disqualified if they have made untrue or false representation in the forms, statements and attachments required in the bid documents;

or

Record of poor performance either due to technical or financial or any other reasons.

- 1.14 If the bidder has submitted tender fee and EMD online & in hard copy, the request of the bidder for not opening of bid shall not be accepted in any circumstances.
- 1.15 The contractor intending to hire/lease equipments/machineries are required to furnish proof of ownership from the company/person providing equipments/machineries on hire/lease deed should cover the entire period of work. In the event of non-submission of above specified documents in proper shape, the document will be summarily rejected.
- 1.16 Before releasing the work order after finalization of tender, it should be ensured that the contractors shall have provident Code Number, if applicable and the contractor shall also ensure compliance of the EPF & MP Act ,1952 by the sub-contractors, if any engaged by the contractor for the said work” (This is as per Lr No.1909(41)/LESI dated 04.3.2017 of Labour and ESI Department, Government of Odisha)
- 1.17 The bidder shall have to upload all required documents as per the submittals and Clause No. 14 & 15 of Section – II duly scanned with his bid. Only scanned copy uploaded shall be considered. The bid shall be considered non-responsive if any required documents are not uploaded duly scanned during online submission of bid.

2.0 DEFINITIONS:

In this document the following words and expressions have the meaning hereby assigned to them.

- 2.1 **Approved / Approval:** Means approval in writing.
- 2.2 **Bidder:** Firm, Limited Company or Corporation, as eligible put to tender.
- 2.3 **Completion of Commissioning** for electrical works shall mean the Charging & continuous operation of the sub-station, transformers & lines for 48 hours without any interruption.
- 2.4 **Consumer installation":** means any composite electrical unit including electric wires, fittings, motors, transformers and apparatus portable and stationary, indoor, outdoor and underground, erected and wired by or on behalf of the consumer in one and at the same premises.
- 2.5 **Construction Plant:** Means all equipment, appliances or things of whatsoever nature required for the execution, completion or maintenance of the work or temporary works but does not include materials or other things intended to form or forming part of permanent work.
- 2.6 **Consulting Engineer/'Consultant'** shall mean any firm or person duly appointed as such from time to time by the Owner.
- 2.7 **Contract:** Means the instructions and information for bidders, general and special conditions of contract, specifications, drawings, tender (including schedules of quantities & tender prices), the formal agreement and all addenda and attachments related to the above.
- 2.8 **Contract Price:** Means the agreed amount stated in the Contract Agreement for the **survey, investigation, planning, design, execution and completion of the works on EPC mode and the remedying of any defects.**
- 2.9 **Contractor:** Shall mean the Bidder whose bid will be accepted by the Owner for the award

of the Works and shall include such successful Bidder's legal representatives, successors and permitted assigns.

- 2.10 Contractor's Equipment:** Means all apparatus, machineries, equipment, vehicles and other things required for the execution and completion of the works and the remedying of any defects. However, Contractor's Equipment excludes Temporary works, Employer's equipment (if any) plant, materials and any other things intended to form or forming part of the permanent works.
- 2.11 Country:** Means the Country in which the site (or most of it) is located, where the Permanent Works are to be executed i.e., INDIA.
- 2.12 Date of Contract'** shall mean the date on which both the parties have signed the Contract Agreement.
- 2.13 Digital Signature:** Any electronic documents, which contains encrypted message digest using hash algorithm and Tenders public key is known as Digitally Signed Documents and the process of generating such document is called digitally signing it.
- 2.14 Drawings:** Means the drawings referred to in the specifications, any modifications of such drawings approved in writing by the DOWR Department, Govt of Odisha/Director (Operation)/ Engineer-in- Charge, and such other drawings as may from time to time be furnished or approved in writing by the Engineer-in-charge.
- 2.15 Engineer/Engineer-in-Charge:**
The contractor will be given a copy of the Corporation authorization designating the Engineer-in-charge by designation and delegating him his authority at the time when contract is signed. It is however, to be distinctly understood that, no delegation of powers shall be made to such departmental assistants or subordinates, except in respect of supervision to ensure compliance of the contract conditions.
- 2.16 'Erection Portion'** of the Contract Price shall mean the value of field activities of the Contract including erection, testing and commissioning to be performed at Site by the Contractor.
- 2.17 e-Tender:** Tender in which you can participate online by means of log in on to the respective website is e-Tender.
- 2.18 Goods:** Means Contractor's Equipment, Materials, Plant and Temporary Works, or any of them as appropriate.
- 2.19 Guarantee Period'/Maintenance Period'** shall mean the period during which the Contractor shall remain liable for repair or replacement of any defective part of the Works performed under the Contract.
- 2.20 Inspector'** shall mean the Owner or any person nominated by the Owner from time to time, to inspect the equipment stores or works under the Contract and/or the duly authorized representative of the Owner.
- 2.21 I.S./ B.I.S:** Means Indian Standard specifications / Bureau of Indian Standard specification.
- 2.22 Manufacturer's Works' or 'Contractor's Works'** shall mean the place of work used by the Manufacturer, the Contractor, their Collaborators or Subcontractors for the performance of the Works.

- 2.23 Materials:** Means things of all kinds (other than Plant) 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.
- 2.24 Month:** Means from the beginning of a given date of calendar month to the end of preceding date of the next calendar month.
- 2.25 Notice of Award of Contract/'Letter of Award'/'Telex of Award'** shall mean the official notice issued by the Owner notifying the Contractor that his under has been accepted.
- 2.26 Offline:** Any activity that is done in conventional route is referred as 'Offline' activity for e.g., Submission of Earnest Money Deposit in Offline fashion would mean the Earnest Money Deposit is to be Submitted in Form of Demand Draft and is to be physically sent to the concerned officer.
- 2.27 Online:** Any activity that is done on website is referred as 'Online' activity for e.g., Submission of Price Bid online would mean that the Price Bid has to be submitted in website.
- 2.28 Owner / Employer:** Odisha Hydro Power Corporation Ltd., Bhubaneswar.
- 2.29 Permanent Works:** Means the permanent works to be designed and executed by the Contractor under the Contract.
- 2.30 Rupees`:** Means Rupees of Indian Currency.
- 2.31 Scanned Copy:** Electronic Copy of any document generated using a Scanner is called scanned copy.
- 2.32 Site:** Means the lands and other places on, under, in or through which, the works are to be executed or carried out and any other lands or places provided by the Owner for the purposes of the contract together with such other places as may be specifically designated in the Contract or subsequently approved as forming part of the site.
- 2.33 Specification'** shall mean the Technical Specifications forming a part of the Contract and such other schedules and drawings as may be mutually agreed upon.
- 2.34 'Sub-Contractor'** shall mean the person named in the Contract Agreement for any part of the Works or any person to whom any part of the Contract has been sublet by the Contractor with the consent in writing of the Competent Authority of OHPC and will include the legal representatives, successors and permitted assigns of such person.
- 2.35 System:** Means the computer which hosts the website (www.tendersodisha.gov.in) where bidders can participate in the tendering process online.
- 2.36 Temporary Works:** Means all temporary works of every kind required for performance of the Contract.
- 2.37 TCC:** -means Tender Contract Committee.
- 2.38 Upload:** The process of transferring electronic document from bidder's computer using internet connection to the website is called uploading.
- 2.39 Week:** Means seven consecutive days.
- 2.40 Works:** Means the works to be executed in accordance with the contract.
- 2.41 'Writing'** shall include any manuscript, type-written or printed statement, under or over signature and/ or seal as the case may be.

- 2.42** When the words 'Approved', 'Subject to Approval', 'Satisfactory', 'Equal to', 'Proper' 'Requested', 'As Directed', 'Where Directed', 'When Directed', 'Determined By', 'Accepted', 'Permitted' or words and phrases of like import are used, the approval, judgment, direction etc. is understood to be a function of the Owner/Engineer.
- 2.43** Words importing the singular only shall also include the plural and vice-versa where the context so requires.
- 2.44** Words importing 'Person' shall include firms, companies, corporations and associations or bodies of individuals, whether incorporated or not.
- 2.45** Terms and expressions not herein defined shall have the same meaning as are assigned to them in the Indian Sale of goods Act (1930), failing that in the Indian Contract Act (1872) and failing that in the General Clauses Act (1897).

3.0 GENERAL DESCRIPTION OF THE WORK: “ The Repair and Rehabilitation of Power channel from HHEP, Burla to CHEP, Chiplima, Sambalpur, Odisha”.

The objective of the present work is to repair the damaged water conductor channel from Hirakud Hydro Electric Project, Burla to Chiplima Hydro Electric Project Chiplima including the repair & modification of the regulating structures like, Surplus escape, Head regulator and cross regulator existing at different chainage of channel in the system. The repair of Service Road, drain, installation of STP etc. is also in the scope of the work.

The details of which is given below.

a) Salient Features of The Project

Table 1.1: Salient feature of Chiplima Power Channel

Power channel	
Total Length	25.44 Km (83480 ft)
1 st Reach upto Pond No 1 Regulator	9.18 Km (30100 ft)
2 nd Reach upto Chiplima Forebay	16.27 Km (53380 ft)
A) 1st Reach (Fully Lined)	
Bed Width	52.42 m (172 ft)
Bed Slope	1 in 10000
Side Slope (H: V)	1:1
Full Supply Depth	7.01 m (23 ft)
Discharge At RL 520	509.77 Cumecs (18000 Cusec) *
Discharge At RL 525	708.01 Cumecs (25000 Cusec)(Design values) *
Storage Capacity of Pond 1 from RL 516 ft to RL 521 ft	7.10 M Cum (5764 Acft)
B) 2nd Reach (Partially Unlined & Partially Lined)	
Bed Width in Unlined Section	83.51 m (274 ft)
Bed Width in Lined Section	52.42 m (172 ft)

Bed Width in Hill Channel (Fully Lined)	38.40 m (126 ft)
Bed Slope (Except Hill Channel)	1 in 10000
Hill Channel (Bed Slope)	1 In 5000
Discharge	368.11 Cumecs (13000 Cusec) * 353.96 Cumecs (12500 Cusec)
<i>*Designed Value in Actual Practice Limited to 12,500 Cusec</i>	
C) Surplus Escape RD 2070 ft	
Bed level of Power channel	RL. 502.82 ft
FSL of Power channel	RL. 524.00 ft
Bed width of Power channel	247 ft Up to Escape
Downstream floor level of Escape	RL. 506.1 ft Beyond Escape
Crest level of surplus Escape	RL. 511.02 ft
Type of Escape	Gate Controlled Ogee Type
No of Bays	5 Bays
Size of Bay	6.65 m Span, Height 4.5 m
Length of Approach channel of escape	70.20 m
Width of approach channel	42.25 m
Maximum discharge	4250 Cusecs/Gate
D) Head Regulator at Pond No 1	
No of Vents	6
Size of Vents	7.62 x 3.048 m (25 ft X 10 ft)
Sill Level	RL 505 ft
Capacity	382.32 Cumecs (13500 Cusec)
E) Syphon Spillway at Pond No. 1	
Capacity	566.41 Cumecs (20000 Cusecs)
Priming	RL 521.30 ft
Depriming	RL 519.50 ft
No of Slots	27 Nos.
No of Vent	54 Nos.
F) Cross Regulator at RD 63450 ft	
No of Vents	3
Size of Vents	4.876 m x 2.438 m (16'x5')
Sill Level	RL 500 ft

Capacity	65.13 Cumecs (2300 Cusecs)
G) Forebay	
Normal Forebay Level	RL 509 ft (Since May 1963 Maintained at RL 507 ft)
Maximum Forebay Level	RL 509.375 ft
Average Tail water Level	RL 435.00 ft
Tail water Level During Extra Ordinary Flood	RL 460.00 ft

a) BRIEF DESCRIPTION & SCOPE OF WORK UNDER THIS TENDER:

The project is proposed to be implemented on Engineering, Procurement and Construction (EPC) contract.

a. **Scope of work:** the tentative description of works envisaged to be included in the contract are as follows

➤ **Design Engineering**

- ❖ Submission of Investigation report after Investigation and topographic survey of the project area, Geologist visit, Geotechnical investigation etc. The contractor shall also submit a realistic work schedule and programme keeping in the mind the scheduled closure of power channel during May/June and Nov/ December of every calendar year.
- ❖ Approval of Investigation report and work schedule by OHPC.
- ❖ **The firm shall submit the draft design report & drawings to OHPC for approval of design and drawings from DoWR prior to execution of work. The contractor shall liaise with DoWR at their own cost & efforts for obtaining the said approval, failing which the contract so awarded may have to be rescinded by OHPC.**
- ❖ **The price implication, if any, of alterations made by DOWR shall be to the account of the successful bidder. Any request for positive price variation regarding the above matter, would not be entertained by OHPC on a later date. The bidders are therefore advised to make their own assessment and submit their quotes accordingly.**
- ❖ As built drawings & Completion report shall be submitted by the contractor after successful completion of work.

➤ **Other infrastructure and miscellaneous works**

- ❖ It is the responsibility of the executing agency to Obtain necessary Forest Clearance and any other approvals/clearances from the appropriate authority prior to the execution.
- ❖ Dewatering during the power channel closure with suitable means shall be carried out by the firm.
- ❖ Construction of coffer dams of suitable size and type at appropriate location during the closures.
- ❖ Construction of approach ramp to the Power channel including all relative work as per project requirement and making good after completion of work.

➤ **Repair and rehabilitation of Power channel from RD 0.00 ft. to RD 16,000 ft.**

- ❖ Clearing and grubbing Side slope including surface preparation with metal wire brush, uprooting wild vegetation, grass, bushes, shrubs, saplings.
- ❖ Providing and laying Cement concrete of M15 grade at the damaged areas of side slopes and bed as per approved design and drawing.
- ❖ concrete lining (150mm thick) on both side slopes of power channel with Reinforced Cement concrete of M25 grade as per approved design and drawing.
- ❖ Supplying, fitting and placing HYSD bar reinforcement as per drawings and technical specification.
- ❖ Rehabilitation of power channel bed with Roller Compacted Concrete (RCC) M 20 grade of 200mm thick.
- ❖ Providing and installing PVC Water Stop 230 mm wide in construction joint

➤ **Repair and rehabilitation of Power channel from RD 30,000 ft. to RD 76,000 ft.**

- ❖ Clearing and grubbing Side slope including uprooting wild vegetation, grass, bushes, shrubs, saplings.
- ❖ Providing and laying Cement concrete of M15 grade at the damaged areas.
- ❖ Repair and rehabilitation of both side training walls upstream and downstream of Head regulator with Reinforced Cement concrete of M25 grade as per approved design and drawing.
- ❖ Supplying, fitting and placing HYSD bar reinforcement as per drawings and technical specification
- ❖ Dismantling and Construction of Coursed rubble hard Granite stone masonry (first class) in cement mortar (1.4) in the damaged and distressed areas.
- ❖ Flush pointing to stone masonry in cement mortar 1:3 after filling the cracks and crevices with sand.
- ❖ Construction of Retaining wall of M30 grade of grade at right side wall downstream of Head regulator.
- **Repair and rehabilitation of Hill channel portion of Power channel from RD 76,000 ft. to RD 83,480 ft.**
 - ❖ Clearing and grubbing Side slope including surface preparation with metal wire brush, uprooting wild vegetation, grass, bushes, shrubs, saplings.
 - ❖ Providing and laying Cement concrete of M15 grade at the damaged areas of side slopes and bed as per approved design and drawing.
 - ❖ concrete lining (150mm thick) on both side slopes of power channel with Reinforced Cement concrete of M25 grade as per design.
 - ❖ Supplying, fitting and placing HYSD bar reinforcement as per drawings and technical specification.
 - ❖ Rehabilitation of power channel bed with Roller Compacted Concrete (RCC) M 20 grade of 200mm thick.
 - ❖ Providing and installing PVC Water Stop 230 mm wide in construction joint
- **Construction of single lane flexible Inspection Road. with appropriate design**
 - ❖ It is envisaged for construct new flexible payment roads at following sections
 - ✓ Burla section- Right bank RD 3120 ft. – RD 12074 ft.
 - ✓ Burla section- Left Bank RD 2070 ft. to RD 11,047 ft.
 - ✓ CHEP Section- RD 59,000 ft. to RD 83,480 ft.
 - ❖ Clearing and grubbing of road land including uprooting wild vegetation, grass, bushes, shrubs, saplings and surface preparation by loosening the ground for GSB Construction.
 - ❖ Construction of embankment and shoulder with approved material
 - ❖ Construction of Granular Sub-Base
 - ❖ Providing, laying, spreading and compacting stone aggregates of specific sizes to water bound macadam of Grading no. -II
 - ❖ Providing and laying of 50mm thick Bituminous Macadam over the primer coat and tack coat
 - ❖ Providing and laying 30 mm thick S.D.B.C
 - ❖ Providing & laying Selection no. 1 doob grass turf with earth 50mm to 60mm thickness.
 - ❖ **The construction of Inspection road at above chainages shall be carried out as per actual requirement during site. The scope of work may be revised during the execution stage of work and accordingly, the amount payable to contractor towards construction of inspection road, drain, protection work may be revised in proportion to the total length of road actually constructed to that to length of road envisaged.**
- **Construction of Drain along the inspection road as per requirement**
 - ❖ Earthwork in excavation for the drain
 - ❖ Filling in foundation with sand trenches as per drawing
 - ❖ Providing M-20 Grade concrete for plain/reinforced concrete in Drainage wall, Bed, and slab all complete as per drawings.
 - ❖ Supplying, fitting and placing HYSD bar reinforcement as per drawings and technical specification.

- ❖ Providing formwork for concrete with F1 finish for upstream faces of drain, road pier, retaining wall with steel shutters rigidly fixed and removal of forms.
- Providing and erecting a "W" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 70 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 1.8 m high, 1.1 m below ground/road level, all steel parts and fitments to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a spacer of channel section 150 x 75 x 5 mm, 330 mm long complete all along the Inspection Road.
- **Civil works related to rehabilitation of Surplus escape, Head Regular, Cross Regulator and 2 nos. of Trestle bridge**
 - ❖ Providing and laying plain/reinforced concrete as a wearing coat and jacketing of piers with cement concrete M30 grade
 - ❖ Painting on plastered/concrete surface over a primer coat and epoxy paint over the steel surfaces of the structure.
 - ❖ Construction of Roller Compacted Concrete (RCC) M 20 at apron area of head regulator and trestle bridge. Approx. area of 625 sqm both u/s and d/s of bridge and head regulator.
 - ❖ Supplying, fitting and placing HYSD bar reinforcement as per drawings and technical specification for the jacketing structure around the piers.
 - ❖ Providing and injecting approved grout in proportion recommended by the manufacturer into cracks/honey-comb area of concrete/masonry.
- **Hydromechanical and electrical works of Surplus Escape, Head Regulator and Cross Regulator.**
 - ❖ Refurbishment of gate parts (wheels, bearings, springs, guide pad/wheel, bumpers, rubber seal, seal clamps, and fasteners) including dismantling and assembly of parts and their erection at surplus escape. Complete replacement of hoisting mechanism of 5 nos. of service gates.
 - ❖ Repairing, testing and commissioning of 1 no. of emergency/stoplog gate at Surplus Escape. Complete replacement of Monorail hoisting mechanism of emergency gates
 - ❖ Designing, dismantling, fabrication, erection, testing and commissioning of 6 nos. of new service gates at Head Regulator along with their hoisting arrangement and electrical works.
 - ❖ Designing, fabrication, erection, testing and commissioning of 1 no. of emergency gate at Head Regulator along with its hoisting arrangement and electrical works.
 - ❖ Designing, dismantling, fabrication, erection, testing and commissioning of 3 nos. of gates at Cross Regulator along with their hoisting arrangement and electrical works.
 - ❖ Designing, fabrication, erection, testing and commissioning of 1 no. of emergency/stoplog gate at Cross Regulator along with its hoisting arrangement and electrical works.
- **Development of 4 nos. of sit out areas of approximate size of 30 ft. X 12 ft. at suitable location and beautification of power channel area with plantation and landscaping.**
- **Erection, testing and commissioning of 2 nos. of STP of required capacity at Burla portion of power channel.**

b) Other Responsibilities:

The scope also includes necessary co-ordination and management to obtain consent or permission from affected bodies/ authority/ parties whose damage to property is involved in construction of all the components. The contractor will be responsible for processing all the documents required for permission for right way/right of use from Govt., Semi Govt. and private parties etc. All statutory charges required to be paid for this shall be borne by the

OHPC. The Engineer-in-Charge will sign the necessary documents required for permissions/clearances/land acquisition. Required co-ordination for sanction from the concerned authority & NOC from the concerned authority / field owner for satisfactory completion shall be provided by the contractor. On satisfactory completion of the work required NOC is to be obtained from the concerned department by the bidder.

The contractor shall be responsible for compensation to be paid for standing crops, trees etc. and the cost there upon shall not be borne by the OHPC.

Forest land Acquisition: During planning & Design of the work care shall be taken by the contractor to avoid forest land. In unavoidable situations, the contractor shall process all forest clearance paper works on behalf of the Department. Cost of forest land, if any to be acquired & Cost of afforestation if any required shall be paid by OHPC.

For cutting/felling of tress, necessary clearances and permissions from appropriate authority will be taken up by the contractor on behalf of OHPC. Only statutory dues shall be paid/reimbursed by OHPC for the same.

5.0 PARTICULARS PROVISIONAL

The particulars of the proposed work given herein as well as in the accompanying brief note are provisional and must be considered only as advance information to assist applicants.

6.0 COMMUNICATION

6.0 Airports: Jharsuguda is the nearby airport in Odisha.

6.1 Railways: Main railway station nearest to the work site available is Hirakud Railway station.

6.2 Roads: Nearest townships connected by State Highway/National Highway.

6.3 Approach to work site: The bidder has to make his own arrangement for approaching to the work site from nearest point of connecting roads.

7.0 GENERAL FACILITIES:

7.1 Transport Communication Facilities: The contractor has to make arrangement at his own cost to transport all his construction equipments, construction materials and labour to work site.

7.2 Availability of Labour: Both Semi-skilled & unskilled labour required for the work are available in project area and it is preferable to engage local labour, However the Contractor must make his own arrangements for labour / machineries/ plants/equipments.

7.3 Availability of petrol, Diesel and other lubricants: The nearest petrol pumps for procurement of petrol, diesel and other lubricants are available at nearest State High ways/ National high ways/ Sub-Division/District Head Quarters. The contractor shall make his own arrangement for procurement of same at his own cost required for the machineries and equipments engaged for the work.

7.4 Electricity Supply: The Contractor shall make his own arrangement for extension of electric connection at his own cost from the Distribution Companies if so required by him.

7.5 Housing Facilities: Private house may not be available in the vicinity of the work site. The Contractor shall make his own arrangement of housing for the Labourers, workers and staff at the work site.

7.6 Medical Aid: The Health Centre is available at Govt. Hospitals at the nearest Block/Sub-Division/District headquarters. However, the Contractor shall make first aid arrangement at

his own cost in accordance with rule and regulations of prevailing Labour Act.

7.7 Post, Telegraph & Telephones: Post, Telegraph, Telephones & Fax are available at Block/Sub-Division/District headquarters. The site is covered by different mobile networks.

8.0 CLIMATE AND WORKING SEASON:

8.1 Climate: The Project area has moderate climate with temperature varying from 7⁰C to 45⁰C. The rainy season is generally confined to four months from 15th June to 15th October.

9.0 COST OF TENDER:

All costs and expenses incidental to preparation of the proposals, to attend discussion and conferences, if any, including pre-award discussion with the successful bidder, technical and other presentation including any demonstration, etc. shall be borne by the bidders and the Employer shall bear no liabilities whatsoever on such cost and expenses.

10.0 LANGUAGE OF TENDER:

Tender documents shall be submitted in prescribed form in English only. All literature or correspondence in connection with tender shall be made in English only.

11. BID VALIDITY:

Bids shall remain valid for a period of not less than one hundred eighty (**180**) days from the last date of submission of Bids.

11.1 During the above-mentioned period no plea by the Bidder for any sort of modification of the Bid based upon or arising out of any alleged misunderstanding or misconceptions or mistake or for any reason will be entertained.

11.2 In exceptional circumstances, prior to expiry of the original time limit, the Bid Inviting Officer may request the bidders to extend the period of validity for a specified additional period. Such request to the bidders shall be made in writing.

12.0 METHOD OF TENDERING:

12.1 If the tender is uploaded by an individual, it shall be digitally signed by the individual.

12.2 If the tender is uploaded by a proprietary firm, it shall be digitally signed by the proprietor.

12.3 If the tender is uploaded by a limited company or a corporation, it shall be digitally signed by a duly authorized person holding the power of attorney for signing the tender in which case a certified copy of the power of attorney shall accompany the tender. Such limited company or corporation may be required to furnish satisfactory evidence of its existence before the contract is awarded. They should also furnish Articles of Memorandum of Association.

12.4 Each bidder shall submit only one bid for the particular work. A bidder who submits more than one bid in the particular work will be disqualified.

13 EARNEST MONEY DEPOSIT (EMD):

13.1 The bid must be accompanied with the EMD amounting to Rs.1,40,35,985/- in the form of Insurance Surety Bond/ Account payee demand draft/ fixed deposit receipt/ bank guarantee including e-Bank Guarantee from any of the scheduled commercial banks or payment online in an acceptable form. A standard format provided in the bid document in Annexure-I of Section-III.

13.2 No interest shall be paid by OHPC on the EMD amount and will be refunded to all the unsuccessful bidder. The EMD of the successful bidder shall be refunded after signing of agreement.

- 13.3** The bids without EMD will be summarily rejected.
- 13.4** In case of successful Bidder if the Bidder withdraws the Bid during the validity period of Bid, they will be suspended for a period of three years for participating in any tenders and the EMD may be forfeited.
- 13.5** In case of successful Bidder, if he fails to submit ISD as specified in instructions to bidder, he will be suspended for three years from participating in the tender and the EMD may be forfeited.
- 13.6** In the case of a successful Bidder, if he fails to sign the Contract for whatever the reason, he will be suspended for three years from participating in the tender and the EMD may be forfeited.
- 13.7** If required, OHPC may request to extend the bid validity period.

14.0 ACCOMPANIMENTS TO TENDER:

The bidder shall have to upload following legible documents duly signed digitally.

14.1 Scanned copy of the PAN and GSTIN.

14.2 Declaration showing the works in hand of the bidder and the value of works that remain to be executed in each case in prescribed forms required for evaluation of qualification of the bidder.

14.3 Scanned copy of the certificate of Registration as Approved Bidder of concerned State Government / Railway / CPWD / Government bodies.

14.4 Scanned copy of prescribed financial instrument towards tender document fee and Bid Security/EMD

14.5 Scanned copy of current year solvency certificate & Credit Facility available from any nationalized bank / scheduled bank so as to assess the capability of the bidder for execution of work.

14.6 The copy of power of attorney, if power is delegated for signing the bid to another person by the bidder. (As per para 12 of Section-II)

14.7 Forms with Annexure shall have to be submitted in Electronic form and where the space / window of the prescribed form are not sufficient to fill required matter, bidder may submit the details in separate "scanned sheet". In online submission, the bidders have to mention relevant form number in heading of above mentioned separate "scanned sheet",

14.8 Other documents as mentioned in Tender Notice.

All other document mentioned in the tender documents in physical form shall also be uploaded.

15. SUBMISSION OF TENDER:

15.0 The bidders shall submit their tender online only. In case of any failure, malfunction or breakdown of electronic system used during the e-procurement process, the tender inviting authority shall not be held responsible for failure or breakdown other than in those systems strictly

within his own control.

- 15.1 The e-procurement applications are PKI (Public Key Infrastructure) enabled and supports the digital Signature certificates (DSC) of appropriate class (Class-II or Class-III) issued from a registered Certifying Authority (CA) as stipulated by Controller of Certifying Authorities (CCA), Government of India such as n-code, Sify, TCS, e-Mudhra etc., for signing the bids at the time of submission by contractor. The contractor has to procure digital Signature certificates issued by above authority as per the procedure. Digitally signed bids are to be submitted electronically through e-procurement, without which the tender will not be considered for opening the price Bid.
- 15.2 State Procurement Cell, Nirman Soudh, Bhubaneswar may be contacted to know the procedure of bid submission on e-procurement platform. The telephone No is 18003456765 (Toll free), 0674-2530998.
- 15.3 The bidders would be required to register on the e-procurement market place www.tendersodisha.gov.in and submit their bid online. The Department will not accept any bid submitted in the paper form. The bidders should quote their Tender contract price at the prescribed field / place provided in the e-market place.
- 15.4 The bidder may ask question online in the e-procurement portal using his/her DSC, provided the questions are raised within the period of seeking clarification as mentioned in the particular of tender. The officer inviting tender will clarify queries related to the tender.
- 15.5 Intending bidders can contact the office of the C&P Head, OHPC Ltd, Unit- IX, Bhoi Nagar, Bhubaneswar-22 for any clarification, and information on any working day during working hours during the period of seeking clarification. No clarification will be entertained after the pre-bid meeting.
- 15.6 The bidders are requested to submit the bids in single stage with two covers. Cover-1: Qualification criteria and Technical bid and Cover-2: Financial bid in separate.
- 15.7 All Bidders should submit the certified copies and fulfill the following criteria.
- a) The bid shall include all the information's listed as below: -
 - (i) Copies of original documents defining the constitution or legal status, place of registration, and principal place of business; written power of attorney of the signatory of the Bid to commit the Bidder;
 - (ii) Total monetary value of construction work performed by the bidder during the last five years;
 - (iii) Experience in works of a similar nature in the last seven years, and details of works or committed contracts; and clients who may be contacted for further information on those contracts;
 - (iv) Major items of construction equipment proposed to carry out the Contract;
 - (v) Qualifications and experience of key site management and technical personnel proposed for the Contract;
 - (vi) Reports on the financial standing of the Bidder, such as profit and loss statements and auditor's reports for the past five years duly signed by CA with UDIN.
 - (vii) Evidence of adequacy of working capital for this contract (access to line (s) of credit

and availability of other financial resources);

- (viii) Authority has the right to seek references from the Bidder's bankers;
- (ix) Information regarding any litigation or arbitration resulting from contracts executed by the Bidder in the last five years or currently under execution. The information shall include the names of the parties concerned, the disputed amount, cause of litigation, and matter in dispute if any;
- (x) The proposed methodology and Programme of construction including Environmental Management Plan backed with equipment, materials and manpower planning and deployment, duly supported with broad calculations and quality control procedures proposed to be adopted, justifying their capability of execution and completion of the work as per technical specifications within the stipulated period of completion as per milestones.

Cover-1: Qualification criteria:

Technical bid: This will contain the following documents **in three PDF files.**

File-I

The intending bidders can submit bid as an individual.

1 EXECUTION OF SIMILAR WORK

The intending bidders should have satisfactorily completed not less than 80% of the original contract value as a prime contractor of at least one **similar work** of value not less than **Rs. 113 Cr.** (excl. GST) each or two nos. of similar works of value not less than Rs. 71 Cr. (excl. GST) each or three nos. of similar works of value not less than Rs. 56 Cr. (excl. GST) each at Financial year 2025-26 price level in last 7 (seven) Financial years ending March 2025.

The value of work executed shall be brought to current costing level by enhancing the actual value of work (excluding GST/ Taxes) at simple rate of 7% (seven percent) per annum calculated from the date of completion to the date of this bid opening.

The self-attested copy of certificate of authenticity is to be enclosed from the concerned **Superintending Engineer / Executive Engineer / Competent officer in charge of execution.** The detailed correspondence address / e-mail id of the authority issuing certificate shall be furnished. **Failure to submit the proof in support will result in non-consideration of the tender.**

Similar work means:

Similar work means execution/Construction of Canal Lining/ Dams/ Barrages/ Weirs/ Major Irrigation Structures/ Spillways/Major Bridges/ Hydro-Mechanical works over river.

2. ANNUAL TURN-OVER

(a) Work Experience

The intending bidder in its name should have in any one year during the last five year (from FY 2020-21 to FY 2024-25) achieved minimum annual turnover (in similar nature of work only) of **Rs. 55 Crore** at current costing level as aforesaid at Cl. No.15.7(vi).

(b) Documents

Attested copy of certificate of authenticity regarding annual turnover in last five years ending March 2025 duly certified by a Chartered Accountant with UIDN are to be submitted.

3. Credit Facilities/ Avg. Annual Financial Turnover Financial Capabilities:

The intending bidders must possess credit facilities for the required cash flow requirements and average annual financial turnover of not less than **Rs. 50 Crore during the last three years ending March 2025.** and furnish the credentials from any Nationalized / Scheduled Commercial Bank located anywhere in the country with branch at Bhubaneswar along with the bid against the specific work by mentioning the name of the work and tender identification number in prescribed proforma as mentioned in (Annexure-VI(A))

File-II: This shall contain

1. Letter of Submission (Form-A),
2. Details of Cost of Tender Document in Form-C,
3. Registration Certificate,
4. GST Registration No.,
5. Any other Registration No. (if any)
6. PAN.
7. Latest income tax return certificate,
8. Declaration by Affidavit (Form-J),
9. Relationship Declaration (Form-D),
10. Registered Power of Attorney.
11. Assessed Available Bid capacity as specified in clause No. 16.4
12. Details of Financial Capability (Form-G),
13. Details of works in hand (Form-F),
14. Details of Machinery & Equipment Proposed to be deployed for the works (Form-E),
15. List of Similar nature of works executed,
16. Details of personnel to be engaged in this work (Form H),
17. Additional information (Form-I)
18. Litigation History (annexure-V)
19. Bank Certificate for credit facilities & Solvency Certificate (Annexure-VI A& VI B) and any other document required as per bid documents.

File-III: This shall contain

1. Details of technical proposal along with all technical data in the format in accordance with technical specification of bid document describing broadly the technology and methodology of Survey & Investigation, Planning, Design and Construction of major civil works, Hydro-mechanical and electrical components of the project.
2. A work Programme for completion of the project in **36 months** is to be furnished.
3. Milestones for execution of work as per Appendix -F1 & F2.

Cover-2:

Financial bid: This will contain Financial Bid (Appendix-F),

File – I: The Financial Bid (Appendix–FB) shall be in intelligent Excel format. This is to be downloaded from website, the lump sum price is to be filled up without any change in wording & format and uploaded.

- 15.8 The bidder must submit online duly filled in Forms, Schedules, i.e. of Technical bid and Forms and Annexure of Financial bid etc. All the forms, annexure shall be submitted duly filled in electronic form & shall be available on website.
- 15.9 The bidder shall fill & submit the required details / data / information in the prescribed form of tender document i.e. Volume-I.
- 15.10 The bidder shall quote his/her rate only in Cover-II: Financial Bid.
- 15.11 Tender in off-line mode will not be accepted.
- 15.12 If EMD is not received with the tender as mentioned in Para.13 of Section- II, tender shall be rejected.
- 15.13 The authority at his discretion can extend the last date for submission of tender by amending the Tender document in which case all rights and obligations of the employer and bidder will thereafter be subject to the last date as extended.
- 15.14 All duties, taxes, royalty and other levies payable by the contractor as per State/Central Government rules, shall be deemed to have been included in the contract value **except GST** quoted by the Bidder. The royalty charges vide Gazette notification No.2280 dated 14.12.2016 of Odisha minor minerals concession rules-2016 shall be taken into consideration for calculation of royalty charges in their bid. **The royalty charges for the use of earth excavated from the foundation of the structure shall not be levied.** The contractor is expected to quote the bid price in lump sum rate after careful analysis of cost involved for the performance of work complete considering all specification and conditions of contract. In case it is noticed that the price quoted by the Bidder is unusually high or unusually low, unless the employer is convinced about the reasonableness of bid price on scrutiny of the analysis for such price to be furnished by the Bidder, it will be sufficient cause for the rejection of the bid.
- 15.15 OHPC has prepared milestones for executing the work which may be referred while Tender. During execution of work, subsequent breaking of milestones may be made keeping the original percentage for a milestone constant in order to maintain cash flow of contractor. The bidder shall pay special attention as regards achieving of critical milestones on schedule, so as to ensure final commissioning in time. The employer shall critically monitor both the physical as well as financial targets, on monthly and quarterly basis. Shortfalls, if any, in the monthly targets shall be immediately rectified by supplementing the resources by the contractor leading to increase in the progress, at no extra cost to the Employer, so as to achieve the quarterly targets as per schedule.
- 15.16 The contractor will be responsible for processing of permission for right of way/right of use, Forest clearance, felling of trees and land acquisition till the same is obtained. Demarcation of acquisition area, preparation of schedules for acquisition is the responsibility of the contractor. Similarly, preparation of all the base papers for right of way/right of use the NOC from different authorities/owners is the responsibility of the contractor. The contractor should be responsible for compensation to be paid for standing crops, trees etc. and the cost there upon will not be borne by the OHPC.

16.0 OPENING OF TECHNICAL BID

- 16.0 The Technical Bid will be opened **on Dt. 03.06.2026 at 11.30 AM** onwards on website www.tendersodisha.gov.in. Intending bidders or their representative who wish to participate in online tender opening can log on to www.tendersodisha.gov.in on the due date and time after online opening of the bid by the authorized officer. The bidders who wish to remain present at Head Office, OHPC premises at the time of tender opening can do so. Only one representative of each firm will be allowed to remain present. The price bid will be opened after Corporation's decision on technical bid of tender. All the statements, documents, certificates, Bank Guarantee and technical proposals will be verified for evaluation. The clarification on particulars, if any required from the Bidders will be obtained by addressing the bidders. The bids will be evaluated

against the specified parameter/criteria and the qualified bidders will be identified.

- 16.1 If any of the Bidders is not present at the time of opening of Bids, the Bid opening authority will open the Bid of the absentee Bidder, read out and record the deficiencies if any, which shall be binding on the Bidder.
- 16.2 The bids not accompanying with documents as per clause No 14 of “Instruction to Bidders” will be considered as **Non-Responsive**.
- 16.3 Bid capacity & the technical proposal of the bidders who have submitted the Bid Security, tender fee, registration certificate, Power of attorney & No relationship Certificate, shall be scrutinized.
- 16.4 To qualify for award of contract, each bidder who meets the minimum qualification criteria will be qualified only if their available bid capacity is more than employer’s estimated cost of the work. The available bid capacity will be calculated as under:

$$\text{Assessed Available Bid capacity} = (A * N * 2 - B)$$

Where

A = Maximum value of works executed in any one financial year during the last five years (updated to the current price level). The rate of inflation may be taken as 10% per year (escalation factor) which will take into account the completed as well as works in progress.

N = Number of years prescribed for completion of the works for which the bid is invited.

B = Value at current price level of the existing commitments and on-going works to be completed during next N years. (Period of completion of the works for which bids are invited).

The statement showing the value of existing commitments and ongoing works as well as stipulated period of completion remaining for each of the works listed should be countersigned by the Engineer-in-Charge not below the rank of Executive Engineer.

Technical Bids shall be scrutinized in accordance with the conditions stipulated in the Bid document. In case of any discrepancy or non-adherence of conditions, the Bid accepting authority/ C&P head may communicate the same to the concerned bidder on recommendation of TCC. In case of any ambiguity, the decision taken by the Bid Accepting Authority on Bids shall be final.

- 16.5 **Corporation reserves the right to accept or reject any of the bid on the ground of qualification without assigning any reason thereof.**
- 16.6 After opening of the same, the technical evaluation will be carried out by TCC & details will be scrutinized by the TCC. In case of any clarification, same will be obtained from the bidder. After completing the above procedure & evaluation of Technical Bid, the bid accepting Authority shall be moved for acceptance of the Technical Bid. The date of opening of online Price Bid will be intimated to the bidders on acceptance of the technical bid by C&P Head.

17.0 OPENING OF FINANCIAL BID:

- 17.1 On acceptance of the technical bid by the Bid Accepting Authority the date & place of opening of price bid shall be notified by the Bid Inviting Authority/ C&P Head. The price bid of technically responsive bidders shall be opened on the notified date & time in presence of bid opening officials of OHPC and the bidders or their authorized representatives who wish to be present. The details submitted by the bidders online in Cover-II, Financial Bid shall be opened.

- 17.2.1 The responsive bidder’s name, bid price shall be announced.

18.0 EVALUATION OF FINANCIAL BID

- 18.1 The prices shall be considered as filled up by the bidder online in the prescribed Financial Bid Format given in Cover- II: Financial Bid.

- (i) The bid is for execution of the work on “EPC” basis. The lump sum price mentioned in Financial Bid (Appendix-FB) shall be considered for evaluation.

18.2 The TCC shall evaluate and compare the price bids of all the responsive & qualified Bidders. **The lowest lump sum price quoted by the technically qualified bidder, shall be considered the successful bidder.**

18.3 Selection of Bidder among the lowest & equally quoted Bidders will be in the following orders:

- The Bidder whose bid capacity is higher will be selected.
- In case the bid capacity is same the Bidder whose annual turnover is more will be preferred.
- Even if the criteria incidentally become the same, the turnover on similar works and thereafter machinery available for the work and then the clean track record of the firm will be considered for selection.
- In case of any discrepancy between the overall Contract price quoted in words and figures, the price quoted in words shall prevail.

19.0 PROCESS TO BE CONFIDENTIAL

19.1 Information relating to the examination, clarification, evaluation and comparison of Bids and recommendations for the award of a contract shall not be disclosed to bidders or any other persons not officially concerned with such process until the award to the successful bidder has been announced by the Bid accepting authority.

19.2 Any effort by a Bidder to influence the processing of Bids or award decisions may result in the rejection of his Bid.

19.3 No Bidder shall contact the bid inviting authority or any authority concerned with finalization of Bids on any matter relating to its Bid from the time of the Bid opening to the time the Contract is awarded.

19.4 Before recommending / accepting the Bid, the Bid recommending / accepting authority shall verify the correctness of certificates submitted to meet the eligibility criteria and specifically experience. The authenticated contracts of previous works executed by the lowest Bidder shall be called for.

19.5 If the contract price quoted by a Bidder is found to be either abnormally high or within the reasonable limits but under collusion or due to unethical practices adopted at the time of Tender process, such Bids shall be rejected.

20.0 AWARD OF CONTRACT: The C&P Head, Corporate Office, OHPC Ltd after evaluation of price bid by the T.C.C. shall recommend to the Competent Bid accepting authority for acceptance of the bid to the Bidder who is found qualified as per the Bid conditions and whose price bid is evaluated as the lowest responsive bidder.

20.1 The Bid accepting authority reserves the right to accept or reject any Bid or all Bids and to cancel the Tender process, at any time prior to the award of Contract, and shall not bear any liability for such decision and shall not have obligation to inform the affected Bidder of the reasons.

20.2 The Bidder whose Bid has been accepted will be notified of the award of the work by the Bid inviting authority, prior to expiry of the Bid validity period by registered letter/Speed Post. This letter (hereinafter and in the Contract called “Letter of Acceptance”) will indicate the sum that the OHPC will pay the Contractor in consideration of the execution, completion, and maintenance of the Works by the Contractor as prescribed by the Contract (**hereinafter and in the Contract called “Contract Amount”**).

21.0 INITIAL SECURITY DEPOSIT

- 21.1** When a Bid is accepted the concerned Bidder shall attend the office of the concerned Engineer-in-Charge concerned on the date fixed in the Letter of acceptance. Upon intimation being given by the C&P Head, Corporate Office, OHPC Ltd. of acceptance of the Bid, the successful Bidder shall have to pay initial security deposit (ISD). **The ISD @ 5% of the contract amount** (excluding GST) in the shape of Insurance Surety Bond/ fixed Deposit Receipt / Demand Draft/ Bank Guarantee (BG) drawn on any Nationalized/ Scheduled Commercial Bank located anywhere in the country with branches at Bhubaneswar with facility of authentication & encashment of FDR at Bhubaneswar Branch, pledged in favour of **ODISHA HYDRO POWER CORPORATION LIMITED**, Bhubaneswar **within 14 days from issue of LOA.**
- 21.2** The **validity of the ISD: Validity of the ISD** shall be for a total period not less than the stipulated period of the completion of the work in question, plus the defects liability period plus three months.
- 21.3** The bidder shall enter into a contract in the form prescribed by the department within the time limit fixed by OHPC for the due fulfillment of the contracts. Failing which, **the contractor/ firm will be suspended for a period of three years from participating in any tender.** The written contract entered into between the contractor and the OHPC shall be the foundation of the rights and obligations of both the parties and the contract shall not be deemed to be complete until the contract has first been signed by the contractor and then by the proper officer authorized to enter into contract on behalf of the OHPC.
- 21.4** The successful Bidder has to sign the contracts within the 14 days or date as specified in the letter of acceptance. The issue of letter of acceptance shall be treated as closure of bid process and commencement of the contract process. On failure to do so his Bid will be cancelled and **he will be suspended for a period of three years from participating in any tender** without issuing any further notice and action will be initiated for black listing the Bidder.

22 BID AMOUNTS:

The bid amount to be quoted by the bidder shall be exclusive of GST but inclusive of all statutory taxes, royalty, duties & other ancillary works mentioned in the documents. The royalty charges vide Gazette notification No.2280 dated 14.12.2016 of Odisha minor minerals concession rules-2016 shall be taken into consideration for calculation of royalty charges in their bid. **The royalty charges for the use of earth excavated from the foundation of the structure shall not be levied.** No claim whatsoever in this connection shall be entertained under any circumstances.

23 NO SANCTION FOR FOREIGN EXCHANGE

It should be clearly understood that no foreign exchange sanctions will be made available either for purpose of equipments, plants, and machineries, materials of any kind or other things required for execution of work. It should be clearly understood that no request for importing equipments, materials, plants, etc. that may be required in carrying out the work even from rupee payment currency will be entertained except specifically mentioned in respective item of the tender documents.

24 CONSTRUCTION PROGRAMME

- 24.1** The Bidder shall include in his/ her Bid, a detailed construction programme of executing the project, describing broadly the Technology and Construction Methodology of Major Components of the Project including survey, investigation, soil exploration, design & Engineering, estimation, land acquisition proposal, commissioning of total project. The

programme shall be supplemented with Master Control Network. _

- 24.2 The Employer reserves the right to request for changes in the Master control Network during pre-award discussion with the responsive bidder. Mutually agreed Master Control Network shall form part of the Contract.

25 SPECIFIC ISSUES:

- 25.1 Every Bidder is expected, before quoting his bid, inspect the site of proposed work. He should also inspect the quarries and satisfy himself about the quality and availability of materials. The best class of materials to be obtained from quarries, or other source shall be used in the work. In every case the material must comply with the relevant standard specifications. Samples of materials as called for in the standard specifications or in the Bid notice or as required by the Tender accepting authority/Engineer-in-Charge, in any case shall be submitted for the Tender accepting authority/Engineer-in-Charge's approval before the supply to site of work is begun.
- 25.2 The Bidder's particular attention is drawn to the sections and clauses in the standard specifications dealing with
- 25.2.1 Test, Inspection and rejection of defective materials and work.
 - 25.2.2 Carriage.
 - 25.2.3 Construction plant.
 - 25.2.4 Water and lighting.
 - 25.2.5 Cleaning up during the progress and for delivery
 - 25.2.6 Accidents.
 - 25.2.7 Delays.
 - 25.2.8 Particulars of payments.
- 25.3 The contractor should closely peruse all the specifications clauses, which govern the bid he is tendering.
- 25.4 The contractor is responsible for the quality of works executed. If any defects are noticed during execution of the work and the defect liability period after completion of works, the contractor has to rectify at his own cost.
- 25.5 The Bidder will quote lump sum price for the work as a whole.
- 25.6 No alteration which is made by the Bidder in the contract form, the conditions of the contract, the drawings, and specifications shall be recognized and if any such alterations are made, the Bid will be void.
- 25.7 A Bidder submitting a quotation which the Bid accepting authority considers excessive and or indicating insufficient knowledge of current Prices or definite attempt of profiteering will render himself liable to be debarred permanently from Tender or for such period as the Bid accepting authority may decide.
- 25.8 The Bidder should demonstrate availability (owned or leased or to be procured against mobilization advance) of the Key and critical equipment in the shape of list and declaration supported by ownership documents necessarily be enclosed to the Bid on Non Judicial Stamp Paper of worth of Rs.100/- stating. "I do hereby solemnly declare that I own procured on lease the following equipment".
- 25.9 A prospective bidder is expected to examine all instructions, terms & conditions, forms and specifications in the Bid Document and fully inform himself as to all the conditions and matters which may in any way affect the works, his bid or the cost thereof. Further, failure of furnishing

all information required by the Bid Document or submission of incomplete offers, conditional bids containing deviations from the bid document shall be rejected as non-responsive.

- 25.10 It will be imperative for each Bidder to fully inform himself of all local conditions and factors which may have any effect on the execution of the Works covered under the specifications and documents. In their own interest, the bidders are particularly requested to familiarize themselves with the prevailing Income Tax Act, Companies Act, Customs Act, prevailing Labour Laws and other related Acts and Law.

Further, the bidders are requested to comply with the Insurance Act including Workmen's Compensation Act and third-party insurance and other relevant provisions particularly with reference to the requirements of taking insurance for storage, Civil, Structural and Architectural Work, Erection, testing and commissioning, operation and Maintenance, till the project is handed over to Employer. Employer shall not entertain any request for clarification from the bidders regarding such local conditions. It must be understood and agreed that such factors have properly been investigated and considered by the bidders while submitting their bids. Failure to do so will not relieve the bidders from responsibility for estimating properly the cost of successfully performing the work and completion time required for the Work. Employer will assume no responsibility for any understanding, or representation concerning conditions made by any of its officers or agents prior to award of the Contract. Neither any change in the time schedule of the contract nor any financial adjustments arising thereof shall

be permitted by the Employer, which arises out of lack of such clear knowledge or its effect on the cost of execution of the contract on the part of the bidder. Employer shall not entertain any request for clarifications from the Bidders, regarding any statutory provisions.

- 25.11 Being an EPC Contract, the Bidder is to take full responsibility for the survey, Investigation, planning, Design & Engineering and execution of entire work including approval of design & drawings from DoWR, commissioning, Trial run of the work complete.
- 25.12 Survey, Investigation, planning, Designs, Technical Specifications and Technical Parameters shall conform to Bureau of Indian Standard Codes and/or International Standards & practices/C.W.C. Manuals / IRC Codes/ Odisha Govt. Department specifications / Circulars issued by Department from time to time and technical specification of the bid documents.
- 25.13 It is understood that all plant, equipment, and works connected with the normal efficient execution of the Project are covered in the scope, brought out in Bid Documents. In case of decisions to be taken on issues relating to technical matter of planning, design & construction, decision of **Tender Inviting Authority** is final & binding on the contractor.
- 25.14 While working out their price bid, the bidders are required to take into account entire scope of the work defined in Bid documents, additional Infrastructure and other related activities, whatsoever required.
- 25.15 Bidder shall also include in his price bid, cost of de-mobilization and shipping back the construction equipment and other equipment/materials etc. from the Project Site.

26 Corrupt or Fraudulent Practices.

- 26.1 The OHPC requires that the bidders/ suppliers / contractors, observe the highest standard of ethics during the procurement and execution of such contracts, failing which action as deemed fit under the contract shall be initiated.
- 26.1.1 Deleted.
- 26.1.2 "**Corrupt practices**" means the offering, giving, receiving or soliciting of anything of value to influence the action of any OHPC official in procurement process or in contract execution:
and

- 26.1.3 "**Fraudulent practices**" means misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the OHPC and includes collusive practice among Bidders (prior to or after a Bid submission) designed to establish Bid prices at artificial non-competitive levels and to deprive the OHPC of the benefits of free and open competition.
- 26.1.4 Will reject a proposal for award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question.
- 26.1.5 Will blacklist / or debar a firm either indefinitely or for a stated period of time, if at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for, or in executing a OHPC Contract with OHPC.
- 26.1.6 Furthermore, Bidders shall be aware of the provisions stated in the General Conditions of Contract.

27 SUBLETTING OF CONTRACT:

No part of the contract shall be sublet without written permission of the Employer nor shall transfer be made by power of attorney, authorizing others to receive payment on the contractor's behalf. If the prime contractor desires to sublet a part the work he should submit the same at the time of filing Bids itself or during execution giving the names of the proposed sub-contractor along with the details of his qualification and experience. The Bid accepting authority should verify the experience of the sub-contractor and if the sub-contractor satisfies the qualification criteria with reference to the value of work proposed to be sublet, he may permit the same. However, the total value of works to be awarded on subletting shall not exceed 50% of contract value. The extent of subletting shall be added to the experience of the sub-contractor and to that extent deducted from that of the main contractor.

-Sd-
C&P Head

SECTION – III
FORMS & ANNEXURES

FORM-A**LETTER OF SUBMISSION OF BID(ON
BIDDER'S LETTER HEAD)****To,****THE C&P HEAD
ODISHA HYDRO POWER CORPORATION LTD
UNIT-IX, BHOINAGAR, BHUBANESWAR****Sir,**

I / We do hereby Bid and if this Bid be accepted, under take to execute and complete the following work ***“Repair and Rehabilitation of Power channel from HHEP, Burla to CHEP, Chiplima, Sambalpur, Odisha”***.

As provided for in the “conditions of the bid document”

1. I/We have quoted the bid in Price Bid vide **APPENDIX – F** for which I/we agree to execute the work at the quoted lump sum amount under the terms of the contract.
2. In case of any discrepancy between the bid price quoted in words and figures, the bid price quoted in words only shall prevail.
3. I/We agree to keep the Bid validity in this Bid for a period of 180 days from the last date of submission of bid, mentioned in the Bid notice and not to modify the whole or any part of it for any reason within above period. If the Bid is withdrawn by me/us for any reasons whatsoever, the earnest money paid by me/us will be forfeited to OHPC.
4. I/We hereby distinctly and expressly, declare and acknowledge that, before the submission of my/our Bid I/We have carefully followed the instructions in the Bid document and have read the technical Specification therein and the and that I/We have made such examination of the contract documents and the plans, specifications and of the location where the said work is to be done, and such investigation of the work required to be done, and in regard to the equipments and material required to be furnished as to enable me/us to thoroughly understand the intention of same and the requirements of covenant/contracts, stipulations and restrictions contained in the contract, and in the said plans and specifications and distinctly agree that I/We will not hereafter make any claimor demand upon the OHPC based upon or arising out of any alleged misunderstanding or misconception /or mistake on my/or our part of the said requirement of covenants/contracts, stipulations, restrictions and conditions.
5. I/We shall not assign the contract or sublet any portion of the same. In case if it becomes necessary I/We shall submit the same at the time of filing Bids itself or during execution, giving the name of the sub-contractor with details of his qualification and experience and agree to sublet with permission of Bid accepting authority only to such of the sub- contractors

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who satisfies the qualification criteria in proportion to the value of work proposed to be sublet. No part of the work shall be sub-let to other short-listed bidders.

6. If upon written intimation to me/us about acceptance my/our bid, by the Authorized officer of OHPC, I/We fail to attend the said office on the date herein fixed or and if I/We fail to make the initial security deposit (ISD) to enter into the required contract as defined in the instructions to Bidders, then I/We agree to **be suspended for a period of three years from participating in any tender**. Any notice required to be served on me/us here under shall be deemed to have been sufficiently served on me/us if delivered to me/us personally or forwarded to me/us by post (registered/Speed Post/ ordinary/e-mail) or left at my/our address given herein.
7. I/We fully understand that the written contract to be entered into between me/us and OHPC shall be the foundation of the rights of the both the parties and the contract shall not be deemed to be complete until the contract has first been signed by me/us and then by the proper officer authorized to enter into contract on behalf of OHPC.
8. I/We declare that I/We agree to recover the salaries of the technical staff actually engaged on the work by the department, from the work bills, if I/We fail to employ technical staffs per the Bid condition.

BIDDERS / CONTRACTOR'S CERTIFICATE

1. I/We am/are prepared to furnish detailed data in support of all my quoted rates, if and when called upon to do so without any reservations.
2. I/We hereby declare that I/We shall not claim any price escalation except as provided in the Tender documents.
3. I/We declare that the I/We shall take up the responsibility for processing for land acquisition, for execution of all components of work, in the name of OHPC as per conditions **of contract** and arranging and obtaining the land for disposal of spoil/soil not useful for construction purposes shall rest with me/us.
4. I/We hereby declare that the responsibility of processing for getting statutory clearances of forest & environment & other department/commission/authority and approval of drawing & design from DoWR, GoO on behalf of the OHPC as per Conditions of Contract for execution/completion of work rests **on me/us**.
5. I/We declare that I/We will execute the work as per the Mile Stone Programme, and if I/We fail to complete the work as per the Mile Stone Programme I will abide by the condition to recover liquidated damages from my Bills/ PSD as per the Bid conditions.
6. I/We declare that I/We will abide for settlement of disputes as per the Bid conditions.
7. I/We have not been black listed in any department in Govt. of Odisha and in any other state/Union Govt. due to any reasons.

8. I/We have not been demoted to the next lower category for not filing the Bids after buying the Bid schedules in a whole year and my/our registration has not been cancelled for a similar default in two consecutive years.
9. I/We hereby certify that all the statement made and information supplied in enclosed Forms and accompanying statements and Annexure are true and correct.
10. I/We agree to disqualify me/us for any wrong declaration in respect of the above and to summarily reject my/our Bid.

Address of the Bidder:

Phone No:

Fax No:

Email id:

Bidder/Authorized Signatory

SEAL

Form – B

ARTICLES OF CONTRACT

Articles of contract made this _____ day of _____ between **ODISHA HYDRO POWER CORPORATION LTD** (herein after called **Corporation** which expression shall, where the context so admits, include his successors in office and assignees) of the one part and _____ of _____ (herein after called the contractor which expression shall, where the context so admits, include his heirs, executors, administrators and legal representative) with Head Office at-----in the state of on the other part.

Whereas the ODISHA HYDRO POWER CORPORATION LTD (herein after called the Corporation) are desirous of taking up the work for “*Repair and Rehabilitation of Power channel from HHEP, Burla to CHEP, Chiplima, Sambalpur, Odisha*” and have caused a proposal contained in Basic Project Profile, Instruction to Bidder, Conditions of contract, Special Conditions of Contract, Technical Specifications and drawings describing the work to be prepared /to be done.

And whereas the said Basic Project Profile, drawings, Notice inviting Tenders Instruction to Bidders, General condition of Contract, Special conditions & Technical Specification & other appendices and annexures etc. of contract documents (herein after referred as contract) as have been signed by on behalf of the parties here to.

And whereas for the Part I: Works of Agreement, the contractor has produced

1. Rupees _____ paid by him vide FDR/DD No. _____
Date _____ issued by (Bank) _____
_____ pledged in favour of ODISHA HYDRO POWER CORPORATION LIMITED, Bhubaneswar

and

2. Rupees _____ paid by him vide BG No. _____ date _____
_____ issued by (Bank) _____ with validity of all the instruments upto _____ towards Initial security deposit (ISD) of 5% of contract Amount (excluding GST) for the due fulfilment of the contract.

And whereas the contractor has agreed that during the course of the contract period an amount

C&P HEAD

at the rate of **5.0 % (five)** of the value of work done (excluding GST) will be withheld from the bills as Performance Security Deposit.

And whereas the contractor has agreed to execute upon the contract, subject to the Scope of work described in all sections and conditions & specifications forming part of the contract (herein after referred to as the said conditions), and set forth in Annexure - FB as the Financial bid and comply with the rate of progress noted in the conditions for a sum of rupees Rs.

_____ (Rupees _____) on lump sum basis and such other sum as may be arrived at under the clauses of the contract documents relating to payment

And whereas the contractor has agreed to execute the subject work for a sum of Rs.

_____ (as mentioned in the
Para above.

Note: It is hereby agreed as follows:

1. Time shall be considered as the essence of the contract and the contractor hereby agrees to commence the work as soon as the contract is signed and agrees to complete the work within **36 months** from the date of commencement of work and to show the progress as per milestone subject nevertheless to the provisions for extension of time contained in the conditions of contract.
2. The conditions of the bid document & technical specification shall be read and construed as forming part of this contract and the parties here to will respectfully abide by and submit themselves to the conditions and stipulations and perform the contract on their part, respectively.
3. Upon the terms and conditions of this contract being fulfilled and performed to the satisfaction of the C&P Head, OHPC, the security deposited by the Contractor as herein before recited or such portion thereof as he may be entitled to under the said condition shall be returned to the contractor as provided in the contract.

In witness thereof, the contractor M/s. _____ duly represented by Sri _____ has here unto set his hand and **C&P Head, OHPC Ltd** has here unto set his hand the day and year first above written.

Signed by contractor: _____

SEAL

Address : _____

C&P HEAD

Phone No.: Fax No.: e-mail id.:

In the presence of Witness i) Sri _____

Address

Signed by on behalf of Corporation Sri _____

SEAL

Phone No.: Fax No.: e-mail id.:

In the presence of Witness i) Sri _____

Address

Form – C 1

DETAILS OF COST OF TENDER DOCUMENTS

Sr. No.	Description	Remarks
1	Name of bidder	
2	Details of cost of Tender documents	
[A]	D/D No.	
[B]	Date	
[C]	Name of Bank	
[D]	Amount in Rs.	

Address of the Office

SIGNATURE OF BIDDER

Telephone No:

Form – C2

DETAILS OF COST OF ISD

Sr. No.	Description				Remarks
1	Name of bidder				
2	ISD Details				
	Total ISD Amount `.				
	[A]	FDR Details (In favor of the Odisha Hydro Power Corporation only) (no joint operation)			
		For Rs.,_____Lakh for ISD in form of DD/FDR			
	FDR No.	Date	Bank Name	Amount in Rs	Validity Period
	(B)	Details of Bank guarantee Rs._____Lakhs.			
	Bank guarantee No	Date	Bank Name	Amount in Rs.	Validity period

Note–Please see clause 21& its sub clause Instruction to Bidders for validity period.

Address of the Office

SIGNATURE OF BIDDER

Telephone No:

Form - D
RELATIONSHIP DECLARATION

To,
The C&P Head,
ODISHA HYDRO POWER
CORPORATION LTD Unit- IX,
Bhoinagar, Unit-IX Bhubaneswar

Subject: “Repair and Rehabilitation of Power channel from HHEP, Burla to CHEP, Chiplima, Sambalpur, Odisha”

Reference: “e” Procurement Notice No. 01/2025-26/3780 (on-line)

Sir,

Pursuant to clause 79 of the GCC, it is to inform that I have relative(s) employed as an Officer in the rank of an Assistant Engineer/Assistant Manager under the_____Department.

His (Their) details are as follows.

Relationship:	Name:
Designation	Office
Address	

Pursuant to clause 79 of the GCC, I am to submit herewith the names of persons who are working under my firm having near relatives to any gazette officer in the rank of an Assistant Engineer/Under Secretary in the_____Department.

Sl. No	Name of my employee and his designation in the firm	Presently working at	Details of his relatives working in the Department
			Relationship Name: Office Address
			Relationship Name: Designation Office Address

I am also duty bound to inform the relationship of any subsequent employment with any gazette officer in the rank of an Assistant Engineer /Assistant Manager under the Department. I am aware that any breach of this condition would render my firm liable for penal action for suppression of facts.

I am also duty bound to inform that I have no relations with any employee working in the rank of or above the rank of any Assistant Engineer/ Assistant Manager under this OHPC Ltd.

Yours Sincerely,

NB: Please strike out the Para not applicable.

SIGNATURE OF THE BIDDER

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Form – F
DETAILS OF WORKS IN HAND

Sl. No.	Name of work	Place	Work Order amount in Crores	Date of issue of work order	Stipulated period of completion	Amount of work done up to the month previous to the month in which tender are invited in Lakhs	Amount of works to be done during 2026-27, 2027-28 & 2028-29	Brief detail of delay if any	Remarks
1	2	3	4	5	6	7	8	9	10

Date:

SIGNATURE OF THE BIDDER

Note1: Amount of work done in column 7 should be given up to the month previous to the month in which tender invited.

Note2: Necessary certificates in support of amount of work done in col 7 from the officer concerned shall be attached with the tender.

Note3: In Col. 8 amount of works to be done during the completion period for which the bid is invited is to be furnished

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Form - G
DETAILS OF FINANCIAL CAPABILITY

FINANCIAL CAPABILITY					
NAME OF APPLICANT:					
Financial information in Indian Rupees	Actual: Previous Five years				
	2020-2021	2021-22	2022-23	2023-24	2024-25
Annual Turn over (from execution of similar nature of work as per this tender)					
Total Assets					
Current Assets					
Total Liabilities					
Net Worth					
Working Capital					
Current liabilities					
Profits Before Taxes					
List of Banks & their addresses:					
Financial resources like	a) Bank Guarantee Limits				
	b) Lines of Credit				
	c) Solvency				

SIGNATURE OF THE BIDDER

NB: Relevant Audited Financial data as per above statement duly certified by a practicing Chartered Accountant with UDIN are to be furnished.

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Form - H

DETAILS OF PERSONNEL

Give details of key Technical and Administrative Personnel who could be assigned the work in the following Proforma.

A)		Details of the Board of Directors 1) Name of the Director 2) Address 3) Organization of the Board of Director	
B)		Key Technical and administrative Personnel and Consultants 1) Project Manager (Min. 5years experience) 2) Site Engineer (a) Civil (b) Mechanical (c) Electrical 3) Supervisor (a) Civil (b) Mechanical (c) Electrical 4) Technical assistants.	
C)		Skilled and other labour (indicate number category wise) 1) Skilled labour 2) Other labour	

SIGNATURE OF BIDDER

C&P HEAD

Form - I**ADDITIONAL INFORMATION**

- (A) Please add any further information which the applicant considers relevant in regard to his capabilities.
- (B) Please give a brief note indicating why applicant considers him self-eligible
- (C) List of works for which tenders have already been submitted to the bidder's client but not awarded.

Sr. No	Name of Work	Estimated amount (In Cores)	Date of Submission of Offer	Name of Client	Likely date of award	Position with ref. to lowest bid.
[1]	[2]	[3]	[4]	[5]	[6]	[7]

SIGNATURE OF BIDDER

Form – J
DECLARATION BY AFFIDAVIT
(ON NON-JUDICIAL STAMP PAPER)

I / We have gone through carefully all the Bid conditions and solemnly declare that I / we will abide by any penal action such as disqualification or black listing or termination of contract or any other action deemed fit, taken by, the Department against us, if it is found that the statements, documents, certificates produced by us are false / fabricated.

I /we hereby declare that, I / We have not been blacklisted / debarred / Suspended / demoted in any department in Odisha or in any State/ or by any Govt. PSU due to any reasons.

I /we hereby declare that the Technical bid and financial bid are without any deviations and are strictly in conformity with the documents issued by the Employer.

Signature of the Bidder

Annexure – I

Model Bank Guarantee Format for furnishing EMD

Whereas (hereinafter called the “tenderer”)
has submitted their offer dated..... for the supply of
.....
..... (hereinafter called the “tender”) against the purchaser’s tender enquiry
No..... KNOW ALL MEN by these presents that
WE..... of having our registered office
at..... are bound unto (hereinafter called the “Purchaser) in the sum
of for which payment will and truly to be made to the said Purchaser, the Bank
binds itself, its successors and assigns by these presents. Sealed with the Common Seal of the said Bank
this..... day of20..... THE CONDITIONS OF THIS OBLIGATION ARE: (1) If the tenderer
withdraws or amends, impairs or derogates from the tender in any respect within the period of validity of this tender.
(2) If the tenderer having been notified of the acceptance of his tender by the Purchaser during the period of its
validity:- a) If the tenderer fails to furnish the Performance Security for the due performance of the contract. b) Fails
or refuses to accept/execute the contract. WE undertake to pay the Purchaser up to the above amount upon receipt
of its first written demand, without the Purchaser having to substantiate its demand, provided that in its demand the
Purchaser will note that the amount claimed by it is due to it owing to the occurrence of one or both the two
conditions, specifying the occurred condition or conditions. This guarantee will remain in force upto and including
45 days after the period of tender validity and any demand in respect thereof should reach the Bank not later than
the above date. Our..... branch at.....* (Name &
Address of the* branch) is liable to pay the guaranteed amount depending on the filing of claim
and any part thereof under this Bank Guarantee only and only if you serve upon us at our* branch
a written claim or demand and received by us at our* branch on or before Dt.....otherwise
bank shall be discharged of all liabilities under this guarantee thereafter. (Signature of
the authorized officer of the Bank)
..... Name and designation of the officer
..... Seal, name & address of the Bank and address of the Branch

(Signature of the authorized officer of the Bank)

.....
.....

Name and designation of the officer

.....

Seal, name & address of the Bank and address of the Branch

Annexure – II

BANK GUARANTEE FOR INITIAL SECURITY DEPOSIT (ISD)

[Ref: - Clause 21.0 of Section – II, Volume – I of Bid Identification No. -01/2026-27/3780]

WHEREAS _____ (name and address of Contractor) (hereinafter called “the Contractor”) has to undertake a contract, in pursuance of Letter of acceptance No. _____ dated _____ of OHPC,to execute the work of _____ [name of work] (hereinafter called “the contract”)

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a Nationalized/Scheduled Commercial Bank with branches at Bhubaneswar for the sum specified therein as Initial Security, for compliance with his obligations in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee;

NOW THEREFORE we hereby affirm that we are the Guarantors and responsible to you, on behalf of the Contractor, up to a total of Rs _____ [amount of guarantee] Rupees _____ [in words], such sum being payable and we undertake to pay you, upon your first written demand declaring the supplier to be in default under the contract and without cavil or argument, any sum or sums within the limits of Rs _____ [amount of guarantee] as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed there under or of any of the contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall be valid up to _____ day of _____ 20_____ i.e. up to 3 (three) months beyond the date of expiry of the Defects Liability period for the works portion / up to 3 months beyond the O&M period for O&M portion.

We _____ (Name of Bank) hereby also undertake to have the signature of Branch Manager issuing Bank Guarantee verified from Local Branch of the Bank in Bhubaneswar, _____ (address of Local Branch Bhubaneswar, Odisha) for due authentication.

Our _____ branch at Bhubaneswar (Name & Address of the _____ branch) is liable to pay the guaranteed amount depending on the filing of claim and any part thereof under this Bank Guarantee only and only if it is served upon us by the employer at our Bhubaneswar Branch, a written claim or demand and received by us at our Bhubaneswar branch on or before Dt. _____ Otherwise bank shall be discharged of all liabilities under this guarantee thereafter.

(Signature of the authorized officer of the Bank)

.....
.....

Name and designation of the officer

.....

Seal, name & address of the Bank and address of the Branch

Annexure-III

Bank Guarantee Format for Mobilization Advance Payment
 [Ref. Clause 54.0, Section – IV, Vol – I of Bid Identification No. --01/2026-27/3780]

THIS DEED OF GUARANTEE made on day of 20.....BETWEEN
 Bank, a Banking Company incorporated under the Banking Companies Act, 19
 And having its registered office at In the State of(hereinafter called the
 ‘Guarantor’) of the ONE PART AND the ODISHA HYDRO POWER CORPORATION LTD (hereinafter
 called the ‘Corporation’) of the OTHER PART.

WITNESS AS FOLLOWS: -

In consideration of the Corporation having agreed to advance a sum of Rs.....(Rupees
) to..... (Name
 and address of the contractor) (hereinafter called “the Contractor”) against the work concerned by and under the terms
 and conditions upon agreement No. dated made between the contractor and
 ODISHA HYDRO POWER CORPORATION LIMITED, on production of a bank guarantee for ` (Rupees
) we hereby guarantee the payment of sums of money that may be due
 to the Corporation on account of any breach of the terms and conditions contained in the aforesaid contract on
 demand with interest at 12% per annum till payment.

1. We hereby further agree that we are aware of all the terms and conditions of the said contract and shall abide by the decision of the Corporation, as to whether there has been any breach of the terms and conditions of the said contract and as to whether the supplier is liable to pay any sum as so determined.
2. Any demand made to us for payment of any sum in discharge of this guarantee shall be conclusive proof of the fact that there has been a breach of said contract by the suppliers which warrants the enforcement of this guarantee and is binding on the Bank without prejudice to the claims and counter claims of the parties in the proper court of law.
3. This guarantee shall continue to be enforceable till all dues of the Corporation under or by virtue of the said contract have been fully paid and its claims are satisfied or discharged or till Corporation certifies that the terms and conditions of the said contract have been fully and properly carried out by the said contractor and according discharges the guarantee subject however that the Corporation has no right under this bond after the expiry of contract period or the extended contract period from the date of its execution, unless the OHPC choose to further extend the said period or extended period of guarantee by giving reasonable notice in writing to the bank on account of any special circumstances of which the Corporation shall be the sole judge.

This guarantee shall be valid until the day of, 20

We (Name of Bank) hereby also undertake to have the signature of Branch
 Manager issuing Bank Guarantee verified from Local Branch of the Bank in Bhubaneswar,
 (Address of Local Branch Bhubaneswar, Odisha) for due authentication.
 Our..... branch at Bhubaneswar (Name & Address of the
branch) is liable to pay the guaranteed amount depending on the filing of claim and
 any part thereof under this Bank Guarantee only and only if it is served upon us by the employer at our Bhubaneswar
 Branch, a written claim or demand and received by us at our Bhubaneswar branch on or before Dt.
 otherwise bank shall be discharged of all liabilities under this guarantee thereafter.

.....
 (Signature of the authorized officer of the Bank)

 Name and designation of the officer

 Seal, name & address of the Bank and address of the Branch

ANNEXURE – IV

BANK GUARANTEE FOR PERFORMANCE SECURITY DEPOSIT (PSD)

[Ref. Clause 55.0, Section – IV, Vol – I of Bid Identification No. --01/2026-27/3780]

WHEREAS _____ (name and address of Contractor) (hereinafter called “the Contractor”) has undertaken a contract, in pursuance of Work Order No. _____ dated _____ of OHPC, to execute the work of _____ [name of work] (herein after called the contract”)

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a Nationalized/Scheduled Commercial Bank with branches at Bhubaneswar for the release of Performance Security, for compliance with his obligations in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee;

NOW THEREFORE we hereby affirm that we are the Guarantors and responsible to you, on behalf of the Contractor, up to a total of Rs _____ [amount of guarantee] _____ [in words], such sum being payable and we undertake to pay you, upon your first written demand declaring the supplier to be in default under the contract and without cavil or argument, any sum or sums within the limits of Rs _____ [amount of guarantee] as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed there under or of any of the contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall be valid up to _____ day of _____ 20 _____ i.e. up to 3 (three) months beyond the date of expiry of the Defects Liability period for the works portion / up to 3 months beyond the O&M period for O&M portion.

We _____ (Name of Bank) hereby also undertake to have the signature of Branch Manager issuing Bank Guarantee verified from Local Branch of the Bank in Bhubaneswar, _____ (address of Local Branch Bhubaneswar, Odisha) for due authentication.

Our _____ branch at Bhubaneswar (Name & Address of the _____ branch) is liable to pay the guaranteed amount depending on the filing of claim and any part thereof under this Bank Guarantee only and only if it is served upon us by the employer at our Bhubaneswar Branch, a written claim or demand and received by us at our Bhubaneswar branch on or before Dt. _____ otherwise bank shall be discharged of all liabilities under this guarantee thereafter.

(Signature of the authorized officer of the Bank)

.....
.....

Name and designation of the officer

.....

Seal, name & address of the Bank and address of the Branch

ANNEXURE-V

LITIGATION HISTORY

Name of Bidder:

Please describe: Bidder's history of litigation or arbitration from contract executed in the last ten years or currently under execution. Please indicate for each case the year, name of employer, cause of litigation, matter in dispute, disputed amount, and whether the award was for or against the Bidder.

SIGNATURE OF BIDDER.

C&P HEAD

2 ANNEXURE –VI (A)

BANK CERTIFICATE

This is to certify that M/S..... is a reputed company/ firm with a good financial standing.

If the contract for the work namely “**Repair and Rehabilitation of Power channel from HHEP, Burla to CHEP, Chiplima, Sambalpur, Odisha**”.is awarded to the above firm, we shall be able to provide overdraft/ credit facilities to the extent of Rs.....(In _____ words) to meet their working capital requirements for executing the above work.

Place _____ Signature & Seal of Bank Manager
 Date _____ [Name & Address of Bank]

3 ANNEXURE –VI (B)

FORM OF SOLVENCY CERTIFICATE BY BANKS

I, _____ Manager
 / General Manager / Agent of _____
 _____ bank Limited do hereby certify
 that a _____
 _____ [here the Names and addresses of the
 agency] to be solvent to the extent of _____ [Rupees
 _____]
 _____] as disclosed by the information and
 record which are available with the aforesaid bank.

For the _____ Bank

Date:
 Place: _____ Signature of Bank Manager
 [Authorized Signatory]

SECTION – IV

**GENERAL CONDITIONS OF
CONTRACT (GCC)**

SECTION – IV

GENERAL CONDITIONS OF CONTRACT

A. GENERAL

1 Interpretation:

- 1.1 In interpreting these Conditions of Contract, singular also means plural, male also means female, and vice-versa. Headings have no significance. Works have their normal meaning under the language of the contract unless specifically defined. For any clarification & queries, the bidder may ask to C&P Head, OHPC in writing and also attend the pre-bidding meeting as per schedule.
- 1.2 The documents forming the Contract shall be interpreted in the following order of priority:
- a) Notice to proceed with the works
 - b) Contract agreement duly signed by OHPC and successful bidder
 - c) Letter of Acceptance by successful bidder,
 - d) Communication, negotiation between OHPC & successful bidder
 - e) Bid documents submitted by the successful bidder
 - f) Replies to pre-bid queries
 - g) Tender specification/ conditions/ documents/ drawings issued by OHPC with corrigendum.

2 Competent Authority of OHPC's Decisions:

- 2.1 Except where otherwise specifically stated, the Competent Authority of OHPC will decide the contractual matters between the Corporation and the Contractor in the role representing the Department.

3. Communications:

- 3.1 Communications between parties, which are referred to in the conditions, are effective only when in writing. A notice shall be effective only when it is delivered (in terms of Indian Contract Act)
- 3.2 The contractor at time of signing of Agreement shall furnish the permanent and temporary address of the firm for correspondence. He shall also designate his authorized representative for liaising with the Department. In case of change of authorized representative, the new representative shall be promptly designated. The e-mail address, telephone number and Fax number of the firm & the representative shall also be furnished.

4. Sub-contracting:

- 4.1 If the prime contractor desires to sub-let a part of the work, he should submit the same at the time of filing Bids itself or during execution, giving the name of the proposed Sub-contractor, along with details of his qualification and experience. The Bid Accepting Authority should verify the experience of the Sub-contractor and if the Sub-contractor satisfies the qualification criteria in proportion to the value of work proposed to be sub-let, including his past track record of completion and quality of work, he may permit the same. The total value of work to be awarded on sub-letting shall not exceed 50% of contract value. The extent of subletting shall be added to the experience of the sub-contractor and to that extent deducted from that of the main contractor.

- 4.2 Notwithstanding any sub-letting with such approval as aforesaid and notwithstanding that the Engineer-in-Charge shall have received copies of any sub-contracts, the contractors shall be and shall remain solely responsible for the quality and proper and expeditious execution of the works and the performance of all the conditions of the contract in all respects as if such sub-contract or sub-letting had not taken place, and as if such work had been done directly by the contractor.
- 4.3 If any sub-contractor engaged upon the works at the site executes any work which in the opinion of the Engineer-in-Charge is not in accordance with the contract documents, the owner may upon received the report from EIC by written notice to the contractor request him to terminate such sub-contract. The contractor upon the receipt of such notice shall terminate and dismiss the sub-contract and the sub-contractor. The owner shall have the right to remove such sub-contractor from the site if contractor fails to vacate the sub-contractor immediately

5. Other Contractors:

- 5.1 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Department. The Contractor shall also provide facilities and services for them as directed by the Engineer-in-charge.

6. Personnel:

- 6.1 The Contractor shall employ the required Key Personnel named in the Schedule of Key Personnel as per Form-H to carry out the functions stated in the Schedule or other personnel approved by the Tender accepting authority. The Tender accepting authority will approve any proposed replacement of Key Personnel only if their qualifications, abilities, and relevant experience are substantially equal to or better than those of the personnel listed in the Schedule.
- 6.2 Failure to employ the required technical personnel including quality management staff by the contractor, the employer would engage any quality assurance staff for implementing quality management Plan. The amounts spent on such deployment will be recovered from the contractor over and above the provision made in part two of schedule-A from the contractors bills. However, this will not absolve the contractor from the responsibility of quality management on contract works.
- 6.3 The technical personnel including quality assurance personnel should be on full time and available at site whenever required by Engineer-in-Charge to take instructions.
- 6.4 The names of the technical personnel including quality assurance personnel to be employed by the contractor should be furnished in the statement enclosed separately.
- 6.5 In case the contractor is already having more than one work on hand and has undertaken more than one work at the same time, he should employ separate technical and quality assurance personnel on each work.
- 6.6 If the contractor fails to employ technical and quality assurance personnel the work will be suspended, department will engage technical and quality assurance personnel and recover the cost thereof from the contractor. This will not absolve the contractor from the responsibility of maintaining quality of work and implementing quality management plan.
- 6.7 If the Engineer-in-Charge asks the Contractor to remove a person who is a member of Contractor's staff or his work force stating the reasons, the Contractor shall ensure that the person leaves the site forthwith and has no further connection with the work in the contract. The contractor has to make an alternative arrangement with equivalent or more skilled/ experienced/ qualified person as may be required at his own risk and cost for execution of the work with due approval of Tender accepting authority/ Director (Operation).
- 6.8 All Contractors' personnel employed at the plant at any time during the period covered by the

present Contract will be provided by him. The Employer is not liable for personnel in any way and cannot be held responsible in the event of litigation of any sort between the Contractor and members of plant personnel or their representatives

7. Contractor's Risks:

- 7.1 All risks of loss or damage to physical property and of personnel injury and death, which arise during and in consequence of the performance of the Contractor, are the responsibility of the Contractor.

8. Insurance:

- 8.1 The Contractor shall provide, in the joint names of the Employer/Owner and the contractor, insurance cover from the start date to the end of the Defects Liability Period i.e., **for 24 months from the date of completion** for the following events.

- i. Loss of or damage of property in connection with the Contract; and
- ii. Personal injury or death of persons employed for construction
- iii. Loss of or damage to the Works, Plant and Materials
- iv. Loss or damage to the Equipment.

The minimum insurance amounts shall be:

- (a) For the Works, Plant and Materials: Amount fixed by insurance company for 5% of the Contract Price.
- (b) For loss or damage to Equipment: Amount fixed by insurance company for 5% of the Contract Price.
- (c) For loss or damage to property (except the Works, Plant, Materials, and Equipment) in connection with Contract: Amount fixed by insurance company for 2% of the Contract Price.
- (d) For personal injury or death of the contractor's employees or other people: For death: Insurance coverage of Rs. 5.00 lakhs per occurrence
For injury: Insurance coverage of Rs. 1.00 lakh per occurrence

- 8.2 Policies and certificates of insurance for events i. & ii. above shall be delivered by the Contractor to the Engineer-in-Charge at the time of concluding Contract. The policies and certificates of insurance for the events (iii) & (iv) of above clause shall be delivered by the contractor to Engineer-in-Charge on commencement of work & after finalization of planning & design. All such insurance shall provide for compensation to be payable to rectify the losses or damage occurred.

- i. The contractor shall furnish insurance policy in force in accordance with proposal furnished in the Bid and approved by-the Employer/Owner for concluding the contract.
- ii. The contractor shall also pay regularly the subsequent insurance premium and produce necessary receipt to the Engineer-in-Charge, well in advance.
- iii. In case of failure to act in the above said manner the department will pay the premium and the same will be recovered from the Contractors payments.

- 8.3 Alterations to the terms of insurance shall not be made without the approval of the Engineer-in-Charge/ **C&P Head**.

Any amounts not insured or not recovered from the insurers shall be borne by the Contractor in accordance with their responsibilities under Clause-8.1 above.

The Contractor shall, except if and so far as the Contract provides otherwise, indemnify the Employer against all losses and claims in respect of:

- a. Death of or injury to any person, or,
- b. Loss of or damage to any property (other than the Works),

Which may arise out of in consequent of the Operation and Maintenance of the works and the remedying of any defects therein, and against all claim's proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

The insurance policy shall include a cross liability clause such that the insurance shall apply to the Contractor and to the Employer as separate insurers.

The Employer shall not be liable for or in respect of any damages or compensation payable to any workman or other person in the employment of the Contractor or any Subcontractor, The Contractor shall indemnify and keep indemnified the employer against all such damages and compensation, as aforesaid, and against all claims, proceedings, damages, costs, charges, and expenses whatsoever in respect thereof or in relation thereto.

The Contractor shall insure against such liability and shall continue such insurance during the whole of the time that any persons are employed by him on the Facility. Provided that, in respect of any persons employed by any Subcontractor, the Contractor's obligations to insure as aforesaid under this Sub-Clause shall be satisfied if the Subcontractor shall have insured against the liability in respect of such persons in such manner that the Employer is indemnified under the policy, but the Contractor shall require such Subcontractor to produce to the Employer, when required, such policy of insurance and receipt for the payment of the current premium.

9. Site Inspections:

- 9.1 The contractor should inspect the site and also proposed quarries of choice for materials source of water and quote his bid price including quarrying, conveyance and all other charges etc.
- 9.2 The responsibility for arranging the land for borrow area rests with the Contractor and no separate payment will be made for procurement or otherwise. The contractor's quoted bid price will be inclusive of such cost.

10. Contractor to Construct the Works:

- 10.1 The Contractor shall conduct Surveys, investigation, Planning, approval of designs, construction of all component, supply & erection of mechanical and electrical equipments and Commission the Work in accordance with the approved specifications and Drawings and work programme. The contractor has to arrange for getting the design & drawings approved from DoWR, Govt. of Odisha. OHPC will provide necessary official support in this regard.

11. Coffor Dam, Access Road, Dewatering, Diversion of Discharge:

- 11.1 The contractor shall at all time carry out construction of cross drainage works in a manner creating least interference to the natural flow of water during each closure while consistent with the satisfactory execution of work. Payment as per approved milestones shall be made for this work.
- 11.2 No separate payment for bailing out sub-soil water, drainage or locked up rain water for diversion, shoring, foundations, bailing of pumping water either from excavation of soils from foundations or such other incidental. The bid price to be quoted by the contractor is for the finished item of work in situ and including all the incidental charges. The borrow pits are also to be de-watered by the contractor himself at his expense, if that should be found necessary.

- 11.3 The work of diversion arrangements should be carefully planned and prepared by the contractor and forwarded to the Engineer-in-Charge technically substantiating the proposals and approval of the Engineer-in-Charge obtained for execution.
- 11.4 The contractor has to arrange for bailing out water, protection to the work in progress and the portion of works already completed and safety measures for men and materials and all necessary arrangements to complete the work.
- 11.5 All the arrangements so required should be carried out and maintained at the cost of the contractor and no separate or additional payment is admissible.
- 11.6 Necessary Cofferdams and ring bunds have to be constructed at the cost of contractor and same are to be removed after the completion of the work. The contractor has to quote his bid price keeping the above in view.
- 11.7 All cost of access road, dewatering, diversion will be borne by the contractor.

12. Power Supply:

- 12.1 The contractor shall make his own arrangements for obtaining power from the Electricity Distribution Company (DISCOM) for carrying out construction work at his own cost. The contractor will pay the bills of DISCOM for the cost of power consumed by him.
- 12.2 The contractor shall satisfy all the conditions and rules required as per Indian Electricity Act 2003 as amended from time to time and other pertinent rules.
- 12.3 The power shall be used for Bonafide Departmental work only.

13. Temporary Diversions (Works on Public Road):

- 13.1 The contractor shall at all time carryout work on the public road in a manner creating least interference to the flow of traffic while consistent with the satisfactory execution of the same. For all works involving improvements to the existing highway, the contractor shall in accordance with the directions of the Engineer-in-Charge provide and maintain during the execution of the work a passage for traffic, either along a part of the existing carriage way under improvement or along a temporary diversion constructed close to the highway without any additional financial burden on OHPC.
- 13.2 If in the opinion of the Engineer-in-Charge, it is not possible to pass the traffic on part width of the carriage-way for any reason, a temporary diversion close to the public road shall be constructed as directed. It shall be paved with the materials such as hard moorum, gravel and stone, metal to the specified thickness as directed by the Engineer-in-Charge. In all cases, the alignment, gradients and surface type of the diversion including its junctions, shall be approved by the Engineer-in-Charge before the highway is closed to traffic and the cost will be borne by the contractor.
- 13.3 The contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags lights and information and protection of traffic approaching or passing through the section of the highway under improvement without any additional cost on OHPC. Before taking up any construction, an agreed phased programme for the diversion of traffic on the highway shall be drawn up in consultation with the Engineer-in-charge.
- 13.4 The barricades erected on either side of the carriage way portion of the carriage way closed to traffic, shall be of strong design to resist violation and painted with alternative black and white stripe. Red lanterns or warnings lights of similar type shall be mounted on the barricades at

night and kept lit throughout from sunset to sunrise.

14. Ramps:

Ramps required during execution may be formed wherever necessary and same are to be removed after completion of the work. No separate payment will be made for this purpose.

15. Monsoon Damages:

Damages due to rain or flood either in cutting or in banks shall have to be made good by the contractor till the work is handed over to the Department. The responsibility of de-silting and making good the damages due to rain or flood rests with the contractor. No extra payment is payable for such operations and the contractor shall therefore, has to take all necessary precautions to protect the work done during the construction period.

16. The works to be completed by the Intended Completion Date:

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

17. Safety:

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

18. Discoveries:

Anything of historical or other interest or of significant value unexpectedly discovered on the Site is the property of the Government/Corporation. The Contractor is to notify the Engineer-in-Charge of such discoveries and carry out the Engineer-in-Charges instructions for dealing with them.

19. Possession of the Site.

The Department shall give possession of the site to the Contractor. If possession of a part site is given, the Department will ensure that the part site so handed over is amenable to carry out the work at site by the Contractor.

20. Access to the Site:

The Contractor shall provide the Engineer-in-Charge any person authorized by the Engineer-in-Charge, access to the site and to any place where work in connection with the Contract is being carried out or is intended to be carried out.

21. Instructions:

The Contractor shall carry out all instructions of the Engineer-in-Charge comply with all the applicable local laws where the Site is located.

22. Contractor to Indemnify the Owner:

The contractor shall indemnify the Owner and every member, Officer and employee of the owner, also the Engineer-in-Charge and his staff against all actions, proceedings, claims, demands costs and expenses whatsoever arising out of or in connection with the matter and elsewhere and all actions, proceedings, claims demands costs and expenses which may be made against the Owner for or in respect of or arising out of any failure by the contractor in the performance of his obligations under the contract. The Owner shall not be liable for or in respect of any demand or compensation payable by law in respect or in consequence of any accident or injury to any workman or other person in the employment of the contractor or his sub-contractor and contractor shall indemnify and keep indemnified the Owner against all such damage and compensation and against all claims, damages, proceedings, costs, charges and expenses whatsoever thereof or in relation thereto.

23. NOTICE AND LEGAL DEFENCE

(a) Promptly after receipt by a party of any claim or Notice of the commencement action, administrative or legal proceeding, or investigation as to which the indemnities provided may apply, such Party shall notify the other Party in Writing of such provided that the failure of a Party to give any such Notice promptly shall not excuse indemnifying party from its indemnification obligations hereunder except to the any such failure actually prejudices the indemnifying Party in the defense of matters.

(b) In any claim, action, proceeding, or investigation arises as to which the indemnities provided may apply, and the indemnifying Party fails to assume the defense of such claim, action, proceeding or investigation, then the indemnified Party may at the indemnifying Party's expense contest or settle such claim.

24. LIMITATION OF LIABILITY

Notwithstanding to the clause 46, the aggregate liability of the bidder to the Owner, whether under the contract, in tort, or otherwise, shall not exceed the amount specified in the contract price, provided that this limitation shall not apply to any obligation of bidder to indemnify the Owner.

25. RISK -PURCHASE

In addition to the clauses defined in the bid document, the Owner shall have the right to act as per the following-

- a) In case the selected bidder fails to complete the work as stipulated in the contract, the Owner reserves the right to complete the same from other contractor at the risk, cost and responsibility of the selected bidder.
- b) If the selected bidder does not perform satisfactorily or delays execution of the contract despite the Owner's notice, the Owner reserves the right to get the balance work executed by another party of its choice by giving one month notice for the same. In this event, the selected bidder is bound to make good the additional expenditure which the Owner may have to incur in executing the balance work.

26. Governing Law & Jurisdiction

The contract shall be governed by and interpreted in accordance with the laws of India. The Hon'ble High Court of Orissa shall have the exclusive jurisdiction with respect to bidding process, award of contract and execution of contract.

27. Settlement of Disputes:

27.1 If any dispute or difference of any kind whatsoever arises between the department and the Contractor in connection with, or arising out of the Contract, whether during the progress of the works or after their completion and whether before or after the termination, abandonment or breach of the Contract, it shall in the first place, be referred to for settlement by the Engineer-in-Charge who shall, within a period of (30) *thirty days* of receipt of request of the Contractor to do so, give written notice of OHPC decision to the Contractor. Upon receipt of the written notice of the decision of the OHPC, the Contractor shall promptly proceed without delay to comply with such notice of decision.

27.2 If the Engineer-in-Charge fails to give notice of his decision in writing within a period of thirty days after being requested or if the Contractor is dissatisfied with the notice of the decision of the Engineer-in-Charge, he may within thirty days of receipt of such notice, appeal to the *Director (Operation)*, OHPC who shall offer an opportunity to the contractor to be heard and to offer evidence in support of his appeal. The Director (Operation), OHPC, shall give notice of his decision

within a period of thirty days after the Contractor has given the said evidence in support of his appeal. Such decision of the *Director (Operation)*, OHPC, in respect of every matter so referred shall be final and binding upon the Contractor and shall forthwith be given effect to by the Contractor, who shall proceed with the execution of the works with all due diligence whether he requires further appeal as hereinafter provided, or not. If the *Director (Operation)*, OHPC fails to give notice of his decision, as aforesaid within a period of thirty days after being requested as aforesaid, or if the Contractor be dissatisfied with any such decision, then the contractor within thirty days may refer the matter or matters in dispute to Chairman, OHPC Ltd. who shall decide within thirty days of receipt of such reference by the contractor and his decision will be final & binding.

- 27.3** In case the Contractor is dissatisfied with any such decision of *Chairman, OHPC Ltd*, for the purpose of jurisdiction in the event of any dispute, the contract would be deemed to have been entered in to within the State of Odisha and it is agreed that neither party to the contract will be competent to bring a suit in regard to the matter by this contract at any place outside the state of Odisha.
- 27.4** In case failure as stated at Clause- 27, such disputes and differences arising out of this contract shall be referred to arbitration as per the provisions of Arbitration & Conciliation Act 1996 under the aggies of Orissa High Court Mediation Centre at Cuttack which shall be final and binding.
- 27.5** The Venue of the arbitration shall be High Court of Orissa Arbitration Centre, Cuttack.
- 27.6** The Seat and Place of the arbitration shall be Bhubaneswar and it excludes all places outside state of Odisha.
- 27.7** All disputes below Rs.10 Cr. shall be adjudicated by a sole arbitrator who shall be appointed U/s 11 of the Arbitration and Conciliation Act, 1996.
- 27.8** All disputes above Rs.10 Crores shall be adjudicated by a three-member arbitration tribunal. Each party shall nominate one arbitrator and the third arbitrator shall be appointed U/s 11 of the Arbitration & Conciliation Act, 1996. The fees shall be as per the Schedule IV of the Arbitration & Conciliation Act, 1996.
- 27.9** The Cost and expenses and fees of arbitrator shall be borne by the parties equally and shall not be saddled on one party by way of award.
- 27.10** In case of three-member tribunal, the arbitrator nominated by each party shall be designated Senior Advocate and the presiding arbitrator shall be retired judge of the High Court or Supreme Court of India.
- 27.11** Notwithstanding anything to the contrary contained herein, the work under the contract shall continue during the pendency of any disputes or differences in arbitration proceedings and no payment due from the Owner shall be withheld on account of such proceedings except to the extent which may be in dispute and the Owner shall be entitled to make recoveries of amounts, if any, due from the Contractor as per the provisions of the contract except to the extent which may be in dispute.

B. TIME FOR COMPLETION

28. Period of Completion:

- 28.1** Time is the essence of the contract. The total period of completion is **36 calendar months** from the date of handing over of site during the 1st closure period of power channel, which shall be the date of commencement of work.
- 28.2** The period is inclusive of rainy season. After signing the contract, the Engineer-in-Charge shall forthwith notify the contractor to go ahead with the work & the contractor shall forthwith begin the work. The contractor shall furnish a work programme containing CPM/PERT network within

fifteen days of signing of contract so as to achieve the milestones specified in the bid as per Appendix-F1 & F2-.

- 28.3 This being an EPC contract on turnkey EPC basis, conducting of surveys, investigation, planning and design, preparation of land plan schedules is within the scope of the contract and the contractor shall meticulously plan so as to obtain the required site for carrying out the work in all schemes simultaneously.
- 28.4 The contractor shall bear all costs and charges for special or temporary way leases required by him in connection with access to the site. The contractor shall also provide at his own cost any additional accommodation outside the site required by him for the purposes of the work.

29. Construction Programme:

- 29.1 The Contractor shall furnish within fifteen days of signing of the contract a work programme, containing CPM/PERT showing the sequence in which he proposes to carry out the work, monthly progress expected to be achieved, indicating date of procurement of materials plant and machinery. The schedule should be such that it is practicable to achieve completion of the whole work within the time limit fixed and in keeping with the Mile Stone programme specified and shall obtain the approval of the Director (Operation). Further, rate of the progress as in the program shall be kept up to date. In case it is subsequently found necessary to alter this program, the contractor shall submit sufficiently in advance the revised programme incorporating necessary modifications and get the same approved by the competent authority of OHPC. The Engineer-in-Charge will get the program approved by the Director (Operation), OHPC before communicating to the contractor.

The Director (Operation) shall have, all times, the right, without any way violating this contract, or forming grounds for any claim, to alter the order of progress of the works or any part thereof in the interest of OHPC and the contractor shall after receive such directions proceed as per the order directed.

30 Speed of Work:

- 30.1 The Contractor shall at all times maintain the progress of work to conform to the latest operative progress schedule approved by the Director (Operation). The contractor should furnish progress report indicating the programme and progress once in a month. The Engineer-in-Charge may at any time in writing direct the contractor to slow down any part or whole of the work for any reason (which shall not be questioned) whatsoever in the interest of OHPC, and the contractor shall comply with such orders of the Engineer-in-Charge. The compliance of such orders shall not entitle the contractor to any claim of compensation. Such orders of the Engineer-in-Charge for slowing down the work will however be duly taken into account while granting extension of time if asked by the contractor for which no extra payment will be entertained.

30.2 Delays in Commencement or progress or neglect of work:

If, at any time, the Engineer-in-Charge shall be of the opinion that the Contractor is delaying Commencement of the work or violating any of the provisions of the Contract or is neglecting or delaying the progress of the work, he shall so advise the Contractors in writing and at the same time demand compliance in accordance with instructions to Bidder and conditions of Contract. If the Contractor neglects to comply with such demand within seven days after receipt of such notice, it shall then or at any time thereafter, be lawful for the Engineer-in-Charge to take suitable action in accordance with relevant Clauses of contract.

31 Suspension of Works by the Contractor:

- 31.1 If the Contractor suspends the works, or sublet the work without sanction of OHPC, or in the opinion of the Engineer-in-Charge shall neglect or fail to proceed with due diligence in the

performance of his part of the Contract as laid down in the Schedule rate of progress, or if he shall continue to default or repeat such default, the OHPC shall take action in accordance with Clauses of termination of contract.

32. Extension of completion date:

- 32.1 No claim for compensation on account of delays or hindrances to the work from any cause whatever shall be accepted. Reasonable extension of time will be allowed only by OHPC, competent to sanction the extension, for unavoidable delays, such as may result from cause(s), which in the opinion of the OHPC, are undoubtedly beyond the control of the contractor. The Engineer-in-Charge shall assess the period of delay or hindrance caused by any written instructions issued by him.
- 32.2 The Contractor shall give written notice to the Engineer-in-Charge whenever planning or progress of the works is likely to be delayed or disrupted unless any further drawings or order including a direction, instruction or approval is issued by the Engineer-in-Charge within a reasonable time. The notice shall include details of the drawing or order required and of why and by when it is required and of any delay or disruption likely to be suffered if it is late. If by reason of any failure or inability of the OHPC to issue within a reasonable time in all the circumstances, any drawing or order requested by the contractor the Contractor suffers delay, then the OHPC shall take such delay into account in determining any extension of time for which no compensation shall be claimed by the contractor.
- 32.3 In the event of the Engineer-in-Charge failing to issue necessary instructions and thereby causing delay and hindrance to the contractor, the latter shall have the right to appeal to the *Director, OHPC* whose decision will be final and binding. The contractor shall lodge in writing to the Engineer-in-Charge a Statement for time extension for any delay or hindrance referred to above, within **fourteen (14)** days from its occurrence for taking suitable decision by OHPC.
- 32.4 Whenever authorized alterations or additions made during the progress of the work are of such a nature in the opinion of OHPC as to justify an extension of time in consequence thereof, such extension may be granted in writing by the competent authority of OHPC when ordering such alterations or additions.
- 32.5 Application for extension of time for the completion of a work on the grounds of unavoidable hindrance or any other grounds shall be submitted by the contractor within 14 days of such hindrance & the Engineer-in-Charge shall authorize or recommend such extension of time if felt necessary or proper within fifteen days of the receipt of the such an application. In cases where the sanction of the higher authorities to the grant of extension of time is necessary, the Engineer-in-Charge should send his recommendation as expeditiously as possible. The higher authority should communicate his decision within 60 days from the date of receipt of recommendation in his office. If the orders of the competent authority are not received in time, the Engineer-in-Charge may grant extension of time under intimation to the concerned authorities so that the contract might remain in force, but while communicating this extension of time, he must inform the contractor that the extension is granted without prejudice to OHPC's right to levy compensation/ LD under relevant clauses of contract.
- 32.6 The power to grant extension of time vests with OHPC as per rules only.

33. Delay Ordered by the Engineer-in-Charge.

The Engineer-in-Charge may instruct the Contractor to delay the start or progress of any activity within the Work in the interest of OHPC/ Govt

34. Early Reporting:

The contractor is to bring to the notice of the Engineer-in-Charge at the earliest opportunity of specific likely future events or circumstances that may adversely affect the Execution of work.

The Contractor shall cooperate with the Engineer-in-Charge in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the work and in carrying out any resulting instruction of the Engineer-in-Charge.

35. Management Meetings:

OHPC may require the Contractor to attend management meetings. The business of a management meeting shall be to review the programme for remaining work and to deal with matters raised in accordance with the early reporting procedure. The minutes of the meeting shall be given in writing for follow up by the parties.

C. QUALITY CONTROL

36 Identifying Defects:

The Engineer-in-Charge shall check the Contractor's work and notify the Contractor of any Defects that are found. The Engineer-in-Charge may instruct the Contractor to verify the Defect and to uncover and test any work that the Engineer considers may be a Defect.

37 Tests:

If the Engineer-in-Charge instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect, the Contractor shall promptly comply and carry out the test and any sampling.

38 Defect Liability: -

(a) The defect liability period is 2 (Two) years from the date of completion of project unless extended.

(b) The contractor is responsible for the quality of works executed. If any defects are noticed during execution of the work and within the defect liability period after completion of work, the contractor has to rectify the defects at its own risk & cost. Failing to do so within the stipulated time as fixed by EIC/Employer, the same shall be carried out by the Employer at the risks & costs of contractor. In addition to the costs, the employer shall be entitled to claim such costs towards the damages suffered by the employer.

(c) The defect liability period shall be deemed to be extended till the identified defect have been remedied.

39 Action in case of improper materials and workmanship:

If in the opinion of the Engineer-in-Charge any work or part thereof is executed with improper materials or defective workmanship the contractor(s) shall when required by the Engineer-in-Charge, forthwith re-execute the same and substitute proper materials and workmanship and in case of default by the contractor(s) in so doing within a week from the date of the requisition, OHPC shall have full power to employ other persons to re-execute the work and the cost thereof shall be borne by the contractor(s). Every time notice of a Defect is given, the Contractor shall correct the notified defect within the length of time specified by the Engineer-in-Charge's notice.

40. Action and compensation payable in case of bad work:

40.1 If at any time before any security deposit is refunded to the contractor it appears to the Engineer-in-Charge or his subordinate in charge of the work that any work has been executed with unsound, imperfect or unskillful workmanship or with materials of inferior quality or that any materials or article provided by him for the execution of the work are unsound or of a quality

inferior to that contracted for or otherwise not in accordance with contract, it shall be lawful for Engineer-in-Charge to intimate this fact in writing to the contractor and then notwithstanding the fact that the work, materials or article complained of may have been inadvertently passed, certified and paid for, the contractor shall be bound forthwith to rectify or remove and reconstruct the work so specified in whole or in part as the case may require or if so required shall remove the materials or articles so specified and provide other proper and suitable materials or articles at his own charge and cost and in the event of his failing to do so within a period to be specified by the Engineer-in-Charge in the written intimation aforesaid, the contractor shall be liable to pay compensation at the rate of **one percent (1%) of the agreement amount** for every day not exceeding ten days during which the failure so continues and in the event of any such failure as aforesaid, the Engineer-in-Charge may rectify or remove and re-execute the work or remove and replace the materials or articles complained, at the cost of the contractor. If the Engineer-in-Charge considers that such inferior work or materials as described above may be accepted or made use of it shall be within his discretion to accept the same at such reduced rates as he may fix therefore.

40.2 The Engineer-in-Charge shall introduce O.K. cards and prescribe the formats thereof. O.K. cards shall relate to all major components of the work. The contractor / his authorized representative shall be required to initiate and fill in and present the O.K. card to the construction staff who would check the respective items and send to Engineer-in-Charge or his representative for final check and clearance / O.K. Any defects pointed out by the supervision staff of department shall promptly be attended to by the contractors and the fact of doing so be duly recorded on the back of O.K. card.

40.3 The Engineer-in-Charge may also introduce checklists, which shall be kept in Bound registers by the construction supervision staff. The contractor may be required to fill up these lists in the first instance and shall be subsequently checked by the Construction / Quality Control Engineers.

41. Quality Control:

Quality control monitoring reports, test results, reports - of corrective action etc, shall be furnished to the employer at regular intervals.

Quality Audit shall be got conducted by OHPC departmentally or by other organization and the contractor shall extend the testing facilities to them also.

The contractor shall produce the Quality records maintained by him to the OHPC or his authorized agent for the quality audit.

D. COST CONTROL

42. Contract Price-Schedule of Payment – Bill of Quantities

42.1 The contract price shall be the total value of work on EPC turnkey contract as per contract agreement.

42.2 The contractor will be paid a firm contract price for completion of all works as specified under the scope of the work under the contract unless variation is there due to applicability of Price Variation (PV) clause.

42.3 Variation in any respect other than due to PV clause shall not be considered for compensation.

42.4 Notwithstanding anything that is stated, the contract price once accepted by the employer shall be final and shall not be subject to any claims on any ground whatsoever of the Contractor other than applicability of PV clause if any.

- 42.5** The contract price of the total work is divided among different component of works as per the percentages specified in milestone chart and payments will be regulated accordingly. Keeping the said percentages of a work component intact and approval of competent authority, subsequent division of a work component into various sub-works may be carried out during the execution of work.
- 42.6** The contractor shall pay all duties and taxes in consequence of his obligations under the contract and OHPC shall not pay any other taxes or duties except GST against the value of works executed.
- 42.7** Contract price will be paid to the Contractor in Indian Rupees only.

43. Changes in the Quantities:

- 43.1** Being a lump sum contract on EPC-Turnkey basis, the contractor is bound to complete the entire work under the contract on a firm lump sum price quoted and on a single source responsibility basis other than applicability of Price Variation clauses as specified in this tender. The Contractor shall be deemed to have satisfied himself as to the correctness and sufficiency of the contract price. Therefore, the contractor is bound to execute all supplemental works that are found essential, incidental and inevitable for completion of work in all respect during execution of the work.

43.2 Entrustment of additional items:

- 43.2.1.** Entrustment of the additional items contingent on the main work will be authorized by the employer and the contractor shall be bound to execute such additional items at no extra cost to the employer and the cost of such items shall be deemed to have been included in the contract price quoted.

44. Cash Flow Forecasts:

When the program is updated, the contractor is to provide the Engineer-in-Charge with an updated cash flow forecast.

45. Financial Bid & Payment Schedules:

- 45.1** The bidder shall quote lump sum Bid Price for the entire work and format given in APPENDIX -FB of Financial Bid.
- 45.2** The total work specified under EPC turnkey contract is divided into some major components of work to facilitate payments component wise as specified in Appendix-FB under Financial Bid.
- 45.3** The payment for each of the components of works shall be limited to the respective amounts arrived on the basis of percentages specified in Appendix- F1 & F2.
- 45.4** The components shown in Appendix-F have been further sub-divided into appropriate stages for the purpose of stage payment as specified in Appendix-F1 & F2.
- 45.5** This stage payment shall be limited to the respective amounts arrived on the basis of percentages specified in the Appendix F1 & F2.
- 45.6** The stage payment mentioned in F1 to F2 may be further sub divided into sub components with amount as percentages of the stages by the contractor, which may be duly approved by the Director (Operation), OHPC at his discretion at the time of placing work order. The sub-component should have relation to the programme of construction taking due cognizance of interdependency of various activities. The sum of payment for each of the sub components shall be limited to the respective stage amounts arrived on the basis of percentages specified in Appendix F1 to F2.
- 45.7** Payment shall be released against monthly running bills only on the basis of completion of work of respective component / sub-component subject to certification of EIC.

- 45.8** The Engineer-in-Charge shall check the Contractor's monthly statement within 7 days of submission.
- 45.9** The value of work executed shall be determined by the Engineer-in-charge as per the approved milestones after approval of design and sanctioned by the competent authority.
- 45.10** The Engineer-in-Charge may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.
- 45.11** The contractor shall be permitted to submit their work bills once in a month and payment will be made after proper check of quantity and quality within 21 days of the receipt of the bills in proper shape.
- 45.12** The Competent authority of OHPC is empowered to modify the percentage of components, on approval of design and drawing based on the detailed investigation, detailed drawings and detailed estimation done by the contractor and sanctioned by competent authority, keeping the total price bid unaltered.
- 45.13** The Director (Operation), OHPC is empowered to modify the sub components stage wise keeping the percentages of stages unaltered.
- 45.14** The contractor shall give "Bill of Quantities" based on the detailed estimates prepared on the basis of approved design; drawings and items of the estimate shall be suitably clubbed or grouped for assessment of value of work done.
- 46. Measurement**
- 46.1** The contractor shall execute the various components of work as per approved drawings and specifications. The contractor shall arrange to take and record all measurements of work done of various components of work in the Measurement Books/Level field books issued to him and plotted in the cross-section sheets and quantities arrived as per actual execution as and when required.
- 46.2** In respect of works, Measurement Books/Level field books have to be issued by the Engineer-in-Charge to Contractor duly certified and numbered for recording measurements and levels. The Measurement Books/Level field books shall be maintained by Contractor and bills are to be submitted to the Engineer-in-Charge by the Contractor along with a true extract of the entire set for checking and record. The Engineer-in-Charge has to keep the full set of true extract with him and return the originals to the agency for further use. The entire original record shall be finally handed over for record to the Engineer-in-Charge by the Contractor.
- 46.3** Measurements will be recorded by the contractor for the finished work only for which all tests are conducted and work done in accordance with specifications and contract conditions by using the materials specified in the contract.
- 46.4** The contractor shall prepare RA bills based on the completed milestones for which measurements have already been recorded as stated above and submit to Engineer-in-Charge duly signed by them or his authorized signatory for checking and record keeping. Only completed portions of the works will be billed as per Break up of components & sub components by the contractor.
- 46.5** The Engineer-in-Charge shall exercise check to see that the bill submitted by the Contractor is in accordance with Agreement conditions & certified by the Department quality control authority and 3rd party quality control agency if both are deployed on the work.
- 46.6** The Engineer-in-Charge should check the claim with reference to the measurements recorded to see that the percentage at which the bill is claimed is clearly traceable into the documents on which payments are to be made. Payments shall be adjusted for recovery of advance payments, liquidated damages in terms of agreement conditions, security deposit for due fulfillment of the contract. Recoveries shall be affected towards royalty charges on the material used and GST, IT and other statutory recoveries such as labour cess etc. as per State and Central Government rules and Acts.
- 46.7** In case of over payments or wrong payment if any made to the contractor due to wrong interpretation of the provisions of the contract or Contract conditions etc., such unauthorized payment will be deducted in the subsequent bills or final bill for the work or from the bills under any other contracts with the OHPC or at any time thereafter from the deposits available with the OHPC.

- 46.8** Any recovery or recoveries advised by the Government Department either state or central, due to non-fulfillment of any contract entered into with them by the contractor shall be recovered from any bill or deposits of the contractor.
- 46.9** No claim shall be entertained, if the same is not represented in writing to the Engineer-in-Charge within 15 days of its occurrence.
- 46.10** The contractor is not eligible for any compensation for inevitable delay in handing over the site or for any other reason. In such case, suitable extensions of time will be granted after considering the merits of the case, if any.
- 46.11** The Employer shall within 28 days of receiving a Statement and supporting documents, give to the Contractor notice of any items in the Statement with which the Engineer in charge disagrees, with supporting particulars. Payments due shall not be withheld, except that;
- a) If anything supplied or work done by the Contractor is not in accordance with the Contract, the cost of rectification or replacement may be withheld until rectification or replacement has been completed; and / or
 - b) If the Contractor was or is failing to perform any work or obligation in accordance with the contract and as notified by the Engineer in charge, the value of this work, or obligation may be withheld until the work or obligation has been performed.
- The Employer may, in any payment, make any correction or modification that should properly be made, to any amount previously considered due. Payment shall not be deemed to indicate Engineer-in-Charge's acceptance, approval, consent or satisfaction.
- 46.12** All progressive payments made to the Contractor shall be reviewed on quarterly basis and reconciled with the break-up of the schedule. Over payments/under payments made, if any, shall be adjusted in the next interim/final payments.
- 46.13** Measurement shall be signed and dated by both parties on the Site. If there is any dispute in any of the measurements a note to the effect shall be made in the measurement record against the disputed items and such note shall be signed and dated by both parties engaged in taking the measurements and the Parties shall discuss and resolve the same in accordance with relevant clauses of the contract.

47 Interest on Money due to the Contractor:

No omission by the Engineer-in-Charge to pay the amount due upon certificates shall vitiate or make void the contract, nor shall the contractor be entitled to interest upon any guarantee fund or payments in arrears, nor upon any balance which may, on the final settlement of his accounts, found to be due to him.

48 Commissioning of Project:

After completion of the work, it shall be run for testing and commissioning in consultation with Engineer-in-Charge and the defects are to be rectified promptly. The date of commissioning of the project is to be notified by the Engineer-in-Charge in consultation with the contractor considering the availability of water for ponding.

The Engineer-in-Charge shall notify the date on which a work was finally commissioned, to all concerned. This date of commissioning of the work shall be considered as the start date of defect liability period.

49 Certificate of Completion of Works:

- 49.1** On request of contractor, on completion of the work, the contractor shall be furnished with a certificate by the Engineer-in-Charge of such completion. But no such certificate shall be given nor shall the work be considered to be complete until the defects noticed has been rectified, the contractor(s) have removed from the premises on which the work shall have been executed, all scaffoldings, surplus materials and rubbish and shall have cleaned dirt from all wood work, doors, windows wall floors or other parts of any structures in or upon which the work has been executed or of which he / they may have had possession for the purpose of executing work, nor

until the work shall have been measured by the Engineer-in- Charge or where the measurements have been taken by his subordinate until they receive the approval of the Engineer-in-Charge, the measurements being binding and conclusive against the contractor(s). If the contractor(s) shall fail to comply with the requirements of this clause as to the removal of scaffolding, surplus materials and rubbish and cleaning of dirt on or before the date fixed for the completion of the work, the Engineer-in-Charge may at the expense of the contractor (s) remove such scaffolding, surplus materials and rubbish and dispose of the same as he thinks fit and clean off such dirt as aforesaid, and the contractor(s) shall forthwith bear all the expenses to be incurred, but shall have no claim in respect of any such scaffolding or surplus materials as aforesaid except for any sum actually realized by the sale thereof.

The completion certificate of the Engineer-in-Charge shall be conclusive evidence of the work having been duly completed and that the contractor(s) shall be entitled to receive payment of the final balance as determined by the paying officer in accordance with such certificate, but without prejudice to the liability of the contractor(s) under the provisions of any other the clauses as per the contract.

49.2 Similarly, the Contractor may request and the Engineer-in-Charge shall issue a Certificate of Completion in respect of:

- a) Any section of the Permanent works in respect of which a separate time for completion is provided in the Contract, and
- b) Any substantial part of the Permanent Works, which has been both completed to the satisfaction of the Engineer-in-Charge and occupied or used by the Department.

49.3 If any part of the Original/Permanent Works shall have been completed and shall have satisfactorily passed any final test that may be prescribed by the Contract, the Engineer-in- Charge may issue such certificate, and the Contractor shall be deemed to have undertaken to complete any outstanding work in that part of the Works during the period of Maintenance.

49.4 Issue of completion certificate shall not free the contractor of its obligation to the execution of the works that may be pointed out by the Engineer-in-charge as essential for the fulfillment of the scope of work at a later date during maintenance period.

50 Taxes included in the Bid:

50.1 The Bid price quoted by the contractor shall be deemed to have included all taxes & duties but exclusive of GST for performance of this Contract. The GST shall be paid extra as per the prevailing rate during the period of execution.

51 PRICE ADJUSTMENT OF CONTRACT PRICE:

51.1 Contract price shall be adjusted for increase or decrease in rates and price of labour, materials, fuels and lubricants in accordance with the following principles and procedures stipulated in Office memorandum no. 15847 dtd. 19.11.2019 of Works Department, Govt. of Odisha and as per formula given in following Paras.

- (a) The price adjustment shall apply for the work done after 18 months from the date of signing of the contract and upto the date of scheduled completion of work or extensions granted by OHPC if any, on the ground of force majeure or defaults by OHPC, if any due to delay not attributable to the contractor and shall not apply to the work carried out beyond the stipulated time for reasons attributable to the contractor.

However, a downward price variation would be availed by OHPC even beyond the original

scheduled delivery date for defaults due to any reasons. by OHPC.

- (b) The Price adjustment shall be determined during final payment as per the contract considering both escalation as well as downward trend in the cost, if any.
- (c) Following expressions and meanings are assigned to the work done during each month:
 - R= Total value of work done during the month. It would include the amount of secured advance granted, if any, during the month, less the amount of secured advance recovered, if any during the month. It will exclude value for works executed for extra items under variations.
- (d) Where the resultant increase in contract price due to application of price variation formula is lower than 2% (two percent) of the contract price, no price adjustment will be made in favour of the contractor.
- (e) If advance or stage payments are made, no price variations will be admissible on such portions of the price, after the dates of such payment.

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

51a(i): Adjustment of other materials Component

Price adjustment for increase or decrease in cost of local materials other than cement, steel, bitumen pipe and POL procured by the contractor shall be paid in accordance with the following formula:

$$V_M = 0.85 \times P_m/100 \times R \times (M_1 - M_0)/M_0$$

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

M_p - The all-India wholesale price index (all commodities) on 28 days preceding the date of opening of Bids, as published by the Ministry of Commerce and Industry, Government of India, New Delhi.

M_1 - The all-India wholesale price index (all commodities) for the month under consideration as published by the Ministry of Commerce and Industry, Government of India, New Delhi

P_m - Percentage of local material component (other than cement, steel, bitumen and POL) of the work.

51a(ii): Adjustment for Cement Component

Price adjustment for increase or decrease in the cost of cement Procured by the contractor shall be paid in accordance with the following formula:

$$V_C = 0.85 \times P_c /100 \times R \times (C_1 - C_0)/C_0$$

V_C = Increase or decrease in the cost of work during the month under the month under consideration due to changes in the rates for cement

C_0 = The all-India wholesale price index for Ordinary Portland Cement (OPC) on 28 days preceding the date of opening of Bids as published by the Ministry of Commerce and Industry, Government of India, New Delhi

C_1 = the all-India wholesale price index for Ordinary Portland Cement (OPC)

for the month under consideration as published by the Ministry of Commerce and Industry, Government of India, New Delhi.

P_C = Percentage of Cement Component of the work

51a(iii): Adjustment for Steel Component

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

$$V_S = 0.85 \times P_S / 100 \times R \times (S_1 - S_0) / S_0$$

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

S_0 = The all-India wholesale price index for steel (Mild Steel long products) on 28 days preceding the date of opening of Bids as published by the Ministry of Commerce and Industry Government of India, New Delhi.

S_1 = The all-India wholesale price index for steel (Mild Steel long products) for the month under consideration as published by the Ministry of Commerce and Industry, Government of India, New Delhi.

P_S = Percentage of steel component of the work

Note: For the application of this clause, index of (Mild Steel long products) has been chosen to represent steel group.

51(a)(iv): Adjustment of Bitumen Component

Price adjustment for increase or decrease in the cost of bitumen shall be paid in accordance with the following formula:

$$V_b = 0.85 \times P_b / 100 \times R \times (B_1 - B_0) / B_0$$

V_b = Increase or decrease in the cost of work during the month under consideration due to changes in the rate for bitumen.

B_0 = The official retail price of bulk bitumen at the IOC / BPCL depot at nearest center on the day 28 days prior to date of opening of Bids.

B_1 = The official retail price of bulk bitumen at IOC / BPCL depot at nearest center for the 15th day of the month under consideration.

P_b = Percentage of bitumen component of the work

51(a)(v): Adjustment towards differential cost of Pipes.

Price adjustment for increase or decrease in the cost of pipe shall be paid in accordance with the following formula:

$$V_{pi} = 0.85 \times P_{pi} / 100 \times R \times (P_{i1} - P_{i0}) / P_{i0}$$

V_{pi} = Differential cost of pipe i.e. amount of increase or decrease in rupees to be paid or

recovered during the month under consideration.

P_{pi} = Percentage of pipe component of the work

P_{11} = All India Whole sale price index of pipe for the period under consideration as published by the Ministry of Commerce and Industry, Government of India, New Delhi.

P_{10} = All India Whole sale price index of pipe on 28 days preceding the date of opening of Bids as published by the Ministry of Commerce and Industry, Government of India, New Delhi.

51(b): Adjustment of Labour Component

Price adjustment for increase or decrease' in the cost due to labour shall be paid in accordance with the following formula

$$V_L = 0.85 \times P_L/100 \times R \times (L_1 - L_0) / L_0$$

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

L_0 = The minimum wages for unskilled labour as Notified by Government of Odisha as prevailed on the last stipulated date of receipt of tender including extension, if any.

L_1 = The minimum wages for unskilled labour as Notified by Government of Odisha as prevailed on the last date of the Month previous to the one under consideration.

P_L ===== Percentage of labour component of the work.

51(c): Adjustment of POL(fuel and Lubricant) Component

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

$$V_f = 0.85 \times P_f/100 \times R \times (F_1 - F_0) / F_0$$

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

F_0 = The official retail price of High-Speed Diesel (HSD) at the existing consumer pumps of IOC / BPCL/ HPCL at nearest center on the day 28 days prior to the date of opening of Bids.

F_1 = the official retail price of HSD at the existing consumer pumps of IOC / BPCL/ HPCL at nearest center for the 15th day of the month under consideration.

P_f = percentage of fuel and lubricants component of the work

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

51(d): Adjustment for Plant and Machinery Spares Component

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

$$V_p = 0.85 \times P_p / 100 \times R \times (P_1 - P_0) / P_0$$

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

P_0 = The all-India wholesale price index for manufacture of machinery for mining, quarrying and construction on 28 days preceding the date of opening of Bids as published by the Ministry of Commerce and Industry Government of India, New Delhi.

P_1 = The all-India wholesale price index for manufacture of machinery for mining, quarrying and construction for the month under consideration as published by the Ministry of Commerce and Industry, Government of India, New Delhi.

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

Note : For the application of this clause, index of manufacturing of machinery for mining, quarrying and construction has been chosen to represent the Plant and machinery Spares group.

Regarding wholesale price Index (WPI) for appropriate commodity for payment of price adjustment, due to change of base year of WPI from 1993-94 to 2004-05 & 2011-12, it is observed that, the commodity 'Bars and Rod', 'Cement', 'Heavy machinery and parts' included in the list of WPI 1993-94 series are not mentioned as such in the WPI 2004-05 & 2011-12 series. Therefore, the following items in the WPI 2004-05 & 2011-12 series shall be considered corresponding to items in WPI 1993-94 series:

SI. No.	Item in WPI 1993-94 series	Item in WPI 2004-05 series	Item in WPI 2011-12 series
1.	Cement	Grey Cement	Ordinary Port land cement
2.	Bars & rods	Rebars	Mild steel long products
3.	Heavy Machinery & parts	Construction Machinery	Manufacture of machinery for mining, quarrying & construction.

To finalise the price variation before the final payment is made considering both escalation as well as downward trend in the cost if any and in case no claim is made for escalation or if final payment is made before considering Price Variation clause, to obtain certificate for the contractor that, *"there has been no decrease in the price variation indices and in the event of any decrease of such*

indices during the currency of this contract, we shall promptly notify this to OHPC and offer the requisite reduction in the contract rate.”

51(e): APPLICATION OF ESCALATION CLAUSE:

The contractor shall for the purpose of availing reimbursement/refund of differential cost of steel, bitumen, cement, pipe, pol and wages, keep such books of account and other documents as are necessary to show that the amount of increase claimed or reduction available and shall allow inspection of the same by a duly authorized representative of government and further, shall at the request of the engineer-in-charge, furnish documents to be verified in such a manner as the engineer-in-charge may require any document and information kept. The contractor shall within a reasonable time of 15 days of his becoming aware of any alteration in the price of such material, wages of labour and/or price of p.o.l, give notice thereof to the engineer-in-charge stating that the same is given pursuant to this condition along with information relating to there to which he may be in a position to supply.

Percentage Table

Sl. No.	Category of works		% Component (Cost wise)		
			Labour (Pl)	POL (Pf)	Steel (Ps)+ Cement (Pc) + Bitumen (Pb) + Pipes (Ppi)+ Plant & Machinery Spare & Component (Pp) + Other Materials*
1	R&B works (% of Component)	Road Works	5	5	90
		Bridge Works	5	5	90
		Building Works	5	5	90
2	Irrigation Works (% of Component)	Structural works	5	5	90
		Earth, Canal & Embankment works	5	5	90
3	P.H Works	Structural works	5	5	90
		Pipe line work	5	5	Pipe- 70% *Machinery + Other Materials- 20%
		Sewer line	5	5	Pipe- 70% *Machinery + Other Materials- 20%

*Note: - Further breakup may be worked out considering the consumption of Cement, Steel, Bitumen, pipe and Plant & Machinery Spare Component in the concerned works and shall be provided in the bid document in shape of schedule of Adjustment Data as an “Appendix to Bid”. (enclosed herewith).

Appendix. to Bid

Schedule of Adjustment Data

[For all works, adjustment factor for Labour and POL shall be considered @ 5 % each. Steel, Cement, Pipes, other Materials and Machinery shall contribute to 90% of Price Adjustment and shall be calculated for each work separately during preparation of estimate, shall be approved by the authority during technical sanction as a "Schedule of Adjustment Data" and shall form part of the Bid Document]

' CI. No- 51 Contracts Sl. No	Index description	Source of index	Base value*	Base Date*	Weight age of item**
51(a) (i)	Other Materials	All India Whole sale price index (all commodities) as published by the; Economic Advisor to the Govt. of India, Ministry of Commerce and Industry.			25%
51(a) (ii)	Cement	Whole sale price index for Cement (Ordinary Portland Cement) as published by the office the Economic Advisor to the Govt. of India, Ministry of Commerce and Industry			25%
51(a) (iii)	Steel	Whole sale price index for Steel (Mild Steel-Long Products) as published by the office of the Economic Advisor to the Govt. of India, Ministry of Commerce and Industry			25%
51(a) (iv)	Bitumen (VG-30)	Official retail price of bulk bitumen at the nearest IOC/ HPCL depo			4%
51(a) (v)	Pipes	Whole sale price index for the type of Pipe under consideration, as published by the office the Economic Advisor to the Govt. of India, Ministry of Commerce and Industry			1%
51(b)	Labour	Minimum Wage notified by the Labour and Employee's State Insurance Department of Government' of Odisha, India			5 %
51(c)	POL	Official retail price of HSD at nearest IOCL/ HPCL/ BPCL Consumer pump depot			5 %
51(d)	Plant and Machinery	Whole sale price index for Manufacture of Machinery for Mining, Quarrying and Construction as published by the office the Economic Advisor to the Govt. of India, Ministry of Commerce and Industry			10%
				Total	100 %

* Values to be filled up at the time of drawl of contract

**Values to be filled up in the bid document.

52 Liquidated Damages for Delay:

- 52.1** If the work will not be completed / finished within the stipulated completion period, Liquidated damage will be **imposed @ ½ % per week** of delay or part thereof of the contract value (Excluding GST) subject to **maximum 10% of total Contract Price** (excluding GST). If the period of delay exceeds the period for which maximum compensation amount of **10%** is leviable, the OHPC reserves the right to cancel the work order and has the sole discretion to execute the work on his own accord and recover the additional financial implication if any from the contractor.
- 52.2** Delays requiring payment of liquidated damages amounting to **10% of the contract amount** may be a cause for termination of contract and for forfeiture of security deposit where decision of OHPC shall be final.

53 Rescission of Contract

Delays requiring payment of **10%** of contract amount, as liquidated damages shall be one of the causes for rescission of contract.

To rescind the contract (of which the recession notices in writing to the contractor under the hand of the Engineer-in-Charge/competent authority shall be conclusive evidence) 20% of the value of left- over work will be realized from the contractor as penalty in addition to applicability, of Liquidated Damage as per the contract.

In the Event of any of the above courses being adopted by OHPC the contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchased or procured any materials, or entered into any engagements, or made any advances on account of or with a view to the execution of the work or the performance of the contract. And in case the contract shall be rescinded under the provision aforesaid, the contractor shall not be entitled to recover or be paid any sum for any work thereto for actually performed under this contract, unless and until the Engineer-in-Charge shall have certified in writing the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified. (Works Dept No.10639 dated 27.05.2005).

54 Mobilization Advance:

- 54.1** The contractor is permitted to avail the facility of mobilization advance equivalent to 10% of the contract amount plus GST if applicable against a BG for 110% of the amount of advance payment including GST. Payment of the such advance will be made in two instalments of 50% each, where 1st instalment shall be paid on application of contractor and under certification by the Engineer-in-Charge after (i) Execution of the form of contract by the parties there to (ii) provision by the contractor of requisite Bank Guarantee from any Nationalized / Scheduled Commercial Bank located anywhere in the country with branches at Bhubaneswar with facility of authentication & encashment of the bank guarantee, for an amount equal to the mobilization advance applied for such bank guarantee shall remain valid until the said advance has been completely repaid by the contractor out of the current earnings under the contract and certified accordingly by the Engineer-in-charge regarding the value of required percentage of work completion. The 2nd instalment of mobilisation advance shall be paid after completion of work with value at least to the extent of amount of 1st instalment released.
- 54.2** A form of Bank Guarantee acceptable to Engineer-in-Charge is indicated in Section III (under Forms and Annexure). The advance mobilization shall be used by the contractor exclusively for mobilization expenditures, including the mobilization of constructional plant, in connection with the works.

- 54.3** Should the contractor misappropriate any portion of the advance; it shall become due to OHPC and payable immediately in one lump by the contractor and no further advance will be considered thereafter.
- 54.4** The above advance shall bear an interest of 12% per annum. The interest on the amounts paid, as advance is chargeable from the date the amount is paid.
- 54.5** The value of Bank Guarantee for the advance payment given to the contractor can be progressively reduced by the amount repaid by the contractor and as certified by the Engineer-in-Charge regarding proportionate work completion as per requirement under clause 49.3. Such progressive reduction can be considered for maximum 3 (three) times during the tenure of the contract.
- 54.6 Recovery of Advances:**
- a.** The advance together with interest at the rate of **12%** shall be repaid by way of deductions from the intermediate payments under the contract. Deduction shall commence in the next interim payment following that in which the total of all such payments to the contractor have reached 20 percent of the contract amount. The mobilization advance along with interest shall be recovered in such a way that the full amount is recovered, **by the time 80% work is completed or within 2 years from the date of advance payment whichever is earlier.**
 - b.** Each installment of mobilization advance shall be repaid by the contractor not later than 365 (Three hundred & sixty-five) days from the respective date of mobilization advance payment. The contractor shall repay each installment/phase of the advance payment on or before the due date of repayment. The parties expressly agree that for any delay in repayment of the mobilization advance payment, the contractor shall pay interest to the employer for each day of delay, such interest to be calculated @ 18% (eighteen) per annum. In the event of the contractor's failure to make the repayment on time, the employer shall be entitled to encash the bank guarantee for recovery of mobilization advances along with interest.
 - c.** If the advance payment has not been fully repaid prior to termination as per the agreement, the whole of the balance mobilization advance, along with interest, outstanding against the contractor shall immediately become due & payable by the contractor to the employer. Without prejudice to the provisions of clause of termination for contractor's default, the advance payment along with interest @ **12%** per annum from the date of advance payment to the date of recovery by encashment shall be recovered from the contractor from the bills payable or, by encashment of the bank guarantee at the discretion of OHPC. For the avoidance of doubt, the aforesaid interest shall be payable on each installment/phase of the advance payment regardless of whether the installment or any part thereof has been repaid to the employer prior to termination.

55 Securities Deposit:

55.1 Performance Security Deposit:

OHPC shall retain from each bill due to the contractor towards performance security deposit @ 5% (five per cent) of bill value excluding GST. The Performance Security Deposit shall be released upon expiration of 3 months after successful completion of Defect Liability Period of the works and after Final Payment is made on certification by E.I.C.

In case BG is submitted for release of Performance Security Deposit to the extent as permissible as per codal procedure, the same shall remain valid till such period as aforesaid.

- 55.2** All compensation, liquidate damages or other sums or money payable by the contractor to OHPC under the terms of this contract shall be deducted from or recouped by the realization of a sufficient part of his security deposit, or from the interest arising there from or from any sums which may due or may become due by Government to the Contractor on any account whatsoever whether in

respect of this contract, or any other contract, or otherwise. In the event of his security deposit being reduced by reason of any such deduction or recoupment as aforesaid, the contractor shall within ten days thereafter, make good the sum or sums required to make good the shortfall in the amount of the security deposit.

55.3 All dues under this contract or other contract, or otherwise; shall be recovered from the aforesaid amount of security deposit and the balance shall be refunded as per clause 49.1.

56 Cost of Repairs:

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

E. FINISHING THE CONTRACT

57 Taking Over:

The Department shall take over the site and the Works within fifteen days of the Engineer-in-Charge issuing a certificate of successful completion of Operation & maintenance work.

58 Final Account:

The Contractor shall supply to the Engineer-in-Charge a detailed account of the total amount that the Contractor considers payable under the Contract before the end of the Defects Liability Period. The Engineer-in-Charge shall issue a Certificate regarding successful completion of defect liability period and certify any final payment that is due to the Contractor within 90 days of receiving the Contractor's account if it is correct and complete. If it is not, the Engineer-in-Charge shall issue within 90 days a schedule that states the scope of the corrections or additions that are necessary. If the final Account is still unsatisfactory after it has been resubmitted, the Engineer-in-Charge shall decide on the amount payable to the Contractor and issue a payment certificate within 90 days of receiving the Contractor's revised account.

59 Termination:

The Department may terminate the Contract at any time during the tenure of the contract, if the contractor causes a fundamental breach of the Contract.

59.1 Fundamental breaches of Contract include, but shall not be limited to the following.

- a) The Contractor stops work for 28 days when no stoppage of work is shown on the current program and the stoppage has not been authorized by the Engineer-in-Charge.
- b) The contractor is gone bankrupt or goes into liquidation other than for a reconstruction or amalgamation.
- c) The Engineer-in-Charge gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Engineer-in-Charge; and
- d) The Contractor does not maintain the security deposit with OHPC which is required and
- e) The Contractor has delayed the completion of works by the number of days for which the maximum amount of liquidated damages is to be paid as defined
- f) If the contractor, in the judgment of the Department has engaged in corrupt or fraudulent practices in competing for or in the executing the contract

For the purpose of this paragraph: "corrupt practice" means the offering, giving, receiving or

soliciting of anything of value to influence the action of a public official in the procurement process or in contract execution. "Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Government and includes collusive practice among Bidders (prior to or after Bid submission) designed to establish Bid prices at artificial non-competitive levels and to deprive the Government of the benefits of free and open competition.

59.2 Notwithstanding the above the Department/ Employer/OHPC may terminate the contract in the interest of OHPC or Govt.

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

60 Payment upon Termination:

If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Engineer-in-Charge shall issue a certificate for the value of the work done less advance payments received upon the date of the issue of the certificate, less other recoveries due in terms of the Contract, less taxes due to be deducted at source as per applicable laws and **less 20 percent** of the value of work not completed. If the total amount due to the Department exceeds any payment due to the Contractor the difference shall be a debt payable to the Department. In case of default for payment within 28 days from the date of issue of notice to the above effect, the contractor shall be liable to pay interest at 12% per annum for the period of delay.

61 Property:

All materials on the site, plant, equipment, Temporary works and works are deemed to be the property of the Department if the Contract is terminated because of Contractor's default.

62 Releases from Performance:

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

F. OTHER GENERAL CONDITIONS

63 Water Supply

The Contractor has to make his own arrangements for water required for the work and to the colonies and work sites, which are to be established by the Contractor.

64 Electrical Power

The Contractors will have to make their own arrangements for drawing electric power from the nearest power line after obtaining permission from the DISCOM at his own cost. In case of failure of electricity, the Contractor has to make alternative arrangements for supply of electricity by Diesel Generator sets of suitable capacity at place of work. If the supply is arranged by the Department, necessary Tariff rates shall have to be paid based on the prevailing rates.

The contractor will pay the bills of DISCOM for the cost of power consumed by him.

The contractor shall satisfy all the conditions and rules required as per Indian Electricity Act 1910 and under rule-45 (1) of the Indian Electricity Rules, 1956 as amended from time to time and other pertinent rules.

The power shall be used for Bonafede Departmental works only.

64.1 Electric Power for Domestic Supply:

- a) The contractor has to make his own arrangements for the supply of electric power for domestic purposes and the charges for this purpose have to be paid by him at the rates as fixed by the DISCOM from time to time.
- b) The contractor will have to make his own arrangements to lay and maintain the necessary distribution lines and wiring for the camp at his own cost. The layout and the methods of laying the lines and wiring shall have the prior approval of the Engineer-in-Charge. All camp area shall be properly electrified. All lines, streets, approaches for the camp etc., shall be sufficiently lighted for the safety of staff and labour of the contractor, at the cost of the Contractor and it will be subject to the approval of the Engineer-in-Charge.

65 Land:

65.1 Land for Contractors use:

The contractor shall have to make his own arrangements for acquiring and clearing the site, leveling, providing drainage and other facilities for labour staff colonies, site office, work-shop or stores and for related activities.

65.2 Surrender of Occupied Land:

The contractor shall make good to the satisfaction of the Engineer-in-Charge any damage to areas, which he has to return or to other property or land handed over to him for purpose of this work. Temporary structures may be erected by the contractor for storage sheds, offices, residences etc., for non-commercial use, with the permission of the Engineer-in-Charge on the land handed over to him at his own cost. At the completion of the work these structures shall be dismantled site cleared and handed over to the Engineer-in-Charge. The land required for providing amenities will be given free of cost from Government lands if available otherwise the contractor shall have to make his own arrangements.

66 Approach Roads and Roads in Work Area:

In addition to existing public roads and roads Constructed by Government, if any, in work area all additional approach roads inside work area and camp required by the Contractor shall be constructed and maintained by him at his own cost. The layout design, construction and maintenance etc. of the roads shall be subject to the approval of the Engineer-in-Charge. The contractor shall permit the use of these roads by the Government free of charge.

It is possible that work at, or in the vicinity of the work site will be performed by the Government or by other contractors engaged in work for the Government during the contract period. The contractor shall without charge permit the government and such other contractor and other workmen to use the access facilities including roads and other facilities, constructed and acquired by the contractor for use in the performance of the works.

The contractor's heavy construction traffic or tracked equipment shall not traverse any public roads or bridges unless the contractor has made arrangement with the authority concerned. In case contractor's heavy construction traffic or tracked equipment is not allowed to traverse any public roads or bridges and the contractor is required to make some alternative arrangements, no claim on this account shall be entertained.

The contractor is cautioned to take necessary precautions in transportation of construction materials to avoid accidents.

67 Payment for Camp Construction:

No payment will be made to the contractor for construction, operation and maintenance of camp and other camp facilities and the entire cost of such work shall be deemed to have been included in the Bided rate for the various items of work in the schedule of quantities and bids.

68 Explosive and Fuel Storage Tanks:

No explosive shall be stored within 1/2 (half) KM of the limit of the camp sites. The storage of gasoline and other fuel oils or of Butane, Propane and other liquefied petroleum gases, shall conform to the regulations of Odisha State Government and Government of India. The tanks, above ground and having capacity in excess of 2000 liters, shall not be located within the camp area, nor within 200m, of any building.

69 Labour:

The contractor shall, make his own arrangements for the engagement of all staff and labour, local or other, and for their payment, housing, feeding and transport.

Labour importation and amenities to labour and contractor's staff shall be to the contractor's account. His quoted percentage shall include the expenditure towards importation of labour amenities to labour and staff.

The contractor shall, if required by the Engineer-in-Charge, deliver to the Engineer-in-Charge a written in detail, is such form and at such intervals as the Engineer-in-Charge may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the contractor on the Site and such information respecting Contractor's Equipment as the Engineer-in-Charge may require.

69.1 Transportation of Labour:

The contractor shall make his own arrangement for the daily transportation of the labour and staff from labour camps colonies to the work spot and no labour or staff of the contractor shall stay at the work spot. No extra payment will be made to the contractor for the above transportation of the labour and his quoted percentage to the work shall include the transportation charges of labour from colonies to work spot and back.

The contractor will at all times duly observe the provisions of employment of children Act XXVI of 1938 and any enactment or modification of the same and will not employ or permit any person to do any work for the purpose under the provisions of this contract in contravention of said Act. The contractor here by agrees to indemnify the department from and against all claims, penalties which may be suffered by the department or any person employed by the department by any default on the part of the contractor in the observance and performance of the provisions of the employment of children Act. XXVI of 1938 or any enactment or modification of the same.

The contractor shall obtain the insurance at his own cost to cover the risk on the works to labour engaged by him during period of execution against fire and other usual risks and produce the same to the Engineer-in-Charge concerned before commencement of work.

70 Safety Measures:

The contractor shall take necessary precautions for safety of the workers and preserving their health while working in such jobs, which require special protection and precautions. The following are some of the measures listed but they are not exhaustive and contractor shall add to and augment these precautions on his own initiative where necessary and shall comply with directions issued by the Engineer-in-Charge or on his behalf from time to time and at all times.

1. Providing protective foot wear to workers situations like mixing and placing of mortar or concrete sand in quarries and places where the work is done under much wet conditions.
2. Providing protective head wear to workers at places like underground excavations to protect them against rock falls.
3. Providing masks to workers at granulates or at other locations where too much fine dust is floating about and sprinkling water at frequent intervals by water hoses on all stone crushing area and storage bins abate to dust.
4. Getting the workers in such jobs periodically examined for chest trouble due to too much breathing in to fine dust.
5. Taking such normal precautions like fencing and lightening in excavation of trenches, not allowing rolls and metal parts of useless timber spread around, making danger areas for blasting providing whistles etc.
6. Supply workmen with proper belts, ropes etc., when working in precarious slopes etc.
7. Avoiding named electrical wire etc. as they would electrocute the works.
8. Taking necessary steps towards training the workers concerned on the machinery before they are allowed to handle- them independently and taking all necessary Precautions in around the areas where machines hoist and similar units are working.

71 Fair Wage Clause:

71.1 The contractor shall not employ for the purpose of this contract any person who is below the age of eighteen (18) years and shall pay to each labourer for work done by such labourers fair wages. PWD No.-22059 Dtd-16.08.77

Explanation – “Fair Wage” means wages, whether for time or piece work prescribed by the state Public Works Department provided that where higher rates have been prescribed under the Minimum Wages Act.1948 wages at such higher rates should constitute fair wages.

- (a) The Engineer-in-Charge shall have the right to enquire into and decide against complaints alleging that wages paid by the contractors to pay labourer for work done by such labourer is less than the wages as per the sub-paragraph (1) above.
- (b) The contractor shall not withstand the provisions of any contract to contrary, cause to be paid a fair wage to labourers indirectly engaged on the work including any labour engaged by his sub-contractors in connection with the said work, as if the labourers had been immediately employed by him.
- (c) In respect of all labour directly or indirectly employed in the works for the performance of the contractor's part of this agreement, the contractor shall comply with or cause to be complied with all regulations made by Government in regard to payment of wages period deductions from wages, recovery of wages not paid and deductions unauthorizedly made, maintenance of wage register, wage cards, publications of scale of wages and other terms of employment, inspection and submission of periodical return and all other matters of a like nature.
- (d) The Engineer-in-Charge or Sub-divisional Officer concerned shall have the right to deduct, from the money due to the contractor, any sum required or estimated to be required for making good the loss suffered by a worker or workers by reason of non-fulfillment of conditions of the contract for the benefit of the workers, non-payment of wages or of deductions made from his or their wages, which are not justified by their terms of the contract or non-observance of the regulations. Money so deducted should be transferred to the workers concerned.

- (e) Vis-à-vis, the Government of Orissa, the contractor shall be primarily liable for all payments to be made under and for the observance of the regulations aforesaid without prejudice to his right to claim indemnity from his sub-contractor.
- (f) The regulations aforesaid shall be deemed to be a part of this contract and against breach thereof shall be breach of this contract.
- (g) Under the provisions of the minimum wages Act, 1948 and the minimum wages (Central Rules 1950) the contractor is bound to allow or cause to be allowed to the labourers directly or indirectly employed in the work one-day rest for six days continuous work and pay wages at the same rate as for duty. In the event of default, the Engineer-in-Charge or Sub-divisional Officer concerned shall have the right to deduct the sum not paid on account of wages for weekly holiday to any labourers and pay the same to the person entitled there to from any money due to the contractor.
- (h) The contractor shall at his own expense provide or arrange for the provision of foot wear for any labour doing cement mixing work and black topping of roads (The contractor has undertaken to execute under this contract) to the satisfaction of the Engineer-in-Charge and on his failure to do so, OHPC shall be entitled to provide the same and recover the cost from the contractor.
- (i) The contractor shall submit by the 4th & 10th of every month to the Engineer-in-Charge true statement showing in respect of the Second half of the preceding month and the First half of the current month respectively (1) the number of labours employed by him on the work (2) their working hours (3) the wages paid to them (4) the accident that occurred during the said fortnight showing the circumstances under which they happened and the content of damage injury caused by them and (5) the number of female workers who have been allowed maternity benefit according to clause K and the amount paid to them failing which the contractor shall be liable to pay to OHPC a sum not exceeding Rs.50/- for each default to materially incorrect statement. The decision of the Engineer-in-Charge shall be final in deducting from any bill due to contractor amount levied as fine.
- (j) In respect of all labour directly or indirectly employed in the work for the performance of the contractor's part of this agreement, the contractor shall comply with or cause to be complied with all the rule, framed by Government / Orissa Public Works Department. This will apply to work places having 50 or more workers.

72 Odisha P.W.D./Electricity Department Contractor's Labour Regulation.

72.1 Short Title – These regulations may be called “The Orissa Public Works Department/Electricity Department Contractor's Regulations.”

1. **Definitions** – In these Regulations, unless otherwise expressed or indicated the following words and expressions shall have the meaning hereby assigned to them respectively that is to say –

(i) “**Labour**” means works employed by a contractor of the Orissa Public Works Department/Electricity Department directly or indirectly through a sub-contractor or other person, by an agent on his behalf.

(ii) “**Fair wages**” means wages whether for the time of piece work described by the State Public Works Department/Electricity Department for the area in which the work is done.

(iii) “**Contractor**” shall include every person whether a sub-contractor or headman or agent employing labour on the work taken on contract.

(iv) “**Wages**” shall have the same meaning as defined in the payment of Wages Act. and include

time and piece rate wages, if any –

2. Display of notices regarding wages, etc.

The contractor shall –

(a) Before he commences his work on contract display and correctly maintain and continue to display, in a clean and legible condition, in conspicuous places on the work, notices in English and in the local Indian language spoken by the majority of the workers, giving the rate of wage prescribed by the State Public Works Department/Electricity Department for the district where the work is done.

(b) Send a copy of such notices to the Engineer-in-Charge of the work.

3. Payment of Wages

(i) Wages due to every worker shall be paid to him direct.

(ii) All wages shall be paid in current coin or currency or in both.

4. Fixation of wage period

(i) The contractor shall fix the wage period in respect of which wages be payable.

(ii) No wage period shall exceed one month.

(iii) Wages of every workman employed on the contract shall be paid before the expiry of 3 days, after the last day of the wage period in respect of which the wages are payable.

(iv) When the employment of any worker is terminated by or on behalf of the contractor, the wages earned by him shall be paid before the expiry of the day succeeding the one on which his employment is terminated.

(v) All payment of wages shall be made on a working day.

5. Wages book and wage cards, etc.

(i) The contractor shall maintain a wage book of each worker in such form as may be convenient, but the same shall include the following particulars –

(a) Rate of daily or monthly wages.

(b) Nature of work on which employed.

(c) Total number of days work during each wage period.

(d) Total amount payable for the work during each wage period.

(e) All deductions made from the wages with an indication in each case of the ground for which the deduction is made.

(f) Wage actually paid for each wage period.

(ii) The contractor shall also maintain a wage card for each worker employed on the work.

(iii) The Engineer-in-Charge may grant an exemption from the maintenance of wage bond, wage cards to a contractor who, in his opinion may not directly or indirectly employ more than 10 persons on the work.

6. Fines deduction which may be from wages

(i) The wages of a worker shall be paid to him without any deduction of any kind except the following.

- (a) Fines
- (b) Deductions for absence from duty, i.e. from the place or place where by the terms of his employment he is required to work. The amount of deductions shall be in proportion to the period for which he was absent.
- (c) Deductions for damages for damage to or loss of good expressly entrusted to the employed person for custody or for loss of money for which he is required to account where such damage or loss is directly attributable to his neglect or default.
- (d) Any other deductions, which the Orissa Government may from time to time allow.
- (i) No fines shall be imposed on a worker and no deduction for damage or loss shall be made from his wages until the worker has been given an opportunity or showing cause against such fines or deductions.
- (ii) The total amount of fines which may be imposed in any one wage period on a work shall not exceed an amount equal to five paise in rupee of the wages payable to him in respect of that wage period.
- (iii) No fine imposed on any worker shall be recovered from him by installments, or after the expiry of 60 days from the date on which it was imposed.

7. Register of fines, etc.

- (i) The contractor shall maintain a register of fines and of all deductions for damage or loss. Such Register shall mention the reason for which fine was imposed or deduction for damage or loss was made.
- (ii) The contractor shall maintain a list in English and in the local Indian language, clearly defining acts and omissions for which penalty or fine can be imposed. It shall display such list and maintain it in a clean and legible condition in conspicuous places in the work.

8. Preservation of Register

The wage register, the wage cards and the register of fines, deduction required to be maintained under these regulations shall be preserved for 12 months after date of the last entry made in them.

9. Power of Labour Welfare Officer to make investigation or enquiry –

The Labour Welfare Officer or any other persons authorized by the Government of Orissa on their behalf shall have power to make enquiries with a view to ascertaining and enforcing due and proper observance of the fair wage clauses and the provision if these of these regulations. He shall investigate into any complaint regarding default made by the contractor, sub-contractor in regard to such provisions.

10. Report of Labour Welfare Officers-

The Labour Welfare Officers or others authorized as aforesaid shall submit a report of the results of his investigation or enquiry to the Engineer-in-Charge concerned, indicating the extent, if any, to which the default has been committed with a note that necessary deduction from the contractor's bill be made and the wages and other dues be paid to the labourers concerned.

11. Appeal against the decision of Labour Welfare Officers-

Any persons aggrieved by the decision and recommendation of the Labor Welfare Officer or other person so authorized may appeal against such decision to the Labour Commissioner within 30

days from the date of decision forwarding simultaneously a copy of his appeal to the Engineer-in-Charge concerned but subject to such appeal, the decision of the officer shall be final and binding upon the contractor.

12. Inspection of Registers –

The contractor shall allow inspection of the wage book and wage cards to any of his workers or to his agent at a convenient time and place after due notice is received, or to the Labour Commissioner or any other person authorized by the Government of Orissa on his behalf.

13. Submission of return –

The contractor shall submit periodical returns as may be specified from time to time.

14. Amendments –

The Government of Orissa may from time to time, add to or amend these regulations and on any question as to the application, interpretation of effect of the regulations, the decision of the Labour Commissioner or any other person authorized by the Government of Orissa in that behalf shall be final.

72.2 Maternity benefit rules for female workers employed by Contractor.

Leave and pay during leave shall be regularized as follows.

1. Leave: i) In case of delivery: Maternity leave not exceeding 8 weeks up to and including the day of delivery or 4th weeks following that day.
 - ii) In case Miscarriage: Up to 3 weeks from the date of miscarriage.
2. Pay: i) In case of delivery: Leave pay during maternity leave will be at the rate of the women's average daily earning calculated on the total wages earned on the days when full time work was done during a period of three months immediately preceding the date of which she gives notice that she expects to be confined or at the rate of twelve annas a day whichever is greater.
 - ii) In case of Miscarriage: Leave pay at the rate of daily earnings calculated on the total wages earned on the date when full time work was done during a period of 3 months immediately preceding the date of such miscarriage.

Condition of the Grant of Maternity Leave: No maternity leave benefit shall be admissible to women unless she has been employed for a total period not less than 8 months immediately preceding the date on which she proceeds on leave.

72.3 MODEL RULES FOR HEALTH AND SANITARY ARRANGEMENTS FOR WORKERSEMPLOYED BY ODISHA P.W.D ON ITS CONTRACTOR.

1. Application: These rules shall apply to construction work in charge of Odisha Public Works Department, which are expected to continue for a year or more.
2. Definitions: (i) "Work Place" means a place at which an average of fifty or more workers is employed in connection with construction work.
(ii) Large work place means a place at which an average of 500 or more workers is employed in connection with construction work.
3. First Aid: (a) At every work place there shall be maintained in readily accessible place First-Aid appliances including an adequate supply of sterilizer dressings and sterilized cotton wool. The appliances shall be kept in good order and in large work place they shall be readily available during working hours.

- (b) At large works places, where hospital facilities are not available within easy distance of the works, First-Aid posts shall be established and run by a trained compounder.
- (c) Where large work places are remote from regular hospital an indoor ward shall be provided with one bed for every 250 employees.
- (d) Where large work places are situated in cities, towns or in their surplus and no beds are considered necessary owing to the proximity of city town hospital and ambulance shall be provided to facilitate removal of urgent cases to these hospitals. At the work place, some conveyance facilities such as a car shall be kept ready to take injured person or persons suddenly taken seriously ill, to the nearest hospitals.
4. (a) Drinking Water: In every work place, there shall be provided and maintained at suitable place easily accessible to labour, a sufficient supply of water fit drinking.
- (b) Where drinking water is obtained from an intermittent public water supply each work place shall be provided with storage where such drinking water shall be stored.
- (c) Every water supply of storage shall be at a distance of not less than 60 feet from any latrine, drain or other sources of pollution. Where water has to be drawn from an existing well, which is within such proximity of latrine drain or any other source of pollution, the well shall be properly chlorinated before water is drawn from it for drinking. All such wells be entirely closed in and be provided with a trap door which shall be dust and water proof.
- (d) A reliable pump shall be fitted to each covered well, the trap door shall be kept locked open only for cleaning or inspection which shall be done at least once 2 months.
- (e) The temperature of drinking water supplied to workers shall not exceed 30^o C.
5. Washing and Bathing Place:
- (i) Adequate washing and bathing place shall be provided separately for man and women.
- (ii) Such places shall be kept in clean and drained condition.
6. Scale of accommodation in latrines and Urinals: There shall be provided within the premises of every work place latrine and urinal in an accessible place and the accommodation, separately for each of them shall not be less than the following.
- (a) Where the number of persons employed does not exceed 50.No. of seats 1.
- (b) Where the number of persons employed exceeds 50 but does not exceed 100. No. of seats 3 per 100.
- (c) For every additional 100, 3sets
- (In particular cases the Engineer-in-Charge shall have the power to vary the scale where necessary). Latrines and Urinal for women: If women are employed, separate latrines and urinal for women. If women are employed, separate latrines separate from that for women and marked in the vernacular in conspicuous letter. For women only shall be provided on the scale laid in rule.
7. Latrines and Urinals: Except in work places provided with water flushed latrine es connection with a water borne sewerage system, all latrines shall be provided with receptacle on dry earthen system which shall be cleaned and at least four times daily and at least twice during working hours and kept in a strictly sanitary condition. The receipt tables shall be tarred inside and outside at least once a year.
8. Constructions of latrines: The inside wall shall be constructed of masonry or stone materials

and shall be cement washed inside and outside at least once a year. The dates of cement washing shall be noted in register maintained for this purpose and kept available for inspection.

9. Disposal of Excreta: Unless otherwise arrange for by the local sanitary authorities, arrangement for a paper disposed of excreta by incineration at the work place shall be made by means of a suitable incinerator approved by Asst. director of Public Health or Municipal Medical Officer of Health as the case may be, in whose jurisdiction the work place is situated. After natively excreta may be disposed of putting of a layer of.
10. Night soil at the bottom of pucca tank prepared for the purpose and covering it with a layer of waste or refuse and then covering it up with a layer of 6; layer if waste or refuse and then covering it up with a layer of each for a fortnight (when it will turn in to manure).
11. Provision of shelters during rest-at every work place, there shall be provided free of cost two suitable sheds and for meals and the other for rest the use of labourers. The height of the shelter shall not be less than 11 feet, from the floor level to the lowest of the roof.
12. Creche: (a) At every work place at which more than 50 women workers are employed, there shall be provided only one but for the use of children under the age of 6 years, belonging to such women and shall be used for infants games and play and their bed room. The huts shall not be constructed on a lower standard than the following:

- i) Thatched roofs
- ii) Mud floors and walls
- iii) Planks spared over the mud floor and covered with matting

The hut shall be provided with suitable and sufficient innings for light and ventilation. There shall be ad equates provisions for sweepers to keep the place clean. There shall be two daises in attendance, sanitary, utensils shall be provided to the satisfaction of the Health Officer of the area concerned. The use of the hut shall be restricted to children, their attendants and, mothers of the children.

- (b) Where the number of women workers is more than 50, the Contractor shall provide one but and a Dai to look after the children of women workers.
 - (c) The size of crèches shall vary according to the number of women workers.
 - (d) The crone shall be properly maintained and necessary equipment like toys etc. shall be provided.
13. Canteen: A cooked food Canteen on moderate scale shall be provided for the benefits of workers whenever it is considered expedient.

73.0 Indemnity Bond:

The contractor has to furnish the bond at the time of signing the Agreement.

Name of work- **Repair and Rehabilitation of Power channel from HHEP, Burla to CHEP, Chiplima, Sambalpur, Odisha.**

I _____ contractor S/o _____ aged _____
 _____ Resident of _____ do hereby
 bind myself to pay all the claims may come (a) under Workmen's Compensation Act. 1933 with any statutory modification thereof and rules there under or otherwise for or in respect of any damage or compensation payable in connection with any accident or injury sustained (b) under

Minimum wages Act 1948 (c) under payment of wages Act.1936 (d) under the Contractor labour (Regulation and Abolition) Act. 1970 by workmen engaged for the performance of the business relating to the above contract i.e., failing such payment of claims of workmen engaged in the above work, I abide in accepting for the recovery of such claims, effected from any of my assets with the departments.

74.0 Compliance with Labour Regulations:

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

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

75.0 Salient features of some major labour laws applicable to establishment engaged in buildings and other construction work:

- a) Workmen compensation Act 1923: The Act provides for compensation in case if injury by accident arising out of and during the course of employment.
- b) Payment of Gratuity Act 1972: Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if any employee has completed 5 years' service or more, or on death, the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments, employing 10 or more employees.
- c) Employees P.F. and Miscellaneous provision Act 1952: The Act provides for monthly contributions by the Department plus workers @ 10% or 8.33%. The benefits payable under the Act are:
 - i) Pension or family pension on retirement or death, as the case may be.
 - ii) Deposit linked insurance on the death in harness of the worker.
 - iii) Payment of P.F. accumulation on retirement/death etc.,
- d) Maternity Benefit Act 1951: The Act provides for leave and some other benefits to women employees in case of confinements or miscarriage etc.
- e) Contract Labour (Regulation & Abolition) Act 1970: The Act provides for certain welfare measures to be provided by the contractor to contract labour and in case the Contractor fails to provide, the same are required to be provided by the Principal Department by Law. The

Principal Department is required to take certificate of Registration and the contractor is required to take license from the designated Officer. The Act is applicable to the establishments or Contractor of Principal Department if they employ 20 or more contract labour.

- f) Minimum wages Act 1948: The Department is supposed to pay not less than the Minimum wages fixed by appropriate Government as per provisions of the Act if the employment is a scheduled employment construction of Buildings, Roads, Runways are scheduled employments.
- g) Payment of wages Act 1936: It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.
- h) Equal Remuneration Act 1979: The Act provides for payment of equal wages for work of equal nature to Male or Female workers and for not making discrimination against Female employee in the matters of transfers, training and promotions etc.
- i) Payment of Bonus Act 1965: The Act Is applicable to all establishments employing 20 or more employees. The Act provides for payment of annual bonus subject to a minimum of 8.33% of wages and maximum of 20% of wages to employees drawing Rs. 3500/- per month or less. The bonus to be paid to employees getting Rs.2500/- per months or above and up to Rs.3500/- per month shall be worked out by taking wages as Rs.2500/- per monthly only. The Act does not apply to certain establishments. The newly set-up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20 to 10 for the purpose of applicability of this Act.
- j) Industrial Disputes Act 1947: The Act lays down the machinery and procedure for resolution of Industrial disputes, in what situations a strike or lock- out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment.
- k) Industrial Employment (Standing Orders) Act 1946: It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the State and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the Department on matters provided in the Act and get the same certified by the designated Authority.
- l) Trade Unions Act 1926: The Act lays down the procedure for registration of trade unions of workmen and Departments. The Trade Unions registered under the act have been given certain immunities from civil and criminal liabilities.
- m) Child Labour (Prohibition & Regulation) Act 1986: The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes, Employment Child Labour is prohibited in Building and Construction Industry.
- n) Inter-State Migrant workmen's (Regulation of Employment & Conditions of service) Act 1979: The Act applicable to an establishment, which employs 5 or more inter -state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another State). The inter State migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home upto the establishment and back, etc.

- o) The Building and Other Construction workers (regulation of Employment and conditions of service) Act 1996 and the Cess Act of 1996: All the establishments who carry on any building or other construction work and employs 10 or more workers are covered under this Act. All such establishments are required to pay cess at the rate not exceeding 1% of the cost of construction or at the rate as may be modified by the Government. The Department of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as Canteens, First-aid facilities, Ambulance, Housing accommodations for workers near the work place etc. The Department to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government.
- p) Factories Act 1948: The Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours, annual earned leave and rendering information regarding accidents or dangerous occurrences to designated authorities. It is applicable to premises employing 10 person or more with aid of power or 20 or more persons without the aid of power engaged in manufacturing process.

76.0 Liabilities of the Contractor:

76.1 Accident Relief and Workmen Compensation:

The contractor should make all necessary arrangements for the safety of workmen on the occurrence of the accident, which results in the injury or death of any of the workmen employed by the contractor, the contractor shall within 24 hours of the happenings of the accident and such accidents should intimate in writing to the concerned Engineer-in-Charge of the Department the act of such accident. The contractor shall indemnify OHPC against all loss or damage sustained by the OHPC resulting directly or indirectly from his failure to give a intimation in the manner aforesaid including the penalties or fines if any payable by OHPC as a consequence of OHPC's failure to give notice under workmen's compensation Act or otherwise conform to the provisions of the said Act. in regard to such accident.

76.2 In the event of an accident in respect of which compensation may become payable under the workmen's compensation Act IX 23 whether by the contractor, by the Government it shall be lawful for the Engineer-in-Charge to retain such sum of money which may in the opinion of the Engineer-in-Charge be sufficient to meet such liability. The opinion of the Engineer-in-Charge shall be final in regard to all matters arising under this clause.

76.3 The contractor shall at all times indemnify the OHPC against all claims which maybe made under the workmen's compensation act or any statutory modification thereafter or rules there under or otherwise consequent of any damage or compensation payable in consequent of any accident or injuries sustained or death of any workmen engaged in the performance of the business relating to the contractor.

77.0 Contractor's Staff, Representatives and Labour:

- (a) The contractor shall, at all times, maintain on the works, staff of qualified Engineers, and Supervisors of sufficient experience of similar other jobs to assure that the quality of work turned out shall be as intended in the specifications. The contractor shall also maintain at the works, a Work Manager or sufficient status, experience and office and duly authorize him to deal with all aspects of the day-today work. All communications to any commitments by the Work Manager shall be considered as binding on the Contractor.
- (b) The Contractor shall at all times submit details of skilled and unskilled labour and equipment employed to the Engineer-in-Charge in prescribed proforma as he may require to assess and

ensure the proper progress of work.

- (c) If the contractor does not employ the technical person agreed to on the work a fine of Rs.25, 000/- will be imposed. If he does not employ for 30 days, thereafter it becomes a fundamental breach of contract.
- (d) The Contractor shall at all times, maintain on the work a staff of qualified Engineers and Supervisors of sufficient experience of similar other jobs to ensure that the quality of work turned out shall be as intended in these-specifications and they shall be present at the work spot during working hours and at the time of inspection by the Department Officers. All orders and direction given to such supervisory or other staff of the contractor to be present on any specified inspection and the contractor shall comply with such requisitions.
- (e) The contractor shall supply to the Engineer-in-Charge details of name, qualifications and experience in regard to all supervisory staff employed by the contractor and notify the changes when made and satisfy the Engineer-in-Charge regarding the quality and adequacy of staff thus employed.
- (f) The Engineer-in-Charge will have the unquestionable right to ask for change in the contractor's supervisory staff and to other removal from the work and connection herewith of any of such staff. The contractor shall comply with such order and effect replacement to the satisfaction of the Engineer-in-Charge.
- (g) The Contractor shall not without written authorization of OHPC permit entry on site of work of any person authorized agents, engaged in connection with work.
- (h) All vehicles used by the contractor shall be clearly marked with contractor's name.

78 Accommodation and Food:

The contractor should arrange accommodation he needs, at his own cost. The contractor shall make his own arrangements for supply of food grains, fuel and other provision to his staff and labourers including controlled commodities.

79 Relationship:

Contractor shall have to furnish information along with Bid, about the relationship he is having with any officer of the Department/Government of Odisha of the rank Assistant Engineer/ Assistant Manager and above engaged in the work.

80 Protection of adjoining premises:

The contractor shall protect adjoining sites against structural, decorative and other damages that could be caused by the execution of these works and make good at his cost any such damages.

81 Work during night or on Sundays and holidays:

The work can be allowed to be carried out during night, Sundays or authorized holidays in order to enable him to meet the schedule targets and the work shall require almost round the clock working keeping in view:

- (i) The provisions of relevant labour laws being adhered to:
- (ii) Adequate lighting, supervision and safety measures are established to the satisfaction of the Engineer-in-Charge and
- (iii) The construction programme given by the Contractor and agreed upon by the Engineer-in-Charge envisages such night working or working during Sundays or authorized

holidays.

82 Layout of Materials Stacks:

The contractor shall deposit materials for the purpose of the work on such parts only of the ground as may be approved by the Engineer-in-Charge before starting work. A detailed survey, clearly indicating position and areas where materials shall be stacked and sheds built is to be conducted by the contractor at his own cost and only after obtaining necessary approval of the plan for use of sites by the Engineer-in-Charge, the Contractor can use the sites accordingly.

83 Use of Blasting Materials:

Procurement of blasting materials and its storage is the responsibility of the contractor. The contractor shall engage licensed blaster for blasting operation. The contractor is to act in accordance with Indian Explosive Act and other rules prevailing, during the execution of work. It is the responsibility of the contractor to see, that work by other agencies in the vicinity are not hampered, in such cases if any claim is made by other agencies that should be borne by the contractor. Carriage of blasting materials, from the magazine to the work site, is the responsibility of the contractor.

84 Plant and Equipment:

84.1 The contractor shall have sufficient plant, equipment and labour and shall work such hours and shifts as may be necessary to maintain the progress on the work as per the approval progress schedule. The working and shifts hours shall comply with the Govt. Regulations in force.

84.2 It is to expressly and clearly understood that contractor shall make his own arrangements to equip himself with all machinery and special tools and plant for the speedy and proper execution of the work and the department does not undertake responsibility towards their supply.

84.3 The department shall supply such of the machinery that may be available on hire basis but their supply cannot be demanded as matter of right and no delay in progress can be attributed to such non-supply of the plant by the department and the department cannot be made liable for any damage to the contractor. The Contractor shall be responsible for safe custody of the departmental machinery supplied to him (which will be delivered to contractor at the machinery yard at site of work) and he has to make good all damages and losses if any other than fire, wear and tear to bring it to the conditions that existed at the time of issue to the contractor before handing over the same to the department. The hire charges for the machinery handed over to the contractor will be recovered at the rate prevalent at the time of supply. The contractor will have to execute supplemental contract with Engineer-in-Charge at the time of supply of the machinery.

84.4 The acceptance of departmental machinery on hire is optional to the contractor.

85 Steel Forms:

Steel forms should be used for all items involving use of centering and shuttering. They shall be such that the concrete surface obtained after removal of centering and shuttering shall be single plane without any dents and undulations.

86 Inconveniences to Public:

The contractor shall not deposit materials at any site, which will cause inconvenience to public. The Engineer-in-Charge may direct the contractor to remove such materials or may undertake the job at the cost of the contractor.

87 Conflict of Interest:

Any bribe, commission, gift or advantage given, promised or offered by on behalf of contractor or his partner, agent or servant or any one on his behalf to any officer, servant, representatives, agents of Engineer-in-Charge, or any persons on their behalf, in relation to the obtaining or to execution of this, or any other contract with Engineer-in-Charge shall in addition to any criminal liability, which it may occur, subject to the cancellation of this or all other contracts and also to payment of any loss or damage resulting from any such cancellation. Engineer-in-Charge shall then be entitled to deduct the amount, so payable from any money, otherwise due to the contractor under this or any other contract.

88.0 Contract Documents and Materials to be treated as confidential:

All documents, correspondences, decisions and orders, concerning the contract shall be considered as confidential and/or restricted in nature by the contractor and he shall not divulge or allow access to them by any un-authorized person.

89.0 General Obligations of Contractor:

89.1 The contractor shall, subject to the provision of the contract and with due care and diligence, execute and maintain the works in accordance with specifications and drawings.

89.2 The contractor shall promptly inform the Department and the Engineer-in-Charge of any error, omission, fault and to rectify the defect in the design or specifications for the works which are discovered when reviewing the contract documents or in the process of execution of the work.

90.0 Security Measures

- a) Security requirements for the work shall be in accordance with the Governments general requirements including provisions of this clause and the Contractor shall conform to such requirements and shall be held responsible for the actions of all his staff, employees and the staff and employees of his sub-contractors.
- b) All contractors' employees, representatives and sub-contractor's employees shall wear identifications badges provided by the contractor. Badges shall identify the contractor, showing and employee's number and shall be worn at all times while at the site. Individual labour will not be required to wear identification badges.
- c) All vehicles used by the contractor shall be clearly marked with contractor's name.
- d) The contractor shall be responsible for the security of the work for the duration of the contract and shall provide and maintain continuously adequate security personnel to fulfill these obligations. The requirements of security measures shall include, but not limited to maintenance of order on the site, provision of all lighting, fencing, guard flagmen and all other measures necessary for the protection of the works within the colonies, camps and elsewhere on the site, all materials delivered to the site, all persons employed in connection with the works continuously throughout working and non- working period including nights, Sundays and holidays for duration of the contract.
- e) Other contractors working on the site concurrently with the contractor will provide security for their own plant and materials. However, their security revisions shall in no way relieve the contractor of his responsibilities in this respect.
- f) Separate payment will not be made for provision of security services and the cost of this work shall be deemed to have been included in the bid.

91.0 Firefighting measures:

- a) The contractor shall provide and maintain adequate firefighting equipment and take adequate fire precaution measures for the safety of all personnel and temporary and permanent works and shall take action to prevent damage to destruction by fire of trees shrubs and grasses.

- b) Separate payment will not be made for the provision of fire prevention measures.

92 Sanitation:

The contractor shall implement the sanitary and watch and ward rules and regulations for all forces employed under this contract and if the Contractor fails to enforce these rules, the Engineer-in-Charge may enforce them at the expenses of the Contractor.

93 Ecological Balance:

- a) The contractor shall maintain ecological balance by preventing de-forestation, water pollution and defacing of natural landscape. The contractor shall so conduct his construction operations to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the work. In respect of the ecological balance, contractor shall observe the following instructions.

- Where unnecessary destruction, scarring, damage or defacing may occur, as result of the operation, the same shall be repaired replanted or otherwise corrected at the contractor's expense. The contractor shall adopt precautions when using explosives, which will prevent scattering of rocks or other debris outside the work area. All work is including borrow areas shall be smoothed and graded in a manner to conform to the natural appearance of the landscape as directed by the Engineer-in-charge.
- All trees and shrubbery which are not specifically required to be cleared or removed for construction purposes shall be preserved and shall b protected from any damage that may be caused by the Contractor's construction operation and equipment. The removal of trees and shrubs will be permitted only after prior approval by the Engineer-in-Charge. Special care shall be exercised where trees or shrubs are exposed to injuries by construction equipment, blasting, excavating, dumping, chemical damage or other operation and the contractor shall adequately protect such trees by use of protective barriers or other methods approval by the Engineer-in-Charge. Trees shall not be used for anchorages. The contractor shall be responsible for injuries to trees and shrubs caused by his operations. The term "injury" shall include, without limitation bruising, scarring, tearing and breaking of roots, trunks or branches. All injured trees and shrubs be restored as nearly as practicable without delay to their original condition at the contractor's expense.
- The contractor's construction activities shall be performed by methods that will present entrance or accidental spillage of solid matter contaminants, debris and other it objectionable pollutants and wastage into river. Such pollutant and waste include earth and earth products, garbage, cement concrete, sewage effluent, industrial wastes, radio-active substances, mercury, oil and other petroleum products, aggregate processing, mineral salts and thermal pollution. Pollutants and wastes shall be disposed of in a manner and at sites approved by the Engineer-in-Charge.
- In conduct of construction activities and operation of equipments the contractor shall utilize such practicable methods and devices as are reasonably available to control, prevent and otherwise minimize the air pollution. The excessive omission of dust in to the atmosphere will not be permitted during the manufacture, handling and storage of concrete aggregates and the contractor shall use such methods and equipment as a necessary for collection and disposal or prevention of dust during these operations. The contractor's methods of storing and handling cement shall also include means of eliminating atmospheric discharges of dust, equipment and vehicles that give objectionable omission of exhaust gases shall not be operated. Burning of materials a resulting from clearing of trees, bushes, combustible construction materials and rubbish

may be permitted only when atmospheric conditions for burning are considered favorable.

- b. Separate payment will not be made for complying with the provisions of this clause and all cost shall be deemed to have been included in the unit rates and prices included in the contract if any provision is not complied with within a reasonable time even after issue of a notice in this respect, the necessary operations would be carried out by the Engineer-in-Charge at the cost of the Contractor, Orders of the Engineer-in-Charge in this respect would be final and binding on the contractor.

94 Preservation of existing vegetation:

1. The contractor will preserve and protect all existing vegetation such as trees, on or adjacent to the site which do not unreasonably interfere with the construction as may be determined by the Engineer-in-Charge. The contractor will be held responsible for all unauthorized cutting or damage of trees, including damage due to careless operation of equipment, stockpiling of materials or trekking of grass areas by equipment. Care shall be taken by the Contractor in felling trees authorized for removal to avoid any unnecessary damages to vegetation and trees that are to remain in place and to structures under construction or in existence and to workmen.
2. All the produce from such cutting of trees by the contractor shall remain the property of Government/OHPC and shall be properly stacked at site, approved by the Engineer-in-Charge. No payment whatsoever shall be made for such cutting and its stacking by the Contractor. If any produce from such cutting is not handed over to the Government OHPC by the contractor, he shall be charged for the same at the rates to be decided by the Engineer-in-Charge. The recovery of this amount shall be made in full from the intermediate bill that follows.
3. The contractor shall also make arrangements of fuel deposits for supply of required fuel for the labourers to be employed for cooking purpose at his own cost in order to prevent destruction of vegetation growth in the surrounding area of the work site.

95. Possession Prior to completion:

The Engineer-in-Charge shall have the right to take possession of or use any completed part of work or works or any part thereof under construction either temporarily or permanently. Such possession or use shall not be deemed as an acceptance of any work either completed or not completed in accordance with the contract with in the interest of Clause 28 of Standard specification except where expressly otherwise specified by the Engineer-in-charge.

96. Access to the Contractor's books:

Whenever it is considered necessary by the Engineer-in-Charge to ascertain the actual cost of execution of any particular extra item of work or supply of the plant or material on which advance is to be made or of extra items or claims, he shall direct the contractor to produce the relevant documents such as payrolls, records of personnel, invoices of materials and any or all data relevant to the item or necessary to determine its cost etc. and the contractor shall when so required furnish all information pertaining to the aforesaid items in the mode and manner that may be specified by the Engineer-in-Charge.

97. Drawing to be kept at site:

The contractor is to supply seven sets of corrected drawings for approval of the approving authority. The approving authority will forward four sets of approved drawing to the Engineer-in-Charge and two sets to the contractor for his/their own use. The contractor shall keep one complete set of drawings and specifications in the site in charge of the contractor's agent to whom the

instructions can be given by the Engineer- in-Charge.

98. B.I.S Books and Standard Specification / OPWD Code to be kept at site:

A complete set of Indian Standard specification and IRC codes referred to in “Technical Specifications” and OPWD code shall be kept at site for reference.

99. Site Order Book:

An order book shall be kept at the site of the work. As far as possible, all orders regarding the work are to be entered in this book. All entries shall be signed and dated by the Department Officer in direct charge of the work and by the contractor or by his representative. In important cases, the Engineer-in-Charge or the Di/Engineer-in-Charge will countersign the entries, which have been made. The order book shall not be removed from the work, except with the written permission of the Engineer-in-Charge.

100 Variations by way of modification, omissions or additions:

The contractor(s) shall not vary or deviate from the drawings or specifications except upon the express authority of the Engineer-in-Charge which shall be obtained by an order in writing of the Engineer-in-Charge or by plan or drawing expressly given or signed by him or by any subsequent written approval signed by him. The foundation shall be carried to the depths in suitable strata, shown in the drawing. But if the Engineer is of opinion that they should be shallower or deeper and so directs the contractor in writing the instruction of the Engineer-in- Charge shall be binding on the contractor.

101 The Power to make additions and alteration in drawing or specification etc.:

The Engineer-in-Charge shall have power to make any alternations in or additions to the original specification, drawing, designs and instructions that may appear to him to be necessary or advisable during the progress of the work and the contractor(s) shall be bound to carry out the work in accordance with the instructions which may be given to him/them in writing signed by the Engineer-in-Charge and such alterations shall not invalidate the contract, and any additional work beyond the scope of the work which the contractors may be directed to do in the manner above specified as part of the work or any curtailment of the work from the scope of the work as designed, which may be found necessary during the period of construction shall be carried out or omitted by the contractor(s) on the same conditions in all respects on which he/they agreed to do the main work. If the additional or altered work for which no rates can be arrived from the main work then the contractor shall within seven days of the date of the receipt by him/them of the order to carry out the work, inform the Engineer- in-Charge of the rate which he/they propose to charge for such class of work. If the Engineer- in-Charge does not agree to this rate he shall by notice in writing be at liberty to cancel his order to carry out such a class of work and arrange to carry it out in such manner as he may consider it advisable. In the event of dispute, the decision of the Director (Operation), OHPC concerned shall be final. The time limit for the completion of the work shall be extended or curtailed in the proportion to the increase or decrease in its costs. As alteration or curtailment bears to the cost of the original contract work, the certificate of the Engineer-in-Charge as to such proportion shall be conclusive.

102. Care and diversion of river / stream:

The contractor shall submit details regarding the diversion and care of river or stream during construction of the work along with a separate print-out of the time table showing earliest and latest start and finish dates of various activities. He should submit a detailed labour plan with drawings for the diversion and care of river during construction of work. The above arrangements shall be at contractor’s cost.

103. Income Tax:

- i. During the currency of the contract, deduction of income tax as per Income tax Rule shall be made from the gross value of each bill of the contract.
- ii. The contractor's staff, personnel and labour will be liable to pay personnel income taxes in respect of their salaries and wages as are chargeable under the laws and regulations for the time being in force; and the contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such laws and regulations. The quoted price shall be deemed to be inclusive of Income Tax & no additional payment on account of Income tax and variation in Tax structure there of shall be admissible.

104. ROYALTY CHARGES:

The contractor shall keep books of accounts and other documents for the purpose of levy of royalty charges as may be necessary to clearly arrive at such amounts and shall allow inspection of the same by a duly authorized representative of the Employer and further shall furnish such other information/document as the Employer may require from time to time.

105.0 GST:

105.1 GST as applicable shall be paid at source during the currency of the contract while making payments to the contractor.

105.2 The contractor shall submit the valid GST Registration Certificate at the time of payment of the final 1st RA Bill; otherwise, payment to the contractor will be withheld.

105.3 The tax structure is liable for revision as per the orders of the Government issued from time to time and in such case, the applicable tax will be deducted at source at the revised rates only while making payment to the contractor.

106 Labour Welfare Cess.

Labour welfare cess @ 1% of gross bill amount or as applicable as per prevailing rate is to be deducted during currency of contract as per the amendments made by Govt. from time to time.

107.0 SUPPLY OF CONSTRUCTION MATERIALS:

The contractor(s) is/are to provide every article or thing which may be necessary and requisite for the due and proper execution of the several works included in the contract according to the true intent and meaning of the drawings and specifications taken together, the list of which are to be signed by the concerned Engineer-in-Charge and by the contractors whether the same may or may not have been particularly described in the specification or shown on the approved drawings provided however that the same are reasonably and obviously to be inferred there from. In case of discrepancy between the drawings and the specifications the Engineer-in-Charge shall decide which of the two is to be followed.

108.0 Setting Out:

The contractor shall be responsible for the true and proper setting out of the works and the correctness of positions, levels, dimensions and alignments of all parts of the work and for the provisions of all necessary instruments, appliances and labour in connection therewith, If, at any time, during the progress of the work, any errors, appear or arise in the positions, levels, dimensions or alignments of any part of the work, the contractor, on being required to rectify such errors by the Engineer-in-Charge shall at his own expense do so to the satisfaction of the Engineer-in-charge, If however, such error is based on incorrect data supplied in writing by the Engineer-in-charge, the expenses of rectifying the same shall be borne by the Department, The checking of and setting

out of any line or level by the Engineer-in-Charge or his representative shall not in any way, relieve the contractor of his responsibilities for their correctness and other things used in setting out of the work, The contractor shall carefully protect and observe all bench-marks, site-hails, pages and other things used in setting out of the work(s).

109.0 Site Data:

The data and information of the Bid Document are based on the topo sheet planning & preliminary Investigations conducted so far. Variations / alternations in the said data / information in respect of Geology, topography sub soils hydrological conditions etc., which have bearing on the Investigation, planning Design and Construction, cannot be ruled out. The contractor shall, therefore, satisfy himself about the adequacy and accuracy of the said data / information and interpretation thereof and if necessary, by any further Investigations to be conducted by the Contractor. Thus, Employer shall not be responsible for the accuracy / adequacy of the said data / information and interpretation thereof by the Contractor.

110.0 Sufficiency of the contract price:

The Contractor shall be deemed to have satisfied himself as to the correctness and sufficiency of the Contract Price. Unless otherwise stated in the Contract, the Contract price covers all the Contractor's obligations under the Contract (including those under provisional sums, if any) and all things necessary for the proper surveys, Investigation, planning & design, execution and completion of the Works and the remedying of any defects during construction and maintenance period.

111.0 Unforeseen Difficulties:

Except as otherwise stated in the Contract:

- a. the Contractor shall be deemed to have obtained all necessary information as to risks, contingencies and other circumstances, which may influence or affect the Works:
- b. by signing the Contract, the Contractor accepts total responsibility for having foreseen all difficulties and costs of successfully completing.
- c. The Works; and the Contract Price shall not be adjusted to take account of any unforeseen difficulties or costs except PV Clause as applicable as per the contract.

112.0 Rights of Way and Facilities:

The Contractor shall bear all costs and charges, including the statutory charges, for special and/or temporary rights-of-way/right-of-use, which he may require, including those for access to the Site. Department shall not bear any such cost or, the statutory charges for ROW. The Contractor shall also obtain, at his risk and cost, any additional facilities outside the site, which he may require for the purposes of the work.

113.0 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.

114.0 Access Route:

The Contractor shall be deemed to have been satisfied as to the suitability and availability of access routes to the Site. The Contractor shall use reasonable efforts to prevent any road or bridge from being damaged by the Contractor's traffic or by the Contractor's Personnel. These efforts shall include the proper use of appropriate vehicles and routes.

Except as otherwise stated in these Conditions:

The Contractor shall (as between the Parties) be responsible for any maintenance which may be required for his use of access routes; the Contractor shall provide all necessary signs or directions along access routes, and shall obtain any permission which may be required from the relevant authorities for his use of routes, signs and directions; the Employer shall not be responsible for any claims which may arise from the use or otherwise of any access route, the Employer does not guarantee the suitability or availability of particular access routes, and Costs due to non-suitability or non-availability, for the use required by the Contractor, of access routes shall be borne by the Contractor.

115.0 Transport of Goods:

- a) The Contractor shall give the Employer, not less than 21 days' notice, of the date on which any Plant or a major item of other Goods will be delivered to the Site;
- b) The Contractor shall be responsible for packing, loading, transporting, receiving, unloading, storing and protection all Goods and other things required for the Works; and
- c) The Contractor shall indemnify and hold the Employer harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from the transport of Goods, and shall negotiate and pay all claims arising from their transport.

116.0 Contractor's Equipment: The Contractor shall be responsible for all Contractors' Equipment. When brought on to the Site, Contractor's Equipment shall be deemed to be exclusively intended for the execution of the work.

- 1) All Constructional Plant, Temporary Works and materials provided by the Contractor shall, when brought on to the site, be deemed to be exclusively intended for the execution of the Works and the Contractor shall not remove the same or any part thereof, except for the purpose of moving it from one part of the site to another, without the consent, in writing, of the Engineer, which shall not be unreasonably withheld.
- 2) Upon completion of the works the Contractor shall remove from the site all the said Constructional Plant and Temporary Works remaining thereon and any unused materials provided by the Contractor.
- 3) The Employer shall not at any time be liable for the loss of or damage to any of the said Constructional Plant, Temporary Works or materials.

117 .0 Progress Reports:

Monthly progress reports shall be prepared by the Contractor and submitted to the Employer in six copies. The first report shall cover the period up to the end of the first calendar month following the Commencement Date. Reports shall be submitted monthly thereafter, each within 5 days after the last day of the period to which it relates.

Reporting shall continue until the Contractor has completed all work. The work which is known to be outstanding at the completion date is to be completed stated in the Taking-Over Certificate for the Works.

Each report shall include:

- a) Charts and detailed descriptions of progress, including each stage of surveys, Investigation, design, Contractor's Documents, procurement, manufacture, delivery to Site, construction, commissioning and trial operation;
- b) Digital photographs/ videography showing the status of progress on 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
 - (iii) Shipment and arrival at the Site;
- (d) The details of Contractor's Personnel and Equipment
- (e) Copies of quality assurance documents, test results and certificates of Material;
- (f) List of Variations, notices given
- (g) 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 jeopardize the completion in accordance with the Contract, and the measures being (or to be) adopted to overcome delays.

118.0 Design:**118.1 General Design Obligations:**

The Contractor shall be deemed to have scrutinized, prior to the Base Data, the Employer's Requirements (including design criteria and calculations, if any). The Contractor shall be responsible for the Investigation planning and Design of the work and for the accuracy of such Employer's Requirements (including design criteria and calculations), except as stated below.

The Employer shall not be responsible for any error, inaccuracy or omission of any kind in the Employer's Requirements as originally included in the Contract and shall not be deemed to have given any representation of accuracy or completeness of any data or information. Any data or information received by the Contractor, from the Employer or otherwise shall not relieve the Contractor from his responsibility for the Investigation, design and execution of the work.

118.2 Contractors Documents:

The Contractors Documents shall comprise the technical documents specified in the Employer's Requirements, documents required to satisfy all regulatory approvals, and the documents.

The Contractor shall prepare all Contractors Documents, and shall also prepare any other documents necessary to instruct the Contractors Personnel.

If the Employer's Requirements describe the Contractor's Documents which are to be submitted to the Employer for review, they shall be submitted accordingly, together with a notice as described below. In the following provisions of this Sub-Clause, (i) "review period" means the period required by the Employer for review, and (ii) "Contractor's Documents" exclude any documents which are not specified as being required to be submitted for review.

The Employers may give notice to the Contractor that a Contractor's Document fails (to the extent stated) to comply with the Contract. If a Contractor's Document so fails to comply, it shall be rectified, resubmitted and reviewed in accordance with this Sub-Clause, at the Contractor's cost.

For each part of the work, and except to the extent that the Parties otherwise agree:

- (a) Execution of such part of the work shall not commence prior to the expiry of the review periods for all the Contractor's Documents which are relevant to its design and execution.
- (b) Execution of such part of the work shall be in accordance with these Contractor's Documents, as submitted for review; and if the Contractor; wishes to modify any design or document which has previously been submitted for review, the Contractor shall immediately give notice to the Employer. Thereafter, the Contractor shall submit revised documents to the Employer in accordance with the above procedure.
- (c) If the Employer's Representative instruct that further Construction Documents are necessary for carrying the work, the Contractor shall upon receiving the Employer's Representative Instructions prepare such construction documents and shall not be considered as variation. Any such contract (under the preceding paragraph) or any review (under this Sub-Clause - or otherwise) shall not relieve the Contractor from any obligation or responsibility.

118.3 As-Built Documents:

The Contractor shall prepare, and keep up-to-date, a complete set of '**as-built**' records of the execution of the work, showing the exact as-built locations, sizes and details of the work as executed. These records shall be kept on the Site and shall be used exclusively for the purposes of this Sub-Clause. Two copies shall be supplied to the Employer prior to the commencement of the quantity checks / Verification Tests on Completion.

In addition, the Contractor shall supply to the Employer as-built drawings of the work, showing all components of the work as executed, and submit them to the Employer for review under Sub-Clause [Contractor's Documents]. The Contractor shall obtain the consent of the Employer as to their size, the referencing system, and other relevant details.

Prior to the issue of any Taking-Over Certificate, the Contractor shall supply to the Employer the specified numbers and types of copies of the relevant as-built drawings, in accordance with the Employer's Requirements. The Work shall not be considered to be completed for the purposes of taking-over [Taking Over of the work and Sections] until the Employer has received these documents.

118.4 Design Error:

If errors, omissions, ambiguities, inconsistencies, inadequacies or other defects are found in the Contractor's Documents, then the work shall be corrected at the Contractor's cost, notwithstanding any consent or approval under this Clause.

119.0 Programme:

- 119.1** The Contractor shall submit a **work** programme to the employer within 15 (fifteen) days after the signing of contract and the programme shall be based on the basic time period for completion and milestone as indicated in the Contract Document. Contractor's programme shall be considered effective upon acceptance by the **Employer's Representative**.

The Contractor shall also submit a revised work programme whenever the previous programme is inconsistent with actual progress or with the Contractor's obligations unless otherwise stated in

the contract each programme shall include:

- (a) The order in which the Contractor intends to carry -out the work, including the anticipated timing of each major stage of the works.
- (b) The periods for reviews under Clause [Contractor's Documents],
- (c) The sequence and timing of inspections and tests specified in the Contract, and
- (d) A supporting report which includes:
 - (i) A general description of the methods which the Contractor intends to adopt for the execution of each major stage of the work, and
 - (ii) The approximate number of each class of Contractor's Personnel and of each type of Contractor's Equipment for each major stage.

The Contractor shall promptly give notice to the Employer of specific probable future events or circumstances, which may adversely affect or delay the execution of the work. In this event, or if the Employer gives notice to the Contractor that if a programme fails (to the extent stated) to comply with the Contract or to be consistent with actual progress and the Contractor's stated intentions, the Contractor shall submit a revised work programme to the Employer in accordance with this Sub-Clause.

119.2 Rate of Progress:

If, at any time:

- (a) Actual progress is too slow to complete within the Time for Completion, and/or
- (b) Progress has fallen (or will fall) behind the current programme under **Clause 29** [Programme],

Then the Employer may instruct the Contractor to submit, under **Clause 29** [Programme], a revised programme and supporting report describing the revised methods which the Contractor proposes to adopt in order to expedite progress and complete within the Time for Completion of the milestone and the work.

Unless the Employer notifies 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 Goods, at the risk and cost of the Contractor.

120.0 Charge of Site

From the commencement of the work to the completion of the same, sites are to be under the contractor (s) charge. The Contractor(s) is / are to be held responsible for and to make good all injuries, damages and repair occasioned or rendered necessary to the same by fire or other causes and they are to hold the employer harmless from any claims for injuries to persons or for structural employer harmless from any claims for injuries to persons or for structural damage to property happening from any neglect, default, want of proper care or misconduct on the part of the contractors(s) or of any one in his/their employees during the execution of the work.

121.0 Changes in Drawing

If at any time before or after the commencement of the work the employer shall for any reason whatsoever.

- a) Cause alterations, omissions or variation a in the drawings and specification involving any curtailment of the work as originally contemplated or

- b) Not required the whole of work as specified in the Bid to be carried out, the contractor(s) shall have no claim to any payment or compensation whatsoever on account of any profit or advantage which he/they might have derived from the execution of the work in full as specified in the Bid but which he/they did not derive in consequence of the curtailment of the work by reason of alterations, omissions or variations or in consequence of the full amount of the work not having been carried out.

122.0 “Force Majeure”

Contractor shall not be considered in default if delay in completion of work occurs due to cause beyond its control such as acts of God, Natural Calamities, Civil Wars, Epidemic/ Pandemic, fire, strike, floods and riots. The Contractor shall notify OHPC in writing with supporting documents within ten days from the date of such occurrence and shall be decided after mutual discussion and agreement amongst OHPC and Contractor within 30 days of such notice.

In the event of delay due to such causes, the completion schedule will be extended for a length of time equal to the period of force majeure.

If either party is prevented from or delayed in performing any of his obligations under the Contract by any circumstances of Force Majeure, then he shall notify the other party thereof within seven days, and specify how these circumstances are detrimental in the performance of the Contract.

If the performance of the operation is substantially disrupted for a continuous period of three months by virtue of any event of Force Majeure, then either party may by written notice to the other terminate the Contract.

-sd-
C&P Head

SECTION-V

**SPECIAL CONDITIONS OF
CONTRACT**

Section-V

Special Conditions of Contract

1. GENERAL

The data and information given in the Contract Document are based on the preliminary survey taken up by the Owner/Employer. The Contractor shall therefore, satisfy himself about the adequacy and accuracy of the said data/information and interpretation thereof and collect fresh data/additional data/information and carry out/conduct further investigations and studies if necessary. The Employer shall not be responsible for the accuracy/adequacy of the data/information and interpretation thereof by the Contractor. The contractor shall receive all the available data/information from the department on his written request.

2. SUFFICIENCY OF BID

- 2.1** The Contractor shall be deemed to have visited and carefully examined the Project site and its surrounding to have satisfied himself to the nature and conditions of the means of transport and communications, whether by land or air, as available at present and as to possible interruptions thereto including the access and regress conditions for the Site. The Contractor is also deemed to have made enquiries, examined and satisfied himself as to the sites source for obtaining sand, stones, bricks and other materials, the sites for disposal of surplus materials and accommodation for depots, colonies, workshops and other infrastructure facilities as may be necessary for executing and completing the Works, as also the sub-soil water and variations thereof, storms, prevailing winds, climatic conditions and all other similar matters affecting the works including law & order.
- 2.2** Any neglect or omission or failure on the part of the Contractor in obtaining necessary and reliable information upon the foregoing or any other matter affecting the Contract shall not relieve him from any risks or liabilities or the entire responsibility for the completion of the works in accordance with the Contract.
- 2.3** No verbal agreement or inference from conversation with any officer or employee of the Employer either before or after the signing of the Contract shall in any way affect or modify any of the terms or obligations herein contained. The Contractor shall also be deemed to have inspected and examined the Site and to have satisfied himself, before submitting his Bid, as to the form and nature thereof including the sub-surface conditions and other local conditions, the hydrological, geological and climatic conditions, the extent and nature of work and materials necessary for the completion of the work, the means of access to the Site and the land for accommodation etc. he may require and in general, shall be deemed to have obtained all necessary information, as to risks, contingencies and all other circumstances which may influence or affect his Bid.

3. MAJOR PROJECT COMPONENTS AND PROJECT BASIC PARAMETERS

3.1 The major components as proposed by the Employer along with the basic project design parameters fixed by the Employer is indicated in the clause 3 & 4, Information to Bidder, Section II.

3.2 Basic Main Parameters

Basic Parameters pertaining to the work are given in the clause 3, Information to Bidder, Section II. provided are fixed parameters and cannot be changed by the bidder. Other parameters are tentative and the bidder is to assess the correctness of the data and adequacy of the data. All additional survey, investigation and testing data and any other data relevant to design shall be collected by the Contractor without any financial burden to the Employer.

4. SCOPE OF WORK

4.1 General

4.1.1. The major components of the work to be executed by the contractor under this contract shall be as described section - wise as follows. Execution of all these works shall include all construction plant / equipment and materials indigenous or imported, survey, investigation, survey equipment, studies and all services and facilities required for completion of the work.

4.1.2. Any requirements of work whether requested by the Employer or otherwise and whether specifically described in the Contract or not but are necessary or required for the proper completion and functioning of the Works in accordance with the Contract including remedying of any gaps and deficiencies in the Works shall not be deemed to be considered as any change in the Scope of Work and shall not entitle the contractor for any extra payment, subject to specific exclusions stipulated under clause no 97.0 of tender document..

4.2 Survey and Detailed Investigation

4.2.1. The scope of work under this section covers surveys and investigation requirement for detailed planning of the work covering foundation exploration work, survey for structures, their longitudinal sections and cross section, etc. for design engineering of the Civil works related to Power Channel Lining, Hydro-Mechanical Work, roads, drains, STP, approach roads, drains, dewatering, Cofferdams etc.

Repair & Maintenance of a watchman and operator shed near the Hydro-Mechanical works of Head Regulator and surplus escape like gates including Hoist and Hoist Bridge, Power system connectivity, allied machineries and facilities for gate operations and lighting of the bridge, hoist bridge and commissioning of the project. The Contractor shall carryout surveys and detailed investigation required for the whole systems under this Contract as per the I.S. Codes, IRC codes, Manuals, Standards, Guidelines, Circulars of the Department issued from time to time. This shall not entitle the contractor to additional cost whatsoever other

than the contract price. Survey is to be carried as far as possible by the Total Station instrument.

4.2.2 Design and Engineering

The present proposal is based on Owner's **DPR**. The contractor is free to change the concept and designs, keeping intact the basic purpose of providing the design discharge in the Power Channel. The Contractor shall submit design of channel sections, Lining, gates and hoists with Hoist Bridge etc. which shall be always in conformity with the basic parameters and in accordance with the Nationally/Internationally accepted practice and for the optimal performance of the works as warranted under the Contract. This shall not entitle the Contractor to additional cost, whatsoever, other than the contract price. The number of copies of the Reports and other Documents to be submitted to the Engineer-in-Charge by the contractor is also specified in Contract Document.

4.3 Civil Works

The scope of work under this section covers provision of all labour, plant and materials for execution of all civil works, complete in all respect, as described in conditions of contract and Technical Specifications of Bid Documents including incidentals and all necessary works not shown or specified but reasonably implied or necessary for the proper completion and functioning of the works in accordance with the contract including any amendments thereof.

4.4 HYDRO MECHANICAL WORKS

The scope of work under this section detailed in Appendix- HM includes provision of all labour, plant and materials for supply and execution of Hydro-mechanical works complete in all respect, as per Technical Specifications of Bid Documents including incidentals and all necessary works not shown or specified but reasonably implied or necessary for the proper completion and functioning of the works in accordance with the contract including any amendments thereof.

5. TESTS AND QUALITY CONTROL

5.1 The Contractor shall be required to carry out all tests in accordance with relevant Clauses of the Conditions of contracts and the Technical Specifications and as per I.S. Codes, IRC codes and Manuals.

Employer's authorized representative and/or an outside inspection agency acting on behalf of the Employer shall have access to the site and shall have the power to inspect and examine all works, the materials and workmanship of the project works, during execution. The Contractor shall provide necessary labours, tools, scaffolding or any other assistance as desired by the Employer's authorized representative without any extra payment. Necessary test results should be submitted to the Client prior to laying at site. The agency has to make arrangements from time to time for inspection of testing of materials at work site.

- 5.2.1** Where the field quality assurance plan provided for witnessing tests/inspection on behalf of the Engineer, the Contractor shall give the Engineer-in-Charge adequate written notice of any inspections/tests.
- 5.2.2** Where the Engineer or his Representative attends the tests as provided in clause 5.2.1 above, and has any objection to any works or workmanship which in his opinion is not in accordance with the Contract he shall advise the Contractor of his objection during tests/inspections. The Contractor shall give due consideration to such objections and shall make modifications that may be necessary to meet the said objective. The inspection/tests by Engineer/ Engineer's Representative/Agency and/or his countersigning inspection/test certificate(s) thereon shall in no way limit the liabilities and responsibilities, of the Contractor as stipulated in the Contract. The Contractor shall maintain and record all measurements and test results and submit the same to the Employer after completion of such inspection/tests.

6. MEASUREMENTS AND PAYMENTS

- 6.1** The Contractor is entitled for interim payment under various sections of the work in accordance with Clause 41 of the General Conditions of Contract. Measurement / verification for interim payment certificate of various items, under various sections of the works, shall be made jointly by the Engineer-in-Charge or his Subordinate Staff and the Contractor or his authorized representative for verifying the claims of the Contractor's interim payment/running bills.
- 6.2** All items having a financial value shall be measured in the manner as prescribed in specification by the contractor and verified by the Engineer-in-Charge so that a complete record is maintained of all work performed under the Contract.
- 6.3** Measurement shall be signed and dated by both parties on the site. If there is any dispute in any of the measurements a note to the effect shall be made in the measurement record against the disputed items and such note shall be signed and dated by both parties engaged in taking the measurements and the Parties shall discuss and resolve the same in accordance with relevant clauses of the contract.

7. SUPPLY OF GATES & ELECTRO-MECHANICAL MACHINERY

- 7.1** Supply at Site of the Gates and connected Electro Mechanical Plant & Machineries, embedded parts and spares etc., shall be made available two months in advance of the scheduled dates of Installation/erection matching with the progress and availability of Civil works to take care of any eventualities of hold ups/delays during transit.
- 7.2** If for any reason, any parts of the work of the Project are delayed, then the total programme may be re-scheduled by mutual agreement between the Engineer-in-Charge and the Contractor, if necessary, keeping the overall completion schedule of the project unaltered. No extra cost whatsoever, on account of such re-scheduling shall be payable to the contractor.
- 7.3** Dismantled gate items to be transported to HHEP, Burla stores by the contractor.

8. SUPPLEMENTARY REQUIREMENTS

8.1 General

The following parts of this Section shall be read in conjunction with the *Section IV* Conditions of Contract, and *Section V: Special Condition of Contract*. The following Clauses shall supplement the provisions of the corresponding clauses of Section IV and V and whenever there is a conflict, the provisions herein shall prevail over those in Section-IV.

8.2 Drawings and Designs:

The Contractor has to get the drawings and designs approved from DoWR, Govt. of Odisha with necessary liaison, compliance & follow up. The OHPC shall extend necessary support for approval of the design and drawings from DoWR, Govt. of Odisha. The designs, drawings of lining, Retaining Wall, Gates, HM&EM works, road, drain, Cofferdams, Dewatering process etc. shall be furnished to the Engineer-in-Charge for approval. All soft copies and software used for computation shall be made available to the Engineer-in-Charge after vetting of the designs, drawings by the competent authority. The documents and drawings shall be in sufficient detail for review. The scale of the drawing has to be chosen in coordination with the Engineer-in-Charge. The drawings shall be of standardized sizes and as instructed by the Engineer-in-Charge. The drawings shall contain the following basic information in the name plate:

- a) Project name
- b) Name and number of the Contract
- c) Contractor's name
- d) Number and title of the drawing
- e) Date and scale
- f) Draftsman's name and signature
- g) Name of the designer responsible and signature
- h) Revision Number (R0 for drawing submitted initially and R1, R2, etc., for Drawings submitted subsequently).
- i) Name and designation of checking official and space for signature.
- j) Approving authorities name and designation as specified by the Engineer-in-Charge and space for the signature.

A blank space 90mm x 50 mm shall be provided immediately above the title block for the approval stamp. If required by the Approving Authority, the detailed design and the

execution drawings shall be submitted by the contractor to the Approving Authority only after verification by the Consultant(s) notified by the Engineer-in-Charge.

The Contractor shall be responsible for preparation of working drawings and the construction documents for works, as specified in the Contract. Drawings given are indicative, but will form part of the contract.

The contractor shall carry out alignment studies including cost economics by examining all possible alternatives to prepare detailed layout, designs and drawings of all components of the work stated in scope of work. The contractor shall use guidelines in the relevant IS codes, IRC publications and circulars issued by the department from time to time for various components of the work.

All the studies of the work, layout drawings and modifications if required to be prepared for taking up execution of the work, shall be prepared by the contractor and shall be got approved from the competent authority. The contractor will have to submit detailed drawings of each component with appropriate scales, measurements, Reduced Levels, full dimensions, index map locations of components such as go down, burrow area, dumping area, internal roads, etc., The contractor is expected to organize his work to the best of his knowledge so that final draft of various types of designs and layouts will be submitted to competent authority within stipulated time period.

All the studies layouts, drawings, design notes, which have been submitted to the department, shall become the absolute property of department under the copy right act and the contractor shall not use the same in whole or part thereof elsewhere for any purpose without explicit written permission from the department. In all difference of opinion on technical matters between the contractor and the Engineer-in-Charge, the decision given by the Director (Operation), OHPC shall be final and binding on the contractor.

8.3 Contractor's Work Programme

8.3.1 Within 15 (fifteen) days from the Date of signing of agreement/contract, the Contractor shall submit the Employer a work programme showing the sequence in which he proposes to carry out various components for completing the works as per the Master Control Network within the stipulated date of completion. The Master Control Network shall indicate the sequence of various activities and highlight the critical activities including delivery of equipment. Such work programme shall be subject to review and revision by the Employer/Engineer-in-charge in consultation with the Contractor from time to time in order to achieve completion of the work within the stipulated date of completion. The contractor shall also use computer aided project management software to generate Bar Chart based on network technique.

8.3.2 The contractor shall also submit to the Employer/Engineer-in-charge the information on detailed methodology of carrying out investigation survey, design engineering, detailed construction methodology along with schedule for deployment of plant & machineries, which shall successively be adjusted in order to meet the actual requirement to complete the work within the stipulated date of completion along with the work programme.

8.3.3 All the survey & investigation, planning, designs, approval processes, procurement and construction work of the project shall be taken up simultaneously; so that the work can be completed within time for completion.

8.4 Action when the progress of any crucial item of work is unsatisfactory : If the progress of a crucial item of work, which is important for timely completion of work is unsatisfactory, the Engineer-in-Charge shall, notwithstanding that the general progress of work is satisfactory, in accordance with relevant clause, be entitled to take action under this clause after giving the contractor 15 days notice in writing and the contractor will have no claim for compensation for any loss sustained owing to such action.

8.5 Programme – Scheduling / Re-Scheduling

8.5.1 The works shall be executed and performed in accordance with the Master Control Network (Work Programme) which shall clearly indicate the interlinking / interdependencies of all the works of the Contract including relative activities of Civil works and Electro-Mechanical works and the Power Connectivity for the project. The Programme shall be reviewed jointly by the Employer/ EIC and the Contractor, at least once in a month wherein the hold ups/delays, if any, in the progress of work, with reference to the agreed Schedule shall be given Special Attention. Necessary modifications (updating / Revisions) of the Programme, within the overall Time for Completion, shall be carried out by mutual agreement between the Employer/ EIC and the Contractor.

8.5.2 If for any reason, any parts of the work of the Project are delayed, then the total programme may be re-scheduled by mutual agreement between the Engineer-in-Charge and the Contractor, if necessary, keeping the overall completion schedule of the project unaltered. No extra cost whatsoever, on account of such re-scheduling shall be payable to the contractor.

8.5.3 Progress Report

The Contractor shall submit to the EIC the monthly progress report by 5th. day of following months in such form and details as prescribed by Engineer-in-Charge.

8.6 Inspection and tests

Except as otherwise provided, all materials and workmanship, If not otherwise designated by the specifications shall be subject to inspection, examination and test by the Engineer-in-Charge at any and all times during manufacture and/or construction and at any/all places where such manufacture or construction are carried on. The Engineer- in-Charge shall have the right to reject defective material and workmanship or require its corrections. Rejected workmanship shall be satisfactorily replaced with proper material without charge thereof and the contractor shall properly segregate and remove the rejected material from the premises, if the contractor fails to proceed at once with the replacement of the rejected material and / or the construction of defective workmanship, the Engineer-in-Charge may replace such material and / or correct such workmanship and charge the cost thereof to the contractor.

The Contractor shall be liable for replacement of all defective equipment/ machineries/ works during the contract period including extended time and Operation and Maintenance period.

The contractor shall furnish promptly without additional charge, all facilities, labour and material necessary for the safe and convenient inspection and tests that may be required by the Engineer-in-Charge.

All inspections and tests by the department shall be performed in such a manner as not to unnecessarily delay the work.

8.7 Damage to Works

The works, whether fully completed or incomplete in any project site, all the materials, machineries, plants, tools, buildings and other things connected there with, shall remain at the risk and in the sole charge of the contractor until whole of the completed work scheme wise under the Contract has been handed over to the Engineer-in-Charge. Until such delivery of the entire completed work, the contractor shall at his own cost take all precautions reasonably to keep all the aforesaid works, materials, machines, plants, temporary buildings and other things connected there with free from any loss or damage and in the event of the same or any part thereof being lost or damaged, he shall forth with reinstate and make good such loss or damage at his own cost. The complete work shall be insured against all possible risks.

8.8 Examination and tests on Completion

On the completion of the work the Engineer-in-Charge shall make such examination and tests of the work as may then seem to him possible, necessary or desirable, and the contractor shall furnish free of cost any materials, equipments and labour which may be necessary thereof, and shall facilitate in every way all operations required by the Engineer-in-Charge, in making examination and tests within one calendar month from receipt of the written notice from the examiner.

8.9 Trial run of gate operations

On the completion or part completion of the work, the fitted gates in the barrage and sluices shall be subjected to trial run for 24 hours up-to 30 days or as decided by Engineer-in-Charge to locate any defect and excessive leakage, if any. The trial run shall not be deemed as commissioning of the project.

8.10 Haul Roads

The Contractor shall have to make the work sites accessible to the departmental officers for inspection by way of constructing/maintaining all weather roads/approaches, the cost of which shall be borne by the Contractor.

8.11 Layout and construction of road

The construction of approach road to site is within the scope of work. The Contractor shall

have to submit detailed plan to the Engineer-in-Charge showing the layout of the work site and approach roads proposed by him, before he starts the actual work. Such a road layout plan will be scrutinized by the Engineer-in-Charge and any modifications suggested by him shall be binding on the contractor. However the contractor may choose to have a separate haul road for transportation of materials and machineries without any additional cost to employer. If it is decided by the Engineer-in-Charge to have some of the roads proposed by the Contractor as common road for common use of department and other contractors or convenient and for compact and planned layout of work site, the Contractor will be bound to construct them and allow them to be used simultaneously by other Contractors and departments. In case of disputes, the decision of the Engineer-in-Charge shall be final and the binding on the Contractor.

9. REGULATIONS AND BYE-LAWS

The contractor shall conform to the regulations, bye-laws, any other statutory rules made by any local Authorities or by the Government and shall protect and indemnify OHPC against any claim or liability arising from or based on the violation of any such laws, ordinance, regulations, orders, decrees, etc.,

10. PASSING OF FOUNDATION, CENTERING, REINFORCEMENT ETC.

After the completion of the work of excavation, the same will be checked and passed by the competent authority. No masonry or concrete or back filling shall be laid unless the foundations are so passed. No concreting shall commence, unless the centering and the reinforcement is checked and passed by the Engineer-in-charge.

11. SIGNING FIELD BOOKS, LONGITUDINAL SECTIONS, CROSS- SECTIONS AND MEASUREMENT BOOKS

Before starting the work, and at the end before the work is covered, levels for plotting the longitudinal sections (along the axis as decided by Engineer-in-Charge or his authorized representative) and cross section of the portion of the work shall be taken by authorized Engineer of the contractor in the presence of the Engineer-in-Charge or his authorized representative and the same shall have to be got attested from the Engineer- in-Charge or his authorized representative in token of acceptance.

If the contractor fails to take measurements and sign them, then the measurements recorded by the Engineer-in-charge, or his authorized representative in the authorized books shall be final and binding on the contractor. For this purpose, suitable date or dates shall be fixed by the Engineer-in-Charge and intimated to the contractor. If the contractor, or his duly – authorized agent fails to attend on the appointed date or dates, the levels and measurements shall be taken in his absence and such levels and measurements and longitudinal sections and cross sections based there on shall be final and binding on the Contractor. The levels will be taken on such alignments and cross sections as will be useful for reference permanently. The point of the locations for the levels will depend upon the roughness of the area and will also be at least in conformity with the requirement of specifications for “Excavation” as far as possible.

Similar procedure for record of measurements shall hold good for all other items and activities involved in execution of the work. All the levels/measurements shall be recorded by the Engineer-in-Charge or his authorized representatives in the authorized level / measurement books.

12. QUALITY CONTROL

The contractor shall produce results of quality control tests carried out on the works by his staff and the quality audit conducted by the department or by Engineer's Representative on these works. If the test result does not fulfil the stipulated criteria laid down in specifications the payment will be limited as per the provisions in the specification(s) and if number of results fail beyond the limit of acceptance, then the contractor shall not be paid unless he rectified all such imperfect work(s). The decision of the Engineer-in-Charge in respect of the matters pertaining to the quality control shall be final and binding on the Contractor.

13. CLEANING UP

- a) The Contractor shall at all time keep the construction areas and his colony and storage free from accumulation of waste or rejected materials.
- b) Prior to the completion of the work, the Contractor shall remove all rubbish from and around the premises and all tools, scaffolding equipment and material which are not part of permanent structures executed or otherwise asked for or as provided under any other Clauses of this contract. The premises will be left in a manner fully satisfactory to the Engineer-in-Charge.

14. COMMUNICATIONS AND NOTICES BY CONTRACTORS:

All communication and or notices pertaining to works and concerning matters, such as passing and approving of foundation, reinforcement, and from work, measurements, mark outs, etc. shall be addressed by the Contractor to the Director (Operation), OHPC Ltd. with a copy to the concerned EIC. The official language shall be English. All such notices communications, etc. shall be addressed in good time so as not to hold up the work. The contractor shall specify the name with designation of the authorised person to be deployed on behalf of the contractor with whom all the communications shall be made by OHPC.

15. COMPENSATION FOR DELAY BY EMPLOYER IN APPROVAL OF DESIGN DRAWING

The contractor shall not be entitled to claim any compensation from Employer for the loss suffered by him on account of delay by department in approval of alignment, designs & drawings. However, this may be considered for grant of time extension provided that critical path gets affected i.e. the main activity as per critical path gets delayed.

16. WORKS TO BE EXECUTED IN ACCORDANCE WITH SPECIFICATIONS, DRAWINGS, AND ORDERS ETC.

The Contractor shall execute the whole and every part of the work in the most substantial and workmen like manner and both as regards materials and otherwise in every respect in strict accordance with specifications. The Contractor shall also confirm exactly, fully and faithfully to the designs, drawings and instructions in writing relating to the work signed by the Engineer or Engineer-in-Charge and lodged in his office, and to which the contractor shall be entitled to have access at such office or on the site of the work for the purpose of inspection during office hours, and the contractor shall, if he so requires, be entitled at his own expense to make or cause to be made copies of specifications and of all such designs, drawings and instructions as aforesaid.

17. ALTERATIONS IN SPECIFICATIONS AND DESIGNS.

Engineer-in-Charge / any Engineers of OHPC authorised by the Director (Operation), OHPC connected with work shall have power to make any alterations in, or omissions from, addition to, or substitutions for the original specifications and approved drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work and the contractor shall be bound to carry out the work in accordance with any such instruction which may be given to him in writing signed by the Director (Operation), OHPC or Engineer-in-Charge and such alterations omissions, additions or substitutions shall not invalidate the contract and any altered, additional or substituted work, which the contractor may be directed to do in the manner above specified as part of the work, shall be carried out by the contractor on the same conditions, in all respects on which he agreed to do the main work and at the same contract cost.

18. TIME LIMIT FOR UNFORESEEN CLAIMS

Under no circumstances whatsoever, the Contractor shall be entitled to any compensation from OHPC on any account other than as admissible as per the terms of the contract.

19. RECOVERY OF DUES FROM THE CONTRACTOR

Whenever any claim, against the Contractor for the payment of a sum of money arises out of or under the Contract. OHPC shall be entitled to recover such sum by appropriating, in part or whole, the Security deposit and performance security deposit of the Contractor and the bills payable to the contractor. In the event of the security being insufficient or if no security has been taken from the Contractor, then the balance or the total sum recoverable, as the case may be, shall be deducted from any sum then due or which at any time thereafter may become due to the Contractor under this or any other contract with OHPC. Should this sum be not sufficient to cover the full amount recoverable from the Contractor then it shall be recovered from him as arrears of land revenue of Govt.

20. WORKS TO BE OPENED FOR INSPECTION

All works, under or in course of execution or executed in pursuance of the contract shall at all times be open to the inspection and supervision of the Engineer-in-Charge and his subordinates and the contractor shall at all times during the usual working hours and at all other times at which reasonable notice of the intention of Engineer-in-Charge or his subordinate to visit the work shall have been given to the contractor, either he himself be present to receive orders and instructions, or have an authorized responsible agent duly accredited in writing, present for that purpose. Orders given to the contractor's agent shall be considered to have the same force as if they had been given to the contractor himself.

21. NOTICE TO BE GIVEN BEFORE WORK IS COVERED UP

The contractor shall give not less than 15(fifteen) days notice in writing to the Engineer-in-Charge of the work, before covering up or otherwise placing beyond the reach of measurement any work in order that the same may be verified/checked and correct dimensions thereof be taken before the same is so covered up or placed beyond the reach of verification/checking of any work without the consent in writing of the Engineer-in-Charge of the work, and if any work shall be covered up or placed beyond the reach of verification/checking without such notice having been given or consent obtained, the same shall be uncovered at the contractor's expense or in default thereof, no payment or allowance shall be made for such work or materials with which the same was executed.

22. CONTRACTOR TO SUPPLY PLANT, LADDERS, SCAFFOLDING ETC.

The contractor shall supply at his own cost materials, plant, tools appliances, implements, tackle, scaffolding and temporary works requisite for the proper execution of the work, whether original, altered or substituted and whether included in the specifications or other documents forming part of the contract or referred to in these conditions or not, or which may be necessary for the purpose of satisfying or complying with the requirements of the Engineer-in-Charge as to any matter as to which under these conditions he is entitled to be satisfied, or which he is entitled to require together with carriage to and from the work. The contractor shall also supply without charge the requisite number of persons with the means and materials necessary for the purpose of setting out works and counting, weighing & assisting in the checking measurement or examinations at any time and from time to time of the work or materials. Failing his so doing, the same may be provided by the Engineer-in-Charge at the expense of the contractor and the expenses may be deducted from any money due to the contractor under the contract, or from his security deposit or the proceeds of sale thereof, or of a sufficient portion thereof. Contractor is liable for damages arising from non-provisions of lights, fencing etc., The contractor shall also provide at his own cost, except when the contract specifically provided other wise and except, for payment due, all necessary fencing and lights required to protect the public from accidents, and shall be bound to bear the expenses or defense of every suit, action or other proceedings of law that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and costs which may be awarded in any such suit, action or proceedings, to any such persons or which may be paid to compromise any claim by any such person.

23. AUDIT AND TECHNICAL EXAMINATIONS:

OHPC shall have the right to cause any audit and technical examination of the works and the running and final bills of the Contractor including all supporting vouchers, abstracts etc to be made after payment of the running and final bill and if as a result of such audit and technical examinations any sum is found to have been overpaid in respect of any work done by the contractor under the contract or any work claimed by him to have been done by him under the contract and found not to have been executed, the contractor shall be liable to refund the amount of overpayment and it shall be lawful for OHPC to recover the same from him in the manner prescribed in clause "Recovery of dues from contractor" and if it is found that the contractor was paid less than what was due to him under the contract in respect of any work executed by him under it, the amount of such under payment shall be duly paid by OHPC to the contractor.

24. PERMISSION FOR CROSSING RAILWAY, NH/ SH/ ROADS

Some component of works may interfere Railway, State Highway, Other Roads, other pipelines etc., and as such necessary letter to grant the permission for crossing those premises shall be issued by the respective authorities of the OHPC. The contractor will have to process, follow-up and obtain timely clearance from the concerned authorities. **Statutory costs of those crossings will be paid by the OHPC or will be reimbursed to the contractor if paid by him on production of receipt.**

25. USE OF SITE

- a) All land required for use of Contractor facility shall be arranged by the Contractor and no claim on this account shall be entertained.
- b) All areas of operation including those of his staff and labour colonies in case handed over to the contractor shall be cleared and handed over back in good condition to the Engineer-in-Charge except the areas under works constructed. The Contractor shall make good to the satisfaction of the Engineer-in-Charge any damage or alterations made to areas, which he has to hand over back or to other property or land handed over to him for the purpose of this work.
- c) The lands shall as herein before mentioned be handed over back to the Engineer-in-charge immediately after completion of the work under this contract or the termination of the contract whichever is earlier. Also, no land shall be held by the Contractor longer than the Engineer-in- Charge shall deem necessary and the Contractor shall on due notice by the Engineer-in-Charge vacate and returned the land which the Engineer- in-Charge may certify as no longer required by the Contractor for the purpose of the works. In case the lands are not handed over back to the department within the time limit specified above, penal rent as may be decided by the Engineer-in-Charge will be recovered from the contractor.
- d) The vegetation and forest are noticeable in project area. The Contractor should

take utmost care for the preservation of this vegetation and forest. Any damage in this vegetation and forest will have to be compensated by the Contractor and decision of Engineer-in-Charge will be final and binding on Contractor.

26. AVAILABILITY OF POWER

The availability of Power is indicated in the Clause no 12 section IV. The contractor is advised to study the provision.

27. OTHER SPECIAL CONDITIONS

The contractor shall review all the information / data available with OHPC and assess the scope of surveys, investigation etc., that are to be carried out to fulfil the obligations under the contract.

- 27.1** The contractors shall take this into consideration while quoting for the bid. No claims whatsoever on this issue will be entertained during execution.
- 27.2** Wherever any component of work of a scheme is crossing Railway line, the contractor has to prepare necessary proposals for seeking permissions of Railway authorities. The Engineer-in- Charge will process such proposals to the Railway authorities concerned for taking up the work by them as a deposit work duly paying the amount demanded by the railway authorities by the Dept and shall be recovered from the next running bill of the Contractor. The Contractor shall include such cost in the bid price.
- 27.3** In order to check the accuracy of the investigation work, the equipment, labour, required transport and other materials etc., at site of work have to be supplied to the Engineer's Representative without extra cost.
- 27.4** No extra payment will be made to the bidder if there is any change in type of structure, specifications, variation in quantities as per actual site conditions.
- 27.5** Display Boards should be displayed of size 2.00m x1.50m, wherever necessary or by engraving on the structure with enamel painting. Boards / direction boards should also be displayed to facilitate for inspection both at investigation and execution stages.
- 27.6** During soil exploration by drilling boreholes for foundations, the contractor shall take required number of Un-disturbed Samples and normal samples and obtain soil classification, soil properties and bearing capacity by getting them tested in the soil testing laboratories of Government Labs/Engineering Colleges or other reputed institutes. The contractor shall provide certain U.D. Samples and normal samples to the Engineer-in-Charge also so as to get them tested parallel at any other lab to be selected by the Engineer-in- Charge, if required. The cost of such testing shall be borne by the Contractor.
- 27.7** The Contractor shall furnish draft reports on design Engineering, drawings, in six copies and soft copy in CD for obtaining the approval of the competent authority. After approval, the contractor shall furnish 11 copies of booklets and 1 soft copy in CD for record of the department at his cost and no separate payment will be made towards this.
- 27.8** Catch drains and drainage vents are to be provided wherever necessary to facilitatedrainage along and across the approach roads of the Barrage at no extra cost.
- 27.9** All the crossings of State Highways, District Roads, Village roads and all other roads/ shall be negotiated as per standards of the respective departments and as per the permissions granted by them. The approaches to these shall be provided as per the standard of their respective departments. The cost of these shall be deemed to have been included in the contract price quoted.
- 27.10** If the proposed work is interfering with any existing irrigation canals or channels, supply channels or Sources / Streams to Minor Irrigation tanks, roads, suitable structures are to

- be provided within the quoted contract price by the contractor.
- 27.11** If the work is interfering oil pipe lines, gas pipe lines, water supply pipeline, or any other pipe lines, the contractor shall provide suitable crossing in consultation with the authorities concerned after obtaining the approval either by himself or getting them executed by the concerned authorities as a deposit work duly depositing the requisite amount to them. The Engineer-in-Charge will help in processing the proposals to the authorities concerned to obtain their permission. The cost of such crossings shall be deemed to be included in the contract price.
- 27.12** Diversion of streams that are interfering with the system into nearby stream(s) is not permitted in general. However, in exceptional cases, the Engineer-in-Charge may consider such proposals depending upon their feasibility, if the distance between them is not much (i.e., less than 200 m) and also if such diversion will not affect the riparian rights of existing or contemplated sources on D/s side.
- 27.13** The contractor has to make his own arrangement for diversion of flow and dewatering of foundation etc. wherever necessary within the quoted contract price.
- 27.14** The concrete mixes to be adopted for all the structures shall be design mixes only and these design mixes shall be conducted in the department / reputed laboratories and got approved by the Engineer-in-Charge before adoption.
- 27.15** In case of crossing works, drainage works, the contractor shall excavate necessary approach/ Tail channels to these structures to have smooth drainage through the structure. The cost of excavation of such channels shall be borne by the Contractor within quoted contract price. The cost of Land Acquisition in favour of OHPC if any for such channels will be borne by the department/OHPC.
- 28. MODERN TECHNOLOGY**

The Contractor should adopt the latest/modern methodologies and State of Art Techniques in the investigation, planning, design, construction of the project.

29.0. Execution Period

The lining works are to be executed in the closure/shutdown period of HHEP/CHEP during the May/June & November/December of each year.

The probable shutdown period will be 45 days (approx.) in May/June and November/December each other works e.g. roads, drains, protection works, HM & EM works, STP etc. can be taken up as per the schedule and convenience.

The total works shall be completed within the stipulated completion period including the six shutdown periods as aforesaid. The contractor has to approach and execute the work in multiple fronts, and sections & reaches for timely completion of the work.

SECTION – VI

APPENDICES

APPENDIX-S&I**SURVEYS AND INVESTIGATION****SCOPE OF SERVICES**

The Contractor's Scope of Services for Survey & Investigation shall include the following activities for the work

1.0 Review and Assessment of Data Requirement:

- 1.1** Review of available Data of the work and identification of Detailed survey, investigation and foundation exploration requirement considered necessary for the design of lining, retaining walls, roads, drains, the design of lining, retaining walls, roads, drains, HM & EM works, STP, Cofferdams, dewatering process and other works. The work will be basically following the DPR.
- 1.2** Review of technical and design parameters for the structures.
- 1.3** Preparation of work programme for carrying out investigations and studies for the information of the Engineer-in-Charge.
- 1.4** The contractor shall submit a review report after carrying out the above activities for acceptance of the Engineer-in-Charge.

APPENDIX - D&E

DESIGN AND ENGINEERING

SCOPE OF SERVICES

The Contractor's Scope of Services for Design and Engineering shall include the following activities for the work.

1. Detailed Design

- 1.1. Review of technical and design parameters for all components of the work including HM, Electro-mechanical works and Electrical system connectivity work.
- 1.2. Detailed design shall be taken up as per Technical Specification, relevant IS Code, IRC Code, manuals etc, for all the Civil works i.e., Power channel lining retaining walls roads, drains Mechanical works like gates and stop logs, including Hoist and hoist supporting structure, Power connectivity allied machineries and facilities for gate operations and lighting of the sites, approach road including drawings required for the execution .The design calculations performed along with the drawing shall be submitted to the Engineer-in-Charge for approval of Competent Authority.
- 1.3. Processing for approval/ vetting of Design & Drawing from DoWR, Govt of Odisha.
- 1.4. Taking up the additional designs and modifications, as needed, during construction.
- 1.5. The contractor shall adopt modern methodology/State of art Techniques in design of the components of the work.
- 1.6. The software and soft copies of designs shall be made available for checking of the Designs and it will be the Property of the Department.
- 1.7. Preparation of operation and maintenance Manuals.

2. Project Completion Report

- 2.1. Preparation of as-built drawings for the Civil as well as Electro Mechanical components of the work and a Detailed Project Completion Report.

3. Project Completion Report

- 3.1. Design liaison with Engineer and his representative, Consultant(s) of the Employer & DoWR, Govt of Odisha.
- 3.2. Preparation of Monthly Reports on the progress of the project work as a whole for information of the Engineer-in-Charge, in respect of:
 - a) Investigation & Surveys.
 - b) Design and engineering.
 - c) Civil Construction.
 - d) Electro-Mechanical components.
 - e) Quality Control arrangement.
 - f) Technical status (Present status and future programme)
 - g) Project status (Time Schedule, achievement of mile-stone, slippage in time schedule with specific reference to activities and acceleration measures proposed)
 - h) Financial status (Present status and future projection)

i) Deployment of Manpower, Labour, Expatriates staff and Construction Equipment
Furthermore, the Report shall include necessary photographs and sketches showing the previous month's progress.

5 Supply of Drawings, Report etc.

5.1 The Contractor shall furnish to the Engineer-in-Charge the following number of copies of drawings, reports and other technical documents:

Sl. No.	Particulars	Hard copies	Soft copies (CD)	Remarks
1.	Drawings for information	6 (six) sets	1 (One)	
2.	Drawings for approval	6 (six) sets	1 (One)	1 (One) One hard copy shall be returned to the Contractor with approval or comments.
3.	Approved drawings	1+ 10 sets	1 (One) copy in CD	
4.	As-built document	6 sets	1 in CD	Shall be submitted in accordance with relevant clause of Conditions of Contract
5.	Review Report/ Design Briefs/ Design Memo / Design Reports (Draft)	3 (Three) sets	1 (One) copy in CD	One hard copy shall be returned to the Contractor with approval or comments.
6.	Review Report/ Design Briefs/Design Memo/ Design Reports (Final)	1 + 10 sets	1 (One) copy in CD	
7.	Progress Reports (monthly)	6 (Six) sets		Also through e-mail to respective authority
8.	Final design computations	6 (six) sets	1 (One) copy in CD	
9.	Detailed Project Completion Report	10 (Ten) sets	1 (One) copy in CD	

5.2 Tentative list of design notes and drawings for the work to be submitted by the contractor (civil & Electro- Mechanical component)

Sl. No.	Design Note	Title of Drawing
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1	Layout Report	Schematic plan, cross section and L-section of the work showing all controlling levels and Arrangements
2	Lining	1. Detail Plan, cross section and L S details of road, drain, STP 2. Reinforcement details
3	Retaining wall & protection works.	Detail plan and sections of all components etc.
4	HM & EM works.	1. General arrangement drawing 2. 1st stage and 2nd stage Embedded parts details 3. Gate details 4. Details of Hoist 5. Details of Hoist supporting structures. 6. E M Detailing
5	Construction of Road, drain.	1. Layout plan of the road with drain 2. C.S of the road showing the details of sub-base and subgrade etc. 3. Cross drainage work details etc.

Note: 1. The list is indicative for design notes and drawing to be submitted by the Contractors. Exact details will be decided as per work requirements.

5.3 No separate payment shall be made for any of the design and engineering works indicated above and needed for the completion of the project and shall be deemed to be included in the quoted price.

APPENDIX – CW**CIVIL WORKS****SCOPE OF SERVICES**

1. Lining of Power channel with RCC with M25 grade concrete as per approved design.
2. Roller compacted concrete of canal beds
3. Construction of Bitumen Roads & CC drains.
4. Construction RCC Retaining walls & protection works.
5. Plantation & Beautification.
6. Sewage Treatment Plant.
7. Civil works related to rehabilitation of regulating structures
8. Rehabilitation of Trestle bridges and culverts..

APPENDIX- EM**Hydro Mechanical & Electro Mechanical Equipments****SCOPE OF SERVICES**

Mechanical works like gates in Regulating structures such as Surplus escape, Head Regulator and Cross regulator including 1st stage and 2nd stage Embedded parts, gate and stop logs, Hoist, Hoist supporting structure, Power connectivity from the nearest 11KV structure or 33/11KV substation, 11/0.43KV sub-station including the power cable/L. T line for gate operation and lighting of the bridge along with all machineries and facilities for gate operations and lighting of the sites.

The scope of work in this section includes, but not limited to the following:

1. Detail design of all components as per the relevant IS codes, OERC norms and manuals.
Detailing, supply and manufacture, inspection, shop assembly, testing, painting etc as per the approved drawing and specification of the respective components.
- 2 Delivery of fabricated components/equipment and transportation to site.
- 3 Site storage, transportation and handling, site erection, painting, testing and commissioning including provision of labour, plant, material etc. for the above.
- 4 Supply and installation of all incidentals not specified but are necessary for proper completion and satisfactory functioning of the system.
- 5 The Contractor shall supply the equipment, which will meet in all respects, the requirements of Employer in regard to performance, durability and satisfactory operation. All the equipment supplied shall conform to the relevant Indian Standards.

APPENDIX- BPP

LINING OF POWER CHANNEL PROJECT PROFILE

1.0 Introduction: OHPC Ltd. proposed to, “**Repair and Rehabilitation of Power channel from HHEP, Burla to CHEP, Chiplima, Sambalpur, Odisha**” to enhance flow velocity to increase power generation.

- 1.1** The main components of the work will be
- a) Canal Bed & slope lining
 - b) Hydro-mechanical works
 - c) Trestle Bridge, culverts etc.
 - d) Inspection Roads & Drains
 - e) Retaining Walls & protection works.
 - f) Beautification works
 - g) STP works

2.0 GENERAL DESCRIPTION OF THE WORK

The scope of work consists of Construction and de-mobilisation of Cofferdam during the closure period, Dewatering of Power Channel, Roller Compacted Concrete of M25 grade for Canal Bed lining from RD 0.00 ft to 16,000 ft and 76,000 ft to 83,480 ft. RCC lining for side slopes from RD 0.00 ft to 16,000 ft and 76,000 ft to 83,480 ft, Repair & rehabilitation of Hydro-mechanical parts of gates at Surplus Escape at RD 2070 ft, Head Regulator at RD 30,000 ft, Cross Regulator at RD 63,000 ft, Rehabilitation of Trestle Bridge, culverts etc., Rehabilitation of Inspection Roads & Drains Construction of Retaining Walls & protection works. Plantation & Beautification works, Provision of Sewage Treatment Plant of suitable capacity.

The details of work are given in Clause no. 3 and 4.

3.0 BRIEF DESCRIPTION & SCOPE OF WORK UNDER THIS TENDER:

The project is proposed to be implemented on Engineering, Procurement and Construction (EPC) & commissioning on Turnkey basis on single point responsibility basis. Detailed design has not been taken up. On the basis of approved DPR tentative salient features of the work have been arrived. The bidder shall be responsible for the designs, getting approval of the design, preparation of technical datasheet, Quality Assurance Programme, construction programme etc. for all components of the project, Construction, supply and erection and installation of all Civil, Mechanical & Electrical systems as per the work specifications provided in the bid documents, and commissioning of the project on turnkey basis.

SECTION – VII

**FINANCIAL BID
&
MILE STONES**

FINANCIAL BID

1.0 General

Details of the Financial Bid has been described under Section IV clause-40.

In case of any deviation/alterations/modifications of methodology leading to change in components or its quantity or incorporation of new items of work after approval of Detailed design and estimates, the competent authority shall have full powers to revise the percentage breakup of components keeping the contract price same as quoted by the bidder.

The work has been divided into two components as given in Appendix F. The bidder has to assign values to these components. Summation of these values for these two components as quoted by the contractor is to be considered for evaluation.

The percentage break up of each Component to Stages is given in Appendix F-1 to F- 2. The competent authority shall have powers to revise the percentage **breakup** of the stages within the components, if felt necessary, after approval of the design and drawing. The successful bidder may furnish further **breakup** of the stages into sub-components after signing of agreement, duly approved by the competent authority, keeping the percentages of stages intact, to facilitate payment. This break up to sub-components shall be finalized only after the finalization of design and approval of drawings. All payments shall be limited to the amount arrived on the basis of milestones as specified in Appendix F1 to F2.

2.0 Evaluation of Bid

Evaluation of Bid shall be carried out as per Clause 18 of Section II: Instruction to Bidder.

<u>The Tentative measure OF QUANTITY in the Scope of Work</u>			
Sl. No	Description	Quantity	Unit
A	<u>Repair and Rehabilitation of Power channel from RD 0.00 ft. to 16000.00 ft. of HHEP, Burla, Sambalpur, Odisha</u>		
	Cutting of trees & Weed Removal		
1	Cutting of trees, including cutting of trunks, branches and removal of stumps, roots, stacking of serviceable material with all lifts and up to a lead of 1000 metres as per the direction of Engineer In Charge.		
	300 mm to 600 mm	994.00	Each
	900 mm to 1800 mm	70.00	Each
2	Filling of earth uprooted tree by earth as per the direction of the Engineer-in-charge.	6384.00	cum
	Lined Canal Repair and rehabilitation		
3	Clearing and grubbing Side slope including uprooting wild vegetation, grass, bushes, shrubs, saplings and trees, removal of stumps of such trees cut earlier and disposal of unserviceable materials and stacking of serviceable material to be used or auctioned, upto a lead of 1000 m as per Engineer in charge	52098.00	m2
4	Excavation, loading, unloading and carriage by mechanical means of all kinds of soil, including Stoney earth, gravel and moorum etc interspread with boulders upto 1/2 cum size with all lifts and delifts including trimming of slopes and bed to design section and depositing the excavated materials away from work site as per the specification and as directed by the Engineer-in- charge within an initial lead of 6 km from the place of excavation complete	42593.40	m3
5	Surface Preparation Includes cleaning with metal wire brush to remove all dust, fungus, etc washing with water all complete	127031.47	m2
6	Providing and laying Cement concrete M15 grade with crushed granite coarse aggregate of size 20mm and downgraded mixed in batching and mixing plant including cost of all materials, machineries and labour and transportation of mixed concrete within initial lead of 5km by mechanical means and laying in Head works and canal with all lifts/delifts upto 7.5m height below average ground level in respective blocks as per direction of Engineer-in charge.	13421.15	m3
7	Cement concrete M25 grade with crushed granite coarse aggregate of size 20mm and downgraded mixed in batching and mixing plant including cost of all materials, machineries and labour and transportation of mixed concrete within initial lead of 5 km by mechanical means and laying in Head works and canal stock with all lifts/delifts upto 7.5m height below average ground level in respective blocks as per direction of Engineer-in charge.	26626.17	m3
8	Supplying, fitting and placing HYSD bar reinforcement (Fe 500 / 500D) complete as per drawings and technical specification	1121.59	Tonne

9	Providing and laying Roller Compacted Concrete M 20 with coarse and fine aggregates conforming to IS:383, the size of coarse aggregate not exceeding 20 mm with minimum cement content of 380 kg per cum, aggregate gradation to be as per Table 602.2 after blending, mixing in batching plant at optimum moisture content, transporting to site, laying with wheel barrows or steel pans or with mechanical paver, compacting with 80-100 kN smooth wheel, tandem vibratory roller, to achieve, the designed flexural strength, finishing and curing as per drawings and Technical Specification	49438.82	m3
10	Providing and installing PVC Water Stop 230 mm wide in construction joint before the placing of concrete as per engineer in charge	15153.57	m
11	Providing weep holes in Canal Slope with 150 mm dia PVC pipe, extending through the full width of the structure towards drawing force all Complete	1495.00	m
Inspection road work (0.00 - 5100 m)			
12	Clearing and grubbing road land including uprooting wild vegetation, grass, bushes, shrubs, saplings and trees of girth upto 300 mm, removal of stumps of such trees cut earlier and disposal of unserviceable materials and stacking of serviceable material to be used or auctioned, upto a lead of 1000 m including removal and disposal of top organic soil not exceeding 150 mm in thickness as per Technical Specification.	57575.40	m2
13	Scarifying the existing granular road surface to a depth of 50 mm and disposal of scarified material within all lifts and leads upto 1000 metres	20272.50	m2
14	Compacting stone aggregates of specific sizes to water bound macadam specification including spreading in uniform thickness, hand packing, rolling with 3 wheeled steel roller 8-10 tonnes in stages to proper grade and camber, applying and brooming requisite type of screening/binding materials to fill up the interstices of coarse aggregate, watering and compacting to the required density		
	WBM-II	1528.63	m3
15	Construction of shoulder with approved materials like moorum obtained from locality with all lift and leads transporting to the site, spreading, reading to required slope and compacting to meet requirement of table 300.2 with all lead and lift as per technical specification.	2359.37	m3
16	Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer at the rate of 0.60 kg/sqm using mechanical means	20354.70	m2
17	Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor at the rate of 0.20 kg per sqm on the prepared bituminous/granular surface cleaned with mechanical broom	20354.70	m2
18	Providing and laying 50mm thick Bituminous Macadam using crushed stone Gr.-2 materials & VG - 30 grade / 60/70 penetration grade of bitumen.	1019.09	m3
19	Providing and laying 30 mm thick S.D.B.C. using crushed stone Gr.-2 materials & VG 30 or 60/70 penetration grade of bitumen.	611.45	m3
20	Providing & laying Selection no. 1 doob grass turf with earth 50mm to 60mm thickness of existing ground prepared with proper level and ramming with required tools wooden and then rolling the surface with light roller make the surface smoothen and light watering the same and maintenance for 30 days or more till the grass establish properly, as per direction of the Engineer in charge	18000.00	m2

	Drainage		
21	Earthwork in excavation for drain structure in all types of soil as per drawing and technical specification including setting out, construction of shoring and bracing, removal of stumps and other deleterious material and disposal upto all lead & lift, dressing of sides and bottom and back filling with excavated suitable material upto 3mt. as per direction of Engineer-in-Charge.	2339.20	m3
22	Filling in drain Trenches with sand as per drawing and technical specification and as per the direction of the Engineer-in-charge.	292.40	m3
23	Providing concrete for plain / reinforced concrete in drainage bed, wall slab all complete and as per drawing as per direction of Engineer-in-Charge M20 grade	1304.48	m3
24	Supplying, fitting and placing HYSD bar reinforcement (Fe 500 / 500D) complete as per drawings and technical specification	32.61	t
25	Providing formwork for concrete with F1 finish for upstream faces of drain, road pier, retaining wall with steel shutters rigidly fixed and removal of forms and making good to the surfaces where necessary complete with all labour, materials and T & P complete as directed by the Engineer-in-charge	14035.20	m2
	Culvert		
26	Dismantling brick or stone masonry in lime or cement mortar under 3m. height including stacking the useful materials for reuse and removing the debris within 50m.	89.76	cum
27	Filling of culvert with hard soil or Moorum as per technical specification and as per the direction of the Engineer-in-charge.	82.19	cum
	Control Room		
28	Providing and injecting approved grout in proportion recommended by the manufacturer into cracks/masonry by suitable gun/pump at required pressure including cutting of nipples after curing etc. complete	100.00	cum
29	20mm, thick lime plaster (1:6) for stone work as per the direction of Engineer in charge	90.00	sqm
30	Priming 1 coat with any approved Primer on concrete / plastered Surface As per Direction of Engineer in charge	69.30	sqm
31	Painting on plastered/concrete surface Providing and applying 2 coats of weather coat paint to plaster/ unplastered concrete surface after cleaning the surface of dirt, dust, oil, grease, efflorescence and applying paint	69.30	sqm
	Protective Works		
32	Providing and erecting a "W" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 70 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 1.8 m high, 1.1 m below ground/road level, all steel parts and fitments to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a spacer of channel section 150 x 75 x 5 mm, 330 mm long complete	2609.00	m

33	Repair of Guard wall by Coursed rubble hard Granite stone masonry (first class) in cement mortar (1.4).	993.92	cum
TRESTLE BRIDGE - 7900 FT / 2407 m			
34	Construction of R.C.C. railing of M 30 grade in cast-in-situ with 20 mm nominal size aggregate, true to line and grade, tolerance of vertical railing post not to exceed 1 in 500, centre-to-centre spacing between vertical posts not to exceed 2000 mm as per drawing and technical specifications	140.00	m
35	Dismantling of existing R.C.C. railing as per direction of Engineer-in-charge.	16.80	m3
36	Providing and laying concrete for plain/reinforced concrete in deck slab as wearing course of 75 mm complete as per drawings and technical specification M 30 Grade	19.32	m3
37	Providing and jacketing of steel pier by plain/reinforced concrete in open superstructure complete as per drawings M30 Grade	176.83	m3
38	Providing and Jacketing of Girder by plain/reinforced concrete in open superstructure complete as per drawings M30 Grade	39.97	m3
39	Supplying, fitting and placing HYSD bar reinforcement ((Fe 500 / 500D)) complete as per drawings and technical specification as per direction of the Engineer in charge	15.42	Tonne
40	Priming 1 coat with any approved Primer on concrete / plastered Surface As per Direction of Engineer in charge	358.59	m2
41	Painting on plastered/concrete surface Providing and applying 2 coats of weather coat paint to plaster/ unplastered concrete surface after cleaning the surface of dirt, dust, oil, grease, efflorescence and applying paint	358.59	m2
42	Providing formwork for concrete with F1 finish for upstream faces of drain, road pier, retaining wall with steel shutters rigidly fixed and removal of forms and making good to the surfaces where necessary complete with all labour, materials and T & P complete as directed by the Engineer-in-charge	644.57	m2
43	Painting two coat of epoxy paint over old girder and built up girders including scaffolding above 4.60m. to any height	200.00	m2
Beautification & Aesthetic Work			
44	Providing and laying 80 mm thick factory-made cement concrete interlocking paver block of M -30 grade made by block making machine with strong vibratory compaction, of approved size, design & shape, laid in required colour and pattern over and including 50mm thick compacted bed of coarse sand, filling the joints with line sand etc. all complete as per the direction of Engineer-in-charge.	180.00	m2
45	Procurement and commissioning the 3 nos. concrete bench at each place (2 X 3 nos)	8.00	each
46	Supplying, fitting and fixing of Stainless steel of 304 grade in hand railing using 50mm dia of 2mm thick circular pipe with Balustrade of size 32mm x 32mm x 2mm @ 0.90mtr. C/C and stainless square pipe bracing of size 32mm x 32mm x 2mm in 3 rows in stair case as per approved design and specification, buffing, polishing etc with cost, conveyance, taxes of all materials, labour, T&P etc. required for the complete in all respect.	60.00	m

47	Brick work with Flyash bricks 23cm x 11cm x 8cm size having crushing strength not less than 75 Kg/cm ² with dimensional tolerance ± 2 percent in cement mortar (1:4) per cum	13.60	cum
48	Plantation of Phoenix Palm having ht. 75 cm to 90 cm with 10 to 15 or more leaves, well developed, fresh and healthy in 25 cm size of Earthen pot / Plastic pot	10.00	each
	Stair case		
48	Providing and laying plain/reinforced concrete to prepare the base for construction the waist slab with cement concrete M 15 grade	8.24	cum
52	Providing and laying plain/reinforced concrete for construction the waist slab with cement concrete M 25 grade	13.18	cum
53	Providing and laying plain/reinforced concrete for construction of the stair's Step with cement concrete M 25 grade	7.10	cum
54	Supplying, fitting and placing HYSD bar reinforcement (Fe 500 / 500D) complete as per drawings and technical specification	0.84	ton
	Sewage treatment plant		
55	Provision for establishment of Sewage treatment plant for the treatment of Drain water (1.3 MLD), including cost of sewage pipe line etc.	1.00	each
56	Provision for establishment of Sewage treatment plant for the treatment of Drain water (1.2 MLD)	1.00	each
	Cofferdam		
57	Construction of Cofferdam with Ordinary/Random Soil obtained from locality with all lift and leads transporting to the site, spreading, reading to required slope and compacting to meet requirement with all lead and lift.	23893.16	cum
58	Dismantling of Cofferdam with all lift and leads transporting to the site, spreading, grading to required slope and compacting to meet requirement with all lead and lift.	23893.16	cum
	Surplus Escape at RD 2070		
	Refurbishment of gate parts (wheels, bearings, springs, guide pad/wheel, bumpers, rubber seal, seal clamps, and fasteners) including dismantling and assembly of parts and their erection. Complete replacement of hoisting mechanism of service gates.	5	No.
	Repairing, testing and commissioning of emergency/stoplog gate at Surplus Escape. Complete replacement of Monorail hoisting mechanism of emergency gates	1	No.

B	<u>Repair and Rehabilitation of Power channel from 30000.00 ft. to 83480.00 ft. of CHEP, Chiplima, Sambalpur, Odisha</u>	-	-
	Cutting of trees		
1	Cutting of trees, including cutting of trunks, branches and removal of stumps, roots, stacking of serviceable material with all lifts and up to a lead of 1000 m and earth filling in the depression/pit.		
	300 mm to 600 mm	1670.00	each
	900 mm to 1800 mm	50.00	each
2	Filling of earth uprooted tree by earth as per the direction of the Engineer-in-charge.	10326.00	cum
3	Clearing and grubbing Side slope including uprooting wild vegetation, grass, bushes, shrubs, saplings and trees of girth upto 300 mm, removal of stumps of such trees cut earlier and disposal of unserviceable materials and stacking of serviceable material to be used or auctioned, upto a lead of 1000 m as per Engineer in charge	61430.00	m2
4	Providing and laying Cement concrete M15 grade with crushed granite coarse aggregate of size 20mm and downgraded mixed in batching and mixing plant including cost of all materials, machineries and labour and transportation of mixed concrete within initial lead of 5km by mechanical means and laying in Head works and canal with all lifts/delifts upto 7.5m height below average ground level in respective blocks as per direction of Engineer-in charge.	659.17	m3
5	Cement concrete M25 grade with crushed granite coarse aggregate of size 20mm and downgraded mixed in batching and mixing plant including cost of all materials, machineries and labour and transportation of mixed concrete within initial lead of 5km by mechanical means and laying in Head works and canal stock with all lifts/delifts upto 7.5m height below average ground level in respective blocks as per direction of Engineer-in charge.	354.00	m3
6	Supplying, fitting and placing HYSD bar reinforcement ((Fe 500 / 500D)) complete as per drawings and technical specification	293.66	ton
7	Dismantling brick or stone masonry in lime or cement mortar under 3m. height including stacking the useful materials for reuse and removing the debris within 50m. Lead per 1 cum	57.95	m3
8	Construction of Coursed rubble hard Granite stone masonry (first class) in cement mortar (1.4)	57.95	m3
9	Filling of 5 mm thick sand in Side slope Before the Flush point as per drawing and technical specification	700.49	cum
10	Flush pointing to stone masonry in cement mortar 1:3 including racking out joints 5mm deep, cleaning, pressing cement mortar finishing and curing including cost of materials, labour, scaffolding with initial lead and lift upto 10m etc. complete as per the direction of Engineer-in-charge	140098.20	m2

11	Providing and laying Cement concrete in Retaining wall of M30 grade with crushed granite coarse aggregate of size 20mm and downgraded of mixed concrete within initial lead of 1000 m by mechanical means with all lifts/delifts upto 8 m height below average ground level in respective blocks as per direction of Engineer-in charge.	1849.40	m3
12	Providing weep holes in Retaining wall with 150 mm dia PVC pipe, extending through the full width of the structure towards drawing force all Complete	105.00	m
13	Clearing and grubbing Side slope including uprooting wild vegetation, grass, bushes, shrubs, saplings and trees of girth upto 300 mm, removal of stumps of such trees cut earlier and disposal of unserviceable materials and stacking of serviceable material to be used or auctioned, upto a lead of 1000 m as per Engineer in charge	13122.00	m2
14	Surface Preparation Includes cleaning with metal wire brush to remove all dust, fungus, etc washing with water all complete	51229.09	m2
15	Providing and laying Cement concrete M15 grade with crushed granite coarse aggregate of size 20mm and downgraded mixed in batching and mixing plant including cost of all materials, machineries and labour and transportation of mixed concrete within initial lead of 1000 m by mechanical means and laying in Head works and canal with all lifts/delifts upto 7.5m height below average ground level in respective blocks as per direction of Engineer-in charge.	1864.00	m3
16	Cement concrete M25 grade with crushed granite coarse aggregate of size 20mm and downgraded mixed in batching and mixing plant including cost of all materials, machineries and labour and transportation of mixed concrete within initial lead of 1000 m by mechanical means and laying in Head works and canal stock with all lifts/delifts upto 7.5m height below average ground level in respective blocks as per direction of Engineer-in charge.	7946.80	m3
17	Supplying, fitting and placing HYSD bar reinforcement (Fe 500 / 500D) complete as per drawings and technical specification	424.85	Tonne
18	Construction of Roller Compacted Concrete (RCC) M 20 with coarse and fine aggregates conforming to IS:383, the size of coarse aggregate not exceeding 20 mm with minimum cement content of 380 kg per cum, aggregate gradation to be as per Table 602.2 after blending, mixing in batching plant at optimum moisture content, transporting to site, laying with wheel barrows or steel pans or with mechanical paver, compacting with 80-100 kN smooth wheel, tandem vibratory roller, to achieve, the designed flexural strength, finishing and curing as per drawings and Technical Specification	15431.47	m3
19	Providing and installing PVC Water Stop 230 mm wide in construction joint before the placing of concrete as per engineer in charge	6935.45	m
	Inspection Road Work		
20	Clearing and grubbing road land including uprooting wild vegetation, grass, bushes, shrubs, saplings and trees of girth upto 1 m, removal of stumps of such trees cut earlier and disposal of unserviceable materials and stacking of serviceable material to be used or auctioned, upto a lead of 1000 m including removal and disposal of top organic soil not exceeding 150 mm in thickness by manual means as per the direction of the Engineer in charge.	44205.42	Sqm

21	Loosening the ground upto a level of 300mm below the sub-grade level watered & graded, compacted in layers to meet the requirement of Table 300.1 and 300.2 for sub-grade construction as per Technical Specification	36837.85	sqm
22	Construction of embankment with approved material obtained from borrow pits with a lift upto 1.5 m, transporting to site, spreading, grading to required slope and compacting to meet requirement of Tables 300.1 and 300.2 with a lead upto 1000 m as per Technical Specification	45800.00	cum
23	Construction of Granular Sub-Base by Providing Locally available gravel material having maximum size 5mm or 10mm spreading in uniform layers with grader on prepared surface by mixing by mix in place method with rotavator at OMC and compacting with smooth wheel roller to achieve the desired density, complete as per Table 2.3 of IRC SP-77-2008 as per direction of Engineer- in- Charge.	2811.23	Cum
24	Providing, laying, spreading and compacting stone aggregates of specific sizes to water bound macadam specification including spreading in uniform thickness, hand packing, rolling with three wheel 80-100 kN static roller in stages to proper grade and camber, applying and brooming, crushable screening (moorum and sand admixture) to fill-up the interstices of coarse aggregate, watering and compacting to the required density as per direction of Engineer-in-Charge.		
25	Grading No. -II (63-45mm size) with crushable screening like moorum and sand admixture	2074.13	Cum
26	Construction of shoulder with approved materials like moorum obtained from locality with all lift and leads transporting to the site, spreading, grading to required slope and compacting to meet requirement of table 300.2 with all lead and lift as per technical specification.	3765.74	m3
27	Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer at the rate of 0.60 kg/sqm using mechanical means	9066.70	m2
28	Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor at the rate of 0.20 kg per sqm on the prepared bituminous/granular surface cleaned with mechanical broom	9066.70	m2
29	Providing and laying 50mm thick Bituminous Macadam using crushed stone Gr.-2 materials & VG - 30 grade / 60/70 penetration grade of bitumen.	453.63	m3
30	Providing and laying 30 mm thick S.D.B.C. using crushed stone Gr.-2 materials & VG 30 or 60/70 penetration grade of bitumen.	272.31	m3
31	Providing & laying Selection no. 1 doob grass turf with earth 50mm to 60mm thickness of existing ground prepared with proper level and ramming with required tools wooden and then rolling the surface with light roller make the surface smoothen and light watering the same and maintenance for 30 days or more till the grass establish properly, as per direction of the Engineer in charge	29470.28	m2
	Drainage		

32	Earthwork in excavation for structures as per drawing and technical specifications Clause 305.1 including setting out, construction of shoring and bracing, removal of stumps and other deleterious material and disposal upto a lead of 50 m, dressing of side	2947.03	Cum
33	Filling in foundation with sand trenches as per drawing and technical specification clause 3005.3.9	368.38	Cum
34	Providing M-20 Grade concrete for plain/reinforced concrete in Drainage including Drainage wall, Bed, and slab all complete as per drawings and technical specification	1627.48	Cum
35	Supplying, fitting and placing HYSD bar reinforcement (Fe 500 / 500D) complete as per drawings and technical specification	40.66	tonne
36	Providing formwork for concrete with F1 finish for upstream faces of drain, road pier, retaining wall with steel shutters rigidly fixed and removal of forms and making good to the surfaces where necessary complete with all labour, materials and T & P complete as directed by the Engineer-in-charge.	23747.30	m2
	Protection Work		
37	Providing and erecting a "W" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 70 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 1.8 m high, 1.1 m below ground/road level, all steel parts and fitments to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a spacer of channel section 150 x 75 x 5 mm, 330 mm long complete.	7461.13	m
	HEAD REGULATOR BRIDGE - 30000 FT / 9159 m		
38	Providing and laying plain/reinforced concrete as a wearing coat with cement concrete M30 grade	22.70	m3
39	Priming 1 coat with any approved Primer on concrete / plastered Surface As per Direction of Engineer in charge	96.61	m2
40	Painting on plastered /concrete surface Providing and applying 2 coats of weather coat paint to plaster/unplastered concrete surface after cleaning the surface of dirt, dust, oil, grease, efflorescence and applying paint	96.61	m2
41	Construction of Roller Compacted Concrete (RCC) M 20 with coarse and fine aggregates conforming to IS:383, the size of coarse aggregate not exceeding 20 mm with minimum cement content of 380 kg per cum, aggregate gradation to be as per Table 602.2 after blending, mixing in batching plant at optimum moisture content, transporting to site, laying with wheel barrows or steel pans or with mechanical paver, compacting with 80-100 kN smooth wheel, tandem vibratory roller, to achieve, the designed flexural strength, finishing and curing as per drawings and Technical Specification	750.00	m3
42	Supplying, fitting and placing HYSD bar reinforcement (Fe 500 / 500D) complete as per drawings and technical specification as per direction of the Engineer in charge.	1.02	tonne

43	Providing and injecting approved grout in proportion recommended by the manufacturer into cracks/honey-comb area of concrete/masonry by suitable gun/pump at required pressure including cutting of nipples after curing etc. complete as per directions of Engineer-in-Charge. (Assuming 50 kg required for each pier)	200.00	kg
TRESTLE BRIDGE - 61600 FT / 18780 m			
44	Brick work with flyash bricks 23cm x 11cm x 8cm size having crushing strength not less than 75 Kg/cm ² with dimensional tolerance ± 2 percent in cement mortar (1:4) per cum.	2.39	m ³
45	Plastering with cement mortar (1 :3), 12 mm thick on brick work	329.62	m ²
46	Providing and laying plain/reinforced concrete as a wearing coat with cement concrete M30 grade	20.09	m ³
47	Providing and laying plain/reinforced concrete in steel pier with cement concrete M30 grade	144.99	m ³
48	Providing and laying plain/reinforced concrete in Girder with cement concrete M30 grade	39.49	m ³
49	Supplying, fitting and placing HYSD bar reinforcement (Fe 500 / 500 D) complete as per drawings and technical specification as per direction of the Engineer in charge.	13.18	Tonne
50	Priming 1 coat with any approved Primer on concrete / plastered Surface As per Direction of Engineer in charge	329.62	m ²
51	Painting on plastered /concrete surface Providing and applying 2 coats of weather coat paint to plaster/unplastered concrete surface after cleaning the surface of dirt, dust, oil, grease, efflorescence and applying paint	329.62	m ²
52	Providing formwork for concrete with F1 finish for upstream faces of drain, road pier, retaining wall with steel shutters rigidly fixed and removal of forms and making good to the surfaces where necessary complete with all labour, materials and T & P complete as directed by the Engineer-in-charge	538.95	m ²
53	Painting two coat of epoxy paint over old girder and built up girders including scaffolding above 4.60m. to any height	300.00	m ²
CROSS REGULATOR BRIDGE - 63400 FT / 19323 m			
54	Providing and laying plain/reinforced concrete in parapet wall with cement concrete M30 grade	0.06	m ³
55	Providing concrete for plain/reinforced concrete in deck slab as wearing course of 75 mm complete as per drawings M 30 Grade	4.77	m ³
56	Painting two coats including prime coat with epoxy paint of approved brand on steel surfaces after thorough cleaning of surface to give an even shade as per drawing and Technical Specification	45.94	m ²
57	Supplying, fitting and placing HYSD bar reinforcement (Fe 500 / 500 D) complete as per drawings and technical specification as per direction of the Engineer in charge.	0.33	tonne
Beautification & Aesthetic Work			

58	Earthwork in excavation for foundation of structures in all types of soil as per drawing and technical specification Clause 305 and 1104 of MoRD including setting out, construction of shoring and bracing, removal of stumps and other deleterious material and disposal upto all lead & lift, dressing of sides and bottom and backfilling in trenches excavated suitable material.	19.40	cum
59	Construction of embankment with approved material obtained from borrow pits with a lift upto 1.5 m, transporting to site, spreading, grading to required slope and compacting to meet requirement of Tables 300.1 and 300.2 with a lead upto 1000 m as per Technical Specification	21.99	cum
60	Providing and laying 80mm thick factory-made cement concrete interlocking paver block of M -30 grade made by block making machine with strong vibratory compaction, of approved size, design & shape, laid in required colour and pattern over and including 50mm thick compacted bed of coarse sand, filling the joints with line sand etc. all complete as per the direction of Engineer-in-charge.	100.00	m ²
61	Procurement and commissioning the 3 nos. concrete bench at each place (2 X 3 nos)	6.00	each
62	Supplying, fitting and fixing of Stainless steel of 304 grade in hand railing using 50mm dia of 2mm thick circular pipe with Balustrade of size 32mm x 32mm x 2mm @ 0.90mtr. C/C and stainless square pipe bracing of size 32mm x 32mm x 2mm in 3 rows in stair case as per approved design and specification, buffing, polishing etc with cost, conveyance, taxes of all materials, labour, T&P etc. required for the complete in all respect.	40.00	m
63	Brick work with flyash bricks 23cm x 11cm x 8cm size having crushing strength not less than 75 Kg/cm ² with dimensional tolerance ± 2 percent in cement mortar (1:4) per cum.	30.08	cum
64	Plantation of Phoenix Palm having ht. 75 cm to 90 cm with 10 to 15 or more leaves, well developed, fresh and healthy in 25 cm size of Earthen pot / Plastic pot	30.00	each
	Stair case		
65	Providing and laying plain/reinforced concrete to prepare the base for construction the waist slab with cement concrete M 15 grade	6.66	cum
66	Providing and laying plain/reinforced concrete for construction the waist slab with cement concrete M 25 grade	10.66	cum
67	Providing and laying plain/reinforced concrete for construction of the stair's Step with cement concrete M 25 grade	3.67	cum
68	Supplying, fitting and placing HYSD bar reinforcement ((Fe 500 / 500D)) complete as per drawings and technical specification	0.68	Tonne
	Head Regulator at RD 30,000 Ft.		
69	Designing, dismantling, fabrication, erection, testing and commissioning of service gates at Head Regulator along with their hoisting arrangement and electrical works.	6	Nos.
70	Designing, fabrication, erection, testing and commissioning of emergency gate at Head Regulator along with its hoisting arrangement and electrical works.	1	Nos.

	Head Regulator at RD 61,000 Ft.		
71	Designing, dismantling, fabrication, erection, testing and commissioning of 3 nos. of gates at Cross Regulator along with their hoisting arrangement and electrical works.	3	Nos.
72	Designing, dismantling, fabrication, erection, testing and commissioning of 3 nos. of gates at Cross Regulator along with their hoisting arrangement and electrical works.	1	Nos.

❖ **Note: -**

	<ul style="list-style-type: none"> ▪ It may be noted that the Quantities shown is indicative. Any variation in quantity +ve/-ve w.r.t. approved construction drawings / Extra new items shall be absorbed by Contractor. Cost of any other item not specified in BOQ but necessary to complete above repair & rehabilitation works shall be included in bid price of relevant item.
	<ul style="list-style-type: none"> ▪ For completed works, Payment to contractor shall be made on milestone basis.
	<ul style="list-style-type: none"> ▪ Price quoted by the Contractor shall remain fixed for the execution of this project. Only Price Escalation shall be payable extra to contractor as per formula given in tender documents volume-I.
	<ul style="list-style-type: none"> ▪ The work is being awarded on EPC basis, hence detailed construction design & drawings as per site conditions and technical specifications shall to be prepared by Contractor. ▪ Further, it may be noted that Contractor shall not quote any separate amount for the same. ▪ Design & Engineering prepared by Contractor will be reviewed by DoWR, Govt. of Odisha & approved by OHPC/DoWR, Govt. of Odisha.
	<ul style="list-style-type: none"> ▪ De-watering required for execution of the works shall be included in the rates of above works. No separate payment for dewatering shall be made to the contractor.
	<ul style="list-style-type: none"> ▪ Construction of Coffor wall to facilitate construction work on d/s of spillway in segments to avoid spillage of water at the time of plant shutdown for safety of man & material shall be included in the rates of above works.

PRICE SCHEDULE											
(This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevant columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only)											
Sl. No.	Item Description	Quantity	Units	BASIC RATE In Figures To be entered by the Bidder		TOTAL AMOUNT Without Taxes		TOTAL AMOUNT With Taxes		TOTAL AMOUNT In Words	
				Rs.	P	Rs.	P	Rs.	P		
1	2	4	5	13		53		54		55	
1.	Repair and Rehabilitation of Power channel from RD. 0.00 ft. to RD. 16,000.00 ft. of HHEP, Burla, Sambalpur, Odisha.	1.000	Job								
2	Repair and Rehabilitation of Power channel from RD. 30000.00 ft. to RD.83480.00 ft., Chiplima, Sambalpur, Odisha	1.000	Job								
Total in Figures											
Quoted Rate in Words			INR Only								

Note:

- 1.The above quotation should be given inclusive of price for Design, drawing, fabrication, transportation, commissioning, erection, etc. complete in all respect.
- 2.Any other item not specified above but necessary to complete the installation, assembly, erection, testing, commissioning shall be included in Price Schedule.
- 3.All supplies shall be for Burla and Chiplima HEP site.

Signature and Stamp of Bidder

PAYMENT SCHEDULE FOR***1. Burla Power channel from RD 0.00 ft. to 16000.00 ft., Sambalpur, Odisha***

Payment Milestone for Repair and Rehabilitation of Power channel from RD. 0.00 ft. to RD. 16,000.00 ft. of HHEP, Burla, Sambalpur, Odisha				
Sl. No.	Description	Payment milestone %	Breakup	Remarks
<u>1</u>	<u>DESIGN ENGINEERING</u>	<u>3.50%</u>	-	-
1.1	Submission of Investigation report after Investigation and topographic survey of the project area, Geologist visit, Geotechnical investigation etc.		10.00%	-
1.2	Investigation report Approval and work schedule.		10.00%	-
1.3	Submission of draft design report & drawings to OHPC		20.00%	-
1.4	Upon approval of design and drawings from DoWR and issue of GFC drawings		50.00%	-
1.5	As built drawings & Completion report		10.00%	-
	Sub-Total		100.00%	-
<u>2</u>	<u>Other infrastructure and miscellaneous works</u>	<u>5.00%</u>	-	-
2.1	Obtaining Forest Clearance from competent authority		10.00%	-
2.2	Dewatering		40.00%	(25% on respective closure of power Channel)
2.3	Construction of coffer dam		40.00%	(25% on respective closure of power Channel)
2.4	Construction of approach ramp to the Power channel including all relative work as per project requirement and making good after completion of work.		10.00%	-
			100.00%	-
<u>3</u>	<u>Repair and rehabilitation of Power channel from RD 0.00 ft. to RD 16,000 ft.</u>	<u>50.00%</u>	-	the respective percentages shall be divided for every 2500 ft.
3.1	Clearing and grubbing Side slope including uprooting wild vegetation, grass, bushes, shrubs, saplings.		5.000%	-
3.2	Providing and laying Cement concrete of M15 grade at the damaged areas.		15.00%	-
3.3	concrete lining of both side slopes of power channel		40.00%	

	with Reinforced Cement concrete of M25 grade as per design.			
3.4	Supplying, fitting and placing HYSD bar reinforcement ((Fe 500 / 500D)) complete as per drawings and technical specification		15.00%	-
3.5	Rehabilitation of power channel bed with Roller Compacted Concrete (RCC) M 20 grade		20.00%	-
3.6	Providing and installing PVC Water Stop 230 mm wide in construction joint		5.00%	-
			100.00%	-
4	<u>Construction of flexible Inspection Road</u>	<u>12.00%</u>		<u>the respective percentages shall be divided for every 100 ft. out of total length of Road</u>
4.1	Clearing and grubbing of road land including uprooting wild vegetation, grass, bushes, shrubs, saplings and surface preparation by loosening the ground for GSB Construction.		5.00%	-
4.2	Construction of embankment and shoulder with approved material		25.00%	-
4.3	Construction of Granular Sub-Base		12.50%	-
4.4	Providing, laying, spreading and compacting stone aggregates of specific sizes to water bound macadam of Grading no. -II		12.50%	-
4.5	Providing and laying of 50mm thick Bituminous Macadam over the primer coat and tack coat		20.00%	-
4.6	Providing and laying 30 mm thick S.D.B.C		20.00%	-
4.7	Providing & laying Selection no. 1 doob grass turf with earth 50mm to 60mm thickness		5.00%	-
			100.00%	-
5	<u>Construction of Drain along the inspection road</u>	<u>12.00%</u>		<u>the respective percentages shall be divided for every 100 ft. out of total length of Road</u>
5.1	Earthwork in excavation for the drain		5.00%	-
5.2	Filling in foundation with sand trenches as per drawing		10.00%	-
5.3	Providing M-20 Garde concrete for plain/reinforced concrete in Drainage wall, Bed, and slab all complete as per drawings.		40.00%	-
5.4	Supplying, fitting and placing HYSD bar reinforcement (Fe 500 / 500D) complete as per drawings and technical specification		25.00%	-
5.5	Providing formwork for concrete with F1 finish for upstream faces of drain, road pier, retaining wall .with steel shutters rigidly fixed and removal of		20.00%	-

	forms			
			100.00%	-
6	Providing and erecting a "W" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 70 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 1.8 m high, 1.1 m below ground/road level, all steel parts and fitments to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a spacer of channel section 150 x 75 x 5 mm, 330 mm long complete.	5.00%		the respective percentages shall be divided for every 100 ft. out of total length of Road
			100%	
7	<u>Erection, testing and commissioning of STP</u>	5.00%		
			100%	the respective percentages shall be divided after completion of works at respective areas.
8	<u>Rehabilitation works of Surplus escape at RD 2,070 ft and Trestle bridge.</u>	2.00%		the respective percentages shall be divided after completion of works at respective areas.
8.1	Providing and laying plain/reinforced concrete as a wearing coat and jacketing of piers with cement concrete M30 grade		30.00%	-
8.2	Painting on plastered/concrete surface over a primer coat and epoxy paint over the steel surfaces		5.00%	-
8.3	Construction of Roller Compacted Concrete (RCC) M 20 at apron area of surplus and trestle bridge.		30.00%	-
8.4	Supplying, fitting and placing HYSD bar reinforcement (Fe 500 / 500D) complete as per drawings and technical specification for the jacketing structure around the piers.		15.00%	-
8.5	Providing and injecting approved grout in proportion recommended by the manufacturer into cracks/honey-comb area of concrete/masonry		20.00%	-
			100.00%	-
9	<u>Hydromechanical and electrical works of Surplus escape at RD 2,070 ft.</u>	5.00%		-
9.1	Designing, dismantling, fabrication, erection, testing and commissioning of 5 nos. of service gates at Surplus Escape along with their hoisting arrangement and electrical works including supply of		75.00%	<u>the respective percentages shall be divided after completion of works</u>

	materials.			<u>of each gate.</u>
9.2	Designing, fabrication, erection, testing and commissioning of 1 nos. of emergency gate at Surplus Escape along with its hoisting arrangement and electrical works including supply of materials.		25.00%	-
			100.00%	-
10	Development of 2 nos. of sit out area of 30 ft. X 12 ft. at suitable location and beautification of power channel area with plantation and landscaping.	0.50%		<u>the respective percentages shall be divided after completion of works at respective areas.</u>

APPENDIX – F 2

2. PAYMENT SCHEDULE FOR

Chiplima Power channel from RD. 30000.00 ft. to RD.83480.00 ft., Chiplima, Sambalpur, Odisha

Payment Milestone for Repair and Rehabilitation of Power channel from RD. 30000.00 ft. to RD.83480.00 ft. of CHEP, Chiplima, Sambalpur, Odisha				
Sl. No.	Description	Payment milestone %	Breakup	Remarks
<u>1</u>	<u>DESIGN ENGINNERING</u>	<u>3.50%</u>	-	-
1.1	Submission of Investigation report after Investigation and topographic survey of the project area, Geologist visit, Geotechnical investigation etc.		10.00%	-
1.2	Investigation report Approval and work schedule.		10.00%	-
1.3	Submission of draft design report & drawings to OHPC		20.00%	-
1.4	Upon approval of design and drawings from DoWR and issue of GFC drawings		50.00%	-
1.5	As built drawings & Completion report		10.00%	-
	Sub-Total		100.00%	-
<u>2</u>	<u>Other infrastructure and miscellaneous works</u>	<u>5.00%</u>	-	-
2.1	Obtaining Forest Clearance from competent authority		10.00%	-
2.2	Dewatering		40.00%	(15% for each closure of power Channel and balance during final bill)
2.3	Construction of coffer dam		40.00%	(15% for each closure of power Channel and balance during final bill)
2.4	Construction of approach ramp to the Power channel including all relative work as per project requirement and making good after completion of work.		10.00%	-
			100.00%	-
<u>3</u>	<u>Repair and rehabilitation of Power channel from RD 30,000 ft. to RD 76,000 ft.</u>	<u>15.00%</u>	-	the respective percentages shall be divided for every 5000 ft.
3.1	Clearing and grubbing Side slope including uprooting wild vegetation, grass, bushes, shrubs, saplings.		2.50%	-

3.2	Providing and laying Cement concrete of M15 grade at the damaged areas.		5.00%	-
3.3	Repair and rehabilitation of both side training walls upstream and downstream of Head regulator with Reinforced Cement concrete of M25 grade		12.50%	-
3.4	Supplying, fitting and placing HYSD bar reinforcement ((Fe 500 / 500D)) complete as per drawings and technical specification		12.50%	-
3.5	Dismantling and Construction of Coursed rubble hard Granite stone masonry (first class) in cement mortar (1.4)		2.50%	-
3.6	Flush pointing to stone masonry in cement mortar 1:3 after filling the cracks and holes with sand.		40.00%	-
3.7	Construction of Retaining wall of M30 grade of grade at right side wall downstream of Head regulator.		25.00%	-
			100.00%	-
4	<u>Repair and rehabilitation of Hill channel portion of Power channel from RD 76,000 ft. to RD 83,480 ft.</u>	<u>35.00%</u>		The respective percentages shall be divided for every 1000 ft. out of total length of hill channel
4.1	Clearing and grubbing Side slope including surface preparation with metal wire brush, uprooting wild vegetation, grass, bushes, shrubs, saplings.		1.00%	-
4.2	Providing and laying Cement concrete of M15 grade at the damaged areas of side slopes and bed.		5.00%	-
4.3	concrete lining of both side slopes of power channel with Reinforced Cement concrete of M25 grade as per design.		30.00%	-
4.4	Supplying, fitting and placing HYSD bar reinforcement ((Fe 500 / 500D)) complete as per drawings and technical specification		20.00%	-
4.5	Rehabilitation of power channel bed with Roller Compacted Concrete (RCC) M 20 grade		40.00%	-
4.7	Providing and installing PVC Water Stop 230 mm wide in construction joint		4.00%	-
			100.00%	-
5	<u>Construction of flexible Inspection Road</u>	<u>10.00%</u>		<u>The respective percentages shall be divided for every 100 ft. out of total length of Road</u>
5.1	Clearing and grubbing of road land including uprooting wild vegetation, grass, bushes, shrubs, saplings and surface preparation by loosening the ground for GSB Construction.		5.00%	-
5.2	Construction of embankment and shoulder with approved material		25.00%	-

5.3	Construction of Granular Sub-Base		12.50%	-
5.4	Providing, laying, spreading and compacting stone aggregates of specific sizes to water bound macadam of Grading no. -II		12.50%	-
5.5	Providing and laying of 50mm thick Bituminous Macadam over the primer coat and tack coat		20.00%	-
5.6	Providing and laying 30 mm thick S.D.B.C		20.00%	-
5.7	Providing & laying Selection no. 1 doob grass turf with earth 50mm to 60mm thickness		5.00%	-
			100.00%	-
6	<u>Construction of Drain along the inspection road</u>	10.00%		<u>the respective percentages shall be divided for every 100 ft. out of total length of Road</u>
6.1	Earthwork in excavation for the drain		5.00%	-
6.2	Filling in foundation with sand trenches as per drawing		10.00%	-
6.3	Providing M-20 Grade concrete for plain/reinforced concrete in Drainage wall, Bed, and slab all complete as per drawings.		40.00%	-
6.4	Supplying, fitting and placing HYSD bar reinforcement (Fe 500 / 500D) complete as per drawings and technical specification		25.00%	-
6.5	Providing formwork for concrete with F1 finish for upstream faces of drain, road pier, retaining wall. with steel shutters rigidly fixed and removal of forms		20.00%	-
			100.00%	-
7	Providing and erecting a "W" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 70 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 1.8 m high, 1.1 m below ground/road level, all steel parts and fitments to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a spacer of channel section 150 x 75 x 5 mm, 330 mm long complete.	5.00%		the respective percentages shall be divided for every 100 ft. out of total length of Road
8	<u>Rehabilitation works of Head Regular, Cross Regulator and Trestle bridge</u>	4.00%		the respective percentages shall be divided after completion of works at respective areas.
8.1	Providing and laying plain/reinforced concrete as a wearing coat and jacketing of piers with cement concrete M30 grade		30.00%	-

8.2	Painting on plastered/concrete surface over a primer coat and epoxy paint over the steel surfaces		5.00%	-
8.3	Construction of Roller Compacted Concrete (RCC) M 20 at apron area of head regulator and trestle bridge.		30.00%	-
8.4	Supplying, fitting and placing HYSD bar reinforcement (Fe 500 / 500D) complete as per drawings and technical specification for the jacketing structure around the piers.		15.00%	-
8.5	Providing and injecting approved grout in proportion recommended by the manufacturer into cracks/honey-comb area of concrete/masonry		20.00%	-
			100.00%	-
9	<u>Hydromechanical and electrical works of Head Regulator and Cross Regulator including supply.</u>	<u>12.00%</u>		-
9.1	Designing, dismantling, fabrication, erection, testing and commissioning of 6 nos. of service gates at Head Regulator along with their hoisting arrangement and electrical works		50.00%	<u>the respective percentages shall be divided after completion of works of each gates.</u>
9.2	Designing, fabrication, erection, testing and commissioning of 1 nos. of emergency gate at Head Regulator along with its hoisting arrangement and electrical works		12.50%	-
9.3	Designing, dismantling, fabrication, erection, testing and commissioning of 3 nos. of gates at Cross Regulator along with their hoisting arrangement and electrical works		25.00%	<u>the respective percentages shall be divided after completion of works of each gates.</u>
9.4	Designing, fabrication, erection, testing and commissioning of 1 nos. of emergency/stoplog gate at Cross Regulator along with its hoisting arrangement and electrical works		12.50%	-
			100.00%	-
10	Development of 2 nos. of sit out area of 30 ft. X 12 ft. at suitable location and beautification of power channel area with plantation and landscaping.	<u>0.50%</u>		<u>the respective percentages shall be divided after completion of works at respective areas.</u>

APPENDIX – MS

<u>MILESTONES</u>			
MS No.	Particular	Milestone to be achieved as physical % of Respective item	Time in month for achieving milestone from the commencement of work
MS 1.	Repair and Rehabilitation of Power channel from RD 0.00 ft. to 16000.00 ft. of CHEP, Chiplima, Sambalpur, Odisha	100%	By end of 36 th month
MS 2.	Repair and Rehabilitation of Power channel from RD. 30000.00 ft. to RD.83480.00 ft. of CHEP, Chiplima, Sambalpur, Odisha	100%	By end of 24 th month
	Total		36 months

Note: Milestone taken into consideration being completion period 36 months.



**ODISHA HYDRO POWER CORPORATION LTD
(A Govt. of Odisha Undertaking)
Bhoinagar, Unit-IX, Bhubaneswar-22**

“e” Procurement Notice No. 01/2026-27 (on-line)Bid

VOLUME-II

**(Technical Specifications, Cover-I)
(EPC Contract)**

NAME OF WORK

***Repair and Rehabilitation of Power channel from HHEP, Burla to
CHEP, Chiplima, Sambalpur, Odisha.***

C&P HEAD

SECTION-I
GENERAL

SECTION – I

GENERAL

THE SPECIFICATIONS CONTAINED UNDER DIFFERENT SECTIONS IN THIS DOCUMENT ARE FOR GENERAL GUIDANCE. IN CASE OF DISAGREEMENT BETWEEN THE SPECIFICATION OF THE DEPARTMENT AND STANDARD PRACTICES BEING FOLLOWED AND /OR SPECIFICATIONS NOT PROVIDED SPECIFICALLY, THEN RELEVANT SPECIFICATIONS UNDER INDIAN STANDARDS, CWC GUIDELINES, IRC CODES, MOST SPECIFICATION & RELEVANT REGULATIONS OF CEA/CERC/OERC AND APPROVED MANUFACTURER SPECIFICATIONS SHALL PREVAIL.

The specification as described under is mentioned for the work “Repair and Rehabilitation of Power channel from HHEP, Burla to CHEP, Chiplima, Sambalpur,.” in Vol-I, Vol-II & Vol-III.

A. EXTENT OF WORK

1.0 GENERAL

This Technical Specification relates to ***“Repair and Rehabilitation of Power channel from HHEP, Burla to CHEP, Chiplima, Sambalpur, Odisha.”*** on EPC contract comprising of work of Design, Drawing and execution and commissioning of all components. The Basic Project Profile and scope of work of repair of Power Channel work under the package has been detailed in volume –I of the Tender documents.

- (a) These Technical specifications, shall apply to all works as are required to be executed under the contract or otherwise directed by the Engineer. In every case the work shall be carried out to the satisfaction of the Engineer and conform to the location, lines, grades and cross sections shown on the drawings or as indicated by the Engineer. The quality of work and materials, shall comply with the requirements set forth in this and succeeding sections. Where the drawings and specifications describe a portion of the work in only general terms, and not in complete detail, it shall be understood that only the best general practice is to prevail, materials and workmanship of the best quality are to be employed and the instructions of the Engineer are to be fully complied with.
- (b) The words like Employee, Employer, Contract, Employer’s representative, Contractor’s representative, Engineer, Drawings, Government works site etc. used in these specifications shall be considered to have the meaning as understood from the definitions of these terms included in Section II, Vol I Conditions of the Contract.

The contractor shall carry out the works in accordance with the specifications laid down in this section together with the detailed specifications stipulated under succeeding sections, Odisha Standard Specification, relevant codes with all amendments published up to the date of tendering and the departmental manual for quality control

1.1 Test standards for Materials and Quality of works.

The relevant standards for materials, as well as for testing procedures, indicated in this section together with detailed specifications indicated at appropriate places in the succeeding sections shall apply.

If any special material not covered here, is required to be used, it shall conform to relevant Indian Standards, if there are any, or to the requirements specified by the Engineer or any special provisions.

Quality: All materials and workmanship shall be of the respective kinds described in the contract and in accordance with the Engineer’s instructions and shall be subjected from time to time to such tests as the engineer may direct at the place of manufacture of fabrication or on the site or at such other places or places as may be specified in the contract or at all or any of the instruments, equipments, machines, labour and materials as are normally required for examining, measuring and testing any work and the quality, weight or quantity of any material used and shall supply samples of

materials before incorporation in the works for testing as may be selected and required by the Engineer.

The Agency is fully responsible for the quality of the works & strength as well as dismantling of the structure. Field laboratory shall be installed at site by the agency. No defective material shall be placed at site. All materials shall be tested by the Agency in his site laboratory before placing/storing at site. The testing certificate for all stacked materials is required.

1.3 Tests, inspection, rejection of defective material and work:

The contractor shall without extra cost provide samples and cooperate in the testing of materials and inspection of the works. The Engineer shall have access at all times to the places of storage and where material is being manufactured and processed for use in the works under the contract to determine whether their manufacture and process are proceeding in accordance with the drawings and specifications.

The Engineer shall during the progress of the works have power to order in writing from time to time.

- a) The removal from the site, within such time or time as may be specified in the order, of any materials which in the opinion of the Engineer, are not in accordance with the contract.
- b) The substitution of proper and suitable materials and
- c) The removal and proper re-execution, notwithstanding any previous test thereof or interim payment thereof, of any work which in respect of materials or workmanship is not in the opinion of the Engineer, in accordance with the contract.

The contractor shall carry out such order at no extra cost to the employer; in case of default on the part of the contractor in carrying out such order, the employer shall be entitled to employ and pay other persons to carry out the same and all expenses consequent thereon or incidental thereto shall be recoverable from the contractor by the employer or may be deducted by the employer from any moneys due to or which may become due to the contractor.

Defect liability period-02 years from the date of completion & hand over of work.

Notwithstanding the approval/vetting by the Deptt. the responsibility regarding the stability & durability of the structure lies fully on the agency.

1.4 Setting out works.

The contractor shall be responsible for the correct setting out of all works at his cost. The Contractor shall execute the work true to alignment, grade and levels as shown in the approved drawings and as directed by the Engineer and shall check these at frequent intervals. The contractor shall provide all facilities like labour and instruments, and shall cooperate with the departmental officers to check all alignments, grades, levels and dimensions.

1.5 Power Supply.

- i) Power supply is to be arranged by the contractor at his own cost.
- ii) He has to lay all internal lines from the transformer at his own cost and he should bear the cost of power consumption as per bills of electricity authority.
- iii) If the available capacity is insufficient to meet the contractor's requirement, the contractor has to make his own arrangements for alternatives for power supply, including deposits to electricity authority.
- iv) The contractor shall satisfy all the conditions of rules required as per Indian Electricity Act 1910 and under rule 45 (i) of the Indian Electricity rules, 1956 as amended from time to time and other pertinent rules.
- v) The power shall be used for bonafide departmental works only.
- vi) The contractor shall take all precautions to ensure safety to the workers. The department will not take any responsibility for any accidents that may occur on the Contractor's installations.
- vii) The contractor shall take action to rectify the defects if any in the installations pointed out by the departmental Engineers in a reasonable time.
- viii) The following particulars should be furnished in quadruplicate by the contractor to the employer before the power is released to the equipment's.
 - a) A schematic diagram of the installation from the point of commencement of supply to the points of utilization showing therein the various electrical equipment, switch gear, cables with their sizes etc.
 - b) Transformer sub station's drawings.
 - c) Layout plan indicating therein the position of motors and other electrical equipment, their switch gear and earthing arrangements. The contractor shall give the particulars of his power load, if so desired by the Engineer and he shall make necessary arrangements for the Engineer to check these loads if so desired. The total power requirements and the percentage of diesel power proposed to be engaged by the contractor out of total power requirement shall be furnished by the contractor.
- ix) The department is not responsible for any sort of power failures and power break down etc. and no compensation of any kind will be paid by the department on account of such failures and no extension of time will be granted under such reasons.

1.6 Water Supply

It is the responsibility of the Contractor to make own arrangements for water supply for work and labour and drainage from the work site, at his own cost. He will be permitted to draw water from nearby water source, subject to availability. The

contractor has to lay pumping line from water source to barrage site and colony at his own cost. The pumps have to be installed by him at his own cost and pumping charges will also be borne by him. The distribution system, measures for purification of water, shall be the responsibility of the contractor and shall be in accordance with rules and regulations of the Public Health Department. No compensation will be allowed to the contractor on this account.

1.7 Watching and Lighting

The Contractor shall in connection with the works provide and maintain at his own cost all lights, guards, fencing and watching when and wherever necessary as required by the Engineer or Engineer's Representative, or by any duly constituted authority for the protection of the work, or for the safety and convenience of the public or others.

1.8 Approach Roads and Roads in Work Area.

- a) The roads inside the work area required by the Contractor to convey huge machinery and all materials to work site shall be constructed and maintained by him at his own cost. The layout, design, construction and maintenance etc. of the road shall be subject to the approval of the Engineer.
- b) The Contractor shall without charge permit the OHPC officials and such other Contractor and other workmen to see the access facilities including roads, any other facilities constructed and acquired by the Contractor for use in the performance of the works.
- c) The Contractor's heavy construction traffic or tracked equipment shall not traverse any public roads or bridges unless the contractor has made arrangements with the authorities concerned and the approval of the Engineer to such arrangements has been obtained. In case Contractor's heavy construction traffic or tracked equipment is not allowed to traverse any public roads or bridges and the Contractor is required to make some alternative arrangements, no claim on this account shall be entertained.

2.0 LIFE EXPECTANCY OF WORKS

The contractor shall design the works for a life expectancy as follows:

Concrete Structures	:	60 Years
Mechanical Plants	:	20 Years
Electrical Plants	:	25 Years
Buried Earth Electrical System	:	50 Years
Control Panels	:	25 Years
External Instrumentation Systems	:	15 Years

3.0 ELECTRICAL SYSTEMS

All supply and installation works required for appropriate functioning of the work.

4.0 SUPERVISORY /ANNUNCIATION SYSTEMS

Instruments, indicators, measuring and transmitting devices, gauges, gauge plates, cabling and wiring and other equipments, material and accessories necessary for interconnection of earthing and lighting with starter grids.

5.0 GENERAL UTILITIES

Other utilities necessary for the proper functioning of the proposed works which shall be included under this Contract but not limited to the following are:

- a) Site development includes ecological development. Site development also includes raising GL at barrage site by selected excavated earth including proper ramming, watering, consolidation of earth work, etc. The finished ground level of the plot shall be brought to Level above the Flood Level. The filling shall be done in uniform layers of 15 cm. to 20 cm. thick and shall be well watered and well compacted with suitable power roller.
- b) Internal roads & approach road required to Head Works from existing road, etc.
- c) Electric substation and distribution of power supply to all necessary points.

6.0 APPLICABLE STANDARDS

Reference to all the standards shall be meant for the latest revision of that standard and all the equipments shall be of approved make only.

A. SUBMISSIONS TO BE MADE ON DETAILED ENGINEERING OF THE WORK

1.0 DRAWINGS, DOCUMENTS, CERTIFICATES, MANUALS

The Detailed Planning and Design Works can be taken up simultaneously. All the components have to done work wise. The detailed scope of services for Survey & Investigation and Design & Engineering has been explained in Volume – I.

1.1 Submission and review of Engineering Documents

1.1.1 The contractor will submit **within 60 days** from award of contract, the following designs and drawings for review and approval of the Engineer In-charge generally in the sequence given below:

- (a) General layout plan of the entire work on Survey of India sheets and village maps
- (b) General arrangement drawings for all units of works
- (c) Structural design calculations and drawings for all units of work shall be prepared and signed by registered structural engineer. As far as possible all structural drawings shall be drawn with the appropriate scale, neatly giving all the sections and details necessary for the easy understanding of structural details and smooth execution of the work.

- (d) Architectural drawings for all buildings and landscaping for entire project plumbing and electrical drawings.
- 1.1.2 After review by the department/consultant of the department, Engineer in Charge will convey comments, within **30 days** from receipt of details from contractor, which the contractor shall incorporate by modifying designs and drawings accordingly.
- 1.1.3 In no case will design, calculations / drawings be considered complete or acceptable, if
- (a) They are not duly signed by respective Architect/ Civil/ Structural/ Electrical/ Mechanical Design Engineer(s).
 - (b) They are not thoroughly checked and duly signed in the appropriate places by contractor and Sub Contractor (if any).
 - (c) Design calculations are not accompanied by supporting engineering, drawings or appropriate sketches.
 - (d) Design calculations are incomplete or not fulfilling the design requirements or are shabbily done or are without adequate reference, or other necessary back- up data.
 - (e) Any comments previously made are not incorporated on revised drawings /calculations.
- 1.1.4 Such unaccepted drawings / designs as described above shall be summarily rejected and contractor will be informed. Contractor shall arrange to resubmit the same duly checked, revised and signed within 15 days. No claim from contractor for extension of time or for extra cost on this account will be entertained under any circumstances.
- 1.1.5 The review of civil design calculations and drawings shall be carried out only in respect of correctness of center-to-center distances, elevations, important / typical details, orientation and sizes of important members, general design principles and approach, adherence to requirements of the relevant IS or other statutory codes, compliance with the Technical Specifications, general or specific notes and with the requirements of good engineering practice and whether the details shown on drawings conform to design calculations. Check for any interference and taking remedial action is the responsibility of the Contractor.
- 1.1.6 No check will be specifically carried out by the Consultant / Engineer in Charge to verify arithmetical / numerical accuracy of the calculations, which shall remain entirely the Contractor's responsibility, irrespective of any approval that may have been accorded thereto by the Consultant / Engineer in Charge.
- 1.1.7 All values / dimensions / elevations, etc. without supporting back-up data adopted / assumed by the contractor in his calculations / drawings shall be taken by the Consultant / Department to be correct unless they are specified.

1.2 Form of Drawings

- 1.2.1 All drawings submitted for approval shall be ISO standard size sheets, prepared on computer with Auto CAD 2000 / 2007. Every drawing shall have a title block in the bottom right corner showing:

Drawing Title:
 Job:
 Client: OHPC Ltd.
 Consultant:
 Contractor:
 Drawing Number:
 Revision Number:
 Date:

1.2.2 Drawings / Documents

Drawings & Documents to be submitted have been outlined under Appendix-Drawing of Volume-I.

- 1.2.3 Each drawing shall bear the signature of the Authorized Project Manager on behalf of the contractor to the effect that the drawing (whether his own or from any other source) has been checked by the contractor before submission to the Engineer-in-Charge.
- 1.2.4 Each revision shall be properly recorded to show the number, date, specific description of revision/s carried out, and signature of the Project Manager in the revision block. The contractor shall be responsible for incorporating all the comments issued by the Engineer In Charge/ Consultant in the subsequent revision.

1.3 Programme of Submission

- 1.3.1 The contractor shall furnish a programme for submitting all designs, drawings, and documents to Engineer in Charge within (03) three weeks of award of Contract for pre-construction review. The program shall make reasonable provision for resubmission of unapproved designs, drawings and documents and for the time needed to review and transmit such designs, drawings and documents. No designs, drawings and documents will be accepted for review until the programme for submission has been approved by Engineer in Charge. The Engineer-in-charge will approve / convey his comments on the submitted programme within one week from receipt of programme by him.
- 1.3.2 The contractor shall provide six copies of all submissions for review / approval. One copy will be returned to the contractor with comments / approval.
- 1.3.3 The review period of pre-construction documents shall be as per conditions of contract.

1.4 Approval of Designs and Drawings

- 1.4.1 EPC contractor shall submit the Quality Assurance Plan (QAP) for the work and equipment used in the work. The QAP will indicate clearly the tests to be carried out which will be as per I.S and as specified in technical specifications of the tender documents. The QAP shall be approved by Employer. The Engineer-in-charge can depute third party inspector /consultant's representative / Client representative to witness the tests as per approval given for quality assurance Plan and technical specifications given in the tender.
- 1.4.2 Approval from Engineer in Charge to the Contractor's design or drawings shall not relieve the contractor of any of his contractual obligations or liabilities under the Contract or his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, performance particulars and conformity of the suppliers with the Indian statutory laws as may be applicable, nor does it limit the Engineer in Charge's rights under the Contract.
- 1.4.3 Should it be found at any time after approval has been given by Engineer in Charge that any designs, drawings or documents submitted by the contractor are not consistent with any design, drawings or documents submitted or approved previously or deviate from any major aspect of the Contract Document, then such alternations or additions as may be deemed necessary by the Engineer in Charge shall be made therein by the contractor and the works carried out accordingly for which no extra payment shall be made.
- 1.4.4 No revision shall be made by the contractor after design, drawings or documents are "approved" by the Engineer in Charge. In case the contractor desires to incorporate any minor amendments in the "approved" drawing, he shall resubmit the same for formal approval. Contractor shall not make any revision in design / drawings, which is not related to the comments conveyed by Engineer in Charge.

1.4.5 The design would have to be got vetted/ approved from Water Resources Department. All compliance of technical requirements is to be fulfilled.

1.5 Certificates

- 1.5.1 Where certificates are required by the Specification or relevant Reference standard, the original and one copy of each such certificate shall be provided by the Contractor.
- 1.5.2 Certificates of test carried out during the construction or on completion of partsof the Works shall be submitted within 7 days of the completion of the test.

1.6 Work Wise Instruction Manuals

- 1.6.1 The manuals shall cover the setting to work, commissioning, testing, Operation and Maintenance of the works. The greatest importance is attached to completeness and clarity of presentation.
- 1.6.2 Information supplied by sub-Contractors and manufacturers employed by the contractor shall be coordinated into the comprehensive manual. The instruction manuals shall describe the installation as a whole and shall give a step-by-step procedure for any operation likely

to be carried out during the life of each item of work, including erection, commissioning, testing, operating, maintaining, dismantling and repair.

1.6.3 Maintenance instructions shall include charts showing lubrication, checking, testing and replacement procedures to be carried out daily, weekly, monthly and at longer intervals to ensure trouble-free operation. Where applicable, fault location charts shall be included to facilitate tracing the cause of malfunction or breakdown.

1.6.4 A section dealing with procedures for ordering spares shall also be included in the manual.

1.6.5 Six draft copies of the manual shall be submitted to the Engineer in Charge prior to commissioning the works. Ten final copies of the amended and corrected manuals and drawings shall be provided by the contractor at the commencement of the Period of Maintenance.

1.7 Operating Instructions

The instructions shall be written in a simple language. Wherever possible, instructions shall be presented in a tabular form easy to understand.

1.7.2 Maintenance Instructions

A maintenance manual in four copies shall be provided as a supporting document to the equipment manufacturer's instructions.

(a) Maintenance Manual

- i) Checking, testing and replacement procedures to be carried out on all Mechanical and Electrical items on a daily, weekly and monthly basis or at longer intervals to ensure trouble free operations.
- ii) Fault location and remedy charts to facilitate tracing the cause of malfunctions or breakdown and correcting faults.
- iii) A complete list of recommended lubricants, oils and their charts.
- iv) A spares schedule which shall consist of a complete list of itemized spares for all Electrical and Mechanical items with ordering reference and part numbers.
- v) A complete list of manufacturer's instructions for operation and maintenance of all bought out equipment.
- vi) Preventive maintenance details.

(b) Manufacturer's Instructions

Manufacturer's instructions for Operation and Maintenance of all bought out equipment's shall be provided. The instructions shall be supplied complete with Electrical / Mechanical drawings.

B. CRITERIA FOR DESIGN OF CIVIL STRUCTURES

1.0 INTRODUCTION

This section forms the engineering design basis for structural design. The content of these documents is to form the guidelines for engineering design of Structures and to provide information about other disciplines concerned.

This technical specification summarizes the concept and relevant IS codes (Latest Revision) to be followed for Canal Lining, Roads, HM works etc.

2.0 GEO-TECHNICAL INVESTIGATION

The contractor shall be responsible for the geo-technical exploratory survey to obtain accurate information about soil condition at the site. The depth, thickness, extent, composition of each stratum and the depth of ground water shall be determined. Provide a geo-technical report based on survey data which includes boring logs, field and laboratory test results, interpretation of data, building foundation and earthwork recommendations.

3.0 LIST OF DESIGN CODES AND STANDARDS

All designs shall be based on the latest Relevant IS codes and in almanac of Indian Standard codes. Suitable International Codes to be followed as approved by the Engineer-in-Charge. The design standards adopted shall follow the best engineering practice.

4.0 METHOD OF ANALYSIS

The analysis and design for all structures (RCC as well as Steel Structures) are to be carried out by STAAD-pro or equivalent standard software and accepted internationally for the worst/governing combination of loads as specified in relevant IS Codes.

5.0 METHOD OF DESIGN

Limit State method of design is to be followed.

6.0 EXECUTION OF WORKS:

The execution of works is to be carried out as per relevant IS Codes.

7.0 Geological investigation & other parameters:

(a) For Design:

The contractor has to assess soil bearing capacity for all works at his own cost and design the structures on the basis of data received (recommend geological) after investigation. The geological investigation report has to be submitted to Department.

(b) For execution:

At the time of execution, detailed geological investigation for execution purpose at the project site is to be carried out in presence of Engineer-in-Charge or his representative. In case of any variation in the data, the design is to be revisited and vetted accordingly for specific project.

8.0 Safety and durability of the structure:

Notwithstanding the approval/vetting by the Deptt. the responsibility regarding the stability & durability of the structure lie fully on the agency.

TECHNICAL SPECIFICATIONS

SECTION – II

PLANNING, DESIGN AND DRAWING

SECTION – II

A. PLANNING, DESIGN AND DRAWING

1.0 SCOPE OF WORK:

1.1 The scope of work to be carried out under this section under the package shall be as under in addition to that given under Appendix S&I and D&E of Section VI of Volume I of Bid Document 100-year flood, 500-year flood and the pond level provided in the data are binding and shall not be changed. All other data provided are tentative and are for information of bidders. The employer does not guarantee the reliability or accuracy of any of these data and shall assume no responsibilities for any deductions, conclusions or interpretations that may be made from them. The Contractor shall undertake at his expenses such studies as are necessary to assess the reliability and accuracy of the information presented in the data.

1.1.1 Construction of Permanent Bench Marks on either side of the river and temporary benchmarks required for smooth execution of all components of the works in consultation with the Engineer-in-Charge.

1.1.2 Survey work for block contouring at 50 cm intervals on the revenue village maps and Survey of India Topo Sheets required for planning, design and estimate of each component of the Work under the package. Survey work will also be used for preparation of land acquisition cases and operation and maintenance manual.

1.1.3 Preparing a General Arrangement Plan (showing BMs) for each work with alternate alignments proposal with survey wherever necessary. After getting approval for the most economical and feasible alignment from the competent project authorities, contractor has to take up detail survey & investigation for each component of the work and furnish the following details :

A. Kilometer wise L-section and design statements of afflux bund and road connectivity with apex details, location of CD works, detailed designs of curves, part village map showing the alignment of that KM, cross sections at 30 M. interval on alignment for complete afflux bund and road connectivity. L-Section and cross section along the alignment of Barrage, abutments and wing walls.

Preparation of land acquisition cases in required proforma and sketch on revenue village maps as per Land Acquisition Act.

B. Details to be surveyed

The objective of the survey is to provide sufficient detail to enable the design and estimate of the whole work. The survey shall include, but not be limited to the following:

I. Establishment of a network of triangulated control points incorporating benchmarks or with a separate system of benchmarks. Existing monuments should be used wherever possible and their accuracy confirmed. In addition, where control point or benchmarks are not available, new points are to be established. Where the distance between these points exceeds 2.0 Km, intermediate point is to be established.

- II. Pucca, kacha and all other motorable roads and accesses including bridges and railways.
 - III. Principal footpaths and foot bridges.
 - IV. Location and type of all tube wells and open wells, village hand pumps etc.
 - V. Village boundaries (tri-junction marker pillars) where these are located on the ground. Due note of the village name within each boundary shall also be made.
 - VI. Services and utilities including electricity, water supply, sewerage, cable etc. and their supporting high-tension poles or posts:
 - VII. Drainage courses including nallas, ditches, check dams or any other structures on drainage courses etc;
 - VIII. Water bodies including rivers, lakes, tanks and ponds, rock outcrops borrow pits and quarries, forestry (protected, reserved, preserved, private or otherwise) other significant ground cover.
- C.** After getting approval to the alignment from the project authorities, the contractor has to fix the chainage stone at 100m interval along alignment on central line and apex stones at every deviation of alignment duly indicating apex No. and chainage. The chainage stones and apex stones shall be of size 20x20x75 cms. Projection of the stone above ground level will be 25cms.
- D. For Power System Connectivity:** For Planning & development of suitable system connectivity for the work of the package from the Local Grid, the contractor shall conduct Preliminary route survey, finalization of route alignment, detailed survey, structure (tower/pole) spotting, geo-technical investigation, optimization of structure location and check survey in respect of overhead lines. Other detail requirement has been described under Technical Specification for Electrical System Connectivity.
- E. Design and drawing:** Design and Drawing of all components of the work should be as per relevant IS codes, IRC codes, MOST specifications, Departmental and other prevalent norms.
- 1.1.4 **Preparation of Schedule of quantities:** Estimate and Schedule of quantities should be furnished separately for entire project. Item of work should be in accordance with the specification and rates mentioned in the current "Schedule of rates" of the State of Odisha and prevailing market rates for non-scheduled items supported by rate analysis and quotations from manufactures of selected material. The detailed estimates in triplicates sets and also in soft copy, which shall include detailed report, drawing, estimates and detail survey sheets.
- 8.0.1 **Preliminary Survey Reports:** Three copies of the alignment report along with other information, if any, shall be submitted in report form, to competent authority of OHPC/ EIC with copy marked to Director (Operation), OHPC for approval. The **Detailed survey:** - It should be taken up only after the route map is approved. Preliminary route alignment in respect of the proposed line may undergo changes due to alteration of place and other unavoidable constraints. Detailed survey shall be covered by the following general guidelines:
- Route of the electric line shall be as short as possible.
 - The line is as near as possible to the available roads in the area. Difficult and unsafe approaches are avoided

- Good farming areas, religious places, forest, civil and defence installations, aerodromes, public and private premises, ponds, tanks, lakes, gardens, and plantations are avoided as far as practicable.
- Involvement of Forest land should be least & restricted as far as possible.
- The line should be far away from telecommunication lines as reasonably possible. Parallelism with these lines shall be avoided as far as practicable.
- Angle points in the route shall be minimized. Railway and road crossing shall be minimum on the line route and in case it is not possible to avoid the same the crossings at right angles shall be preferred but the crossings shall not be less than 600 in any case.
- The survey shall be conducted along the approved alignment only.
- Relevant drawings & data shall be furnished to the appropriate authorities and obtain statutory clearances for Railway crossings, Highway/Roads, Telephone/Power line crossings etc. All such clearances are the responsibility of the contractor.
- Owner shall arrange all required consent/approvals including civil aviation, road, river, railway, canal, power line crossings and environmental and forest clearance etc. from the concerned authorities.
- Owner in accordance with the requirement of construction shall arrange right of way and way leave clearances. Compensation for right of way and way leaves shall be given as per applicable laws, rules, regulations, guidelines/ directives of local administration/ revenue authorities.
- For river crossing/ Crossing of nallas: Taking levels at 25-meter interval on bank of river and at 50-meter interval at bed of river so far as to show the true profile of the ground and river bed. In case of railway/ Road Bridge, road, the levels shall be taken at least 100 m. on either side of the crossing alignment. Both longitudinal and cross sectional shall be drawn preferably to a scale of 1:2000 at horizontal and 1:200 vertical.
- To facilitate checking of the alignment, suitable reference marks shall be provided. For this purpose, concrete pillars of suitable sizes shall be planted at all angle locations and for others with suitable wooden/iron pegs.

8.1 Way-Leave and Tree cutting: -

8.1.1 Way-leave permission which may be required by the contractor shall be arranged at his cost. While submitting final-survey report for approval, proposals for way-leave right of way shall be submitted by the contractor. Department may extend help/ facilitate to get the permission within a reasonable time for which due notice shall be given by the contractor in such a way so that obtaining permission from appropriate authority do not hinder the continued and smooth progress of the work.

8.1.2 The employer shall not be held responsible for any claim on account of damage done by the contractor or his personnel to trees, crops and other properties.

8.1.3 The contractor shall take necessary precaution to avoid damage to any ripe and partially grown crops and in the case of unavoidable damage, the employer shall be informed and necessary compensation shall be paid by the contractor.

8.1.4 All the documents required for application to the statutory authorities must be prepared by the contractor & submitted to the employer for submission of the application towards approval of Railway Crossing etc. However, the responsibilities lie with the contractor to get the clearance.

8.1.5 Trimming of tree branches or cutting of a few trees en-route during survey is within the scope of survey to be done by the contractor. Contractor shall arrange for necessary way-leave and compensation in this regard. During erection of the line, compensation for tree cutting, damage caused to crops, actual cutting and felling of the trees including way-leave permission for such route clearance shall be arranged by the contractor at his cost. The contractor will identify the number of trees and detail of obstructions to be removed for erection of the line and intimate the employer well in advance in case of any help. Other related works like construction of temporary approach roads, etc. as required, shall be done by the contractor and the same will lie within the scope of contractor's work and such cost shall be considered to be included in the rates quoted by him.

9.0 Work Ownership

Following completion of the survey work and final payment of all dues the survey work including all data and computations satellite imagery and drawings shall become the property of the Employer. The Contractor shall not distribute copies of the Work to third parties except the Departments, without the prior written consents of the Employer.

10.0 Back-up Copies

The Contractor shall submit all records with licensed software in Compact Discs (DVD) in 5 copies with proper referencing and interlinking of data with references so as to access data as web page. The data shall also be supplied in an appropriate capacity hard disc with all operating software used. The data shall also be available with contractor till the expiry of defect liability period and if required by department the same shall be supplied in soft copies.

SECTION - III
CLEARING OF SITE

SECTION - III
CLEARING OF SITE

3.1 Cleaning and Grubbing.

The portion of the right of way, where required for constructing the work under these specifications including borrow area, submergence area, shall be cleared of all plants, bushes, rubbish and other objectionable matters. The timber and other useful materials should be stacked as directed by the Engineer-in-charge and handed over to the Department. Trees designated by the Employer shall not be cut and shall be protected from injury. After handing over useful material to department the waste material shall be disposed of and removed from the site of work before the date of completion of the contract as approved by the Employer. The clearing operation shall be in accordance with clause 4.1, 4.1.1, 4.2 and 4.3 of IS 4701-1982 Indian code of practice for earthwork. Surface boulders either loose or partly embedded in the ground will have to be removed and stacked as directed.

3.2 Site Drainage and diversion and care of the river flows.

The Contractor shall handle all flows from natural drainage channels intercepted by the work. He shall perform any additional excavation and grading for drainage as directed and provide and maintain any temporary construction required to bypass or otherwise cause the flows to be harmless to the work and property. The contractor should design and construct the required coffer dams to divert the flows during execution. He should submit the design of the cofferdams and the diversion plans of the river flows and work progress schedule. They shall be submitted to the Engineer-in-charge for approval. When the temporary construction is no longer needed and prior to acceptance of the work the contractor shall remove the temporary construction and restore the site to its original condition as approved by the Engineer. The cost of all works and materials required for the above work shall be included by the bidder in the unit prices quoted in bill of quantities and no separate payment will be made for the same.

SECTION - VII
STEEL REINFORCEMENT

SECTION - VII
STEEL REINFORCEMENT

7.1 GENERAL

- a. The section covers specifications for providing steel reinforcement to Dams/barrages and ancillary works and the contractor has to make his own arrangements for the procurement of tested mild steel and H.Y.S.D. Bars required for the work only from the reputed manufacturers. Necessary I.S.I. test certificates are to be produced to Engineer before use in work. Steel bars shall be stored in such a way as to avoid distortion and to prevent deterioration by corrosion. The Contractor shall make his own arrangements for transportation and storage.
- b. High yield strength deformed bars shall conform to I.S:1786-1985, The diameter and weight of plain and HYSD steel bars shall be as follows.

Sl. No	Diameter of rod	Sectional weight in Kilogram per running meter both for plain and HYSD steel.
1	6 Millimeters	0.22
2.	8 Millimeters	0.39
3.	10 Millimeters	0.62
4.	12 Millimeters	0.89
5.	14 Millimeters	1.21
6.	16 Millimeters	1.58
7.	18 Millimeters	2.00
8.	20 Millimeters	2.47
9.	22 Millimeters	2.98
10.	25 Millimeters	3.85
11.	28 Millimeters	4.83
12.	32 Millimeters	6.31
13.	36 Millimeters	7.99
14.	40 Millimeters	9.86

Sl. No	Diameter of rod	Sectional weight in Kilogram per running meter both for plain and HYSD steel.
15.	42 Millimeters	10.88

NOTE: If any rods other than those specified above are used, the weights shall be as per standard steel tables.

- c. The work shall consist of shaping and placing reinforcement in conformity to the shape and dimensions shown on the drawings and as specified in the specifications, including cutting, bending, clearing, wedging, placing, binding and fixing in position. A list of IS codes applicable is furnished below:

List of IS Codes:

IS:456-1978/2000	Code of practice for plain and reinforced concrete
IS:1786-1985	Specification for High strength deformed steel bars and wires for concrete reinforcement.
IS:432-1982 (Part-I)	Specifications for mild steel and medium tensile steel bars for concrete reinforcement and hard drawn steel wire.
IS-280-1978	Mild steel wire for general engineering purposes.
IS-2502-1963	Code of practice for bending and fixing of bars for concrete reinforcement.
IS:9417-1989	Recommendations for welding cold worked bars for reinforced concrete construction
IS:2751-1979	Welding of mild steel plain and deformed bars for reinforced construction
IS:814-1991	Covered electrodes for manual metal arc welding of carbon and carbon manganese steel.
IS:1278-1972	Filer rods and wires and gas welding.

In addition to the above Indian Standard codes, the specifications of OSS and manual for quality control and inspection shall also be complied with.

7.2 Material

- i. a. Steel shall be clean and free from loose rust or loose mill scale and other objectionable foreign substances at the time of fixing in position and subsequent concreting. The fact that early-stage rust has no detrimental effect on bond shall not be used as excuse of careless handling and storage of steel.

- b. The contractor shall procure high yield strength deformed bars, conforming to IS:1786-1985.
 - c. The reinforcement bars used by the contractor shall be in accordance with the Section 5.1.
- ii. Cutting, Bending and binding of reinforcement.
- a. Reinforcement steel shall conform accurately to the dimensions given in the bar bending schedules shown on relevant drawings.
 - b. Bars shall be bent cold to the specified shape and dimensions by a bar bender by hand or power to attain proper radius of bends as shown in drawings or as directed by the Engineer. Heating of reinforcement bars to facilitate bending will not normally be permitted. When, however, such heating is permitted in the case of large diameter bars, the temperature of the steel shall not exceed the temperature corresponding to a cherry red colour.
- c. Bars shall not be bent or straightened in a manner that will injure the material**
- d. Bars bent during the transport or handling shall be straightened before being used on work, they shall not be heated to facilitate bending.

7.3 Placing of reinforcement.

- a. Before the reinforcement is placed, the surface of the bars and the surfaces of any metal bar supports shall be cleaned of the rust, loose mill scale, dirt, grease and other objectionable foreign substances.
 - b. All reinforcing bars shall be accurately placed in exact position shown on the drawing, and shall be securely held in position during placing of concrete by annealed binding wire, and by using stays, blocks or metal chairs, spacers, metal hangers, supporting wires or other approved devices at sufficiently close intervals so that they will not sag between supports, nor be displaced during concreting or by any operation of the work.
- c. Wire for binding reinforcement shall be soft and annealed mild steel of 16 SWG and shall conform to IS:280-1978.**
- d. The contractor shall also ensure that there is no disturbance caused to the reinforcing bars already placed in concrete.
 - e. All devices used for positioning shall be of non-corrodible material. Metal supports shall not extend to the surface of the concrete, except where shown on the drawings. Pieces of broken stone or brick and wooden blocks shall not be used. Where portions of such supports will be exposed on concrete surfaces designated to receive F2 or F3 finish, the exposed portion of support shall be galvanized or coated with other corrosion resistant material without which the concreting will not be permitted. Such supports shall not be exposed on surfaces designated to receive F4 finish unless otherwise shown on the drawings.
 - f. Placing of reinforcement bars on layers of freshly laid concrete, as work progresses, for adjusting bar spacing shall not be allowed.
 - g. Layers of bars shall be separated by spacer bars, pre-cast blocks or other approved

devices.

- h. Reinforcement after being placed in position shall be maintained in a clean condition until completely embedded in concrete. Special care shall be taken to prevent any displacement of reinforcement in concrete already placed.
- i. To protect reinforcement from corrosion, concrete cover shall be provided as indicated on the drawings. All bars protruding from concrete and to which other bars are to be spliced and which are likely to be exposed for an indefinite period shall be protected by a thick coat of neat cement grout.
- j. Bars crossing each other, where required, shall be secured by binding wire (annealed) or size not less than 1mm dia and conforming to IS:280-1978 in such a manner that they do not slip over each other at the time of fixing and concreting.
- k. As far as possible, bars of full length shall be used. In case this is not possible, overlapping of bars shall be done as directed by Engineer-in-Charge. When practicable, overlapping bars shall not touch each other, but be kept apart by 25 mm or $1\frac{1}{4}$ times the maximum size of the coarse aggregate which is greater, by concrete between them. Where not feasible, overlapping bars shall be bound with annealed steel wire, not less than 1mm thickness twisted tight. The overlaps shall be staggered for different bars and located at points, along the span where neither shear nor bending moment is maximum.
- l. The minimum allowable clearance between parallel round bars shall not be less than $1\frac{1}{2}$ times the diameter of the large bars and for square bars shall not be less than twice the side dimensions of the larger bars or $1\frac{1}{2}$ times the maximum size of aggregate, whichever is greater.
- m. Dissimilar diameter rods should not be joined together.

7.4 Splicing

- a. Where it is necessary to splice reinforcement, the splices shall be made by lapping or by welding or by mechanical means.

When permitted or specified on the drawings, joints of reinforcement bars shall be butt welded so as to transmit their full strength. Welding of bars shall be done as directed by the Employer and conforming with requirements of clause 11.4 of IS:456-1978.

If it is proposed to use welded splices in reinforcing bars, the equipment, the material and all welding and testing procedures shall be subject to the approval of the Employer. The contractor shall also carry out test welds as required by the

Employer. No extra rate will be paid for welding reinforcement and test-welds, as bid price is inclusive of this item.

For welded splices for reinforcing bars conforming to IS:1786-1985 welding shall be done in accordance with IS:9417-1979. For reinforcing bars conforming to IS:432(Part I)-1982 welding shall be done in accordance with IS:2751-1979. Electrodes for manual metal arc welding shall conform to IS:814(Part-I)-1974 and IS:814(Part-II)-1974. Mild steel filler rods for Oxy-acetylene welding shall conform to IS:1278-1972, provided they are capable of giving a minimum butt weld tensile strength of 41 Kg/mm².

Only electric arc welding using a process which excludes air from the molten metal and conforms to any or all other special provisions for the work shall be accepted. Suitable means shall be provided for holding the bars securely in position during welding. It must be ensured that no voids are left in welding and when welding is done in two or three steps, previous surfaces shall be cleaned well. Ends of bars shall be cleaned of all iron scale, rust, grease, paint and other foreign matter before welding.

- b. Reinforcing bars of 28 mm in diameter and larger may be connected by butt welding provided that lapped splices will be permitted if found to be more practical than butt welding and if lapping does not encroach on cover limitation or hinder concrete or reinforcement placing.
- c. Reinforcing bars 25mm in diameter and less may be either lapped or butt welded, whichever is the most practicable.

Butt welding of reinforcing bars shall be performed either by the gas pressure or flash pressure welding process or by the electric arc methods under cover from weather.

Welded pieces of reinforcement shall be tested at the rate of 0.5% of total number of joints welded. Specimen shall be taken from the actual site of work. Strength of the weld provided shall be at least 25% higher than the strength of bars.

- d. Welded joints or splices shall preferably be located at points where steel will not be subject to more than 75% of the maximum permissible stresses and welds so staggered that at any section not more than 20% of rods are welded. Approval of such additional splices will generally be restricted to splices not closer than 8 meters in horizontal bars or 4 meters in vertical bars measured between mid-point of laps.

7.5 Coupling of bars.

Wherever indicated on the drawings or desired by the Engineer-in-Charge to use mechanical couplings for reinforcing bars, bars shall be joined by couplings which shall have a cross sections sufficient to transmit the full strength of bars. The ends of bars that are joined by couplings shall be upset for sufficient length, so that the effective cross section at the base of threads is not less than the normal cross section of the bars. The threads shall be standard with worm threads. Steel for couplings shall conform to IS:226. The contractor shall submit samples of the proposed coupling to the Engineer for approval not less than 60 days prior to their proposed use.

7.6 Care of placed reinforcement and concrete

Where reinforcement bars at construction joints and afterwards are bent back into their original position, care shall be taken to ensure that at no time the radius of the bend is less than 6xdiameter for deformed bars and 4xdiameter for plain mild steel bars. Care shall also be taken, when bending such bars, to ensure that the concrete around the bars is not damaged.

As specified in clause 11.3 of IS:456-1978 unless otherwise specified by the Engineer-in-Charge, reinforcement shall be placed within the following tolerances.

- i. For effective depth 200 mm or less = $\pm 10\text{mm}$
- ii. For effective depth more than 200mm = $\pm 15\text{mm}$

The cover shall in no case be reduced by more than one third of specified cover or 5mm whichever is less.

- a. The dowels shall be of the same HYSD bars of grade F2 415 conforming to IS-1786-1985 as used for reinforcement
- b. Details for dowels shall be as shown on the drawings or as directed by the Engineer.
- c. Dowels shall be placed in the concrete were shown on the drawings or were directed and will be inspected for compliance with requirements as to size, shape, length, position and quantity after they have been placed but before being covered by concrete.
- d. Before the dowels are embedded in concrete, the surfaces of dowels shall be cleaned of all dirt, grease or other foreign substances which in the opinion of the Engineer are objectionable.
- e. The dowels shall be accurately placed and secured in position so that they will not be displaced during the placing of the concrete.

7.7 INSPECTION BEFORE CONCRETING:

No concreting shall be started unless the reinforcement as laid is finally checked and certified by the Engineer-in-charge or his authorized representative, before starting the concreting the contractor shall make certain that the measurements of the reinforcement placed in have been recorded and that the Engineer-in-charge certifies corrections of reinforcement used. Failure to do so may mean no payment or payment at the discretion of the Engineer-in-charge for the reinforcement concrete.

SECTION - IX
CONCRETE

SECTION - IX

CONCRETE

(Excluding Framework, Reinforcement and Joints)

8.1 SCOPE OF WORK

- (1) The work under this section includes all concrete works in weir, road works, afflux bund etc covering the ingredient materials, testing and services related to the concrete work to be carried out by the contractor under this contract.
- (2) The concrete work shall be performed to the dimensions as shown on the construction drawings or as otherwise directed by the Engineer-in-charge. Lift drawings for each pour showing all embedment, lines and levels shall be prepared by the contractor.
- (3) The contractor shall cooperate with all other contractors and organizations related to the construction of permanent works where the materials or equipment is to be fixed to or embedded in the concrete structures.
- (4) Form work, reinforcement and concrete are covered separately in other sections of this specification.
- (5) The approval given by the Engineer-in-charge to the contractor's plants and equipment or their operation or of any construction methods shall not relieve the contractor of his full responsibility for the proper and safe execution of concrete work or any obligations under this contract.

8.2 STANDARDS

- 1) Unless otherwise specified, the standard and recommendations of Indian Standards Code of Practices shall be followed in respect of all materials, equipment and performances.
- 2) The relevant Indian standards are to be followed in maintaining standard quality.

8.3 SUBMITTALS

8.3.1 Submittals Before Construction

- 1) Submittals listed herein are related to items, which require the consent of the Engineer-in-charge and are to be submitted by the Contractor before the appropriate work may proceed.
- 2) Within 28 days from the date of issue of Notification of Award, but before procuring or mobilizing to the site the equipment, the contractor shall submit to the Engineer-in-charge updated and detailed plans and descriptions, consistent with those submitted with his Tender and any subsequent amendments and additions agreed to by the Engineer-in-charge and the contractor, including but not limited to the following:
 - a) Aggregates Processing Plant:
Description, flow diagrams and drawings in sufficient details to indicate layout, type and capacity of crushing, screening, washing, conveying and other aggregate processing and handling equipment.
 - b) Batching Plant

Description, flow diagrams and drawings of the plants, and details of the equipment the contractor intends to use, to determine and control the quantity of each separate concrete ingredient and mixing thereof into uniform mixture.

c) Transport and Placing of Concrete.

Full details of the equipment and methods for transporting the concrete from the concrete plant to the final point of placing including numbers, type and capacity of transport vehicles, concrete pumps, vibrators, and details of standby plants to be installed.

b) Mode and methodology of concrete compaction and concrete curing.

c) Sampling and Testing of Materials: List and details of equipment of sampling and testing, detailed program for quality control of concrete work and qualification and experience of the proposed personnel.

d) Foundation and surface preparation equipment.

3) At least 56 days in advance of any concrete work being carried out at the site, the contractor shall submit to the Engineer-in-charge following notifications based on the results of the preliminary material testing:

a) Notification on the quantity of cement required, brand of cement to be used on approval of Engineer-in-Charge and the proposed schedule of shipment and storage.

b) Notification of the source, analysis, method of delivery and storage of water for concrete manufacture.

c) Notification of any admixtures which the contractor proposes to use, manufacturers thereof, and information about the chemical names of the principal ingredients and the effects of under or over dosage. Should the contractor intend to use an accelerator in any concrete work for his own convenience, he shall give full details of the type, dosage, influence on construction, and the cost savings involved.

d) Details of the materials for formwork and surface finishes, treatment of construction joints, and construction techniques which the contractor proposes to use in order to achieve the required concrete surfaces and allowable tolerances.

e) Details of special additives like silica fume & steel fibers for production of high-performance concrete.

f) Details of curing methodology

8.3.2 Submittals During Construction

a. Contractor shall provide the Engineer-in-charge with a weekly placing schedule giving the detailed location of the pours, the approximate extent of pours, and the date on which the concrete will be placed. This weekly programme of concrete placement shall be submitted to the Engineer-in-charge for his acceptance at least 2 days prior to the commencement of the week.

b. Before commencement of the concrete placement the contractor shall prepare a checklist regarding all preparations for the specified work such as cleaning and treating rock surfaces and foundations, formwork, reinforcement, embedding, instrumentation and submit this list to the Engineer-in-charge, who after his

satisfaction about the work preparations will permit the contractor in writing to commence concrete placement.

- c. The contractor shall keep and make available to the Engineer-in-charge records of the date, quantity and storage location of each delivery and shall provide facilities for checking the stock of cement.
- d. During the performance of the concrete work, the contractor shall keep a diary where he shall record the construction procedures related to concreting. This diary shall be made available to the Engineer-in-charge upon request. The records shall contain at least the following.
 - a) Commencement and termination of concreting of various parts of the structures.
 - b) Quantities and quality of aggregates and cement provided and the storage from which they were drawn.
 - c) Temperature of air, water and concrete.
 - d) Meteorological conditions
 - e) Sampling and testing performed and summary of results.
 - f) Personnel employed during various stages of the concreting operation and name of the responsible inspector or foreman.
 - g) Equipment used.
 - h) Any special material or procedures employed.
- e. The Engineer-in-charge reserves the right to require any additional information deemed necessary to be included in the submitted documents.

8.4. CONSTITUENTS OF CONCRETE

8.4.1. Cement

- (1) Cement shall be ordinarily Portland cement conforming to IS:269 or low heat-low alkali Portland pozzolana cement (PPC) conforming to IS:1489 or Grade 43 conforming to IS:8112 or Grade 52 cement conforming to IS:12269 depending upon the use and type of structure. If required slag cement may also be used.
- (2) Cement, which does not comply with, relevant IS code or is damaged in consignment, handling or storage shall be promptly removed from the site.
- (3) All facilities for transport and storage of cement shall be subject to approval of Engineer-in-charge and shall be such that easy access for inspection is assured.
- (4) Bulk cement shall be transported from the port or factory to the site in adequately designed weather tight trucks, or other means where cement will be protected from exposure to moisture. Immediately upon receipt at the site, cement shall be stored in a dry, weather-tight and properly ventilated structure with adequate provisions for the prevention of absorption of moisture, and constructed in such a way that there will be no dead storage. The vents of the bins and silos shall be equipped with dust collectors to reduce loss of cement during handling and inconvenience to the personnel.
- (5) Cement bags shall be stored in weatherproof buildings with a raised, well-ventilated wooden floor, and placed so that each consignment can be segregated if required and used in order of its age. Bags shall not be stacked more than 1.5 m high. Cement shall not be stored outdoors, except for immediate use, and in such event shall be protected during storage and handling by waterproof covers and a raised

floor. Unused cement shall be placed back into the storage buildings.

- (6) Cement shall be preferably used in same order in which it has been received at the site. Storage of cement shall be limited to 90 days in bags and 150 days in bulk. Cement that has been in storage for longer than these periods or which may have absorbed moisture shall not be used unless it has been re-tested by the Contractor and approved by the Engineer-in-charge. Cement that has become lumpy shall not be used. The cements coming from different factories or of different makes shall be stored separately.
- (7) The temperature of cement upon arrival to the Site shall not exceed 70⁰C and when entering the mixers shall not exceed 50⁰C unless otherwise approved.
- (8) Fly ash (pozzolana) shall not be allowed to be mixed with cement at place other than factory/manufacturing unit. Fly ash (pozzolana) mixed at factory shall conform to IS:3812 and IS:1344.

8.4.2 Aggregate

8.4.2.1 General

- (1) Unless otherwise specified, concrete aggregates shall conform to the requirements of IS:456 and IS:383. They shall be tested in accordance with the provisions of IS:2386
- (2) Aggregate shall consist of clean, hard, dense, durable and uncoated materials and shall have stable moisture content and grading when delivered to the batching plant. Aggregates shall not contain substances, which may impair the quality of the concrete, attack reinforcing steel or reduce bond. The following substances are regarded as being harmful; loam, clay, pieces with large cavities, foam-like or vitreous pieces and organic materials such as topsoil, roots, wood, coal, lignite etc. In doubtful cases the effects of harmful substances shall be established by tests.
- (3) Use of aggregates containing minerals which can cause alkali reactivity beyond acceptable limits will not be permitted. Presence of such minerals in the stones will be determined by testing.
- (4) The shape of the particles shall be generally spherical or cubical. The amount of flat or elongated particles shall not exceed 25% by weight. A flat or elongated particle is defined as one in which the width to thickness, respectively length to width ratio is greater than 3. Rock, which breaks down into such shape, regardless of the type of processing equipment used, will not be approved for use in the production of aggregates.
- (5) The contractor shall make provisions for crushing and processing of material in accordance with recommendations contained in IS:383 to meet the gradation and other requirements of these specifications, in order to obtain the total amount of aggregate required for concrete manufacture. Crushing, screening and washing operations, beneficiation of aggregates and blending of crushed and natural aggregates shall at all time be subject to the consent of the Engineer-in-charge.
- (6) The handling, transporting and stockpiling of aggregates shall be such that there will be a minimum amount of fines resulting from breakage and abrasion of material resulting from free fall and improper handling. Excess in any of fine or coarse aggregate sizes shall be disposed of in approved manner.
- (7) The contractor shall remove all rejected aggregate from the site.

8.4.2.2 Fine Aggregates.

- (1) The term 'fine aggregate' is used to designate aggregate in which the maximum size of particles is 4.75mm. Sand obtained from natural sources like river shall be used as fine aggregate. Fine aggregates shall be tested for their gradation, specific gravity, water absorption, fineness modulus, soundness, petrography analysis, deleterious constituent and alkali aggregate reactivity to assess the suitability.
- (2) The gradation of fine aggregate shall conform to specifications of IS 383 and the sand shall not fall into grading zone I and IV.
- (3) The percentage of deleterious substance in the fine aggregate shall conform to IS:383, except that the fine aggregate shall contain not more than 0.1% by weight of deleterious (reactive) ferrous sulphide. The total percentage of deleterious substance must not exceed 5% by weight.
- (4) Fine aggregate having specific gravity of less than 2.6 shall be rejected. Fine aggregates, when subjected to soundness test with a solution of sodium sulphate, after five cycles of tests, shall not suffer a loss of weight in excess of 10 percent.
- (5) Fineness modulus of fine aggregate shall be 2.1 to 3
- (6) Fine aggregate, upon delivery to the batching plant, shall have uniform and stable moisture content. The Bulk age of sand shall be less than 20%.
- (7) Sand shall be free from harmful quantity of organic impurities as per IS 2386 Part II. Sand that are producing a color (obtained by dissolving 9 grams of chemically pure Ferric Chloride and 1 gram of CP Cobalt in 100 ml of water to which one-third ml of Hydrochloric Acid has been added) darker than the standard in the test (Organic test for organic impurities) shall be rejected.

8.4.2.3 Coarse Aggregates

- (1) The term "coarse aggregate" is used to designate aggregate which is retained on sieve opening 4.75mm. The coarse aggregate shall be well graded and its gradation will be decided based on the laboratory tests to obtain dense mass of concrete. The gradation will be approved by the Engineer-in-charge before production of the concrete.
- (2) The coarse aggregate shall be tested for gradation, specific gravity, water absorption, impact and abrasion values, soundness, spectrographic analysis, deleterious constituent, flakiness and elongation indices and alkali aggregate reactivity as per IS 2386- 1963(Part I to IX) and other relevant standards.
- (3) Coarse aggregates shall be stored separately in stockpiles or bins in such a manner to avoid intermixing of different size of aggregates. The storing shall be done in following sizes.

5-10 mm

10-20 mm

20-40 mm

40-80 mm

80-150 mm

- (4) The percentage of deleterious substance in the coarse aggregate shall conform to IS:383 except that the coarse aggregate shall contain not more than 0.3% by weight of deleterious (reactivity) ferrous sulphide. The total deleterious material shall not exceed 5% by weight.
- (5) Coarse aggregate shall have a loss not more than 40% as determined by Los Angeles Abrasion test as specified in IS:2386 (Part IV). However, in extreme cases, because of non-availability of such aggregate in near vicinity the Engineer-in-charge may allow aggregates having this value as 50%.
- (6) When subjected to sodium sulphate soundness test, coarse aggregate shall not suffer a loss of weight in excess of 12% after five cycles.
- (7) Coarse aggregate shall be hard, dense, durable, non coated rock fragments. Rock having an absorption greater than 3% or specific gravity less than 2.5 shall not be used.
- (8) Aggregate delivered to the batching plant shall have uniform and stable moisture content.

8.4.2.4 The nominal maximum aggregate size in relation to the structure dimension shall be fixed as per IS 456 & IS 457 and as per the approved drawing. Coarse aggregate shall be well graded and shall conform to the grading specified in Table II of IS 383.

8.4.2.5 Aggregate storage.

- (1) Aggregates shall be stored in a manner so that each size of aggregate is separate in free- draining piles in a manner that reduces breakage, deterioration, contamination and segregation to a minimum. Each grade of aggregates is to be stored separately. Storage arrangements shall be subject to acceptance by the Engineer-in-charge.
- (2) The Contractor shall maintain sufficient aggregate storage at the site at all times to permit continuous placement of concrete in accordance with the contractual time schedule.
- (3) The moisture content of aggregates shall be controlled as far as practicable, by wetting the stockpiles and by adequate drainage. All aggregate shall remain in a free-draining stockpile for at least 12 hours prior to use. To minimize moisture variation, the height of the stock piles shall be kept 1.25m to 1.5m and the lowest layer of about 30cm height shall be used as drainage layer and not used till end. Fine aggregates of the bottom 30cm layer shall not be used for concrete.

8.4.3 Water

- (1) A reliable and adequate water supply shall be installed and maintained by the contractor for washing of aggregates, manufacturing and curing of concrete. The water shall be clean and free from harmful quantities of oil, acids, alkalis, sugar, salt, silt and other organic matters and shall conform to IS:456.
- (2) Permissible limit of Solids in water shall conform to Table I of IS 456. Water shall contain not more than 200mg/l of organic, 3000mg/l of inorganic, 400 mg/l of sulphates (SO₃), 500 mg/l of chlorides (Cl), and 2000mg/l of

suspended matter.

- (3) Adequate water storage shall be provided at the batching plant to ensure smooth concrete production.
- (4) Contractor shall familiarize himself with source and quality of water available. Attention is drawn to the possible requirement of settling pond and other facilities that he may be required to provide.

8.4.4 Admixtures

- (1) Admixtures shall be proposed by the contractor and shall be used only upon written approval of the Engineer-in-charge. Only admixtures, with satisfactory evidence that its use does not adversely affect the properties of concrete particularly its strength, volume changes, durability, and has no harmful effect on the reinforcement, shall be permitted. All admixtures shall be manufactured by a reputed company(ies), supported by a fully staffed technical service organization and research group.
- (2) The contractor may use the following admixtures when required with the approval of the Engineer-in-charge.
 - a) High-range water-reducing admixtures (HRWRA)/ Super plasticizer to improve workability without reducing the strength or durability of the mix.
 - b) Air-entraining agent,
 - c) Non-shrink agent,
 - d) Accelerating agent in the concrete, mortar or grout to increase the rate of hydration, shorten the setting time or increase the rate of hardening or strength development
- (3) Admixtures shall comply with the provisions of IS:9103 or in case of lack of corresponding IS, the ASTM specifications C494 and C260.
- (4) Admixtures shall be stored and handled so as to avoid contamination or damage to their properties by temperature or moisture changes or other influences.
- (5) The quantity of admixture and the method of mixing shall be strictly in accordance with the manufacturer's printed instructions or as required to produce specified results as established by mix design whichever is less, and approved by the Engineer-in-charge. No excess admixtures shall be used for getting more workability than functional requirement of structure. The contractor shall be liable for penalty for such overuse of admixture. No payments shall be made for the concrete produced in case of such overuse of admixture.
- (6) The contractor shall be held liable for any damages and difficulties resulting from the selection and use of admixtures such as delay in concrete placing or damage to concrete during forms removal and shall not be entitled to any time extension or claims resulting there from.

8.5 CONCRETE MIX DESIGN

- (1) Denomination of concrete classes is based on the nominal cube compressive strength in Newton per square mm and maximum aggregate size, e.g., M25 A20
- (2) The cube compressive strength is defined as the strength as measured at 28 days. The strength shall comply with the requirements of IS:456.
- (3) The specific class of concrete to be used in each area will be shown on the Approved Construction Drawings or as designated by Engineer-in-charge.
- (4) At least 4 months prior to commencement of any concreting of permanent works, the contractor shall start the testing of materials, propose the composition of concrete mixes and prepare trial mix of each of the proposed concrete class. The contractor shall prepare the trial mixes using the cement, water, aggregates and admixtures intended for the work and which conform to the requirements specified in this section.
- (5) Contractor shall determine, in accordance with IS standards and/or ACI Manual of Concrete Practice, the mix proportions for the designated classes of concrete. In proportioning concrete, the quantity of both cement and aggregate shall be determined by weight. Water shall be either measured in volume in calibrated tank or by weight. The proportion of ingredients shall be such that concrete has adequate workability for conditions prevailing at work in question and can be properly compacted. The contractor shall submit the test reports to the Engineer-in-charge for approval.

8.6 QUALITY CONTROL

8.6.2 General

- (1) The contractor shall be completely responsible for performing detailed quality control program during the execution of the work. This quality assurance program shall be subject to inspection and checking by the Engineer-in-charge or his authorized representative.
- (2) The Contractor shall keep records of test results, which shall be presented to the Engineer-in-charge upon request.
- (3) Should the Contractor wish to change his approved testing program he shall notify the Engineer-in-charge of these changes 2 weeks in advance.
- (4) Besides Contractor's testing program the Engineer-in-charge will make control test to the extent as he deems necessary. The Contractor shall give all required assistance in sampling and provide for the proper storage and transport of the specimens to be tested by the Engineer-in-charge.

8.6.2 Site Laboratory

- (1) The Contractor shall build, equip and operate the site laboratory in which the tests included in the Quality Control Programme will be carried out. In some cases where special tests are required, they will be made in other specialized laboratories after approval by the Engineer-in-charge.

- (2) The laboratory shall be equipped with all the necessary equipment to carry out the tests indicated below.
- a) Tests on aggregates as per IS 2386 (Parts I, II, III, IV)
- Sieve analysis
 - Compressive strength
 - Specific gravity
 - Water absorption
 - Flakiness
 - Sand equivalent
 - Soundness and organic matter
 - Los Angeles abrasion
 - Impact test
- b) Tests on cement
- Equivalent alkaline content (IS 4032)
 - Specific Blaine surface (IS 4031(6))
 - Standard Mortar
Compressive Strength (IS 4031(6))
 - Shrinkage (IS 4031 (10))
 - Setting time (IS 4031(5))
- (c) Tests on fresh concrete
- Consistency through slump test (IS 1199)
 - Workability
- (d) Tests on hardened concrete
- Compressive strength on all classes of concrete (IS 516)
 - Shrinkage (IS 4031(10))

8.6.3 Concrete Sampling and Testing

8.6.3.1 Aggregates

- (1) Aggregate samples shall be taken from silos at the batching plant or from the conveyor belt.
- (2) The sampling shall be done at the frequency of one every 1,000 m³ of produced concrete (cumulative of all concrete classes) and once a week at minimum.
- (3) The following tests will be carried out.
- Sieve analysis
 - Sand equivalent
 - Cleanliness of gravel

- Flakiness of gravel
- Los Angeles abrasion

8.6.3.2 Cement.

- (1) Quality control of cement shall first take place at the cement factory. This will be exercised by the factory itself under the supervision and the follow-up of the owner. The quality control program at site will be established jointly with the contractor and shall be submitted for the approval of the Engineer-in-charge.
- (2) The following tests will be carried out at both laboratories of the factory and the contractor and compared.
 - Setting time,
 - Expansion
 - Specific Blaine surface
 - Equivalent alkali content
 - Standard mortar compressive strength
- (3) Furthermore, each week, a sample of cement shall be taken at the batching plant and the following tests shall be carried out.
 - Setting time,
 - Specific Blaine surface,
 - Standard mortar compressive strength at 3, 7 and 28 days.

8.6.3.3 Admixtures.

- (1) Admixtures to be used for concrete production shall be tested for their suitability with the cement and other materials under actual working conditions. Each shipment of admixtures shall be tested for density and dry extract.
- (2) mixtures older than 12 months after their manufacturing, shall be tested for deterioration.
- (3) Total lot of admixtures from which the tested sample failed the criteria, shall be rejected.

8.6.3.4 Water

A sample of water will be taken from the concrete batch plant every 3 months and submitted to chemical analysis as described in IS 3025-1964.

8.6.3.5 Fresh Concrete

- (1) A random sampling shall be adopted. Sampling should cover all mixing units and spread over the entire period of concreting.
- (2) Minimum frequency of sampling of concrete of each grade shall be as per IS 456- 2000.
- (3) Three test specimens shall be made from each sample as described in IS 456.

- (4) The test strength of samples shall be average of three specimens. Individual variations shall not be more than 15 percent of the average.

8.6.3.6 Hardened Concrete

- (1) Set of six samples for compressive strength tests at 7 and 28 days will be taken and tested for each part of the work, being defined as per the volume poured in one concreting operation.
- (2) Compressive strength specimens shall be prepared by the Contractor and shall be performed in accordance with Indian Standards and Code of Practice.

8.6.3.7 Analysis of Results.

- (1) The test results will include the different components analysis, the values obtained on fresh and hardened concrete and the characteristics of the corresponding batch given by the printer of the batching plant.
- (2) The contractor shall present regularly to the Engineer-in-charge a synthesis of all the results in the form of tables, charts, statistical analysis (weekly and monthly reports).

8.6.3.8 Concrete Plant

Monthly checks, or when requested by the Engineer-in-charge of the concrete plant's weigh- batching accuracy, including the accuracy of any admixture dispenser, shall be made by the contractor in the presence of the Engineer-in-charge. When checked by standard weights and volumes, its accuracy shall be within 0.5% or as specified by the manufacturer.

8.7 ACCEPTANCE CRITERIA

- (1) The acceptance criteria for hardened concrete shall be as per IS: 456. About 20% of the cubes cast for each day may have values less than the specified strength provided that the lowest value is not less than 85% of the specified strength.
- (2) If analysis of test cube results indicates poorer concrete in the structure as per the acceptance criteria of IS:456, the Engineer-in-charge will order the contractor to provide core tests. Location and number of cores will be decided by the Engineer-in-charge. The contractor shall take out the specified sizes of cores from the structure.
- (3) In case the concrete cores fail to meet the specifications and the Engineer-in-charge is not satisfied with various tests results and quality, he will then instruct the Contractor for removal or subsequent suitable strengthening measures for such works at no extra cost. Wherever necessary the Engineer-in- Charge may make necessary changes in the proportion of mix and the contractor shall have to effect these changes and shall not be entitled to any compensation on account of such changes.

8.8 BATCHING AND MIXING

8.8.2 General

- (1) The contractor shall furnish the plant lay out and the method of concrete

production, transportation and placing to the Engineer-in Charge. The contractor shall provide, operate, and maintain at the site automatic batching equipment to determine and control the quantity of each individual material entering the concrete. Batching equipment shall be designed for such capacities, which will permit performance of the concrete work in accordance with Contractual Construction Program.

- (2) Water, cement, admixtures, fine aggregate and coarse aggregates shall be measured separately and not cumulatively. The accuracy of the measuring devices shall be maintained so that the indicated measure does not vary by more than 1 percent from true measure throughout their range of use. The devices shall be capable of being operated to control the delivery of materials so that the combined inaccuracies in feeding and measuring do not exceed the following limits.

Material	Percent (by weight)
Cement	1
Water	1
Aggregates	3
Admixtures	1

8.8.2 Batching Equipment.

- (1) At the batching plant, standard certified test weights shall be provided and such other auxiliary equipment as may be necessary to check the operating performance of each scale of other measuring devices. When required by the Engineer-in-charge, operator shall make these tests in his presence. Unless otherwise required by the Engineer-in-charge, check tests of equipment used for measuring water, cement, aggregate and admixtures shall be made at least every week. After completion of each check test, operator shall report the results to the Engineer-in-charge and make such adjustment, repairs or replacement as the Engineer-in-charge deems necessary to secure satisfactory performance before further use of the measuring devices.
- (2) The batching equipment shall be so constructed and arranged that the sequence and timing of the batcher discharge gates can be controlled to produce an intermixing of the aggregate, water and cementing materials, as the materials pass through the charging hopper into the mixer. The batching controls shall be so interlocked that a new batching cycle cannot be started until all the weighing hoppers are completely empty.
- (3) The operating mechanism in the water measuring device shall be such that no leakage will occur when the valves are closed and the discharge valve cannot be opened until the filling valve is closed.
- (4) The dispensing device for adding admixtures shall be interlocked with the batching and discharging operation of the water so that the batching and discharging of the admixtures will be automatic. The device shall be capable of permitting the quantity of admixture being batched to be adjusted should this prove necessary, and shall be equipped with a suitable warning device to indicate when the level in the reservoir tank is low.

- (5) The batching equipment shall include an accurate recorder for providing a continuous visible record of the measurement of each separate material, including all added water and admixture.
- (6) The measuring and recording equipment shall be supported on foundations independent of those for the mixing plant to prevent them from being affected by vibration.
- (7) Effective communication system including telephone shall be provided between the concrete plant and the point of placement at all times, and such facilities shall also be available at either location for use by the Engineer-in-charge as required.
- (8) Volume batching will not be permitted.

8.8.3. Mixing

- (1) Concrete shall be mixed in power driven stationary batch mixer of approved type and size. They shall be kept clean and in proper working order. The mixing blades in the drum shall be replaced when worn by 10% of their design dimensions.
- (2) The batching plant shall be provided with a bypass such that the mix materials can be discharged directly into a transit mixer drum. This bypass is to be used only in emergency and with permission of the Engineer-in-charge.
- (3) The mixing equipment shall be capable of combining the aggregate, cementing materials, water and other ingredients, within the time specified, into a thoroughly mixed and uniform mass, and of discharging the mixture without segregation.
- (4) The mixers shall be so charged that some water will enter in advance of cement and aggregate and all materials shall continue to flow in as rapidly as possible. The construction of the mixers should prevent loss of materials during charging.
- (5) The mixers shall not be charged beyond their rated capacities and the entire contents of the mixer shall be discharged before recharging.
- (6) Unless otherwise authorized by the Engineer-in-charge for mixers of 1m³ capacity or less, the mixing of each batch shall continue for not less than 1.25 minutes as specified in IS:457 (but not more than 5 minutes when mixing air-entrained concrete) after all materials, except the full amount of water, are in the mixer. For mixers of larger capacity, the minimum mixing time will be increased by 15 seconds for each additional 0.5m³.
- (7) The mixing time shall be increased when, in the opinion of the Engineer-in-charge, the charging and mixing operations fail to result in the required uniformity of composition and consistency within the batch and from batch to batch.
- (8) Each mixer shall be equipped with a mechanically or electrically operated timing and signaling device for indicating and assuring the completion of the required mixing period and for counting the batches.
- (9) Should a mixer at any time prove unsatisfactory, it shall be replaced or its use discontinued until it is made satisfactory.

- (10) Each mixer shall be cleaned after each period of continuous operation and shall be maintained in such a condition that the mixing action will not be impaired.
- (11) On no account shall any addition be made to any component of a concrete batched, once that batch has been mixed and discharged from the mixer, whether for the purpose of retempering or for any other reason.
- (12) Batching and mixing of concrete shall not commence unless due notice, at least 24 hours in advance, has been given to the Engineer-in-charge and written approval has been obtained for the placing arrangements, and for the preparation and accuracy of the part of the works in which concrete is to be placed.

8.9 HOT AND COLD WEATHER CONCRETING

- (1) Hot weather and Cold weather concreting shall be done as per IS 7861 Part I and Part II. The maximum temperature developed after placement should not be higher than 40°C and the concreting shall be temporarily suspended during excessive hot weather when the temperature inside the form work exceeds 63°C or the condition is such that the concrete cannot be placed at the required temperature.
- (2) Whenever required, the ingredients of concrete and the exposed surface of fresh or green concrete shall be adequately shaded from direct rays of the sun and protected against premature setting. The exposed faces may be kept under fine spray of water.
- (3) Concreting shall be done at night during hot weather.
- (4) For mass concrete in spillway and dam/barrage, the maximum lift height shall be 1.5m.

8.10 CONVEYING

- (1) The method and facilities for concrete transport shall be selected by the contractor within the limitations of these specifications, and he shall be responsible for adequacy and suitability of the transporting system. The time elapse between mixing and the initial set of the concrete shall be taken into consideration. All methods used shall be reviewed by the Engineer-in-charge.
- (2) The concrete transporting methods and facilities shall be such that will prevent segregation of coarse aggregate, excessive loss of slump and loss of ingredients. Equipment such as transit mixers, buckets, cars, conveyers and pumping equipment which may be used for conveying concrete, shall be of such size, design and condition as to ensure an even and adequate supply of concrete at the placement area. All equipment shall be kept clean and in good working condition.
- (3) The use of chutes to convey concrete will not be permitted, except those chutes less than 3m in total length may be used immediately adjacent to or in the forms with acceptance of the Engineer-in-charge. Where chutes are used, they shall be so constructed and arranged as to permit continuous flow of the concrete without separation of the ingredients.
- (4) There shall be no vertical drop greater than 1.5m, except where equipment, satisfactory to the Engineer-in-charge, is used to confine and control the falling concrete.

- (5) Concrete may be dropped through flexible elephant-trunk chutes, provided methods are used at the lower end to retard the speed of the falling concrete and prevent it from segregation. Where it is necessary to drop concrete from more than 1.5m it shall fall into a hopper with a capacity of 1m³ more than the total capacity of the full trunk.
- (6) All conveying plant shall be supported independently of the forms, except as specifically permitted by the Engineer-in-charge.
- (7) The conveying plant shall be kept free from hardened concrete and foreign materials, and shall be cleaned at frequent intervals.

8.11 DRILLING HOLES AND GROUTING ANCHOR BARS IN ROCK.

In case of rock foundation, as shown in the approved drawings or as directed by the Engineer- in-Charge, holes shall be drilled into the rock to receive bars for anchoring concrete structures or parts thereof to the rock. The types and dispersions of the anchor bars and the locations, diameters and depths of the anchor bar holes shall be as shown on the drawings or as directed. The diameter of each hole shall not be less than 1 ½ times the largest transverse dimension of the bar specified for that hole subject to a minimum of 12mm over the bar diameter. Anchor bars shall be cleaned thoroughly before being placed. The holes shall be washed out and cleaned thoroughly and shall then be completely and compactly filled with grout of proper proportions. Each anchor bar shall be forced into place to full depth immediately after the grout has been placed and shall then be rapped or vibrated until the entire embedded surface of the bars is in intimate contact with the grout. Special care shall be taken to prevent any movement of bars after they have been placed till the grout has adequately hardened. Alternatively, the insertion of the anchor bar into the fresh grout filled hole may be carried out immediately prior to placement of concrete in the location, the hardened concrete will then prevent undesirable vibration being imparted to the anchor bar and lead to avoidance of separation.

8.11.1 PLACING ANCHORS IN CONCRETE

Anchor bolts, structural shapes, plates and bearings required in connection with the installation of gates. Gate hoists and operating machinery shall be placed in concrete as shown on the drawings or as found necessary. Wherever practicable, anchors shall be installed before the concrete is placed and except as otherwise provided drilling for the installation of anchors in the concrete will not be permitted. Where the installation of anchors prior to placing the concrete is not practicable, satisfactory formed openings shall be provided and the anchors shall be grouted in to the openings later. Anchor bolts for machine may be placed in approved pipe sleeves to facilitate installation of machinery and the sleeves shall be completely filled with grout after the locations of the holes are finally determined.

8.12 PLACING

8.12.1 General

- (1) Contractor shall place concrete in a given location only after the Engineer-in-charge has agreed with the placement of such concrete. All concrete shall be placed in presence of the Engineer-in-charge. Concrete placed without prior knowledge and approval of the Engineer-in-charge may be required to be removed and replaced at contractor's cost.

- (2) The contractor shall furnish, install, maintain and operate a telephone system or radio, linking the points of placing concrete with the concrete batching and mixing plant. These facilities shall also be available to the Engineer-in-charge at all times.
- (3) When placing the concrete by pumping, direct communication shall be maintained between the concrete placing crew and the pump operator.
- (4) In order to reduce bleeding, slump shall not be higher than necessary to achieve proper placement and consolidation. Concrete shall be placed before initial set has occurred, initial set time being determined in the laboratory.
- (5) No concrete shall be placed when the atmospheric conditions are, in the opinion of the Engineer-in-charge, such that proper placing and hardening of the concrete are not guaranteed. Specifically, the contractor shall have the responsibility for meeting the hot and cold weather concreting requirements and for postponing concreting whenever such requirements cannot be met or, based on weather forecast, probably cannot be met. Even if the above requirements are fulfilled, the contractor has the responsibility of delivering concrete product that meets specified requirement.

8.12.2 Preparation for concrete placing.

- (1) Concrete shall not be placed until all formwork, installation or embedded parts, reinforcing steel, and surfaces against which concrete is to be cast have been accepted by the Engineer-in-charge.
- (2) All surfaces of form and embedded items that have become encrusted with dried material from concrete previously placed shall be cleaned of all such material before the surrounding adjacent concrete is placed.
- (3) Concrete shall not be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or diverted by pipes, or by other means, and carried out of the forms clear of the work. Water shall not be allowed to stand on any concrete surface until it has attained its final set. Water flow over the concrete, which may injure the surface finish will not be allowed.
- (4) Pipes, conduits, dowels and other items to be embedded in concrete shall be so positioned and supported prior to placement of concrete to be stable and provide sufficient clearance (50mm min.) between said items and steel reinforcement to allow proper concreting. Securing such items in position by wiring or welding to reinforcement will not be permitted.
- (5) Where excavated surfaces which are to form the foundations for structural concrete, are absorptive or likely to become otherwise unsuitable, or were shown on the Construction

Drawings, the contractor shall place a 'blinding course' consisting of a layer of Class M10 or M15 concrete 50 to 100 mm. Thick, as directed by Engineer-in-charge, uniformly over the foundation such that the upper surface is at grade elevation. Blinding concrete shall be placed before installing reinforcement or formwork.

- (6) Immediately before concreting, the forms and all other surfaces which will be in

contact with the fresh concrete shall be cleaned of all loose material and debris including shavings, wood chips, sawdust, pieces of wire, nails, fragments of hardened concrete and mortar. Clean-out holes which may be needed for this purpose shall subsequently be securely closed in order to obtain the required surface finish.

- (7) The use of compressed air for cleaning will be allowed only if adequate precautions are taken to avoid the deposition of suspended oil or construction joint surfaces, reinforcement or other items which are to be bonded to concrete.
- (8) The contractor shall provide such personnel and equipment so that the performance of the concrete work is in a satisfactory manner. The transporting and placing equipment shall be clean and in good condition, adequate, and properly arranged to proceed with the placing without undue delays. The number and condition of vibrators for use and standby shall be ample for the requirements during placement. The lighting system shall be sufficient to illuminate the inside of the forms when concrete is placed at night.
- (9) The contractor shall have protective coverings available for fresh concrete surfaces if there is a possibility of rain or hail.
- (10) Rock surfaces against which concrete is to be placed shall be clean and free from oil, standing or running water, mud, loose rock, objectionable coating, debris, and loose or unsound fragment. Faults, fissures and seams shall be cleaned to sound rock, and if directed, backfilled with dental concrete, shotcrete or dry-pack as appropriate.
- (11) Immediately before concrete is placed, all surfaces shall be cleaned thoroughly by the use of high velocity air-water jets, sweeping with brooms, wet stand blasting, bush-hammering, or other satisfactory means including combinations of the above.
- (12) Rock surface against which concrete is to be placed shall be kept wet for at least 12 hours during the 24-hour period prior to placing concrete and shall be in a damp condition at the time of placing, with all pools of water removed.
- (13) Foundation of porous or free draining material shall be thoroughly compacted by flushing and subsequent tamping or rolling, if necessary. The finished foundation surface shall then be blanketed with a layer of tar paper or closely woven burlap carefully lapped and fastened down along the seams so as to prevent the loss of mortar from concrete.
- (14) Before any concrete is cast against previously placed concrete the surface of the old concrete shall be prepared as described in sub-section "Construction Joints".
- (15) If concreting is not started within 24 hours of the approval being given, it shall have to be obtained again

8.12.3 Placing and Compaction.

- (1) Concrete shall be carefully placed in designated position. Where dense reinforcement or deep forms may cause segregation of concrete while placing, suitable methods shall be used to prevent segregation. The free fall of concrete shall not exceed 1.5m.
- (2) Concrete shall be placed directly in its permanent position and shall not be worked along the forms to that position. Vibrations shall not be used to move concrete laterally.

- (3) The addition of water into concrete after batching to compensate for stiffening of the concrete before placing shall not be permitted.
- (4) All concrete, with exception of concrete tunnel lining, shall be placed in continuous approximately horizontal layers. The size of the concrete lift shall be as shown on the construction drawings. The lift height shall generally not exceed 1.5m. The thickness of the layers shall not exceed 500mm for mass concrete, and for structural and all other concrete. Each layer shall be soft when a new layer is placed upon it so that no seams or planes of weakness within the section can form, and the two layers shall be made monolithic by penetration of vibrators.
- (5) The Engineer-in-charge reserves the right to order a reduced thickness of layers where the layers as stated above cannot be placed in accordance with the requirements of these specification.
- (6) Time interval between successive lifts of mass concrete shall be determined by the Engineer-in-charge. Nevertheless, a minimum of 72 hours shall elapse between successive lifts.
- (7) No concrete shall be placed under water except where shown on the Construction Drawings or specifically so required by the Engineer-in-charge. No concrete shall be placed in running water. Water shall not be allowed to rise over freshly poured concrete until final set has been achieved.
- (8) Each layer of concrete shall be consolidated to the maximum practicable density, be free from pockets of coarse aggregate, completely fill all recesses in forms and around embedded parts, and be free of all voids. The concrete shall be compacted and worked into all corners and angles of the forms, around reinforcement and embedded items without permitting the component concrete materials to segregate.
- (9) No layer of concrete shall be placed until the previous layer in the same lift has been thoroughly consolidated. Each layer of concrete within a lift shall be covered with fresh concrete as soon as possible, but certainly within the period when the lower layer is still capable of being revibrated so that successive layers can be thoroughly worked together.
- (10) The maximum permissible time between the placing successive layers in a pour shall not exceed initial setting time of cement or 45 minutes, whichever is less, and shall be reduced to suit the temperature, humidity and job conditions. Concrete shall not be piled up in the forms in a manner that causes movement of the unconsolidated concrete, or permits mortar to escape from the coarse aggregate.
- (11) Treatment of Cold Joint

In placing the concrete, delay may occur resulting in cold joints within a lift. When placement is resumed while concrete is still green and not fully hardened (and therefore capable of ready bonding), all laitance shall be removed by scrubbing the wet surface with wire or bristle brush off with a hand pick, care being taken to avoid dislodgement of any particle of coarse aggregate. The surfaces shall then be thoroughly wetted, all free water removed and then coated with neat cement grout. The first layer of the concrete to be placed on this surface shall not exceed 160mm in thickness and shall be well rammed against old work, particular

attention being given to corners.

- (12) Concrete shall be consolidated with the aid of approved immersion type mechanical vibrators complying with IS:2505 or electric or air driven vibrators operating at speed of at least 7,000 cycles/minute when immersed in the concrete. The vibrating equipment shall at all times be adequate in number of units and power to penetrate concrete when it is being placed, to the satisfaction of the Engineer-in-charge. Vibrators with flexible operating shafts shall be used for reinforced concrete and for concrete in restricted forms. At least one extra vibrator in working condition shall be constantly on hand at each point of placement for emergency use.
- (13) Application of the vibrators shall be made systematically and at such intervals that the zones of influence overlap and the concrete is properly compacted.
- (14) Every vibrator shall be operated in a near vertical position and the vibrating head shall be allowed to penetrate under the action of its own weight. In consolidating each layer of concrete, the vibrating head shall be allowed to penetrate and vibrate the concrete in the upper portion of the underlying layers. Extreme care shall be taken to ensure that the vibrators do not touch or disturb the reinforcing, embedded steel or forms.
- (15) To ensure even and dense surfaces which are free from aggregate pockets, honeycombing or air holes, it may be necessary to supplement internal vibration with hand-spading along the boundaries of the concrete and around embedded part while the concrete is plastic under the vibratory action. Should slip forms be used, the equipment and methods shall be such that the finished concrete will be well consolidated and homogeneous.
- (16) Form vibrators shall not be used unless the forms are designed for form vibration and unless specifically authorized by the Engineer-in-charge.

8.12.4. Pumping Concrete.

- (1) Positive displacement pumping or other approved methods may be used to place concrete in locations approved by the Engineer-in-charge. The type and arrangement of equipment shall be subject to approval and the equipment shall be operated only by experienced persons. Pneumatic placing will not be allowed.
- (2) The equipment and its method of operation shall allow the concrete to enter the forms at a lower velocity.
- (3) Concrete pumps and auxiliary equipment shall be in good condition and shall be maintained as such throughout the duration of the work. Thorough washing down of all parts that come in contact with concrete shall be performed after each concreting operation.
- (4) Pump lines shall consist of rigid steel pipe or flexible pipe made of rubber, spiral-wound flexible metal or plastic, or combination of both. Use of aluminum pipe for pump lines shall not be permitted. Couplings shall be leak proof and strong enough to withstand handling during erection and poor support along the lines. They shall provide a full internal cross section with no constrictions of the smooth

flow of concrete.

- (5) Immediately prior to the start of all concrete pumping, the pump and pump lines shall be primed by pumping an approved grout mixture through the equipment.
- (6) Concrete pumping operations shall be planned in such a way that concrete does not set before the succeeding layer is placed thereon. An adequate supply of fresh concrete shall be provided at all times.

8.12.5 Concrete in Block outs, Second Stage in Restricted Locations, etc.

- (1) All concrete required to be placed in block outs to permit the installation and adjustment of mechanical and other equipment, around formed holes and second stage concrete in other locations shall be included in respective concrete as described in this specification.
- (2) The concrete surfaces of block outs and first stage concrete at other locations shall be chipped and roughened as described herein before second stage concrete is placed at such locations.
- (3) Exceptional care shall be taken to place concrete in block outs in order to ensure satisfactory bond with concrete previously placed and to secure complete contact with all metal works in the block outs.
- (4) The roughening of the first stage concrete surfaces shall be attained by chipping or sand blasting as approved by the Engineer-in-charge and in such a manner as not to loosen, crack or shatter any part of concrete beyond the roughened surfaces.
- (5) After being roughened, the surfaces of concrete shall be cleaned thoroughly of loose fragments, dirt and the objectionable substances and shall be sound and hard to ensure good mechanical bond between the existing and new concrete.
- (6) Second stage concrete shall be placed in lifts of not more than 3.0m and concrete placement rate shall not exceed 1.5m per hour except as otherwise approved by the Engineer-in-charge.

8.13 FINISHING OF CONCRETE

8.13.1 General

- (1) The quality of the surface finish shall be in accordance with the requirements for the particular class of finish specified hereunder. The finished surfaces of concrete shall be free from areas of honeycombs, segregation, loss of cement or fine material, from damage due to stripping of forms, from bolt holes, abrupt irregularities caused by movement of forms or components, loose knots and similar features and bulges or depressions in the general plane of the surface.
- (2) Only one type of formwork shall be used for all parts of a concrete structure which is visible from any direction.
- (3) The classes of finish shall be as shown on the construction drawings or as directed by Engineer-in-charge.

8.13.2 Bush Hammer Finish

Bush hammer finish shall be applied on the surfaces when required by the Engineer-in-charge, but hammering shall not commence until at least one month after placement of concrete. The tool used for bush hammering shall be electrically driven and have a head 3 cm² with 16 pyramid shaped teeth. The surfaces shall be finished at a rate of 250 to 400 cm²/ minute indenting the concrete surface approximately 2 mm.

8.14 CONSTRUCTION JOINTS IN CONCRETE STRUCTURES

- (1) Construction joints are defined as concrete surfaces on or against which concrete is to be placed and to which new concrete is to adhere and which have become so rigid that the new concrete cannot be incorporated integrally with that previously placed.
- (2) Construction joints shall be located in the position shown on the construction drawings or as required by the Engineer-in-charge and the contractor shall not be permitted to form any additional joints or deviate from the joints indicated on the Drawings, without the written authorization of the Engineer-in-charge. Necessary re-arrangement of steel reinforcement arising from such modifications shall be to the contractor's debit.
- (3) Horizontal construction joints shall be arranged, wherever possible, to coincide with joints in the formwork.
- (4) Joints at exposed surfaces of concrete shall be straight and continuous. Feathered construction joints will not be permitted.
- (5) The faces of vertical joints shall be shuttered with expanded metal or other approved rough materials. The expanded metal shall be removed as far as possible before the adjacent lift is poured. If required, the surface shall be cleaned by wet sandblasting and roughened by light bush-hammering.
- (6) The surface of construction joints upon or against which new concrete is to be placed and to which new concrete is to adhere shall be clean, rough and free of water when covered with fresh concrete. The laitance, loose or defective concrete and foreign material shall be removed from the surface of existing concrete. The previous concrete lift shall be saturated by water but surface dry when the successive lift is placed.
- (7) The surface of the hardened concrete shall be cleaned and roughened by wet-sandblasting and washing thoroughly with air-water jet. Care shall be taken to prevent undercutting of aggregate in the concrete during sandblasting.
- (8) Wet-sandblasting equipment shall be operated at an air pressure or approximately 7 bars. Sand to be used for blasting shall be dense, hard, not easily broken and sufficiently dry.
- (9) In lieu of wet-sandblasting the contractor may propose high-pressure water blasting utilizing pressures not less than 400 bars, provided that such high-pressure water blasting produce equivalent results to those obtainable by wet-sandblasting.

- (10) The horizontal surfaces of construction joints may be treated by cutting with an air-water jets ("green-cutting"). This shall be performed after the initial set has taken place but before the concrete has become too hard for effective cutting. This is generally done within 8 to 16 hrs. of laying the concrete. The fresh concrete surface shall be cut with air-water jets to remove all laitance and to expose clean, sound aggregate. For effective green cutting, the air pressure should not be allowed to fall below 6.33 kg/cm². After cutting, the surface shall be washed with clean water. Care shall be taken that the treated surface does not become contaminated before new concrete is placed upon it. Should the surface become contaminated that a satisfactory joint with new concrete is not ensured the contractor shall clean it by means of wet sandblasting.
- (11) Water used in cutting, washing and rinsing of concrete surfaces shall be disposed of in such a way that it does not stain, discolor or affect exposed surfaces of the structures.
- (12) When necessary, as determined by the Engineer-in-charge structural concrete placement in forms shall be started with an over sanded mix with 20 mm maximum size aggregate, an extra 50Kg of cement per cubic meter and a 100 mm slump. This mix will be referred to as a starter mix and shall be placed approximately 50mm deep.
- (13) Disturbance of the surface at a joint during the early stages of hardening shall be avoided, and traffic on the concrete will not be permitted until the concrete has hardened sufficiently to withstand such treatment without injury.
- (14) All construction joints shall be kept continuously moist until they are covered with concrete, provided that, if it becomes necessary to delay the placement of new concrete on or against a construction joint for an extended period, moist curing of the surface of the joint may be discontinued at the expiration of the regular prescribed curing period. If the moist curing is so discontinued, it shall be resumed not later than 24 hours prior to the placement of new concrete against the joints.

8.15 CURING AND PROTECTION OF CONCRETE.

- (1) Plant for curing and protection of concrete shall be available at the location of each concrete placement before concrete placement is started. The water used for curing shall meet the requirements for water used for mixing concrete. The curing water temperature shall not exceed 25°C.
- (2) Exposed surface of concrete, which has been finished as specified, shall be protected from the direct rays of the sun for at least 3 days after placing. Freshly placed concrete shall be protected from damage by rainfall.
- (3) Exposed surfaces shall be kept moist or the moisture in the concrete shall be prevented from evaporating for at least 14 days after placing by means of continuous sprinkling or spraying with water, or by covering with saturated materials like burlop/ hessian cloth etc. or a system of perforated pipes, mechanical sprinklers or hose or by any other methods approved by the Engineer-in-charge.
- (4) Care shall be taken not to disturb the steel reinforcement projecting from any placement for at least 24 hours after the completion of such placement.

- (5) The contractor shall not move any load on concrete surfaces which in the opinion of the Engineer-in-charge have not attained sufficient strength. In case loads are required to be moved, the Engineer-in-charge may permit contractor to do so on condition that contractor provides the means for protecting the concrete surface subject to approval of the Engineer-in-charge.
- (6) The Engineer-in-charge may permit the use of curing by means of membrane forming compounds. Sealing compounds proposed by the contractor will be subject to sampling and testing and will have to be approved of the Engineer-in-charge.
- (7) Curing compounds shall be applied according to the manufacture's recommendations to provide a continuous uniform membrane over all area. Curing compounds shall be applied only after moist curing has been carried out for at least 24 hours. Curing membranes shall be protected from damage at all times.
- (8) Curing compound shall not be used on any uniformed surface where, in the opinion of the Engineer-in-charge, the irregularities in that surface would prevent the membrane forming an effective seal, on any surface which has a temperature lower than manufacturer's recommended application temperature, on any surface where a bond is required for additional concrete or where a bonded surface coating is to be applied. Where a curing compound is placed on a surface where a bond is required, it shall be removed by sand blasting or by other means satisfactory to the Engineer-in-charge.
- (9) Curing compounds used for surfaces exposed to view shall degrade completely when exposed to air for more than 3 months. They are to remain at least 80% impermeable for 1 month after application.
- (10) In case any curing operations are inadequate or unsatisfactory, the Engineer-in-Charge shall be entitled to take such steps as he may feel necessary to make good the deficiencies and defects, at the contractor's risk and cost.
- (11) Curing and protection should conform to latest amendment of IS 457.

8.16 REPAIR OF CONCRETE

8.16.5 General

- (1) Repair of damaged or defective concrete shall be performed by skilled workmen only, and in the presence of the Engineer-in-charge. No repair work shall be carried out until the Engineer-in-charge has inspected the location of the proposed repair and accepted the method of repair proposed by the contractor.
- (2) Contractor shall correct all imperfections on the concrete surface within 24 hours of removal of forms. The proven methods of repair of concrete are outlined in the USBR Concrete manual, which include Dry-pack Mortar, Replacement Concrete, Replacement Mortar, Replaced Aggregate Concrete, Epoxy Concrete etc.
- (3) Where concrete is exposed to flowing water or to weather, porous and fractured concrete and surface concrete to which additions are required to bring it to prescribed lines shall be removed by chipping into the concrete a minimum of 75mm below the reinforcement or to the depth required by the Engineer-in-charge if sound concrete is not encountered at 75mm. Repair areas shall be formed and

area filled with fresh concrete. If the concrete section to be repaired contains no reinforcement, concrete shall be chipped to a minimum depth of 100mm.

- (4) The chipped openings shall be sharp edged and keyed and shall be filled to the requirements with fresh concrete or patching mortar, as approved by the Engineer-in-charge. Where concrete is used for filling, the chipped openings shall not be less than 75 mm in depth and the fresh concrete shall be reinforced and doweled to the surface of the openings, as directed by the Engineer-in-charge.
- (5) Dry pack mortar for patching shall consist of 1 part cementing material, 2 parts by volume of regular sand, and just enough water so that after thorough mixing of the ingredients the mortar will be held together when compacted by squeezing with the hand. The mortar shall be fresh when placed, and any mortar that is not used within 1 hour after preparation shall be washed. Just prior to mortar application, the surface to which the mortar is to bond shall be kept wet for at least 2 hours, then scrubbed with a small quantity of cement grout using a wire brush.
- (6) When repairs are more than 25mm deep, the mortar shall be applied in layers not more than 20 mm thick to avoid sagging. After each layer, except the last is placed, it shall be thoroughly roughened by scratching with a trowel to provide an effective bond with the succeeding layers. The last or finishing layer shall be smoothed with a trowel to form a continuous surface with the surrounding concrete. All patches on exposed surface shall be neat and smooth and as nearly as possible of the same colour as the adjoining concrete. All patches shall be thoroughly bonded to the surfaces of the chipped openings, shall be cured to the satisfaction of the Engineer-in-charge and shall be sound and free from shrinkage cracks and drummy areas.
- (7) For concrete surface where high velocity flows may occur and as required by the Engineer-in-charge, repairs to surfaces having F3 and U3 finishes shall be bonded with an epoxy adhesive approved by the Engineer-in-charge and used in accordance with the manufacturer's instructions.
- (8) All repairs to the surface of concrete required for flowing water shall be ground smooth to meet the tolerances specified for that surface.

8.16.5 Sealing works in Concrete Lining of Underground Structures. (Not Applicable)

- (1) The contractor shall carry out sealing work to reduce water inflow and water losses through, and to guarantee the normal water tightness of the concrete lining of underground structures according to criteria stated hereafter and as directed by the Engineer-in-charge.
- (2) The work shall consist of sealing the cold joints, construction joints, shrinkage cracks both vertical and horizontal, honeycombs, and poorly grouted or sealed grout holes. The work shall be performed intermittently, whenever water inflows are observed and measured wide cracks are discovered (especially after performance of tunnel pressure testing), or the future impermeability is, in the judgment of the Engineer-in-charge, doubtful.
- (3) The sealing work shall be carried out when following phenomena are encountered.

- a) Water inflow equals or exceed 1 liters/min measured at each single inflow source.
 - b) Any water inflow from grout holes and through honeycombs is unacceptable.
 - c) Cracks or joints, regardless whether they are dry or wet, of width greater than;
 - 0.2mm in tunnels and shafts containing reinforcing steel
 - 0.5mm in unreinforced stretches of tunnels or shafts
 - d) Areas of porous concrete (e.g., due to poor vibration) where depth of porosity is obviously deeper than superficial.
- (4) The sealing work shall be executed as follows:
- a) Crack or joint 0.2-0.6 mm wide shall be repaired as stipulated in the Section “Drilling and Grouting”
 - b) Crack or joint wider than 0.6mm shall be repaired as under (1) above, followed by cutting a groove 25x25mm along the joint or crack and subsequent filling with an epoxy mortar.
 - c) Wet joint may also be sealed by applying the “Oberhasli Method”, which consist of cutting a groove as for the dry joint and by collecting the seepage water into one or several flexible plastic pipes. As soon as the groove is without running water shall be filled with a quick-setting mortar and, after its hardening, followed by pumping the cement bentonite-water slurry through the plastic pipe.
 - d) Areas of porous concrete shall be grouted under high pressure (30 bar) with cement grout mix W/C=0.7 by weight, containing suitable water-reducing air-entraining admixture. Grout holes shall be drilled at 500 mm spacing until the rock. After grouting, the area shall be repaired with epoxy mortar.
 - e) Grout holes filled only with water/cement mix shall be redrilled up to 2/3 of the theoretical lining thickness and filled with dry-pack mortar.

8.17 PARTICULAR REQUIREMENTS FOR INDIVIDUAL CONCRETE STRUCTURE

8.17.1 Parts Embedded in Concrete.

- (1) Anchors, anchor bolts, structural shapes, plates shapes, plates for gates, hoists, valves, machinery etc. and other miscellaneous parts shall be installed in the concrete by the contractor, as shown on the construction drawings or as required by the Engineer-in-charge. Wherever practicable, anchors shall be installed before the concrete is placed. Except as otherwise specified, drilling and installation of anchors in the concrete after concrete is placed will not be permitted. Before being placed in position, all anchors and embedded parts shall be thoroughly cleaned of rust, grease, paint, splashed concrete, or other anchors is not practicable before the concrete is placed, formed openings shall be provided, and the anchors grouted into the openings at a later time in a manner acceptable to the Engineer-in-charge.

- (2) Embedded anchors shall be supported during embedding and embedded so that the tolerances specified will not be exceeded. Care shall be taken not to disturb or displace embedded items during concrete placement.
- (3) Concrete may be placed to embed items erected by other agencies in the locations and to the dimensions shown on the construction drawings or as required by the Engineer-in-charge. The methods of placement and rates of placing concrete shall be subject to the approval of the Engineer-in-charge. Care shall be exercised that such parts shall not be damaged or disturbed by placing operations.

Unless otherwise specified the contractor shall provide any foundation, wall or roof openings and coverings, concrete floor filling sleeves in foundations, inclusive of metal works supplied by other contractors. All adjustments to foundation levels, embedding, bedding and grouting works on foundations, and cementing works into walls and floors, shall be done by the contractor including all leveling and adjustment of works in foundations and Grouting.

8.17.2 Concrete in Blockouts for Equipment Embedding.

- (1) The contractor shall form blockouts, place reinforcement and concrete as shown on the construction drawings or as directed by the Engineer-in-charge, and in such manner as to ensure good bond with the existing concrete, to secure complete contact with the metalwork to be embedded in the blockout concrete and to avoid displacement of the metal work.
- (2) Block out concrete shall include the concrete around second stage gate parts, anchor bolts and anchor plates etc.
- (3) Before placing concrete, all parts to be embedded shall be checked to ensure that they are firmly fixed in their required position. The surfaces of blockouts or holes shall be thoroughly cleaned and wetted. Oil and grease shall be removed by brushing and chipping of affected surfaces to a sufficient depth, or by application of approved chemicals and flushed with clear water.
- (4) The parts to be embedded shall be cleaned of rust, mill scale paint, oil or grease before they are set into place. Where bond between metal parts and concrete or grout is not desired, approved material such as flake graphite or paraffin shall be applied to the metal parts. The metal surfaces shall be wetted before placing the concrete or grout.
- (5) Concrete containing an approved non-shrink agent shall be used for concrete in blockouts for equipment embedding as shown on the construction drawing.

8.17.3 Grouting of the Equipment Bearing Plates and Anchors

- (1) Limited spaces and small block outs where equipment bearing plates anchors, rails, etc. are placed shall be grouted under pressure.
- (2) The grouting shall be performed using non-shrink cement-based grout or non-shrink epoxy grout as proposed by the contractor and approved by the Engineer-in-charge. All mixing and grouting shall be performed in accordance with the

manufacturer's recommendations and shall be tested prior to grouting. Technical service by manufacturer shall be organized by the contractor upon request by the Engineer-in-charge.

- (3) Before placing grout, the surfaces of the base concrete to which the grout will be bonded shall be roughened and cleaned of all laitance, loose or defective concrete, any coatings or other foreign material, followed by thorough washing with water.
- (4) Forms for grouting shall be installed where necessary and care shall be taken that the grouts fill all spaces under the plates leaving no voids. The exposed surfaces of the grout shall be cured as recommended by the manufacturer and no loads shall be applied until the grout has reached the design strength.

8.17.4 Porous Concrete

- (1) Porous concrete shall be placed where free drainage is required and shall be produced by gap grading or single size aggregate grading.
- (2) The strength requirements for porous concrete shall be as for class M10/A40 concrete. The porosity shall be such that water will pass through a slab 30 mm thick at a minimum rate of 500 l/mi/m² with a constant depth of water on the slab of 100 mm.
- (3) Porous concrete shall not be vibrated but only placed and lightly rammed. Formed surfaces shall be Class F1 finish. Exposed surfaces of the porous concrete shall be sealed in an approved manner, such as the use of polyethylene or rendering with sand and cement, before structural concrete is placed against it.

8.17.5 Tests

- (1) All cost associated with testing as described in this section shall be borne by the contractor. These shall include, but not be limited to the following.
 - a) The costs for all tests to be carried out prior to the start of concrete work, whether carried out at site or elsewhere.
 - b) Routine tests for quality control during the execution of the concrete work carried out by the contractor as specified herein and as directed.
 - c) Other tests required during execution of the work to be carried out by an approved test laboratory(ies).
 - d) Preparation, storage, handling, curing and delivery of samples to a laboratory designated by the Engineer-in-charge, if so, required for additional independent testing.
- (2) Should the contractor fail to adhere to his testing program, all test deemed necessary by the Engineer-in-charge to check concrete work will be performed by the Engineer-in-charge or a laboratory assigned by him, at Contractor's expense.

8.18 FORM WORK

8.18.1 Procedure for Form, Centering and temporary works.

8.18.2 All centering, for work and temporary works shall be constructed according to the approved drawing and specification.

As soon as practicable, after the acceptance of tender, the contractor shall submit a work showing the procedure and method by which he proposes to carry out the work, together with such details as are necessary to demonstrate the adequacy, stability and safety of the methods.

8.18.3 The approval to the general work of centering as well as design criteria and loading shall be obtained in good time to facilitate all preparatory works. Any delay on this account shall be the responsibility of the contractor.

8.18.4 After approval of the general work, the contractor shall prepare detailed design and drawings for execution of the form work, centering and temporary works. These shall be forwarded to the Engineer-in-Charge for approval. No work shall be carried out without prior approval of the Engineer-in-Charge.

8.18.5 Notwithstanding the approval given to the design criteria and loading and the general work for the centering, the entire responsibility for the satisfactory execution of centering and all temporary works for withstanding concreting and removal of form work after stipulated interval, shall rest with the contractor and he shall be liable to pay all claims and compensation arising from any loss or damage to life and property due to any deficiency, failure or malfunctioning of the centering or the temporary works.

8.18.6 The contractor is responsible to set the forms to line and grade, achieve tightness of forms and braced sufficiently to stay in alignment and strong enough to hold the concrete. There should be no loss of mortar causing any honey-combing. Stability is a very important consideration in form work. Contractor shall ensure that the forms do not suffer from inadequate cross-bracing and inadequate horizontal bracing. Immediately before concrete is placed, the forms should be properly treated with suitable form of oil or other suitable coating material to prevent sticking to the concrete. Joints between the form work and existing concrete structures shall also be grout tight. Form work shall be arranged to facilitate removal of the various parts in correct sequence, without jarring or damaging the concrete. Fixing blocks, bolts or similar devices may be embedded in the concrete, provided they do not reduce the strength or effective cover of any part of the structure below the required standard but the use of through bolts shall be avoided as far as possible. Temporary opening shall be provided at all points necessary in the forms to facilitate clearing and inspection immediately before placing of the concrete.

8.18.7 Forms shall overlap the hardened concrete in the lift previously placed by not more than 75mm and shall be tightened smoothly against the hardened concrete in the lift previously placed by not more than 75mm and shall be tightened smoothly against the hardened concrete. Particular attention shall be paid in setting and tightening the forms for construction joints so as to get a smooth joint free from sharp deviations or projection. No jute bags or other such materials be allowed to be used to make the joints of shuttering plates leak proof.

8.18.8 If a type of form does not consistently perform in an acceptable manner, as determined by the Engineer-in-charge, the type or form shall be changed and method of erection shall

be modified by the contractor at his cost.

8.18.9 Re-use of Forms etc.

8.18.10` Forms required to be used more than once shall be maintained in serviceable condition and shall be thoroughly cleaned and repaired before reuse. When metal sheets are used, the sheets shall be placed and maintained in the forms without lumps or other imperfections. All forms shall be checked for shape and strength before reuse.

8.19 Cleaning of Forms.

8.19.1 ` All rubbish, shall be removed from the interior of the forms. The formwork in contact with the concrete shall be cleaned and thoroughly wetted or treated with an approved composition. Care shall be taken that such approved composition is kept out of contact with the reinforcement. Before concrete is placed, the surfaces of forms designed to produce F1 and F2 finish shall be oiled with commercial form oil that will effectively prevent sticking and will not stain the concrete surface. Form timber forms, oil shall consist of pure refined, pale, paraffin mineral oil or approved form oil. For steel forms, form oil shall be mineral oil suitably compounded with one or more ingredients which are appropriate for the purpose. Care shall be taken to keep form oil out of contact with reinforcement.

8.19.2 Contractor shall give the Engineer-in-charge due notice before placing any concrete in the forms and request him to inspect and accept the form work as to their strength, alignment and general fitness, but such inspection shall not relieve the contractor of his entire responsibility of form work to withstand concreting and for safety of men, machinery and materials.

8.20 Removal of Forms.

8.20.1 The Engineer-in-charge shall be informed in advance by the contractor of his intention to strike any form. Forms shall be removed as soon as the concrete has hardened sufficiently. Thus, facilitating satisfactory curing and earliest practicable repair of surface imperfections.

8.20.2 Form on sloping surfaces of concrete, such as forms on the water sides, shall be removed as soon as the concrete attains sufficient strength to prevent sagging. Any repair or treatment required on such sloping surface shall be performed at once and followed immediately by the specified curing.

8.20.3 Forms shall be removed with care so as to avoid damage to the concrete. Damaged concrete, if any, during form removal shall be repaired in accordance with the specification for repair of concrete.

8.20.4 The following minimum time intervals of form stripping as per specifications in IS-456- 1978 will generally be followed while using ordinary Portland cement.

- Walls, columns and vertical faces 24 to 48 hours or as
may be decided by the Engineer-in-Charge.

- Slabs (Prop left under) 3 days.
- Beam soffits (Prop left under) 7 days.
- Removal of props under slabs spanning up to 4.5m 7 days.
- Slabs spanning over 4.5m 14 days
- Removal of props under beam and arches.
- 8.20.10 Spanning up to 6m 14 days
- 8.20.11 Spanning over 6 m 21 days.

Note:- For other types of cement, the stripping time recommended for Ordinary Portland cement may be suitably modified.

8.20.5 The number of props left under their sizes and disposition shall be such as to be able to safely carry full dead load of slab, beams or arch as the case may be together with any live load likely to occur during the curing or further construction.

8.21 Finish of Formed Surface.

8.21.1 The classes of finish and requirements for finishing of concrete surface shall be as shown in the drawing or as hereinafter specified. In the event of finishing not being specified in the drawings, The finishes to be followed shall be as directed by the Engineer-in-charge. Finishing on concrete surface shall be performed only by skilled workmen.

8.21.2 Completed concrete surfaces will be tested wherever necessary to determine whether surface irregularities are within the limits herein specified.

8.21.3 Surface irregularities are classified as 'abrupt' or 'gradual'. Offsets caused by displaced form sheathing, or lining or form sections or by loose knots or otherwise defective will be considered as abrupt, other irregularities shall be considered as gradual irregularities and will be tested by use of template, consisting of a straight edge or the equivalent there of for curved surfaces. The length of the template shall be 150cm for testing of formed surfaces and 300cm for testing unformed surfaces.

8.21.4 Table for finish of form work.

- | • F1 finish | F2 finish. |
|--|---------------------------------------|
| • Surfaces of the raft remaining below | 1. Deck of the |
| • Block joint. | 2. Piers. |
| • Key for Intermediate construction. | 3. Abutment & flank wall(River side) |
| • Cubes | 4. Abutment & flank wall (river side) |
| • Faces which are not exposed for public | 5. Exposed surface of upstream |

side barrage section i.e. glacis
the profile Rigid, apron, slope.

SECTION - IX

**HYDRO MECHANICAL GATE
WORKS**

CHAPTER – I

1.2 SCOPE OF WORK

1.2.1 SURPLUS ESCAPE Service Gates and Rope Drum Hoists (considering the Maximum Utilization of available material at site.)

Fixed Wheel Type Sluice Gate

Refurbishment of gate parts (wheels, bearings, springs, guide pad/wheel, bumpers, rubber seal, seal clamps, and fasteners) including dismantling and assembly of parts and their erection Rope Drum Hoist - complete in all respect.

Painting of gate with platform, guide plates and second stage embedded parts,

Dismantling, refitting and erection of gates, stoplog and hoisting arrangement etc.

Surplus Stoplog Gates Repainting of stop log hoisting structure

Monorail Hoist for Surplus escape Stop log Gates

Overhauling of 10T Monorail- Hoist Supporting Structure & Trestles complete in all respect & its painting and Lifting of Beam

Providing & fixing New Iron sheet at balcony.

1.2.2 Head Regulator Gates and Rope Drum Hoists

Fabrication & erection of Head Regulator Gates (7.62 W x 3.048 H) and Rope Drum Hoists, complete in all respect Embedded Parts for 2.1T including dogging arrangement

Rope Drum Hoist - Bought Out items complete in all respect for 2.1T with Hoist Supporting Structure & Trestles complete

Fabrication & erection of Head regulator Bulkhead Gates. complete in all respect Embedded Parts including dogging/latching arrangement

13T EOT for Head Regulator Bulkhead Gate - Hoist Supporting Structure & Trestles complete in all respect for

1.2.3 Cross regulator Gates and Rope Drum Hoists

Fabrication & erection of Cross regulator Gates complete in all respect with embedded Parts for 1.01T including dogging arrangement, 11.5T Rope Drum Hoist - Bought Out items complete in all respect of with Hoist Supporting Structure & Trestles complete. Fabrication & erection of Cross regulator Stop Log Gates complete in all respect with embedded Parts for 2.01T including dogging/latching arrangement and Monorail Hoist for Cross regulator Bulkhead Gate with Monorail Supporting Structure.

1.1 .1 Fixed Wheel Vertical Lift Barrage & Under sluice Gate:

- a) Vertical lift wheel type gates for Barrage & Under sluice bay along with all accessories such as wheel assemblies, seals, guide shoes/ rollers, lifting lugs and latching arrangement etc.

- b) Equal No. of embedded parts for each opening of Barrage & Under sluice including S.S tracks, seal seats, sill beam and guides etc. including First stage anchorages and second stage embedment.
- c) Rope drum hoist of adequate capacity mounted on trestles for operation of Barrage & under sluice gates mentioned above consisting of wire ropes, Rope drums, end reduction units, central drive units including worm reducers, E.M. brakes, motors, gate position indicators etc. and arrangement for manual drive. Suitable covers for the hoist equipment shall be provided.
- d) Hoist supporting structure for supporting the above hoist including all fastening bolts, anchor bolts, bearing, chequered plates, side railings, ladders, trestles and other accessories etc.
- e) The Gate shall be reasonably water tight. The maximum permissible leakage being not more than 5 liters/min/meter length of seal.
- f) The Gate shall close under its own weight with or without addition of ballast. Should it require a positive thrust for closing, the hoist shall be suitable for that purpose.

1.1.2 Stoplog for Barrage & Under sluice Gate:

- a) One sets of stoplogs, multiple units, vertical lift, sliding type for Sluice Gates along with all accessories such as sliding block/pad, seals, guide roller, lifting lugs, latching arrangement. etc.
- b) Equal no. of embedded parts for Barrage & under sluice stoplogs including tracks, seats, sill beam, guides etc. including First stage anchorages and second stage embedment.
- c) Gantry crane/monorail for the operation of stoplogs -

One set of Gantry crane/monorail of suitable capacity with fixed hoists for the operation of stoplogs of Barrage & under sluice gates, including rail track and supporting structure/ Rail Bridge for rail as required.

- g) Lifting Beam-

One Lifting Beam of Automatic Engaging and Dis-Engaging type equipped with two hooks shall be provided for handling the above stoplogs. The arrangement of Lifting Beam, location of hooks and lifting lugs and guide rollers and stoppers shall be shown in the drawings.

1.2 Others

- a) The 1st as well as 2nd stage concreting is included in the scope of this work. However, the 2nd stage concreting is to be done under the supervision of fabricating Unit. The frames consisting of embedded parts for gates and stoplogs are also required to be embedded in concrete under the supervision of the fabricating unit. The responsibility of the correctness and accuracy of alignment of embedded parts rests with the Contractor.
- b) All exposed surfaces after fabrication (except stainless steel & Bronze surfaces, lifting pins, Gear teeth) shall be painted in the Shop as well as in the field conforming to IS:14177 with Zinc primer and finished coats of Coal tar epoxy paint. The Hoist supporting structure shall be applied with zinc primer & finished coats of Aluminum paint.

The wire ropes shall be applied with suitable coats of cadmium compound after installation. All open gear surfaces, lifting pins and bronze bushes shall be lubricated suitably.

- c) Dry as well as wet tests are to be carried out by the Contractor. Any defect noticed during testing or during the defect liability period, is to be rectified/removed by the contractor free of cost.
- d) The contractor shall have to perform any extra work, including furnishing material not covered by the specifications or not included in the schedule, but forming an inseparable part of the work contracted for. No extra payment shall be made for such Extra work and materials.
- e) Wastage of Steel

The wastage of steel sections, received from main producers, shall not be compensated to the contractor under price variation clause. The price variation will be reimbursed for the net weight of gate/stoplog based on the sectional unit weight as per the table of standard sections (supplied by SAIL) and used in the gate/stoplog. The weight of nuts, bolts, rivets, welding, etc. will not be considered in the net weight of gate. All the wastage of steel sections supplied by the main producer will be at contractor's account and the contractor should consider this aspect while Tender for the tender.

- f) All structural material shall conform to IS:2062 & all Stainless-steel material shall conform to IS:1570(Part-V) and shall be procured from primary producers of steel such as SAIL/ TATA/ RINL/ JINDAL etc. having integrated steel plants using iron ore as basic raw material. Rerolled & scrap material shall not be used in any work.
- g) All welding shall be done conforming to IS:816, IS:814 and other relevant IS codes, adopting best practices in the industry. Low hydrogen electrodes of Gr. E7018/ E7016 shall be used for welding of structural steel. Welding electrodes of Gr. E309L-16 shall be used for welding stainless steel material with structural steel. Welding electrodes of reputed

manufacturers such as ESAB, D&H, Advani Oerlikon etc. shall only be used.

- h) Suitable ladder upto hoist bridge and hand railing arrangement all along operating platform shall be provided. The hoist bridge shall be covered with min. 8mm thick chequered plate for movement of operating/ maintenance personnel.
- i) Drawings and data to be furnished along with the tender

Each Bidder shall append the following technical information/drawings along with the Technical Bid.

- The general arrangement/installation drawings indicating overall dimensions, materials and weights of various components.
- Type, size, make and ratings of various bought-out items proposed to be used.
- Details of various equipment, machineries and skilled personnel available with the Bidder.

1.3 Drawings and data to be furnished by the contractor after award of work

- a) The contractor shall submit the following, as soon as possible as but not later than 90(ninety) days from the date of issue of letter of intent/signing of contract agreement and before proceeding with the fabrication work, for the approval of the Engineer-in- Charge.
- b) Carefully checked detailed design calculations and fabrication drawings of gates, hoisting equipment, hoist supporting structure and electrical circuit diagrams showing the specifications for each part and the type of heat treatment, wherever used to demonstrate clearly and fully that the equipment to be furnished under this contract shall conform to the provisions and intent of these specifications & specification drawings.
- c) Complete list of all equipment showing the dimensions, type, grade, & class of material, numbers required and weights etc.
- d) Complete details such as makes, capacities, ratings and other relevant details such as speed/torque characteristics of electric motors covering starting & running conditions with controls etc. for all standard articles shall be furnished.
- e) Details of complete coordinated wiring of all electrical equipment along with the detailed drawings supported by catalogues shall be furnished.
- f) The proposed methods of installations of all anchorages and complete equipment.
- g) The sequence of submission of all drawings shall be such that all information is available for checking each drawing, when it is received.
- h) The contractor shall revise the drawings as necessary and shall resubmit fresh prints for approval in the same routine as before. Any fabrication work performed prior to the

approval of drawings will be at the contractor's risk. The Engineer-in-Charge shall have the right to ask the contractor to make changes in the design, which may be necessary in the opinion of the Engineer-in-Charge to make the equipment conform to the stated provisions and intent of the specifications, without any additional cost.

- i) The contractor shall furnish complete sets of final (corrected) assembly drawings & detailed drawings of the various parts which shall be required for erection, maintenance and repair, identification of parts and for making or ordering replacement of parts. All changes and revisions made up to the time that the equipment is complete and ready for dispatch shall be incorporated in drawings.
- j) Any fabrication work performed prior to the formal approval of the Engineer-in-Charge in respect of the designs and drawings shall be at the risk and cost of the contractor. The Engineer-in-Charge shall have the absolute right to ask the contractor to carry out any changes(s) in the designs and drawings, which may be deemed necessary in the opinion of the Engineer-in-Charge to make the equipment conform to the provisions of these specifications and the cost of such changes shall be borne by the contractor. However, the approval of contractor's designs and drawings conveyed by the Engineer-in-Charge shall not relieve the contractor of any of his responsibility under the contract towards the correctness and accuracy of designs, drawings, fabrication, erection, commissioning, performance and guarantee etc.
- k) Unless otherwise specifically provided for in the schedule and/or in the specifications and/or in the specification drawings, the contractor shall furnish all the materials accessories, tools and tackles and appurtenant parts called for in the specification or shown on the specification drawings, but not mentioned in the specifications or any thing called for in the specifications but not shown on the drawings as if required or shown in both.

1.4 Schedule and Progress

Within 60(sixty) calendar days after the receipt of approval of drawings, the contractor shall submit to the Engineer-in-Charge for approval the schedule of fabrications and transport of the equipment so as to ensure its delivery within the specified period. The schedule shall clearly state all the stages of fabrication to enable the Engineer-in-Charge to plan his inspection accordingly as stated in these specifications. The contractor shall also (during the course of fabrication) submit a monthly progress report along with photographs of fabrications done to the Engineer-in-Charge, apprising him of the progress of equipment for the preceding month. The Engineer-in-Charge or his authorized representative shall have the right to inspect the fabrication workshop whenever required.

CHAPTER - 2

2.0 TECHNICAL SPECIFICATIONS

2.1 Description of Components Hydro-Mechanical Gates

2.1.1 Skin Plate

The skin plate and stiffeners shall be designed together in a composite manner for the following conditions:

- a) in bending across the stiffeners or as panels, and
- b) in bending co-acting with the stiffeners.

The stresses in the skin plate for any of the above cited conditions shall be worked out in accordance with IS:4622(latest). The maximum permissible value of stresses shall not be greater than those specified in IS:4622 (latest). The min. thickness of skin plate shall be 10 mm inclusive of corrosion allowance.

2.1.2 Vertical Stiffeners and Horizontal Girders

The vertical stiffeners and horizontal girders shall be designed as simply supported or continuous beams depending upon the framing adopted for the gate. The spacing between the girders shall preferably be such that all girders carry almost equal loads. The deflection in girders shall not exceed $1/800$ of span (*Centre to Centre of wheels*). The end vertical girders shall be designed as continuous beams with concentrated loads, coming from horizontal girder at points where they meet the end vertical girder.

2.1.3 Seals

Rubber seals shall be fixed to the gate by means of counter sunk screws made of stainless steel/ corrosion resistant steel. The screws shall be designed to take up full shear likely to develop during raising or lowering the gate under max. head of water between the seal and bearing plates. The screws shall be adequately tightened to a constant torque and locked by punch mark. Min. threaded length equivalent to one and half times diameters of screws shall be screwed to ensure against their loosening under vibrations during operations.

The seals shall conform to the provisions contained in IS: 11855 (latest) & 15466 (latest). The seal interference/compression shall be 2 to 5 mm. Suitable chamfer shall be provided at the bottom of skin plate/clamp plate to accommodate the bottom wedge seal in compressed position.

2.1.4 Seals seats, Seal Bases and Sill Beams

The min. thickness of seal seats shall be 6 mm after machining. The seal seats shall be stainless steel conforming to IS: 1570 part-V (latest). The seal seats shall be welded to the seal seat bases using Gr. E309L-16 welding electrodes. The seal seat shall be finished smooth to double delta surface finish.

The seal seat bases shall be made of plate or any structural section on which the seal seat is fixed. The sill beam shall be provided with the stainless-steel plate as bottom seal seat. The surface of the sill beam shall be machined smooth and made flush with surrounding concrete.

2.1.5 Guides and Guide Shoes

Guide shoes shall be provided to the sides of gate to limit the lateral motion or sideways of the gate to not more than 6mm in either direction. Guide shoes/ rollers shall be adjustable and removable. These shall slide or roll on guide plate. The guide plates shall be placed at Centre of the gate groove.

The guide shoes/ rollers shall be fixed with the help of bolts/screw, which shall be designed to withstand the load encountered by them during operation of gate.

2.1.6 Ballast

The gate shall be self-closing type under their own dead weight. Suitable ballast, if required to make the gate self-closing, may be provided in the form of dead weight. The ballast shall be in the form of cast iron/pig iron billets, concrete or any other suitable material which shall be securely placed in between the webs of horizontal girders ensuring that it does not get dislodged from its position, when the gate is in operation. The effect of dead weight of the ballast on the horizontal girders shall be analyzed. The Centre of gravity of the gate shall be determined after the ballast has been placed and properly secured in position. The ballast shall be provided such that its weight does not exceed 90% of the dead weight of the gate.

2.1.7 Anchor bolts or Anchor plates

Anchorage shall be provided in the 1st stage concrete with suitable block out openings to hold the 2nd stage embedded parts. The anchor bolts in 2nd stage concrete shall be with double nuts and washers. The anchor bolts shall be of minimum 16 mm diameter.

2.1.8 Tolerances

The tolerances for embedded parts and components of gates shall be as per IS:4622(Latest).

2.1.9 Lifting Arrangement

The lifting arrangement to the gate shall be provided w.r.t the true center of gravity

of the gates in such a manner that when the gate is hung freely shall remain in true vertical plane. In case the lifting lugs are welded on the web of the top horizontal girder the hoisting shall be dispersed through suitable stiffeners to one or more horizontal girders below the top one. The extra stresses, if any arising due to this arrangement shall be combined with other stresses to ensure that the permissible limit does not exceed.

2.1.10 Earthquake effect

The suitability of gate shall be checked for earthquake effect (corresponding to the type of zone of the site) and the permissible stresses shall be enhanced by 33.33 % but in case of welded connection and bolts the values of permissible stresses shall be enhanced by 25% of the permissible stresses only, subject to an upper limit of 85% of yield point of the material.

2.1.11 Design Criteria

(For all the Gates mentioned above)

1	Design stresses for a) Embedded parts b) All Components of gates	Wet & inaccessible condition Wet & Accessible condition
2	Reference of IS codes	IS: 4622 (latest)
3	Hoist	Rope drum hoist of adequate Capacity mounted on trestles
4	Operation	The gates shall be used for regulations, and shall be operated under unbalanced head of water
5	Permissible deflection	Span/ 800
6	Permissible bearing and shearing stresses in concrete	As per IS: 456
7	Grade of concrete to be used 1st stage concrete 2nd stage concrete	As shown in the relevant civil drawings One grade higher than the first stage concrete (Not less than M25)
8	Minimum thickness of skin plate	10 mm
9	Minimum thickness of track plate	10 mm (after machining)
10	Minimum thickness of seal seat	6 mm (after machining)
11	Minimum thickness of guide (for Barrage &	20 mm (after machining)

	Under sluice Gates)	
12	Type of seal Forsides For bottom	Hollow/solid bulb Music note type rubber seal. Wedge type rubber seal

2.1.12 Materials

For general condition of testing the material please refer Chapter-III Recommended materials for gates, stoplogs and its components are given below:

Sl. No	Component	Recommended Materials	Reference
1.	Skin plate, stiffeners	Structural steel	IS: 2062
2.	Main horizontal girders, end vertical girders, seal bases and clamps, guide shoes etc.	Structural steel	IS:2062
3.	Track bases, seal seat bases, guide	Structural steel	IS: 2062
4.	1st stage anchor plates & anchorages etc.	Structural steel	IS:2062
5.	Seal seats	Stainless steel	IS: 1570 (Part-V)
6.	Wheel track	Corrosion resistant/stainless steel plates	IS:1570(Part-V)
7.	Wheel, Lifting pulley, turnbuckles	Cast steel/ Forged steel	IS:1030/ IS:2004/IS:1875
8.	Wheel pin, lifting pin	Stainless steel	IS: 1570(Part-V)
9.	Bearings (a) Bearings in Wheels (b) Bush bearing	Spherical roller selfaligning Aluminum bronze	(SKF or equivalent) IS: 305
10.	Seals		
	(a) Side seals	Natural or synthetic rubber	IS: 11855/15466
	(b) Bottom seals	Natural or synthetic	IS:11855/15466
11.	Screws/ bolts for seals	Stainless steel	IS:1570(Part-V)

For Stoplogs			
12.	Slide block and guide roller etc.	Structural steel	IS: 2062
13.	Sliding track & seal seat	Corrosion resistant / stainless steel plate	IS: 1570 (Part-V)/ IS:6911
14.	Sliding pad	Bronze	IS:305/ IS:308

2.1.13 Stoplogs for Sluice gate

It is proposed to provide one set of stoplog for the maintenance of Barrage & Under sluice gates complete with guide roller/shoe, sliding block/pad, seals etc. The stoplogs shall be operated by means of common Gantry crane of suitable capacity, and automatic engaging disengaging type lifting beam. The Stoplogs shall be operated under balanced water head condition. While raising, the balanced head shall be achieved by crack opening the top unit of Stoplog.

2.1.13.1 Skin Plate

The skin plate and stiffeners shall be designed together in a composite manner for the following conditions.

- c) in bending across the stiffeners or as panels, and
- d) in bending co-acting with the stiffeners.

The stresses in the skin plate for any of the above cited conditions shall be worked out in accordance with IS: 5620 (latest). The maximum permissible value of stresses shall not be greater than those specified in IS:5620 (latest). *The min thickness of skin plate shall be 10 mm inclusive of corrosion allowance.* To take care of corrosion, the actual thickness of skin plate shall be provided by adding 1.5 mm more in the theoretically computed thickness based on the allowable stresses given in IS: 5620 (latest).

2.1.13.2 Vertical Stiffeners and Horizontal Girder

The vertical stiffeners shall be designed as simply supported or continuous beams depending upon the framing adopted for the gate. The spacing between the girders shall preferably be such that all girders carry almost equal loads. The deflection in girders shall not exceed 1/800 of span. The end vertical girders shall be designed as continuous beam with concentrated loads, coming from horizontal girder at points where they meet the end vertical girder.

2.1.13.3 Seals

Rubber seals shall be fixed to the gate by means of counter sunk screws made of stainless steel/corrosion resistant steel. The screws shall be designed to take up full shear likely to develop during raising or lowering the gate under max. head of water between the seal and bearing plates. The screws shall be adequately tightened to a constant torque and locked by punch mark. Min. threaded length equivalent to one and half times and diameters of screws shall be screwed to ensure against their loosening under vibrations during operations.

The seals shall conform to the provisions contained in IS: 11855(latest) & 15466(latest). The seal interference/compression shall be 3 to 5mm. Suitable chamfer shall be provided at the bottom of skin plate/clamp plate to accommodate the bottom wedge seal in compressed position.

2.1.13.4 Seals seats, Seal Bases and Sill beams

The min. thickness of seal seats shall be 10 mm after machining. The seal seats shall be stainless steel conforming to IS: 1570 part-V (latest). The seal seats shall be welded to the seal seat bases. The seal seat shall be finished smooth to double delta surface finish.

The seal seat bases shall be made of plate or any structural section on which the seal seat is fixed. The sill beam shall be provided with the stainless-steel plate as bottom seal seat. The surface of the sill beam shall be machined smooth and made flush with surrounding concrete.

2.1.13.5 Guides and Guide Rollers

Guide rollers shall be provided to the sides of gate to limit the lateral motion or side ways of the gate to not more than 6mm in either direction.

Guide rollers shall be adjustable and removable. These shall slide/roll on guide plate.
The guide plates shall be placed at c.g. of stoplogs.

The guide shoes shall be fixed with the help of bolts/screws, which shall be designed to withstand the load encountered by them during operation of gate.

2.1.13.6 Anchor bolts or Anchor plates

Anchorage shall be provided in the 1st stage concrete with suitable block out openings to hold the 2nd stage embedded parts. *The anchor bolts in 2nd stage concrete shall be with double nuts and washers.* The anchor bolts shall be of minimum 16 mm diameter.

2.1.13.7 Tolerance

The tolerances for embedded parts and components of gates shall be as per IS:5620

2.1.13.8 Lifting Arrangement

The lifting arrangement to the gate shall be provided with respect to the true centre of gravity of the gates in such a manner that when the gate is hung freely shall remain in true vertical plane. In case the lifting lugs are welded on the web of the top horizontal girder the hoisting forces shall be dispersed through suitable stiffeners to one or more horizontal girders below the top one. The extra stresses, if any, arising due to this arrangement shall be combined with other stresses to ensure that the permissible limit does not exceed.

While designing the lifting lug due care shall be taken for impact loads.

2.1.13.9 Earthquake effect

The suitability of gate shall be checked for earthquake effect (corresponding to the type of zone of the site) and the permissible stresses shall be enhanced 33 1/3% subject to an upper limit of 85% of yield point of the material. In case of welded connection, the values of permissible & nuts the **increase in stresses shall be maximum of 25% of the permissible stresses.**

2.1.14 Design Criteria

Sl. No	Particulars	Design Criteria
1	Design stresses for a) Embedded parts b) Components Stoplog	Wet & inaccessible condition Dry & accessible condition
2	Reference of IS codes	IS: 5620 (latest)
3.	Hoist	Gantry crane of suitable capacity mounted on rails or Monorail crane of suitable capacity.
4.	Operation	The stoplog shall be operated under balanced head condition, while raising balanced head condition shall be achieved by crack opening the top unit.
5.	Permissible deflection	Span / 800
6.	Permissible bearing and shearing stresses in concrete	As per IS: 456
7.	Grade of concrete to be used 1 st stage concrete 2 nd stage concrete	As shown in the relevant civil drawings. One grade higher than the first stage concrete (Not less than M25)
8.	Minimum thickness of skinplate	10 mm
9.	Minimum thickness of trackplate	10 mm (after machining)
10	Minimum thickness of seal seat	10 mm (after machining)
11	Minimum thickness of guide	20 mm(after machining)
12.	Type of	Hollow bulb, music note type rubber

	sealFor sides For bottom	seal. Wedge type rubber seal
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2.2 ROPE DRUM HOISTS FOR THE OPERATION OF BARRAGE & UNDERSLUICEGATES.

2.1.14 General

Electrically operated rope drum hoist of adequate capacity shall be installed for the operation of Barrage Bay & Under sluice Gates. (The Rope drum hoist shall be as indicated in the Approved General Installation drawings of respective gates).

The hoist mechanism shall include a driving motor, gears/ worm reducer, rope drums, wire ropes, pulleys, turn-buckles, shafts, bearings, coupling, brakes, emergency manual- operation arrangement, limit switches, gate position indicator etc., all mounted on a fabricated steel frame. Electrical controls and necessary electrical and mechanical accessories shall be provided for the satisfactory operation of the hoist. All machinery is to be supported on hoist supporting structure and trestle of respective gates. The hoisting mechanism shall be provided with covers to protect it from dust, dirt and direct exposure to sun & moisture. Standard clearances, tolerances and finishes shall be adopted. All accessories and equipment shown on the drawings or required by the specifications, shall be of high-class quality, suitable and applicable for the duty or the function that the particular accessory or equipment will be required to perform in the operation of the hoist and shall conform to the general dimensions of the associated parts, within sufficiently close limits to avoid changes in other components/assemblies already approved by the Engineer-in-Charge. The hoist shall be capable of fully opening / closing the gates and holding the gate in its fully opened position as may be required. Suitable ladder rungs for access shall be provided to approach the hoist component and sufficient space shall be provided around them for repair and maintenance.

2.1.15 Hoist Capacity

The hoist capacity shall be determined by taking into consideration the sum of the worst combination of the following forces during either raising or lowering cycle, which might be required to overcome.

- i) Weight of the gate along with its entire components.
- ii) All frictional forces comprising of
 - a) Wheel friction, b) Seal friction including friction due to initial interference, c) Guide friction, etc.
- iii) Any hydrodynamic loads like hydraulic down pull/uplift.

- iv) Silt load, if any.
- v) Any other loads considered specific to the site.
- vi) The hoist capacity thus computed shall be increased by 20 percent as reserve.
- vii) Seating load shall be greater than 250 kg/m length of the gate.

2.1.16 Hoisting Ropes

The wire ropes (hoisting ropes) shall be made from improved plough steel of 6 X 36 or 6 X 37 construction fiber core conforming to IS: 2266 (latest). While calculating the rope tension and selecting the wire rope diameter, the efficiency of the pulleys / sheaves and drums shall be taken into account. In case of multiple falls, the wire rope shall be provided with turn buckle to prevent the unequal stretch of rope. The wire rope shall be guided over as few pulleys as possible. Reverse 'S' shaped bends shall be avoided. The minimum Factor of Safety based on minimum breaking strength and safe working load of wire rope shall be as under:

- i) Normal operation condition 6
- ii) Breakdown torque condition 3

The strength of socket ends of wire rope shall be approximately equal to that of the rope. The ends of the wire rope shall be secured against twisting. The material for wire rope sockets shall conform to IS: 2485(latest). *Molten zinc shall be used to socket the rope. The specimen shall be subjected to destructive tensile test in which ropes fail than socket or joints.*

2.1.17 Rope drums

The rope drum shall be made of cast steel or welded steel plates and shall be adequately designed to sustain the concentrated loads due to the rope tension. The drum shall be flanged at both ends. The height of flanges shall be not less than 2 (two)- rope diameters above the rope. A spur gear secured to the drum may be regarded as forming one of the flanges.

The fleet angle of the rope shall not exceed 5° or 1 in 12 on either side of helix angle of groove in drum. The drum shall be strong enough to withstand the crushing as well as bending. The crushing strength of drum shall be calculated by the following formula:

$$Cr = \frac{K \times T}{P \times t}$$

Where,

Cr = compressive strength in

N/mm^2 K = coefficient

T = tension on one wire rope in N

p= Pitch of scoring

t = Thickness of drum at the bottom of groove in mm

The pitch diameter of drum shall not be less than 20 times the diameter of rope. In case of fabricated drum, the number of segments shall not exceed two. The drum shall be machine grooved. Contour at the bottom of the groove shall be circular over an angle of at least 120° . The radius of the groove shall be 0.53 times the diameter of rope rounded off to next millimeter. The depth of the groove shall not be less than 0.35 times of the diameter of the rope. The groove of the drum shall have clearance as specified in clause

4.3.4.2 of IS: 6938 (latest). The size of the drum shall be such that there will be not more than one layer of rope on the drum when the rope is in fully wound position. The ends of the rope shall be fixed at minimum two points on the drum in such a way that the fixing device is easily accessible and the rope is not subjected to undue twists & turns. Each rope shall have not less than two full turns on the drums before it is fixed.

2.1.18 Sheaves or Pulleys

All sheaves or pulleys shall be made of cast steel or wrought steel. These shall be machine grooved to a depth of not less than 1.5 times the diameter of the rope. The grooves shall be finished smooth and shall be free from surface defects, likely to injure the rope. The pitch circle diameter of sheave shall not be less than those indicated in Table 3 of IS: 6938 (latest). The contour at the bottom of the grooves shall be circular over an angle of approximately $130^\circ \pm 5^\circ$. The radius of the groove shall be 0.53 times of rope diameter. All revolving sheaves/ pulleys shall be in true running balance. The sheaves/ pulleys in the lower block shall be mounted on self-lubricated bronze bushings. The angle between the straight slopes at the sides of the grooves shall be approx. 52° . The diameter at the bottom of the grooves of the equalizing sheaves shall not be less than 62% of the minimum pulley diameter.

2.1.19 Gearing and Gear Boxes

(a) Gearing

All spur gears shall be of cast steel or forged steel or carbon (surface hardened) steel. The gears and pinions shall be made of two different grades of materials. The pinions shall be of higher strength grade material and spur gears shall be of lower strength grade of material. All gears shall be machine cut with smooth finish. The gear shall be designed as per IS: 6938 (latest) and other relevant Indian Standards. The face width of gears shall not be less than two times of circular pitch. Duty factor for appropriate class of mechanism shall be taken into account in design calculation. All allowable stresses for the normal operating condition shall be 20% of UTS of the material used for the manufacture of the gear. The allowable stress at breakdown torque condition shall be 80% of Y.P. of the material. The keys in gears train shall be tight fit and should not

become loose in service

(b) Gear boxes

Gear boxes shall be of rigid construction fitted with inspection covers and lifting handles. The gear boxes shall be made of cast iron or cast steels or fabricated from mild steel.

That shall be so designed to replaced and lubricated. Proper facilities for oil filling and draining, connections for oil level indicator and adequate breathing shall be provided. The gear boxes shall be mounted on a level surface. **The Gear boxes shall have self-locking characteristics.**

2.1.20 Electro-magnetic Brake:

The electro-magnetic Brake shall be of spring set shoe type. It shall be solenoid operated and continuously rated. The brake shall be effective in both direction of rotation and shall be capable of overcoming at least 150 percent of the full load torque exerted by the motor.

The brake shall set automatically when the current is cut off from the motor and it shall be electrically released when the current is applied to the motor. The brake shall be equipped with a hand operated release lever. A weather-proof cover completes with heaters, if required, shall be provided to prevent condensation on moving parts.

In addition to electro-magnetic brake, additional brakes shall be provided, in such case where undesirable gravity fall of gate is to be arrested or where frequent intermediate stopping of gate is required during lowering cycle or where the selected gear box is not of self-locking type.

2.1.21 Bolts, Nuts, Set Screw & Washer

All bolts and nuts for mechanical equipment shall be finished and shall have hexagonal heads. The bolt heads and nuts shall bear the seat at right angle to the bolts. On castings the seats shall be on finished bases or on spot faced surfaces. Nuts subjected to vibration and frequent changes of load shall be secured by effective lock nuts. Double nuts shall be of standard thickness. Bolts shall not be used for transmitting torsion.

All set screws shall be provided with case hardened cup points and shall be of the safety type. Set screws shall not be used for transmitting torsion.

Washer shall conform to IS: 2016 and IS: 3773 with up-to-date amendments / revisions if any.

2.1.22 Shafts

Shafts shall have ample strength, rigidity and adequate bearing surfaces. Shafts shall be designed for the load / torque to be transmitted by them. The ratio between length and diameter shall not exceed 50. The angle of twist and the revolutions / min shall be taken into account in addition to simple bending, pure torsion, or the combined effect of bending and torsion. The twist shall be between to $1/4^\circ$ to $1/3^\circ$ per meter. The linear deflection shall not exceed 1mm/m length i.e., 1/1000.

2.2 Bearings

All bearings shall be either roller or ball bearings or sleeves type removable bronze bushings with flanges at both ends. Bearings shall be easily accessible for lubrication and or replacement. In case of more than one bearing of one shaft, every bearing shall be provided with separate and individual lubricating arrangements. Unless, otherwise specified herein and / or on drawing, the bearings on the revolving shaft shall be divided type, so that each shaft may be removed from the pinions and gears in position, without disturbing the adjacent parts. In all cases, where divided bronze bushings are used, the bearing caps, unless divided, shall be recessed into the base and secured by turned fitted bolts. Cap screws shall not be used for this purpose. This requirement shall not apply in case of roller or ball bearings.

The base casting for gear train bearings shall be made in one piece to ensure the accurate alignment and spacing. They will be held securely in position by turned fitted bolts. Proper provisions shall be made to hold the bearings effectively against rotations and changing position under load. All bearings shall be provided with the arrangement to make them leak proof, weather proof, drip proof, and protection from entrance of rain, dust, dirt and any other foreign matter. The pressure on bronze bushing shall not exceed 70 kg / cm² projected area.

Antifriction bearings shall be as suited for the appropriate load condition. Static capacity of bearing shall provide a minimum safety margin of 25% over B.D.T. loading.

2.3 Coupling

All couplings shall be of forged steel or cast steel design to transmit the maximum torque, which may develop. Solid couplings shall be aligned in such a way that they meet accurately. The flexible couplings shall be initially aligned with the same accuracy as solid couplings. Flexible couplings shall be fitted between motor shafts and extension shafts.

2.4 Lubrication

Grease lubrication shall be provided for all gear trains, sleeve bushings, bearings on motors, wheels etc. Lubrication for all mechanical operating points shall be done by means of high-pressure grease gun and industrial button type fittings. Lubricating nipples, pipes and adapters shall be easily accessible and wherever necessary the copper and brass pipe of ample size shall be provided to a convenient point for lubrication. However, oil lubrication shall be provided for closed worm reducers, helical reducers.

A lubricating chart shall be provided indicating all the lubricating points, type of lubrication and recommended frequency of lubrication.

2.5 Electrical equipment

All electrical equipment and wiring shall meet all the requirements and shall be in

accordance with IS: 6938 and other relevant Indian Standard Specifications unless otherwise specifically called for in the specifications. Nuts, railings, screws and other accessories which are external to the apparatus, but which may be required to meet the codes for installed equipment shall be furnished by contractor. All electrical wiring shall meet the relevant provisions of Indian Electricity Act. The power supply shall be 3 (three) phases, A.C, 415 volts, 50 cycles per sec. with supply voltage variation of $\pm 10\%$ and supply frequency variation of $\pm 3\%$. All electrical equipment shall be designed suitable for continuous operation under tropical conditions.

2.5.1 Motor

Motor provided for operation of the hoist shall be of adequate capacity to meet the duties, speeds and performance called for in these specifications. The rated capacity of each motor shall be such that full load torque shall not exceed in giving the specified performance of the hoist. Motor shall be totally enclosed with fan cooling, high starting torque squirrel cage, 3 (three) phase induction fitted with A.F. converter or Slip ring induction motors fitted with external non-breakable corrosion type resistor for rotor circuit. The rpm of motor chosen shall not be more than 1000 but shall be capable of withstanding a max. speed of 2.5 times the rated speed. The break down torque/pullout torque of the motor with rated voltage and frequency shall not be less than 2 times (200%) of the full load torque. The motor shall be braced and insulated to withstanding plugging service and heavy shocks vibration transmitted to them by the driven machinery. The motor shall be provided with class

– F insulation. The motor shall be out door type crane duty and suitable for reversing frequent accelerations and mechanical braking. In case of stoppage of motion of the hoist occurs due to the electric braking, the motor shall be suitable to withstand this duty. Roller or Ball bearings provided with the motor shall be suitable to withstand the heavy vibrations and shocks. All bearing shall be sealed to prevent leakage of oil and Lubricants and entrance of dust etc. Motor leads shall be brought out from the motor frame to terminals in the Terminal box fixed to the motor frame. The motor shall be so located that the terminals are accessible for inspection and maintenance with unrestricted ventilations. The contractor shall enclose the full technical particulars of each motor, indicating (a) the values of the locked rotor, starting, rated and pull-out currents, (b) starting, rated, breakdown torques, (c) make, class of duty, number of poles, start/hr, CDF, type of insulation etc.

Motor shall be of standard capacity and specification in accordance with BIS or equivalent international standard marked and of reputed make like Siemens, Kirloskar, NGEF, GEC etc. (as mentioned in another para)

Efficiency of various elements of hoisting mechanism shall be as per Table 5 of IS: 6938. The overall efficiency of the system i.e., the product of individual efficiency of element shall be worked out and shall be used in calculating the capacity of the electric motor. The ratio of overall running efficiency to the overall starting efficiency shall be less than the ratio of starting torque to running torque of motor.

2.5.2 Control Equipment

The hoist mechanism shall be complete with one local control panel with push button suitably marked as RAISE, STOP AND LOWER. Lamps, to indicate the conditions of the control circuits and direction of motion shall be provided. Necessary relays, starter heaters fuse, limit switches and indicating lights complete with suitable wiring shall be provided so that all functions are carried out smoothly. All controls shall be interlocked so that proper functioning of individual parts for the purpose is ensured. All the enclosures of the control equipment shall confer to IP55 (with double door) class of protection.

Hoist motion shall be done with the help of standard push Button type switches. The push button control voltage shall not be more than 110 volts. All push button control switches shall be capable of withstanding rough handling without being damaged and the cover shall be effectively secured.

Necessary provision shall be made in the control equipment for remote indication of various parameters like open, close etc. of the hoist control and the gate position.

2.5.3 Limit Switches

The limit switches shall be of the totally enclosed and shall have water proof covering. The limit switches, after being tripped, shall automatically reset within reasonable distance traveled in opposite direction. In case of resetting is achieved by strikers when moving in opposite direction, a changeover type limit switch shall be provided. It shall be suitably designed and tested for normal lift and satisfactory operation under the humid climatic conditions. A limit switch to stop the motion and to apply brake when the gate has risen or lowered to a predetermined level shall be provided to prevent the over winding.

2.5.4 Wiring

All wiring shall be laid in hot dipped galvanized metal conduit. All conductors for primary power lighting and control circuit shall be insulated for not less than 1100 volts and shall have standard moist resisting double braided covering. All conductors between the secondaries of the motor conductor and resistors shall have sufficient current carrying capacity in accordance with Indian Standard and shall be insulated with 1100 volts class asbestos. The primary conductor to the motor shall have standard continuous current carrying capacity of not less than 100% of the rated full load primary current of the motor. Cable having conductors smaller than sq. mm nominal equivalent copper area of the cross section shall not be used for the power wiring for any of the motors. For control circuits and auxiliary wiring, cables having a sectional area smaller than 1.5 sq. mm nominal equivalent copper area of the cross section shall not be used. All cables shall be adequately protected against mechanical damage and metal trunking may be used if desired. Electrical conduit shall comply with the relevant Indian Standard. For outdoor cranes except where flexible unarmoured cable are essential, cables shall be armoured or enclosed throughout their length in galvanized trunking or conduit, either flexible or rigid. A flexible metallic tube or duct may not form an effective earth connection and shall

not be used for the purpose. Tapped and braided varnished cambric insulated cables shall not be used for outdoor crane.

2.5.5 Interlocking and Earthing

Off position interlocking earthing and other electrical equipment shall be provided in terms of provisions contained in IS:3043 (latest)

2.5.6 Hoist Supporting Structure

The hoist supporting structure and trestle shall be designed considering an impact factor of 1.1 as specified in IS:6938 and shall be made of structural steel (weldable) conforming to IS:2062 and shall be designed to withstand the dead weight of the hoist, hoisting load as well as vibrations coming on the hoist, while in operation. In addition, wind/seismic load shall also be taken into account. Suitable anchorages for the hoist frame shall be provided to take the worst combinations of all loads under which the gates and hoists are under operation. The hoist supporting structure and trestle shall be either in riveted or welded construction Diaphragms shall be provided to distribute the loads to the sides properly. Shop connection in the frame shall be either riveted or welded so that the surface of the hoist including the outside of the frame, case and hoist housing and viewed along with the intake structure will be a plane surface except for projections of rivet heads. The structure shall be designed for each of the following combinations.

- i) Dead loads plus live load, impact load, wind load @ 50 kg /sqm and crowd load @ 500 kg/sq. m on entire area of walkway and platform.
- ii) Dead load with no hoisting load plus effect of storm wind load @ 150 kg/sq. m.
- iii) Breakdown torque of the motor. The permissible stresses as specified in IS:800 for normal operation shall be increased by 33 1/3% limited to 80% of yield point.

2.5.7 Miscellaneous

(i) Gate Position Indicator

The gate position Indicator shall be provided with rope drum hoist. The design of the gate position indicator shall be as per IS:6938

(ii) Manual Operation

The manual operation arrangement shall be provided for rope drum hoist as per IS: 6938

(iii) Wrenches and Tools

A suitable grease gun and a complete set of wrenches and tools in a pressed toolbox shall be furnished for the hoist. Sufficient quantity and variety of tools shall be furnished to cover all ordinary maintenance work of the hoist Operating instruction in a suitable metal frame cover with glass shall be mounted at

convenient location.

(iv) Machinery Housing and cover

Weather proof housing and covers shall be provided and fabricated from structural steel sections conforming to IS:2062.

Gear box covers shall be of rigid construction fitted with inspection covers and lifting handles. The covers shall be so shaped that the gears can be easily removed or replaced. Facilities for lubrication, oil draining, oil level indicating etc. shall be provided where necessary. The thickness of metal sheet for cover shall be not less than 3mm.

(v) Hoist Bridge & Trestle, Latch

Suitable hoist bridge & trestle, latch shall be provided and designed as per IS:6938, IS:800

(vi) Platform, Walkways, ladder, hand rails

- (a) All ladders, platforms and walkways necessary to provide access to the hoist machines, shall be provided. The platform and walkways shall be designed for a live load of at least 500kg/sqm and shall consist of suitable non-slip steel plates riveted or welded together and riveted or bolted to the steel framework except that the walkway on the top deck of the rope drum hoist shall be constructed of the floor grating. The floor shall be constructed from reinforced steel plates of welded construction. The thickness of the chequered plate shall not be less than 8mm. *The flooring shall be provided all through the hoist bridge except the area covered by hoist machinery.*
- (b) The ladders shall be not less than 400mm width between side parts and shall have round rungs 20mm in dia. Spaced at 300mm centres.
- (c) The walkways shall provide clearance of not less than 600mm between machinery and/or the structure and the hand rails. Clips shall be provided on all open edges of the walkways and platforms.
- (d) Standard pipe handrails with two horizontal pipe rails shall completely enclose all walkways. The handrails and ladder rungs on the outside of the hoist bridge shall be made of steel having fittings of the flush jointed type. Hand railing shall be provided along the open side of the walkways, platform, stairs and other locations where required. The hand railing along the walkways on the platform shall be 1200mm high.
- (e) The platforms are required to be proportioned for moving a single load

of 300 kg. Railing is to be proportioned for a traveling horizontal single load of 30 kg acting on the rail iron.

(vii) BDT condition

All the components of rope drum hoist including machinery, Hoist bridge, trestle, rope and lifting lug, etc. shall be checked for actual break down torque of motor, while calculating stresses under BDT condition.

2.5.8 Design Data for Rope drum hoist of Barrage Gate.

- (i) Capacity : Adequate Capacity
(ii) Maximum lift of the gate : --- m
(iii) Operating speed of hoist : 0.3 to 0.7 m/min
(iv) Number of hoist : Equal to No. of gates
(v) Governing IS Code : IS:6938(Latest)

Note: Hoist Mechanism shall be checked for Seismic effect

2.5.9 Materials for rope drum hoist for Barrage Gate.

For general condition of testing the material please refer **para 3.0**

Recommended materials for rope drum hoist and its components are given below:

Sl.No	Component	Recommended Materials	Reference
1.	All Structural members	Structural Steel	IS: 2062
2.	Rope drum	Structural Steel	IS: 2062
		Cast Steel	IS: 1030
3.	Wire rope	Improved plough steel fiber core- (Ungalvanized)	IS: 2266
4.	Gears	Cast Steel	IS: 1030
5.	Pinions	Forged Steel	IS: 2004/ IS: 1875
6.	Shafts	Structural Steel/ Forged Steel SENIOR	IS: 2062 MANAGISRI (CIVIL)
7.	Sheaves/Pulleys/	Cast Steel	IS: 1030

	Couplings/roller		
8.	i) Bearing (sleeve) ii) Anti-frication bearing	Phosphor Br., Leaded Tinbronze Bronze, Aluminum Br.SKF, FAG, ZKL or equivalent	IS:28,IS:31 8IS: 305
9.	Keyways and Keys	Mild Steel	IS: 2048/ 2291/2292
10.	Motor	Crane duty	IS: 325 / 900
11.	Cables and conductors		IS: 9968
12.	Conduit		IS:9573
13.	Switch gear		IS:13947
14.	Equalizer bar and turnedbuckles	Mild Steel	IS: 2002/2062
15.	Gate position indicator	Non-rusting metal or Enameled plate or thick Plastic sheet	
16.	Cover	Cast Iron Mild Steel	IS:210 IS: 2062
17.	Wire rope socket	Forged Steel	IS:1875
18.	Bolts and nuts	Mild Steel	IS:1363,1364, 1365,1367
19.	Wheel	Cast Steel	IS: 1030
20.	Axles and pins	Forged Steel Corrosion resistant steel	IS:1875 IS:1570(Part-V)

2.5 Gantry Crane for the operation of Stoplogs for Barrage Gates.

2.5.1 General

One no. Gantry Crane (of suitable capacity) shall be provided for the operation of Stoplogs of Barrage bays & under sluice for isolating the gates for maintenance & inspection purpose. The Stoplogs shall be operated through automatic engaging and dis-engaging type lifting beams.

All the parts of the crane shall be in good working order, of good material and with accurate workmanship, skillfully fixed properly connected and put together. All works, materials and services not expressly called for in these specifications or shown in the drawings, which are necessary to complete and proper operation of the equipment shall be furnished by the contractor at no extra cost.

2.5.2 Materials

All materials shall conform to the requirement indicated on the drawings or referred to in these specifications and when not covered therein metal and materials of standard quality shall be furnished. Material shall be of the classifications and grades approved by the Engineer-in-Charge. In case the contractor desires to use stock materials, not manufactured specifically for the work covered by these specifications, he shall submit satisfactory evidence to the Engineer-in-Charge that such materials conform to the requirements of these specifications. And in such cases detailed test of these materials may be waived in writing by Engineer-in-Charge on an item-by-item basis.

All materials used in the constructions of gantry crane shall conform to the latest relevant India Standard Specification. The manufacturer shall quote the reference of IS Code of practice for materials used.

For general condition of testing the material please refer Chapter-III Recommended materials for Gantry Crane and its components are given below:

Sl No.	Materials	B.I.S Specification
1.	Steel and castings: Structural steel: Cast Iron Structural steel-medium & High strength Cast Steel	IS: 2062 IS: 210 IS: 8500 IS: 1030
2.	Threaded fasteners	IS:1367, IS: 1363, IS:1364, IS: 1365
3.	Wire Ropes	IS: 2266, IS:2365
4.	Steel Forging	IS: 2004, IS: 1875
5.	Shafts	IS: 1875, IS: 2062
6.	Keyways & Kes	IS: 2048, IS: 2292, IS: 2291
7.	Bronze Bushing	IS: 28, IS: 318, IS: 305, IS: 1028, IS:1 458
8.	Gears	IS: 3681, IS: 4460, IS: 4715
9.	Ball and roller bearings	IS: 5935, IS: 5932, IS: 5933, IS: 5692 & IS: 5669
10.	Special steels a. Steel for welded Gear Rings	Carbon content: 0.25% (Max.) Elongation: As per IS: 1608-0.25% Reduction in area: As per IS:1608- 15%. These physical properties shall apply after the gears have been annealed for stress relief. The gear teeth shall be flame hardened and have a maximum BHN value of 170.
	b) Steel for wheels and sheaves	In general, shall have chemical

		composition as under: Carbon: 0.55% to 0.8% Manganese:0.5% to 0.8% Phosphorous: Not more than 0.06% Sulphur: Not more than 0.06% BHN:Not less than 250 IS: 1030, IS: 226, IS: 2062
11.	Motor (crane duty)	IS:325, IS: 900, IS: 1231 & IS: 2223
12.	Cables and conductors	IS: 9968
13	Conduits	IS: 9537
14.	Switch gear	IS: 13947

2.6 Design Criteria

2.6.1 General

The crane shall be manufactured in accordance with class-MS of IS: 3177-1999 (class 2 as per IS: 807-1976)- the Outdoor Traveling Type with rope drum hoist mounted at the top of the crane structure. The operation of the crane shall be completely electrical. The power supply shall be 3 (three) phases, A.C, 415 volts, 50 cycles per sec. with supply voltage variation of $\pm 10\%$ & supply frequency variation 3%. The power supply shall be made available from the plug receptacles located at suitable intervals along with the crane runway. To facilitate a better control of the crane, an operator's cabin shall be provided with the crane. All the controls required for the electrical equipment on the crane shall be provided in the operator's cabin along with the control panel having indicating lights for the various operations. The crane should be made to stop at the centre of each span of Gate with the help of limits switches provided along with the travels.

2.6.2 Data for Gantry Crane for Stoplogs of Barrage Gates.

The capacity, length of travel and the speed of the crane shall be as follows:

1. Capacity of hoist : As per design
2. Total lift :
3. Speed of hoisting : 1.5-1.7m / min
4. Gantry travel speed : 8-10 m /min
5. Centre to centre distance

Between runway rails :

6. Wheel base of crane :
7. Total length of travel : m (tentative)
8. Limiting deflection : As per IS: 6938(latest),IS:807
9. All components such as machinery parts, rope, structure, girder, lifting lug, lifting beam etc. shall be checked for the stress value under actual breakdown torque conditions of motor.

2.6.3 Permissible Stresses

The crane and the structural members shall be proportioned in such a way that the actual calculated stresses for the combination of loading causing most adverse effect on the members, arrived at by any of the accepted methods of calculations, shall not exceed the permissible stresses as specified in IS:807.

The design of the component parts of the mechanism relating to crane motion shall include due allowance for the effects of the duty which the mechanism will perform in service.

In all cases the mechanism shall be classified in accordance with the provision 4.3 of IS: 807-1976 on the basis of the duty and the design of the component parts shall be in accordance with the provision given in this section.

The overall design and fabrication of gantry crane shall conform to IS: 3177, IS: 807, IS: 800, IS: 806, IS: 816, IS: 822 & IS: 9595 (Latest revisions)

2.6.4 Loading

All structural loads shall be computed as follows:

- a) The dead load shall include the weights of the legs, horizontal members of the crane, platform, crane drive, hoist mechanism and operating cabin etc. The effect of the eccentricity of the location of the crane drive mechanism, hoisting mechanism and operator's cabin shall be included in the design.
- b) The tractive force on each wheel shall be considered as 5% on the resultant, maximum wheel load considering the weight of the crane and live load equal to hoist capacity.
- c) The live load shall include the weight of hooks, blocks, ropes and attachments. The live load shall be multiplied by the impact factor as per IS: 807.
- d) The wind load on the crane shall be taken as 50kg per sq. m and also in accordance with IS: 875 & IS: 807. The wind area of the crane shall be taken as the vertical projection of the structure, normal to the direction of the wind. While applying wind pressure, appropriate form factors in accordance with IS: 807 shall be accounted.

2.6.5 Stability.

- a) Considering load under breakdown conditions of motor and steady wind pressure 50 kg per sqm., the stability factor must be greater or equal to 1.3
- b) Considering live load under service conditions with stable wind pressure of 50kg per sq m. and acceleration and retarding forces the stability factor must be greater or equal to 1.8
 - c) In case of crane without load and not operating and considering storm wind pressure of 150 kg/ m², the stability factor must be greater or equal to 1.5.
 - d) Limiting Length of Members
 - e) The 1/r ratio shall not exceed 180 for main compression members and 240 for bracing and subsidiary members.
 - f) The 1/r ratio shall not exceed 300 for solid web girders and shall not exceed 150 for cantilevers.
 - g) The ratio of 1/b for any beam or girder shall not exceed the following limits:
 - h) Riveted box plate girders: $1/b \leq 65$.

Welded box plate girder: $1/b \leq 60$

2.6.6 Rolled Section

All rolled sections used as beams shall have a depth of not less than one sixteenth of the span and where used in pair shall have full depth separators spaced not more than 1.5m Centre to Centre. Stiffeners shall be provided on the webs of the rolled steel beams at the ends and at points of concentrated loads to resist buckling.

2.6.7 Structures

2.8.7.1 General

Care shall be taken in the design to produce a pleasing appearance of the crane. The crane should have the streamlined appearance and general architectural treatment that are considered as essential features of the design and that are required to be incorporated in the design and constructions.

2.8.7.2 Frame

The gantry shall be fabricated from structural steel sections and plates and shall be of either riveted or welded construction. The legs shall be of box type / rolled, with all angles on the inside of the leg. Field welding will not be accepted. Diaphragms shall be provided to distribute the loads properly to the two sides of the legs and plate stiffener shall be provided wherever necessary. Bearing surfaces of joints designed to transmit stress by bearing shall be machine finished to provide full contact. Shop connection in the frame shall be riveted or welded so that the surface of the crane including the outside of the frame cabin and hoist housing when viewed along with runway, will be a plane surface, except for the projection of rivet heads if any. The structures shall be designed to be adequate for each of following load combinations.

- a) Dead and live loads, wind load of 50kg per sqm on the surface of crane with

appropriate impact loads.

- b) Dead and live loads, wind load of 50kg per sqm on the surface of crane with tractive forces.
- c) Dead loads with no load on lifting blocks and 150 kg. /Sqm storm wind loads
- d) Breakdown torque of motor
- e) Collision of buffers and track stops.

2.8.7.3 Legs

The gantry legs shall be connected to the crane members by heavy gussets in a manner that will prevent skewing and ensure rigidity and strengths. Diaphragms shall be provided to distribute properly the loads from the cross members to the side of the legs. If the Centre lines of the legs are not matching with the Centre lines of the crane runway rails, the eccentricity shall be considered in determining the stresses.

2.8.7.4 Machinery Housing

A weather tight housing constructed of structural steel sections and plates shall be provided. The floor shall be constructed of reinforced chequered steel plates not less than 8mm thick and shall be welded or riveted to the framework. Clearance between the machinery floor and the roof framing shall not be less than 2 meters.

2.8.7.5 Operator's Cabin

The cabin shall be of closed type for outdoor services made of structural steel and shall be provided with sufficient ventilating type window to allow the operator to have a clear view of all operations and the cabin shall have ample space for the operation and maintenance of the equipment located in it. The floor of the cabin shall be made of steel plates fastened securely to the frame of the cabin and covered with TRANSITE' having not less than 12mm thickness. A foot operated rotary alarm gong of at least 300mm dia. shall be provided to the crane and shall be arranged for the operation from the cabin. Provision shall be made for access to the cabin by means of walkway from the ladders.

2.8.7.6 Platform, Walkways, ladders and handrails

All ladders, platforms and walkways necessary to provide access to the crane drive machines, shall be provided. The platform and walkways shall be designed for a liveload of at least 500kg/sq m and shall consist of suitable non-slip steel plates riveted or welded together and riveted or bolted to the steel framework except that the walkway on the top deck of the gantry shall be constructed of floor grating. The ladders shall be not less than 400mm width between side parts and shall have round rungs 20mm in dia. spaced at 300mm centres. The walkways shall provide clearance of not less than 600mm between machinery and/or the structure and the hand rails. Clips shall be provided on all open edges of the walkways and platforms. Standard pipe handrails with two horizontal pipe rails shall completely enclose all walkways. The handrails and ladder rungs on the outside of the crane shall be made of steel having fittings of the flush jointed type. Hand railing shall be provided along the open side of the walkways, platform, stairs and other locations where required. The platforms are required to be proportioned for a

moving a single load of 300 kg. Railing is to be proportioned for a traveling horizontal single load of 30 kg acting on the rail iron.

2.8.7.7 Buffers

The spring buffers shall be provided at either end of the travel of gantry crane and movable trolley and shall be capable of bringing the crane to a gradual stop in a distance of not more than 200mm when traveling in either direction at rated speed while power off and brakes not applied, without producing excessive stress or damage in the structure. The buffer stops shall be of cast or structural steel, accurately mounted to meet the buffer squarely. The Centre line of contact shall be above the Centre line of wheel base. The design of the buffers shall provide minimum factor of safety of six.

2.7 Mechanical Equipment

2.7.1 General

The hoist shall be designed in accordance with IS: 6938 & IS: 3177. All mechanical equipments shall be simple and substantial in design and capable of being easily erected, inspected, painted and taken apart. The hoist shall be single motor twin drum type, connected through gearing and shafting. The capacity of motor shall be such that the specific performance of the hoist at rated load will not demand more than full load torque. The shaft connecting and end gear trains shall be provided with flexible coupling of the geared type, or any other approved arrangement which will permit one drum to be rotated with respect to the other drum and keeps the lifting beam in a level position. All shaft loads shall be transmitted by suitable keys, splines or pins. The transmission of loads by press fit only will not be permitted. A factor of safety of FIVE over UTS shall be used in design of all mechanical parts, provided that all parts of the equipment shall have sufficient strength to resist the forces produced by the rated breakdown torque of the motor without exceeding 80% of the yield point strength of material used. If the duty factor is considered in breakdown torque conditions, the stresses shall be limited as per IS: 3177. The hoist shall be so designed as to limit the maximum rope fleet angles to one in twelve, unless otherwise approved. The grooving on the main hoist drum shall be such as to allow the lifting beam to travel vertically. The hoist shall be provided with an electro-magnetic brake and means to control the position of the hooks during lowering and raising.

2.7.2 Wheels and axles

The crane shall be carried on not less than eight wheels, four wheels in tandem, fully equalized and provided for each crane travel base. The wheels shall be heat treated properly and certified copies of the test of the heat treatment shall be furnished by the wheel manufacturer. The tread width shall have the proper clearance for the rail head and shall be of sufficient size to withstand satisfactorily maximum standing and rolling loads. In no case shall the diameter of the crane wheels be less than that given in IS:3177. The wheels shall be turned or ground to true and uniform diameter concentric with the bore. The wheel axles shall be made of forged carbon or alloy steel and shall be

accurately turned, ground and polished at journals. All axles shall be forced into the wheels at a force not less than 3200 kg per cm of axle dia. And driving wheel shall be keyed to the axles in addition to the forced fit all wheel journal boxes shall be drip proof and shall be provided with self-lubricating bronze bearings accurately machined and correctly bored for the axle fits or may be

provided with roller bearings with high pressure grease lubrications. The wheel assemblies shall be designed to facilitate removal of wheels, bearings and journals from the frames. They shall be arranged such that wear may be compensated in order to maintain the drive gears in proper mesh. The size of the journal shall be ample to carry the load at the specified speed without excessive heating during continuous operation. Track sweeps on each end shall be provided and shall extend below the top of the rail on both sides. Wheels shall be exchangeable.

2.7.3 Gantry Drive

The gantry crane motion shall be affected by means of motors and shall be designed to move the crane at a rated speed while supporting the rated load. Not less than 50% of the wheels on each track shall be connected for driving. Each motor shall be mounted at one end of the gantry crane shall be arranged to drive one track on each side of the crane through gears. (The general arrangement is shown in the drawing). The drive shall be free from vibrations while moving and in no case; there shall be any tendency for gantry crane structure to get misaligned.

2.7.4 Brakes

Following brakes shall be provided on the gantry crane

a) Hoist Brake

The hoist shall be provided with an automatic electromagnetic brake and a hydraulic thruster brake of suitable capacity. The electromagnetic brake shall be mounted on the same base as the hoist motor and shall be electrically operated, spring set, solenoid release, shoes type brake and shall be equally effective in both directions of motor rotation. The brakes shall have capacity equal to one and half times the rated full load torque of the motor. The brakes shall be rated on continuous basis and shall be capable of withstanding not less than 4 operations per minute. The brake shall be equipped with manual release, which must be held by hand and cannot be left in the released position. The brake shall reset automatically at all times when the power is disconnected.

The terminals of brake magnet shall be protected from accidental contact. The connections and windings shall be effectively protected from mechanical damage. When necessary, magnet shall be provided with an efficient cushioning device. In addition, a mechanical load brake is to be interposed between the winding drum and the source of power. It shall have a capacity equal to one and a half times the rated load and shall be designed to prevent the load from moving downward unless the hoist motors are revolving under power in the lowering direction. The brake shall preferably be of suitable multiple disc type and shall run in a bath of oil. The casings shall have sufficient heat dissipating capacity to maintain the temperature of both below 93 degrees centigrade when lowering

the rated load with the electric break in operation, and if required, an external cooling device shall be provided to prevent this maximum temperature from being exceeded.

b) Gantry motion and parking brakes

A shoe type mechanically or hydraulically operated brake controlled through a foot pedal in the operator's cabin shall be provided to control the crane travel in both directions of motion. The brake shall have a capacity equal to one and a half times rated full load torque of driving motors and shall be so designed that it may be secured in the set position. The foot brake shall require a force not more than 20 kgs at pedal and the pedal stroke shall not exceed 150 mm.

Electromagnetic brakes shall be provided for parking of crane, which shall apply automatically when the current supply to the mains is switched off. These parking brakes shall be in accordance with IS: 3177. (All brakes shall be of standard/reputed make as mentioned in other para)

2.7.5 Wire Rope

The wire rope shall be made of special improved plough steel of 6x36 or 6x 37 constructions, ordinary lay, fiber core and shall conform to IS: 2266. While calculating the dia. of wire rope, the efficiency of pulleys, sheaves and drums shall be considered. No rope thicker than 38 mm in dia. shall be used.

In case of multiple falls, the wire rope shall be provided with equalizing bar/turnbuckle to prevent the unequal stretch of rope. The rope shall be guided over as few pulleys as possible. Reserve 'S' shaped bands shall be avoided. The minimum factor of safety based on minimum breaking strength and safe working load of wire rope shall be as under:

(ii) Normal operating condition: 6

(iii) Breakdown torque: 3

The strength of socket ends of wire rope shall be approximately equal to that of the rope. The ends of wire rope shall be secured against twisting. The material for wire rope socket shall conform to IS: 2485. Molten zinc shall be used to socket the rope. Such specimen shall be subjected to destructive tensile test in which rope shall fail first than the socket or joints.

2.7.6 Rope Drum

The drum design, shape of grooves etc. shall conform to IS: 6938

2.7.7 Gear and pinions

Spur gears of 20 degrees pressure angle full depth involute system conforming to IS: 3681 shall be provided in end reduction gear unit. While designing the gears and pinions, in accordance with IS: 6938 and IS: 4460 the correction factor for peripheral speeds and the efficiency shall also be considered.

The teeth of gears and pinions shall be cut from solid metal and shall be free from chatter marks and other imperfections. The pitch line shall be scribed on all gears and pinions to facilitate erections, such that gears and pinions shall have a common tangent to P.C.D. In the design of gears, due consideration should be given for duty factor for appropriate class of mechanism. The materials for pinions shall be harder than that of gears by at least 50 B.H.N.

2.7.8 Reduction Gear Box

It shall consist of worm & worm wheel of bronze or steel and whole assembly housed in a dust proof steel casing with suitable lubrication facility. The gear box shall have self-locking characteristic. The shaft shall extend through housing for a sufficient length to permit the attachment of flexible coupling in proper alignment and shall be designed and rated in accordance with the accepted Indian Standard Code of practice. (Gear Boxes shall be of reputed makes as mentioned in another para)

2.7.9 Shafts for gears and pinions

The shafts shall be designed for combined torsion and bending and the angle of twist shall be taken into account, as detailed in the IS: 6938. The shaft for drum shall preferably be stationary.

2.8 Sheaves and Pulleys

The rope sheaves shall conform to IS; 6938. All pulleys shall be in true running balance and shall be provided with antifriction bearing with pressure greasing arrangement.

2.9 Bearings

All the running shafts shall be provided with ball, roller or self-lubricating bush bearings. The selection of the bearings shall be done on considerations of duty, load and speed of the shafts as recommended by the manufacturer. All bearings shall be leak proof, weather proof, drip proof and shall be protected against the entrance of rain, dust or any other foreign matter. (Bearings shall be of standard/reputed make as mentioned in another para)

2.10 Flexible Couplings

Flexible couplings shall be all metallic, fully enclosed, dust proof, self-oiling type and shall be bored for tight fits on the shafts. Straight square keys shall be provided for fitting the coupling on shafts. All couplings shall fit true on shafts and shall be fitted accurately on shafts. The flange couplings between motors and worm gear reducers shall be provided for both angular and offset misalignment of the coupled shafts. (Flexible couplings shall be of standard/reputed make as mentioned in another para.)

2.11 Lifting Hook and block

The block shall be arranged to lift the stoplog without twisting. The pulleys shall be mounted on roller bearing. The blocks shall be so designed and constructed as to guide the hoisting ropes fully and prevent them from leaving the sheaves under any operating condition. A guiding arrangement shall be provided for the pulleys to prevent the rope

from leaving the pulleys due to any jerk.

2.12 Sockets for wire ropes

The sockets may be cast, forged or machined. Molten zinc shall be used to socket the ropes. Such specimen shall be subjected to destructive tensile tests in which rope shall fail first than the socket or joints.

2.13 Gear Box Covers

Gear box covers shall be of rigid construction fitted with inspection covers and lifting handles. The covers shall be so shaped that the gears can be easily removed or replaced. Facilities for lubrication, oil draining, oil level indicating etc. shall be provided where necessary. The thickness of metal sheet for cover shall be not less than 3mm.

2.14 Counter Weight

Suitable counter weight shall be provided to make the crane stable under conditions laid down in para 3.7.3.5.

2.15 Key and Keyways

The size of the keys shall be such as to be within safe bearing and shear limits for the materials in contact and, in general shall conform to the relevant IS codes for square and flat keys. Where round end keys are used, the total cross-sectional area may be considered in effective shear. But in calculating bearing stresses in keys and keyways, the projected area of the rounded ends shall not be included in the effective bearing area. If two keys are used, that shall be placed 120degree apart. The design shall be such as to hold all keys effectively in place. Further, keys and keyways shall have rounded ends having tight fits in the seats. Keyways shall not be extended into the bearings.

2.16 Wrenches and Tools

A suitable grease gun and a complete set of wrenches and tools in a pressed tool box shall be furnished for the crane. Sufficient quantity and variety of tools shall be furnished to cover all ordinary maintenance work of the crane. Operating instructions in a suitable metal frame covered with glass shall be mounted at a convenient location in operator's cabin.

2.17 Electrical Equipment

2.17.1 General

All electrical equipment's furnished under these specifications will be subjected to severe moisture conditions and shall be designed to prevent deterioration from corrosion and shall be insulated accordingly. All wiring of the electrical equipment shall be in accordance with the Indian Electricity Act in force and the relevant IS Code. The wiring shall be in hot dipped galvanized metal conduits. Conductors having nominal equivalent copper area of cross section of a 9.5 sq. mm shall be used for power wiring of motor and those having 1.5 sq. mm for control circuits and auxiliary wiring. Conductors shall

normally be insulated for not less than 1100 volts and shall have standard moisture resisting, double braided insulation cover.

2.17.2 Electric Motor

Motor shall be of totally enclosed with or without fan cooling slip ring type design for operation on 3 phase, 415 volts, 50 cycles per sec. A.C. conforming to IS: 325 of rated capacity. The motor shall be suitable for supply voltage variation of $\pm 10\%$ and supply frequency variation of $\pm 3\%$. Each motor shall be equipped with heater to prevent condensation of moisture drawn into the motor during shut down period.

The contractor shall enclose the full technical particulars of each motor, indicating (a) the values of the locked rotor, starting, rated and pull-out currents, (b) starting, rated, breakdown torques, (c) make, class of duty, number of poles, start/hr, CDF, type of insulation etc.

Selection of motor shall be as per IS: 3177. Motors of 40 h.p. or less shall be rated in accordance with IS:325. Service factor of 1.15 shall be accounted in deciding the capacity of motor. The motor shall be suitable for outdoor, crane duty, S-4 class, 150 starts/hour with 40% CDF and shall be of standard capacity and specification in accordance with BIS or equivalent international standard marked and of reputed make like. Siemens, Kirloskar, NGEF, GEC etc. (as mentioned in another para)

2.17.3 Master Control Equipment

Master control equipment shall be so placed in the operator's cabin that the operator may control all the functions of the crane from there. The operator's stand shall be placed in such a convenient position that enough room is available for various operations of gantry crane and operator may have unrestricted view of the load. All motor controls shall be fully magnetic, reversing with definite time limit and equipped with frequency-controlled acceleration devices, instantaneous over current, over loads and low voltage protections. When starting from complete standstill with full rated load of the hook, they shall be designed so that it will be possible to limit the vertical movement within 10mm from main hook. All hoist motor controllers shall have at least six speed control points in each direction of operation.

The contact of protection relays of any motor shall be so wired that the operation of the relay will trip the motor primary conductor, thus making it necessary to return all control to the OFF position before the motor can be started. The control shall be so interlocked that only one operation can be performed at a time.

The instantaneous relays shall be adjustable between 200% to 300% of motor full load current. The power supply from the main connections shall be protected by three pole $415 \pm 10\%$ Volts. A.C. totally enclosed air circuit breaker equipped with three-time relays, direct acting overload tripping element and one shunt trip coil located in the operator's cabin for emergency tripping. A circuit breaker shall be provided to control and protect the control circuit for each motor and all control circuits shall be fused properly. An indicating lamp shall be provided to show that the control circuit is healthy. All switches,

contactors and relays shall be enclosed in suitable cabinets and placed in accessible location to facilitate inspection and maintenance. All motor controls shall have master switches with vertical handles. Changes in speed while lowering the load shall be under the direct control of the operator and shall permit him to stop the motor without time delay from any position by the master switches. All resistors shall be non-breakable corrosion resisting type and shall have a low temperature coefficient. Where practicable, controller handle should move in the direction of the resultant movement. Each controller shall be marked in a permanent manner to show the motion concluded and wherever practicable of the direction of the movement. The notching for the controller handle in 'off' position shall be more positive than the notching in other position. The control lever shall be provided with stop and/ or latches, to ensure safety and facility of operation.

The resistor shall be placed in accessible places outside the cabin and in a well-ventilated non-combustible cabinet which will not emit flame. Each main supply circuit breaker shall have interrupted capacity of not less than 50 KA. All switches, conductors, primary relays and preliminary circuits on controllers shall have a thermal capacity of 50 KA, for one second without injury. The resistor shall preferably be intermittently rated and their rating will be as per IS: 3177. Allowable temperature rise during operation of the crane under service condition shall not exceed the limits specified in relevant IS code. The contractor shall state in his tender the make and types of all electrical equipment, which he proposes to furnish. All switches controller levers and other operating mechanism and electrical devices shall be subject to the approval of the Engineer-in-Charge.

2.17.4 Cables and Cable Reel

The rubber insulated cable or polyvinyl chloride insulated cables used for crane wiring should comply with the relevant Indian standard code. The gantry crane shall be equipped with an automatic spring actuated device to take up cable reel. Power will be obtained from plug receptacles placed at convenient intervals of the runway.

The cables and reels shall be provided with sufficient length of flexible cable and with limit switches arranged to cut off the power supply to the cable of the motors, when all but two turns of the cable are unreeled. The attachment plugs for the receptacle and of the cable shall be furnished by the contractor.

2.17.5 Wiring

All wiring shall be hot dipped galvanized metal conduit. All conductors for primary power lighting and control circuit shall be insulated for not less than 1100 volts and shall have standard moist resisting double braided covering. All conductors between the secondaries of the motor conductor and resistors shall have sufficient current carrying capacity in accordance with Indian Standard and shall be insulated with 1100 volts class insulation. The primary conductor to the motor shall have standard continuous current carrying capacity of not less than 100% of the rated full load primary current of the motor. Cables having conductors smaller than 2.5 sq.mm nominal equivalent copper

areas of the cross section shall not be used for the power wiring for any of the motor. For control circuits and auxiliary wiring, cables having a sectional area smaller than 1.5 sqmm nominal equivalent copper area shall not be used. All cables shall be adequately protected against mechanical damage and metal trunking may be used if desired. Electrical conduit shall comply with the relevant Indian Standard. For outdoor cranes except where flexible unarmored cables are essential, cables shall be either armored or enclosed throughout their length in galvanized trunking or conduit, either flexible or rigid. A flexible metallic tube or duct may not form an effective earth connection and shall not be used for that purpose. Tapped and braided varnished cambric insulated cables shall not be used for outdoor crane.

2.17.6 Limit Switches

The limit switches shall be of the totally enclosed type. All limit switches shall be capable of being reset by reversing the controllers. The limit switches shall have water proof coverings and shall be suitably designed and tested for normal lift and satisfactory operation under the humid climatic conditions. They shall be of approved and standard type and shall be suitable for service under extreme position in either direction. The design shall be such as to facilitate easy servicing and replacement when worn-out. Limit switches shall be provided for following operations.

- 1) To limit the travel of gantry crane at both ends of the travel and to stop the gantry crane at Centre of each span
- 2) To limit the hoisting travel of the hook
- 3) To limit the travel of the trolley at the both ends of the travel and to stop the trolley at limiting point

2.17.7 Isolating Switches

The manufacturer shall fit a main isolating switch in the cabin or adjacent to it., capable of disconnecting the supply of power driven and associated equipment on the crane but not the auxiliary loads such as lighting and heating circuit. In the case of main isolating switches being combined with the crane protective panel, it shall be mechanically interlocked with the door giving access to the panel, and the terminal shall be screwed to prevent accidental contact when the door is opened. When so combined a suitably worded red warning plate shall be attached to the cover of the protective gear and all other panels and controllers, not fitted with interlocked isolators. The main isolating switch and the additional isolating switches should be so situated that it will be possible to carry out any maintenance work or functional testing on them without danger.

2.17.8 Protective Equipment

Iron clad electric protective gear in accordance with IS:3177 shall be provided except that if the aggregate power of the two largest motors is less than 30kW, and their aggregate current rating is less than 60 amps, a manually operated equipment as per IS:3177 may be used.

2.17.9 Emergency push button

A push button emergency stop shall be so located as to be readily accessible for prompt use by the operator in case of emergency. This emergency push button shall be connected in the operating coil circuit in case of contactor and in the under-voltage release circuit in the case of a circuit breaker.

2.18 Lighting at convenient outlets

The permanent 220 volts lighting system on the crane shall consist of four 500 W high bay lighting units to illuminate the area under the crane, one 500 W high bay lighting unit to illuminate the area under the cantilever and 2x80 W fluorescent tubes in the operator's cabin. The system shall be supplied from $415V \pm 10\%$ crane power system through a circuit breaker with a convenient outlet in the operator's cabin. One branch circuit system shall be connected for lighting hoist mechanism through flexible conduit with 4 x 100 W lighting units. Each of the two 500W high bay lights and another branch circuit shall be connected to give convenient outlets. The wiring shall be done in accordance with the Indian Electricity Rules 1937. The circuit breakers shall be enclosed, two pole type with an over load tripping element for each pole.

2.19 Interlocking and Earthing

- ‘ Off position interlocking, earthing and other electrical equipment shall be provided as per IS: 3177.

2.23 List of approved reputed manufacturers of mechanical and electrical equipment used in hydro-mechanical installations are given below.

Sl. No	Item	Make
1.	Reduction Unit	David Brown, Elecon, New Allenberry, Allen-Max., Allmax., Allroyd, Shanti Gears
2.	Bearings	SKF, FAG, NSK, NTN, KOYO & NBC
3.	Flexible Couplings	New Allenberry, Allflex
4.	Motors	Siemens, Kirloskar, NGEF, GEC, Crompton Greaves Cotton.
5.	Brakes	Electromag, Strom Kraft, Elmar, AEC, Sterling controls.

2.24 Automatic Engaging and Disengaging Type of Lifting Beam for the operation of Stoplogs for Spillways.

2.24.1 General:

1. Lifting beam of automatic engaging and disengaging type equipped with two hooks shall be provided for handling of stoplogs for Spillways.
2. The arrangement of lifting beam, location of lifting lugs and side guide rollers and stoppers shall be as shown in the specification drawings.

2.24.2 Details

1. Two numbers of guide rollers shall be provided on each side of the lifting beam. Guide rollers/shoes on the same side shall be adequately separated from each other to prevent any tilt of the lifting beam during operation. The Centre-to-Centre distance of side guide rollers shall not be less than one tenth of the length of the lifting beam or 500 mm whichever is larger.

2. Hooks:

- a. Lifting beam hook mechanism shall provide for automatic engagement and release of the equipment to be handled. The two hooks shall be mechanically linked together for simultaneous operation.
 - b. Hook profile shall be such that with consideration of the guide plate location and of the clearances provided on the gate equipment to be handled, the hook shall work properly even in the worst condition of alignment due to shoes and due to manufacturer's deviation from design dimensions.
 - c. The hooks and lifting lugs provided with lifting beam shall be located at Centre of gravity of the gate equipment to be operated when the lifting beam guides rollers/shoes are engaged in the guide
 - d. The engaging surface (profile) of the hook shall be hard faced to a minimum depth of 10 mm. and shall be machined smoothly for uniform bearing of pin.
 - e. In case of curved shaped hooks, the design shall be done as curved beam with appropriate structural design method.
3. The lifting beam shall be counter weighted as required to hang plumb and level when suspended.
 4. All rotating parts of the lifting beam shall be provided with corrosion resistant steel pins and aluminum bronze bushing/roller bearings. All nuts, bolts and washers and retaining devices for pins shall be of corrosion resistant steel.
 5. The lifting beam shall be provided with suitable stoppers, which shall rest on the gate equipment to be handled / engaged in spear rods provided on gates when it is lowered and pull of the hoist is completely released.
 6. Seating brackets shall be provided to sit the lifting beam on the floor without damaging the hook. The bracket shall be retractable when required to avoid interference with gate equipment when lifting beam is in operation.

2.25 Design Criteria:

2.25.1 Mandatory features:

General features indicated in the specification drawing shall be adopted without change or substitution. Alternative arrangement and alternative features indicated on specification drawings shall be accepted only if in the opinion of the engineer-in-charge, the result is not inferior to the arrangement and details indicated in the specification drawings. Mandatory features shall be as under: -

- a. All features referred to in these specifications and as shown in the specification drawings.
- b. Feature related to civil construction and equipment to be furnished by other agencies such as civil work outline dimensions and gantry
- c. All elevations.
- d. General layout and arrangement of the equipment to be handled and the dimensions defining

the location of equipment relative to civil work.

- e. Dimensions, clearances, measurements etc. designated by “maximum”, “minimum” to be applied as upper or lower limit for design. All tolerances mentioned in the drawing/ related Indian Standards and as recommended by the Engineer-in-Charge.
- f. All machining involved and designation of surface finish qualities.
- g. All indications referring to manufacturing processes (such as machine after welding” or “drill during shop assembly”) as contained in specifications, specification drawings and related B.I.S. Standards.
- h. All applicable Indian Standards shall be specified by the Engineer-in-Charge.

(Request regarding adoption of a particular Standard only, from contractor shall not be binding on the Engineer-in-Charge.)

- i) If lifting beam frame arrangement is adopted, the depth of frame shall not be less than 1/12 times the span (length) or lifting beam or 1m whichever is more.
- ii) *While computing the deflection of lifting beam, it shall be ensured that due to the deflection of beam, side guide shoes or rollers neither develop excessive gap with guide tracks / plates, nor get jammed with them. The check has to ensure rigidity of the beam for proper functioning.*

2.25.2 Design Loading

a General:

- i) The lifting beam shall be designed to comply with the specified structural and mechanical requirements, when subjected to each one of the loading conditions listed in the Para b
- ii) Calculations may be limited to critical loading cases if it is evident that only those cases are critical. If the selection of the critical cases is not evident or if so requested by the Engineer-in-Charge, the manufacturer shall furnish the technical demonstration to justify its selection
- iii) All load combinations shall be made as specified in these specifications and related Indian standards. Whenever any particular load specification is not specified, the method of calculations shall be submitted to Engineer-in-Charge for his approval.

The overall design loading shall be such that with unfavorable load combinations, greatest factor of safety is achieved in design.

b. Design load:

The lifting beam and its connections with gantry cranes and stoplog gate shall be designed for following conditions: -

- i) Hook loading with impact factor of 1.3 over hoist capacity under the normal load conditions.
- ii) The impact factor need not be considered under breakdown torque condition of gantry hoist motor.
- iii) Loading caused by the guiding system shall be calculated and accounted for in (i) & (ii) above as under: -

- a) When stoplog unit is not submerged in water, the effort required to counteract gate swing shall be considered – higher of either 5% of the weight of gate

or surface loading of 50 kg/sqm of gate surface area. The projected area of gate outline in either direction shall be considered as Gate area.

- b) Water turbulence shall be considered as force acting on projected area of the lifting beam of intensity equal to 200 kg/sqm
- c) Additional friction and/or blocking forces originating in the guiding devices and seal of the gate when the hoist exerts a force equal to the rated hoist capacity instead of the normal hoisting force.
- d) Dead weight of the lifting beam along with its hooks, rollers, links, counter weights etc. shall be combined with all loading conditions.

2.25.3 The Structural Design

The structural design of the lifting beam or frame shall conform to IS: 13591 and IS: 800 (latest). Various provisions as mentioned in IS: 13591 and IS: 800 (latest) for structural components shall be met with allowable stresses as specified in these specifications. Wherever specific value of stress or design factor are not specified decision of Engineer-in-Charge or his representative or his authorized consultant shall be final.

Allowable Stresses:

- a. The allowable stresses shall be adopted as mentioned hereunder: -

Sl.No.	Type of Stress	Normal Loading	B.D.T. Loading
1.	Direct bending and bending in compression/tension (a) Mechanical components like pin, hooks etc (b) Structural members	0.2 U.T.S. of material 0.55 YP of materials	0.8 YP 0.8 YP
2.	Shear stress	0.3 YP of material	0.4 YP
3.	Bearing stress	0.75 YP of material	0.85 YP
4.	Bearing stress for bronze	0.035 U.T.S.	0.08 YP

- b. For overload conditions, allowable stresses given for normal loading may be increased by 33% except that bearing stress shall not exceed 80% of yield point stress.
- c. Equivalent stress resulting from combination of biaxial or triaxial stresses may be 25% higher than allowable monoaxial stresses subject to maximum of 0.8 YP.
- d. In allowable stresses appropriate duty factor of the crane should be accounted for.
- e. Antifriction bearings shall be as suited for the appropriate load condition. Static capacity of bearing shall provide a minimum safety margin of 25% over B.D.T. loading on lifting beam.

2.25.4 Material Specifications:

For general condition of testing the material please refer Chapter-III.

Recommended materials for Lifting beam and its components are given below: -

Sl.No.	Component	Recommended material	Reference
1.	Structural components of lifting beam, guide roller, diaphragms etc.	Structural steel	IS: 2062
2.	Axles	Corrosion resistant steel	IS:1570 (Part 5)
3.	Hooks	a. Forged steel b. Structural steel	IS:1875 IS: 2062
4.	Bush for hooks	Aluminum bronze	IS:305
5.	Bearing for Pulleys	Roller bearings	Standard make
6.	Sheaves & Rollers	Cast steel	IS: 1030

CHAPTER – 3

3.0 MATERIALS

- 3.1** All the materials shall be of tested quality, new, unused, free from defects and of the grades/classification envisaged in the designs. The contractor shall furnish the test certificate for each lot of materials, if so required by the purchaser. Plates with laminations discovered during welding or during inspection shall be rejected. Materials not supplied according to the approved Design/Drawing shall be rejected, removed and replaced. Approval of purchaser shall not relieve the manufacturer from responsibility materials.
- 3.2** The contractor shall furnish a list of names of manufacturer(s) of the bought our items, which are contemplated for incorporation in the work, together with performance characteristics and other pertinent information pertaining to the equipment, for the approval of the purchaser, Samples of materials, if desired and so directed, shall be submitted for approval. Any equipment, materials and articles used or installed without the prior approval of the purchaser shall of the risk and cost of the contractor.
- 3.3** If for any reason, the contractor desires to deviate from these standards, be shall submit a statement starting the exact nature of the deviations or substitution along with complete and detailed specification and test reports for the materials, which are proposed to be used. In all such cases, the prior approval of the purchaser has to be obtained before the fabrication work is taken in hands. All the materials, supplies and articles not manufactured by the contractor shall be the standard products of recognized and reputed manufacturers.
- 3.4** Defective materials shall not be required and used in the construction of the equipment without prior approval. No penning, caulking or filling shall be permitted in repairing cracks, pinholes, or blowholes. Defects in weld shall be repaired by chipping out to sound metal and shall be rewelded. For defects in casting, the method of repair shall be mutually agreed upon by both the contractor and the Engineer-in-Charge. However, this shall not be construed to prevent repair of material purchased in accordance with ASTM or similar standards to the extent and in the manner permitted therein.

CHAPTER - 4

4.0.0 MANUFACTURE

4.1.0 General Workmanship

All fabrication work under this Contract shall be done in accordance with the specifications, which meet the purchaser's approval. All the works shall be performed and completed in a through workman like manner as per best practice in the manufacture and fabrication of materials of the types covered by these specifications. In all cases the work shall be of highest quality and carefully performed to the satisfaction of the Engineer-in-Charge. The Contractor shall warrant all materials and workmanship furnished by him to be free from injurious defects. He shall replace, free of cost, any defective material or workmanship noticed during creation. And shall bear all cost of the modification of any defect, in the field, for which he is responsible. Workmanship shall conform to the latest standards, laid down in Indian Standards Specifications.

All members shall be free of twists, bends or other deformations and all surfaces that will be in contact shall be thoroughly cleaned before assembling, parts shall be adjusted to line and fit and shall be firmly bolted or otherwise hold securely together so that surfaces are in close contact before drilling, reaming or welding commenced.

Plates with lamination discovered during cutting, welding or at any other time shall be rejected. Minor surface imperfections can be required wherever possible with the prior approval of the purchaser. Materials not supplied or workmanship not performed in accordance with approved drawing and specification shall be rejected and replaced. If transport clearances do not permit the weight and size due to limitations, the anchorages and miscellaneous embedded parts shall be fabricated into sub-assemblies into which be propose to fabricate the gates, stoplogs, anchorages, other assemblies and embedded parts for transporting them to site.

All the parts of the gates and stoplogs, shall be fabricated in accordance with these specifications, and drawings. The manufacturer shall take special care in fabrication of the parts affecting strength, rigidity and water tightness of the gate and stoplogs. Attention is directed to the fact that rolled edged plates are not suitable for caulking. The seal bores shall be finished after the plates have been welded to the skin plates and the finished surfaces of the seal bases shall be in the same plane within tolerance as specified in relevant IS code.

The Contractor may submit for the approval of the purchaser an alternative procedure for finishing the seal bases or for fastening them to the gates provided that the suggested method produces a water tight seal arrangement and that the final shape and size of the plate meet the dimensional and the tolerance requirements, shown on the drawing or stated in these specifications.

Holes for the wheel pins shall be bored and counter-bored in pairs to a common axis, after the leaf has been assembled and all the shop welding has been completed. The axis of these holes shall be in common plane, which shall be parallel to the finished surface of the seal bases within specified tolerances. All holes shall be accurately spaced, cylindrical and perpendicular to the members. All counter sinking shall be true and square with holes. The seal rings provided in the wheel assembly shall be products of established manufactures and must be perfectly watertight.

4.2.0 Tolerances

Where tolerance of fits are not specified on the drawing, the Contractor shall follow the best modern shop practice for apparatus of the type covered by those specifications and drawings, due considerations being given to the special nature of function of the parts and to the corresponding accuracy required to secure proper operation.

4.2.1 Fabrication Tolerances

All components shall be fabricated in accordance with relevant IS Code on gates and hoist except as below: -

All dimensions under 400 mm. shall be within a tolerance of ± 0.8 mm. unless otherwise specified and are not-cumulative. All other dimension shall be within a tolerance of ± 1.5 mm.

The machines surface of the sill seat shall be straight with ± 0.5 mm. and level with ± 1.0 mm. over the whole length with a straight

4.2.2 Installation Tolerances

Installation tolerances shall be exceed 1.5 times the corresponding fabrication tolerances or the tolerances specified in the relevant codes on gates and hoists, whichever is more stringent. The design and fabrication of the gates, hoists and embedded parts shall be such that the required tolerances are achieved during installation.

4.3.0 Machine Finish

The type of finish, unless otherwise specified shall be the most suitable for the part to which it applies and shall be smooth, average or rough as defined under IS: 3073- 1974. In general, a very smooth finish (three delta > 0.2 to 1.6 microns) will be required for all surfaces in sliding / rolling contact, an average or commercial finish (two delta > 1.6 to 6.3 microns) for surfaces in contact where a tight joint is required and a rough finish (single delta > 6.3 microns) for all other machined surfaces where selective assembly for matching parts is required. The parts shall be ground to obtain the limiting tolerances, if necessary.

4.4.0 Castings

While making patterns for the castings, care shall be taken to avoid sharp corners or abrupt changes in cross section and sample fillets shall be used. All casting shall be true to patterns and the thickness of the metal shall not vary at any point by more than 5 mm from that shown in the drawings. Care shall be taken in the foundry to cool the castings properly so that they will not warp or twist. No casting will be accepted if it is warped or twisted to such an extent that machined surfaces cannot be properly finished to the dimensions shown on the drawing.

All casting shall be sound, clean, free from cracks, holes or sand holes and other defects. These shall have a workman like finish. Castings shall not be required, plugged or welded without the permission for the purchaser. Such permission shall be given only when the defects are small and do not affect the strength, use or mach inability of the castings. No welding shall be done after the castings are finally annealed. No defect shall be removed / painted nor oil be applied to the surface of any casting until it has been inspected by the Engineer-in-Charge.

The treatment for casting involves heating slowly up to a temperature of about 40°C above is upper critical temperature, holding its at such temperature long enough to attain uniform temperature throughout the casting and then allowing it to cool slowly in furnace. During the process of annealing the temperature shall not exceed and over heating shall be avoided. End products shall conform to the requirement of relevant Indian Standard. All casting shall be ultrasonically tested to ascertain soundness of castings. Acceptance criteria as specified by purchaser shall be binding.

4.5.0 Forgings

Forging unless otherwise specified, shall be in accordance with IS 2004. The ingots from with the forgings are made shall be casted in metal moulds. The workmanship shall be first class in every respect and the forging shall be free from all defects affecting strength and durability, including seams, pipes, flows, cracks, scales, fins, porosity, hard spots, excessive non-metallic inclusions and segregations.

4.5.1 All forging shall be given such uniform heat treatment as required to produce materials conforming to the requirements of the specification, and shall be annealed or normalized and tempered as final heat treatment. In case of shafts forged solid, required to be bored, and final heat treatments shall be performed after the forging has been rough bored.

4.5.2 In each heat treatment, the forging shall be held at a desired temperature for a sufficient length of time to ensure penetration of the heat and proper grain refinement throughout the whole forging. A record of heat treatments to which the forging has been subjected shall be supplied to Engineer-in-Charge.

4.5.3 The billet corresponding to largest section shall be used wherever a change in section occurs. Tool marks or tearing of metal by the finishing tool shall not be acceptable on the surface of fillets. Such marks, if occurred, shall be removed by grinding or polishing. All finished surfaces or forging shall be smooth and free from tool marks.

4.5.4 All-important forging like gate wheels, wheel pins, hoist drum, gears, crane, wheels etc. shall be ultrasonically tested. The acceptance limit of ultrasonic testing of forging shall be as per SA 388 of ASME section-5.

4.6.0 Fabrication of Structural Steel

The contractor is expected to perform fabrication in the best possible manner to meet the requirements of design and drawings.

4.6.1 Straightening of Members

Before being laid off or worked in any manner, structural steel be straight, without twists, bends or kinks, and if straightening is necessary, it shall be done by a method which shall not injure the metal to ensure good welding and fittings of members. All steel shall be cleaned of dirt, mill scale and rust prior to fabrication.

4.6.2 Shearing, chipping and gas cutting

Shearing, chipping and gas cutting shall be performed carefully and all portions of the work, which will be exposed to view, shall present a neat appearance. Sheared or cut edges of plates shall be finished to shapes as noted in this specification.

4.6.3 Edges to be welded

The edges of plates and shapes to be joined by welding shall be properly formed to suit the type of welding selected. The edges, of sheared plates to be joined by welding, shall be machined or chipped to sound metal. Plates and shapes to be field welded shall have their edges prepared in the shop for the type of weld selected.

4.6.4 Bent Plates and Shapes

Where bending or forming of plates or shapes is required, the plates or shapes shall be bent by cold forming. Heating and hammering to correct bends will not be permitted.

4.6.5 Welding

a. Welding Technique

Care shall be taken in designs that the welds, when being made, are well accessible. Overhead welding is to be avoided, if possible flat position should be strived for. Drawings should clearly indicate the joint position, shop or field welding kind of welding method of welding, welding sizes and other required information. Symbols to be shown on the drawing should conform to relevant Indian Standards.

All welding shall be done by the electric arc method by a process which will exclude the atmosphere from the molten metal, except where otherwise specifically permitted. All welding electrodes shall be finished by the contractor. Correct selection of electrodes shall be done taking due care of welding method and base metals of components. The welding electrodes shall be of the heavily coated type designed for all position welding. The make, type and size of all welding electrodes shall be subjected to the approval of the purchaser.

In assembling and during welding, the component parts of built-up members shall be held in place by sufficient clamps or other adequate means to keep all parts in proper position. The surface to be welded shall be cleared of scale, slag, rust, paint and other foreign matter. The thin coat of linseed oil need not be removed before welding. Where weld metal is deposited in two or more layers, each layer shall be brushed with a wire brush or otherwise cleaned before the subsequent layer is deposited. In welding, precautions shall be taken to minimize stresses due to heat by using the proper sequence in welding.

Upon completion, the welds shall be brushed with wire brush and shall show uniform section smoothness of weld metal. Edges and ends of fillets and butt joint welds shall indicate good fusion and penetration into base metals. Specific requirements for butt joints and fillet joints are given below.

Radiographic tests shall be carried out for all critical full strength butt weld. Welded joint requiring radiographic testing shall be decided by the purchaser.

i. Butt joints

In principle, butt joints should be made with back run. Should it not be possible to do the back-run, a backing strip should be placed and welding should be so made that the method metal fully penetrates to the backing strip of the slide butt welding should be executed so that the method metal reaches the back of the groove and a full penetration is achieved. Die-penetration test shall be carried out after each pass of the weld.

ii. Fillet Joints

All fillet welds shall be continuous. For the main members, no fillet welding should be made on members whose thickness differ substantially. Filled weld at 'T' joined should be made as a rule, on each side of the joint, unless it is otherwise agreed due to some practical reasons. Radiographic tests is not normally required for fillet welds. However, they shall be tested ultrasonically for soundness.

a. Qualification of Welding Process

A specification of the welding process, that is proposed to be used, shall be established and recorded and, if required, a copy of such specification together with a certified copy of report of results of tests made in accordance with the process and specifications shall be finished. The qualification of the welding process shall be at least equal to that required by 'Standard Qualification Procedure' of the Indian Standards and the minimum requirement of the tests shall be at least as stated in the said 'Standard Qualification Procedure'.

b. Qualification of welders

The contractor shall be responsible for the quality of the work performed by his welding staff. All welders assigned to the work shall have passed qualification tests for welders. If at any time the work of any welder appears questionable, the welder shall be required to pass additional qualification tests to determine his ability to perform the type of work on which he is engaged.

4.6.6 Riveting

Rivets shall be driven by power riveters, employing pneumatic, hydraulic or electric power. After driving their finished heads shall be of approximately hemispherical shape of uniform size throughout the work for the same size rivet, nearly finished and heated uniformly to a temperature not exceeding 1065° C. They shall not be driven after their temperature has fallen below 528° C. All shop driven rivets within a distance of 425 mm. from a shop welded joint shall be driven after the welding is completed. Recapping and caulking of loose or defective rivets will not be permitted. While removing defective units, care shall be taken not to injure the adjacent metal and, if necessary, this shall be drilled out.

4.6.7 Turned and Fitted Bolts

In cases where bolts have to be used but strength of a riveted connection is required, this can be obtained by using special bolts in special holes to a driving fit. The bolts are specially made from black round bars and turned down to the exact diameter. The inside of the head and flat face of the nut should be machined. The hole must be accurately drilled or reamed with a clearance of not more than 0.25 mm. The holes after assembly of the parts must be true throughout the thickness of all parts and perpendicular to axis of the member. Washers for turned and fitted bolts should be machined on both faces.

4.6.8 Set Screws

All set screws shall be provided with case hardened cup points and shall be safety type. They shall not be used for transmitting torsion.

4.6.9 Drilling and Reaming

Holes shall be accurately located and drilled or reamed perpendicular to the face of the member and, if necessary, shall be drilled to a template. Counter sinking, where required, shall be done carefully and to the full depth of head. Open holes in materials of 18 mm or less in thickness, shall be sub-drilled or sub-punched before assembly and reamed during assembly. Holes in structural steel of more than 18 mm in thickness shall be drilled 3 mm smaller than the normal diameter of the rivet or bolt, before assembly and reamed to the full-size during assembly. All members shall be shop assembled before reaming or drilling holes for field connections.

4.6.10 Punching

For sub-punching, the diameter for the punch shall be 4.5 mm smaller than the nominal diameter of the rivet or bolt and holes shall be clean cut without torn or ragged edges.

4.7.0 Stress Relieving

Stress relieving of welded parts shall be done where permitted after all the welding is complete. Machined surfaces of the parts requiring stress relief shall be machined to final dimensions after the parts have been stress relieved. Localized stress relieving will not be permitted for shop welded parts. The procedure for stress relief shall conform to IS :10801, IS: 10234 and IS:2825 (latest).

4.8.0 Painting

4.8.1 General

All paints, painting materials and accessories for painting shall be supplied by the contractor and shall be included in the price bid. The paints proposed by the contractor must be approved by the representative of the purchaser before application of the same. The analysis in respect of paint properties, paint composition and performance requirements of the paints shall be submitted by the contractor for examination and approval.

4.8.2 Preparation of Surface

1. Gate, Stoplogs, Hoists, Cranes, Lifting beam and Embedded parts
 - a. Surface preparation shall be done in accordance with IS: 14177 and as per the following classification: -
 - i) Gates, Exposed Embedded parts – Class A (Clause 4.2.1.1)
 - ii) Stoplogs, Lifting beam, Rope drum hoist, Gantry crane, - Class B (clause 4.2.1.2)
 - b. Weld spatters or any other surface irregularity shall be removed by any suitable means before cleaning.
 - c. All oil, grease and dirt shall be removed from the surface, which is to be painted, by the use of clean mineral spirits, xylol, or white gasoline etc. and clean wiping materials prior to sand blasting is done. All surfaces to be painted shall, thereafter, be cleaned by sand grit blasting to bare metal without any residual adherents in any form. Small quantities or oil may be removed by the blasting process in which case, however, the abrasive should not be re-used, if it contains sufficient oil or grease to render it unsuitable for blast cleaning

purposes.

The average surfaces roughness after sand blasting should not exceed 40 microns. Sand blasting should be conducted with sand / grit/ shot of type approved as per IS : 14177 (Part –I). After blast cleaning, surface should be cleaned of loose dust and debris etc. with the help of air blast or blower.

- d. Surface of stainless steel, nickel, bronze and machined surface adjacent to metal work being cleaned or painted shall be protected by masking tape or by other suitable means during the cleaning and painting operations.
- e. Primers shall be applied as soon as the preparation of surface is complete and prior to the development of rust. The time gap between the application of primer and surface preparation shall normally not exceed six hours. In case there is considerable time gap, the surface should be re-brushed prior to priming.

II. Hoist and Supporting Structures

In respect of hoist, support structures and latch, the surface preparation shall be done as per the requirements of class B as specified in para 4.2.12 of IS :14177. In case the surface preparation is done manually by wire brush, mechanical tool etc. instead of sand blasting all ferrous surfaces exposed to atmosphere or water shall give a coat or rust inhibitive phosphate wash by brush immediately following cleaning operation and surface shall be thoroughly wetted with rust inhibitive wash @ approximately 30 ml / sqm and allowed to dry for 24 hours rinsing after application generally not required but unreacted residue, if any, shall be removed wiping the inhibitive surface with damp cloth within one hour of rust inhibitive wash had dried thoroughly and after removing unreacted residue, the application of primer and finishing coats shall be carried out as indicated in the following paras.

4.8.3 Painting Schedule

4.8.3.1 Measures During Painting

- a. Any bare spot shall be recoated with additional application of primer.
- b. All run, sags, floods, or drips shall be removed by scrapping and cleaning. The cleaned area should be re-touched or all such effects shall be remedied by re-blasting or re- priming.
- c. Special attention should be given to good coverage on rivets, welds and sharp edges and covers.
- d. Suitable measure shall be taken to protect the applied primer from contact with rain, fog, mist dust or other foreign matter until completely hardened and next coat is applied.
 - c. The air temperature at the time of application must not be below 10 deg. C and relative humidity must not be above 90%.

4.8.3.2 Application Procedure

All paints and coating materials shall be in homogeneously mixed condition at the time of application and shall not be thinned except as hereinafter specifically provided. Warming of the paint shall be performed by means of hot water bath. All surfaces to which paint shall be applied immediately after cleaning and except otherwise specifically provided, shall be applied by either brushing or by airless spray. When paint is applied by spraying, a mechanical agitator type of paint pot shall be used. Means shall be provided for removing all free oil and moisture from the air supply line of all spraying equipment. Each coat of paint shall completely cover the surfaces and shall be free from runs, sags, pinholes etc. Each coat of paint shall be allowed to dry for harden thoroughly before the succeeding coat is applied.

All paints shall be applied by skilled workers in a workmanlike manner. Paint shall not be applied during damp weather and on the surfaces, which are not entirely free from moisture. Rust preventive compound shall be applied by any convenient method to ensure complete coverage of heavy coating. After the final application, the paint film shall be allowed to cure at least for 7 days.

4.8.3.3.0 Gate & Embedded parts

4.8.3.3.1 Primer coat

After surface preparation the following coats of primer paints shall be applied:

a) Exposed Embedded parts

Over the prepared surfaces one coat of Inorganic Zinc Silicate primer preferably with the help of airless spraying equipment giving a dry film thickness of 70 ± 5 microns should be applied. Alternatively, two coats of Zinc rich primer, which should contain not less than 85% Zinc on dry film, should be applied to give a total dry film thickness of 75 ± 5 microns.

b) Gate & Stoplogs

Over the prepared surfaces one coat of Inorganic Zinc Silicate primer preferably with the help of airless spraying equipment giving a dry film thickness of 70 ± 5 microns should be applied. Alternatively, two coats of Zinc rich primer, which should contain not less than 85% Zinc on dry film, should be applied to give a total dry film thickness of 75 ± 5 microns.

4.8.3.3.2 Finishing coats

a) Exposed embedded parts

Finishing coat shall consist two coats of solvent less Coal tar epoxy paint. These shall be applied at an interval of about 24 hours. Each coat shall give a dry film thickness of 150 ± 5 microns. The total dry film thickness of all the coats including primer coating shall not be less than 350 microns.

Gate & Stoplogs

Finishing coat shall consist two coats of solvent less Coal tar epoxy paint. These shall be applied at an interval of about 24 hours. Each coat shall give a dry film thickness of 150

± 5 microns. The total dry film thickness of all the coats including primer coating shall not be less than 350 microns.

4.8.4.0 Hoists & Supporting Structure

4.8.4.1 Primer Coat

After surface preparation the following coats of primer paints shall be applied:

a) Structural Components

Two coats of Zinc Phosphate primer shall be applied to give a dry film thickness of 40 ± 5 microns per coat.

b) Machinery

Except machined surfaces, all surfaces of machinery including gearings, housing, shafting, bearings and pedestal etc. shall be given one coat of Zinc Phosphate priming paint to give a minimum dry film thickness of 50 microns. Motors and other brought out items shall be painted, if necessary.

c) Un-machined Surfaces

All unmachined surfaces shall be given one primer coat of Chlorinated rubber-based Zinc Phosphate primer to give a dry film thickness of 50 ± 5 microns.

4.8.4.2 Finishing Coats

a) Structural components

The finishing coats of paints shall consist on one coat of alkyd based Micaceous Iron Oxide paint to give a dry film thickness of 65 ± 5 microns followed by two coats of synthetic Enamel paint conforming IS: 2932 to give a dry film thickness of 25 ± 5 microns per coat. The interval between each coat shall be 24 hours. The total dry thickness of all coats of paint including the priming coat shall not be less than 175 microns.

b) Machinery

The finished paint shall consist of three coats of Aluminium paint conforming to IS: 2339 or Synthetic Enamel conforming to IS : 2932 to give a dry film thickness of 25 ± 5 microns.

c) Unmachined Surfaces

The un-machined surface of rope drum hoist, monorail crane and supporting structure shall be cleaned and given three coats of Vinyl Resin/ Chlorinated Rubber to give a dry film thickness of 30 ± 5 microns per coat to obtain a minimum dry film thickness of 125 microns including priming coat.

d) Machined Surfaces

All machined surfaces of ferrous metal including screw threads, which will be exposed during shipment or installation shall be cleaned by suitable solvent and given a heavy uniform coating of gasoline soluble removable rust preventive compound or equivalent. Machined surfaces shall be protected with the adhesive tapes or other suitable means during the cleaning and painting operation of other components.

4.8.5.0 Embedded Parts in contact with concrete

All surface of embedded parts, which are in contact with concrete shall be cleaned as given in para 4.2.1.4 of IS : 14177 to meet the requirement of class D and shall be given a coating of cement Latex to prevent rusting. Exposed machined surfaces of ferrous metal, which are to in rolling and sliding contact shall not be painted but shall be coated with heavy gasoline soluble rust preventive compound. In all exposures, where metal will be partially embedded in concrete, it is good practice to extend the protective coating on the non-embedded portion a short distance into the area later to be embedded, thus eliminating problem at the junction point.

4.8.6.0 Surface not to painted

The following surfaces are not to be painted unless or otherwise specified.

- (a) Machine finish or similar surfaces, however, such surfaces should be protected with a corrosion preventive compound.
- (b) The surfaces, which are in contact with concrete.
- (c) Stainless steel overlay surfaces
- (d) Surfaces in sliding or rolling contact,
- (e) Galvanized surfaces, brass and bronze surfaces
- (f) Aluminum alloys surfaces.
- (g) Bare electrical conductors and insulating materials.
- (h) Equipment name plates and instruction etc.

4.8.7.0 Handling of painted metal work

The metal work to transported by rail or road transport shall be loaded so as to prevent shifting and scuffing or gauging of the coating. In loading and unloading and during insulation reasonable are and suitable handling equipment shall be employed to keep abrasion damage at a minimum.

4.8.8 Inspection and testing of painting

Inspection and testing of paint shall be carried out in accordance with the provisions laid down in IS : 14177.

4.8.9 Field Painting

The painted metal work shall be handled with care so as preserve the shop coats. The area of the shop paint, which has been damaged during transport shall be cleaned to base metal and re-painted. Paint applied to such areas shall be of the same type used originally in shop painting.

5.0 Catalogues and Operating Instructions

Six sets of catalogues indicating the complete list of parts and operating instructions in the English language, which may be needed or useful in operation, maintenance, repair, dismantling or assembling and for the repair and identification of parts for ordering the replacement, shall be supplied by the contractor to the purchaser. Such catalogues shall be in hard cover bound books and should have suitable jacketed ofthick polythene paper.

5.10 Instruction Parts

All gauges, meters and other instruments etc. shall have dials or scales calibrate in metric system. All name plates, instruction plates, warning signs, etc. shall be in English language as well as in Odia. All markings to be used shall be submitted tothe purchaser for approval before the equipment is marked or labeled.

5.11 Shop Assembly and Test

All gates, frames, and appurtenances shall be assembled in the shop to assure accurate fit and proper alignment of all parts and that the overall dimensions and clearance are as covered by these specifications. All the shop connection of gates shall be tested for water tightness prior to shop painting. While the units are assembled, the holes for field connection shall be reamed to full size.

The embedded metalwork to be furnished under these specifications shall be shop assembled the extent possible.

Special care shall be taken in all phases of work affecting the strength and rigidity of anchorage ties and embedded girders since the correct operation and stability of gates are largely dependent upon the strength and accuracy of these parts.

The stoplogs shall be shop assembled so as to allow for adjustment of various dimensions to make it confirm with the designed dimensions, fits, tolerances, surface finish, clearances etc. in the event it is not possible to complete the assemblyof stoplog unit or such other components in the shop, they will be accurately assembled in the shop using temporary connections and various critical dimensions shall be verified.

The cost of carrying out the test, not including the cost of inspection by the government personnel shall be borne by the contractor and included in the lump sum, price bid in the schedule. However, at the discretion of the Engineer-in-Charge the above tests shall be carried out by the contractor on the shop assembled parts and brought our items to the extent and in accordance with the instructions of the Engineer-in-Charge.

5.12.0 Preparation for Dispatch**5.12.1 Unit marking, Match Marking and Transportation Designation.**

Each part of the stoplogs and embedded parts, which is to be transported as a separate price, shall be marked to show the unit which it is a part and match marked to show its relative position in the unit to facilitate assembly in the field. Unit marks and match marks shall be made with heavy steel stamps and paint. Each price, sub- assembly or package transported separately shall be labeled or tagged with transport designation consisting of the specifications number and the marks number of such prices, number of parts grouped of such sub –assemblies are contained in package.

5.12.2 Weights

Before dispatch the contractor shall determine (by the most accurate means available) the net weight of each piece of assembly that is to be shipped as a unit exclusive of boxes, crates or kits. These copies listing the net weight shall be painted on the respective prices of assemblies or stated on the tags attached thereto.

5.12.3 Packing

All parts shall be prepared for dispatch so that slings for handling may be attached readily while parts are to be moved. Where it is unsafe to attach slings to the box, parts shall be packed with slings attached to the part and slings shall project through the box or crate so that attachment can be made easily. All parts shall be properly secured, packed to withstand handling during transportation. All packing shall allow for easy removal and checking at sites. Special precautions shall be taken to prevent rusting of steel and iron parts during transit.

Suitable methods proposed to be adopted for protection against moisture shall be subject to the prior approval of the purchaser. Each bale or package is to contain packing note, quoting number and date of contractor's order and the name of office placing the order.

After delivery of material at site, all packing shall become property of the purchaser. Notwithstanding anything stated in this clause the contractor shall be entirely responsible for loss, damage or depreciation to the stores due to faulty and insecure packing. The equipment shall be insured for loss or damage during transit at the cost of the contractor.

CHAPTER - 5

5.0.0 ERECTION

The equipment covered by these specifications shall be furnished and created by the contractor at the project site. The contractor shall be required to furnish all erection drawings. The contractor shall prepare a complete erection procedure, which shall describe the sequence of operations to be carried out and the method to be used, the measurement to be taken out and the tolerances to be met, in the erection and alignment of the equipment. Such procedure shall have the approval of the purchaser prior to the commencement of fabrication and when approved shall form a part of the specification furnished by the contractor.

5.1.0. Installation of 1st Stage Embedded parts

The contractor should be prepared to accept reasonable inaccuracy in the location of 1st stage anchors, without asking for compensation.

5.2.0. Installation of 2nd Stage Embedded Parts

All gate frames, guides, tracks and seal seats etc. - shall be assembled and installed, brought to line, grade and plumb within the erection tolerances and secured in place by anchorages as shown on the drawings or otherwise according to the best method in practice and as may be necessary for successful functioning of these units. The erection tolerances for the frames and guides shall be as indicated on the drawings or as per latest relevant BIS codes. Extreme care shall be taken to ensure that their surfaces be in a true plane within the tolerance throughout their entire length. The 2nd stage anchorages shall be strong enough to hold the frames and guides securely in position while concrete is being placed.

5.3.0 Installation of Gate leaves, Stoplogs, Hoists and operating mechanism

All the components of the gates, and operating mechanism for gates shall be erected perfectly, giving due cognizance to the unit and match marks on the components. All components shall be designed and assembled to fit snugly and shall be watertight.

It is desirable to avoid the flood period to perform erection of gates. Should it be necessary to do so, due precaution shall be taken against floods, as the gates may be submerged in water sustaining damages, or the half-erected gates may disturb the water flow causing damages to the civil structures. One of the measures may be that the hoists should be erected first, and when the flood forecast is made, the half-erected gates should be hoisted up to clear the flooding water.

5.4.0 Placing of Concrete

Concreting shall be done by the purchaser and the contractor shall give a detailed programme of fixing and aligning the embedded parts to the purchaser for this purpose. Before placing the concrete in anyone lift and between placement of successive lifts, alignment tolerances shall be checked and remedial action taken by the contractor, if any displacement has occurred.

5.5.0 Erection Personnel

Except for the concreting, skilled as well as unskilled personnel shall be arranged by the contractor for erection of the equipment covered in these specifications.

5.6.0 Tools & Tackles

At the time of tender the contractor shall submit the list of tool & tackles that he proposed to supply for erection, testing and maintenance of equipments.

The contractor shall provide all tools & tackles used in the erection testing and maintenance work.

CHAPTER - 6

6.0.0 INSPECTION, TESTING AND FINAL ACCEPTANCE

6.1.0 Place of manufacture & inspection

The tenderer shall state in his tender the place of manufacture, testing and inspection of various portions of the work included in the contract. Authorized representatives of the purchaser may be present at the time of any or all tests and the tenderer shall provide all necessary facilities for the same. Representatives of the purchaser shall be entitled to access works of tenderer, sub-contractor at any time, during the working hours, for the purpose of inspecting the manufacture of equipment and materials.

6.2.0 Inspection

All supplies (which include without limitation raw materials, components, intermediate assemblies and end products) shall be subject to inspection and test by the purchaser to the extent practicable at all times and places. Inspection shall be carried out in accordance with relevant Indian standards.

If any inspection or test is made by the purchaser in the premises of the contractor or sub-contractor, the contractor without additional charge shall provide all reasonable facilities and assistance for the safety and convenience of inspectors in the performance of their duties. If on the request of the purchaser, inspection or test is made at a point other than the premises of the contractor or sub-contractor of the contractor, it shall be at the expense of the purchaser except as otherwise provided in the contract, provided that in case of rejection, the purchaser shall be liable for reduction in value of samples used in connection with such inspection and test. All inspection and tests by the purchaser shall be performed in such a manner as not to unduly delay the work. The purchaser reserves the right to charge the contractor any additional cost of inspection and test when supplies are not ready at the time of such inspection and test. Acceptance or rejection of the supplies shall be made as promptly as practicable after delivery except as otherwise provided in the contract but failure to inspect and accept or reject supplies shall not relieve the contractor of the responsibility for such supplies to be in accordance with the contract requirements.

The inspection and test by the purchaser of any supplies or lots thereof does not relieve the contractor from any responsibility regarding defects or other failure to meet the contract requirements, which may be discovered prior to the acceptance. Except as otherwise provided in the contract, acceptance shall be conclusive except as regards latent defects, fraud or such gross mistakes as amount to fraud.

The contractor shall provide and maintain the inspection system, acceptable to the purchaser covering the supplies hereunder. Records of all such inspection of works shall be kept complete by the contractor and available to the purchaser during the performance of the contract and for such longer period as may be specified elsewhere in the contract.

6.3.0 Operational Tests

The contractor shall carry out in the presence of project authorities such tests on the gate equipment to determine that the gates will fulfill the functions for which it has been designed. Tests shall be repeated, if necessary, until successfully carried out to the satisfaction of the purchaser. Leakage tests and operational tests shall be carried out at the convenience of the project authorities after completion of other portions of the work.

6.3.1 Dry Test

Operational tests in dry shall be carried out as soon as possible after completion of erection. The tests shall include at least two complete traverses from the maximum raised position to the fully closed seating position. All adjustments, clearance etc., shall be checked for proper operation.

6.3.2 Wet Test

These tests should simulate the actual operating conditions as closely as possible. At least two complete traverses will be made from the fully closed position to the normal raised position as follows:

- a. When gate is closed, raise gate to their normally open position in steps and observe the performance including vibration.
- b. Lower the gate to the fully closed position in steps and observe the performance of the gate including vibration.
- c. Operation of filling valves for stoplogs shall be tested.
- d. Checkup proper operation of Limit switches.

6.4.0 Leakage Tests

Leakage tests shall be carried out with the gate/stoplog lowered on to the sill. Before measuring the leakage, the gate/stoplog shall be raised and lowered several times by a metre or so in order to dislodge any debris that may have lodged in the side seal seats. The leakage shall be measured and recorded. The maximum permissible leakage shall not exceed 5 to 10 litres per mm. per metre length of sealing surface.

6.5.0 Final Acceptance

The final acceptance of the equipment shall be based on the following:

- a. Quality and workmanship of the equipment.
- b. Satisfactory operation of the equipment after erection as required under this specification.
- c. Acceptance of various tests or test certificates by the purchaser as mentioned in above paras.
- d. All tests may be witnessed by the contractor or his authorized representative. On successful completion of all tests the equipment shall be accepted but all the responsibilities shall remain with the supplier within the guarantee period.

6.6.0 Guarantee

Within (To be filled in by project authority, minimum one year) year after acceptance of the equipment if any part of the gate, embedded parts, hoist etc., is found defective because of workmanship or material or otherwise, the contractor shall at his own expense, furnish and install new parts and materials approved by the purchaser.

6.6.1. Failure to Meet Guarantee

Should any of the equipment or part fail to meet the guarantees or other requirements of the technical specifications within the time covered by the guarantees, the purchaser may direct the contractor to proceed at once to make alterations or furnish new parts as may be necessary to meet the requirements. AU expense of furnishing, delivering, and installing new parts or making alterations to existing parts and of tests made necessary by failure of the equipment to meet the guarantees and other requirements of the technical specifications shall be borne by the contractor.

If, after due notice, the contractor refuses or persistently neglects to correct any failure of the equipment to meet the requirements of the technical specifications during the guarantee period, the purchaser may proceed at his own expense to correct such failure and to collect from the contractor an amount equal to the actual expenses so incurred, including overhead and all other incidental expenses. The remedy of the purchaser is in addition to any and all other remedies provided for in the technical specifications, or as provided by law.

6.6.2 Defective Equipment

In case any part of the equipment is found to be defective in materials or workmanship or develops defects or does not otherwise meet the requirements of the specifications including errors or omissions on the part of the contractor the following shall apply:

a. Defects Disclosed Prior to Final Acceptance

Any defect in materials or workmanship or other failure to meet the requirements of these specification including errors or omission on the part of the contractor, which are disclosed prior to final payment or prior to final acceptance tests, whichever occurs at a later date, shall, if so directed by the purchaser, be corrected entirely at the expense of the contractor.

b. Defects Disclosed After Acceptance

Any latent defect not disclosed before date of final acceptance shall be corrected promptly by the contractor entirely at his expense provided that the total period during which the contractor is liable for replacement due to latent defects shall not exceed twelve months after date of final acceptance of the equipment.

6.6.3 Operation of Unsatisfactory Equipment

The purchaser shall have the right to operate all permanent equipment as soon as and as long as it is in operating condition whether or not such equipment has been accepted. Such operation by the purchaser shall not lessen or impair any express or implied warranties concerning such equipment. All repairs or alterations required shall be made at such times as directed by the purchaser and in such a manner as will cause the minimum interruption in the use of the equipment by the purchaser. Operation of the equipment pursuant to this section shall not relieve the contractor of his responsibility to supply all equipment in complete accordance of technical specifications. While unsatisfactory articles can be taken out of service, for correction of latent defects, errors or omissions, the period of such operation of any use pending the correction of latent defects, errors or omissions shall not exceed one year without mutual consent of the contractor and the purchaser.

SECTION – X

**EMBANKMENT CONSTRUCTION &
SLOPE PROTECTION**

SECTION – X

EMBANKMENT CONSTRUCTION & SLOPE PROTECTION

10.0 EMBANKMENT CONSTRUCTION

10.1 SCOPE

Site clearance, stripping and formation of embankment of homogeneous section/zonal section viz. casing zone/hearding zone with the useful excavated soils and balance soils of approved quality from the borrow area including the cost of soil, if any sampling, testing and pre-wetting of soils at source of excavation and conveyance of soil and extra soils required for shrinkage including swell factor with all leads, lifts, delfts, laying on bank, spreading, breaking clods, sectioning, extra watering and consolidation including benching of old embankment slopes, joining with the new embankment formation of Dowel banks etc. as per drawing and as directed by the Engineer-in-charge to complete the finished item of work.

10.2 General Requirements.

- a) The cross sections for embankments are to be designed to suit the characteristics of the best quality soils available in the vicinity of the proposed work. If the contractor proposes to use any other type of soils than those mentioned in the design pursuant to the relevant I.S Code and standard specification. The contractor has to form the embankment to the approved profiles.
- b) Embankment shall be built to the height, top width and side slopes as shown in the drawings. All the edges of the embankment shall be neatly aligned symmetrical to the centre line. They shall be absolutely straight in all reaches except at bends. At bends they shall be smoothly curved.
- c) The top of each embankment shall be leveled and finished so as to be suitable for road way and given a cross slope to drain away rain water. The bank carrying road shall be given a suitable cross slope.

10.3 Materials; -

- a) The suitability of foundation for placing embankment materials thereon and all materials proposed for use in construction of embankment shall be determined well in advance on the basis of Laboratory Test results. Chemical and physical tests of the material proposed for construction of embankment shall be carried out to ensure that the soil does not contain soluble lime content, soluble lime salt content or cohesion less fines, in quantities harmful to the embankments.
- b) Material for construction of embankment should be free from organic materials. Unless otherwise directed by the Engineer all materials shall be deposited in embankments so that cobbles, gravels and boulders are well distributed through other material and not nested in any portion within or under the embankment as per clause 6.4 of IS.4701-

1982.

- c) Suitable excavated materials available from the cut off trenches, canal cutting, extra cutting for seating to lining, foundation excavation for structures, approach and tail channels for structures, nalla diversions, removal of ramps, obstruction removal on the upstream and downstream of surplus weirs and excavation in surplus course and any such excavations, shall be used for construction of adjacent embankments and also embankments of deficit reaches.
- d) After completing the construction of embankments with the materials as indicated in (c) above, material required for the construction of balance embankment shall be obtained from the borrow area.
- e) The soils and moorum excavated and useful for construction of the embankment shall be classified as impervious and semi-pervious based on laboratory Test result. They shall be utilized on the embankment work.

10.4 Preparation of ground surface for embankment.

- a) Clearing site : As per Section III
- b) Stripping : As per Section III
- c) All portions of excavation made for test pits or other subsurface investigations, all holes, hollows and all other existing cavities found within the area to be covered and to the extent below the established lines of excavation for embankment seat shall be filled in earth of the corresponding zone of the embankment and suitably compacted. The pits of surface boulders shall be filled with suitable material and compacted at no extra cost.
- d) Pools of water shall not be permitted in the foundation for embankment and such water shall be drained and cleared prior to placing the first layer of embankment materials.
- e) On sloping ground or in case of existing banks, where embankment portion are to be modified, benching of slopes shall be done with a little slope towards the inside of benching so as to give a good grip to the embankment soil with the sub-grade. Unless otherwise specified the benches shall be 0.3x0.6m on the front and rear slope of the embankment. Before benching, the bank slopes shall be clear of all roots and vegetables matter. No separate payment will be made for either benching or refilling. The bank section shall be brought to design standards by filling the scours with suitable material and compacting to 95% proctor density by suitable compaction measures.
- f) Soil foundation:

The ground surface under embankment and area of bed filling wherever necessary (except rock surfaces) shall be loosened or scarified making open furrows by means of a plough, or ripper or any other methods to a depth of not less than 20mm, deep below the stripped surface at intervals of not more than 1m. to the satisfaction of the Engineer-in-

charge. Roots or other debris turned up during scarifying, shall be removed from the entire foundation area for the fill. The areas under the embankments shall be prepared by sprinkler before the construction of embankment begins. The moisture content shall be optimum.

g) Rock foundation:

The treatment of the rock surface under the embankment shall be done so as to ensure tight bond between embankment and the foundation. This shall be done by the following procedure.

- i) The area of the rock surface which is to be in contact with the embankment shall be fully exposed by removing all the loose and disintegrated rock having the surface of rock rugged. Hard rock projections and overhangs shall be removed. If blasting is to be resorted to, care shall be taken to avoid objectionable shocks to foundation rock. As far as possible the whole contact area shall be exposed at one time to enable examination of rock surface characteristics and planning the method of treatment.
- ii) Exposed rock shall be benched.

10.5 Compaction.

a) General

The earth compacting equipment specified in Appendix-C of IS.4701-1982 shall be used for compacting the soils shown against them. The compacting equipment shall conform to the relevant I.S specification. While the I.S. specifications specify the compacting, it is contended that the use of improved compaction equipment for embankment construction shall be encouraged as may be most suited to the site conditions and the programme of construction. The methods of compaction shall conform to clause 7.2, 7.2.2 and 7.2.3 of I.S 4701-1982.

10.6 Cohesion Materials:

- a) When each layer of material has been proposed so as to have the proper moisture content uniformly distributed throughout the material, it shall be compacted by passing the roller. The layer shall be compacted thin strips over lapping not less than 0.30m. Rolling shall commence at edges and progress towards Centre longitudinally. The roller shall travel in a direction parallel to the axis of the bank. Turns shall be made carefully to ensure uniform compaction. Density tests shall be made after rolling and dry density attained shall be not less than 95% of the maximum dry density (standard proctor) as obtained in the laboratory for the type of material used. The density achieved shall not normally be less than the designed density. The dry density of soil in field shall be determined in accordance with IS 2720 (Part-XXVII)- 1974 or IS.2720(Part-XXIX)-1975.
- b) Standard proctor density test shall be carried out at regular intervals to account for

variations in the borrow area materials as well as that in in-situ excavated material. Not less than three tests shall be carried out to indicate variations in the standard proctor density attained in the laboratory.

- c) Engineer might review the design, if necessary, on examination of density test results and the contractor shall have no claim arising out of such a review and consequent change, if any, in the design.
- d) In case embankment covers the barrels of cross drainage or any other structure, first 45cm. of the embankment shall not be compacted with roller but it shall be compacted with pneumatic/hand tampers in thin layers. The compaction above this layer of total 45cm shall be done by using suitable light rollers to avoid damage to the structure, by adjusting the thickness of layers until sufficient height is achieved to permit compaction by heavy rollers. Density test shall be conducted from time to time on site to ascertain whether the compaction is attained as specified above.
- e) Separate tests shall be conducted for each zone of the embankment for every 1500 cubic meters of compacted earth work. At least one field density test shall be taken in each layer. Minimum two density tests shall be taken in each layer per day irrespective of the quality of earth work specified above. In case the test shows that the specified densities are not attained, suitable measure shall be taken by the contractor either by moisture correction or by entire removal and relaying of layer or checked again by taking fresh tests at the same locations. Necessary skilled labour required for carrying out such density tests shall be provided by the contractor.
- f) Compaction shall be achieved by the use of smooth roller pneumatic type rollers, sheep foot rollers, mechanical compactors like vibratory rollers, vibrating plates, rammers, power rammers, slope compacting equipment, pneumatic tamping equipment and such other equipment as shall be specified by the Engineer based on the type of material and actual field tests.
- g) The dimensions and weight of the rollers should be such as to extend a ground pressure of not less than 12 Kg/cm² of tamping when it is empty and 25kg/cm² when blasted. The number of passes required for each layer to obtain the specified density shall be determined by actual field tests.

10.7 Cohesionless Materials

- a) Where compaction of cohesionless free-draining material such as sand and gravel is required, the materials shall be deposited in horizontal layers and compacted to the relative density specified. The excavating and placing operations shall be such that the material, when compacted, shall be blended sufficiently to secure the highest practicable degree of compaction and stability. Water shall be added to the materials, if required to obtain the specified density depending on the method of compaction being used.
- b) As per clause 6.6.2.1 of IS.4701-1982, the thickness of embankment layer shall not exceed

25cm. (loose) before compaction and it should be spread over the full width of embankments and compaction shall be done by rollers or tampers to obtain specified density. The thickness of the horizontal layers after compaction shall not be more than 10cm, if compaction is performed by tampers. Similarly, the thickness of layers shall not be more than 15cm if compaction is done by 8 to 10 tonnes rollers and not more than 30cm if compaction is performed by vibratory or pneumatic rollers or similar equipments. The relative density of the compacted materials shall not be less than 70 percent as determined by Laboratory tests as per I.S 2720 Part –XI. If compaction is performed by internal vibrators, the thickness of layers shall not be more than the penetrating depth of the vibrator.

10.8 Embankment without controlled compaction.

- a) No materials shall be placed in any section of the earth fill portion of the embankment until the embankment seat for that section has been approved by the Senior Manager (Civil), OHPC.
- b) Where the natural ground surface is above the maximum water level but below the top of the embankment, the embankment shall be built in layers not exceeding 15cm in thickness and to the full width of embankment. Each layer shall be commenced from the edge farthest from excavation. It shall be compacted with two ton roller.
- c) The excavating and hauling equipments shall travel over the embankments to evenly distribute the material and compacting effort over the whole surface.

10.9 Embankment with controlled compaction:

- a) Bushes, roots, sods or other perishable or unsuitable material shall not be placed in the embankment.
- b) (i) Unless otherwise specified embankment materials shall be spread in successive horizontal layers generally not exceeding 25cm. thickness (loose layer) in the zones where these are required to be laid extending to the full width of the embankment including slopes at the level of the particular layer. Each layer shall be commenced from the edge farthest from excavation. In no case shall embankments be widened by material dumped from the top.
 - ii) Top of each layer shall be kept slightly depressed in the Centre.
- c) i) Extra width of 600mm in thickness perpendicular to the slope shall be provided on either side so that when compacted, lines of the finished embankment slopes shall have not less than specified density.
 - ii) Later on, the extra width shall be neatly trimmed and the trimmed material shall be permitted for re-use in embankment at higher elevations.
 - iii) No payment shall be made for providing removal of the extra section. Removal of extra section in the embankment shall be deemed to have been included in the bid price.
- d) Thickness of layers shall be adjusted with particular type of compactors used to give the

required density by carrying out trial compaction and requisite tests and required number of passes should also be determined as directed by the Engineer.

- f) No fresh layer shall be laid until the previous layer is properly watered and compacted as per requirement. The work of spreading and compaction shall be so adjusted as not to interfere with each other and in such a way that neither of the operations is held up because of non-completion of the rolling and watering. The surface of the banking shall at the times of construction be maintained true to required cross sections. If the surface of any compacted layer of earth fill is too dry or too smooth it shall be moistened and scarified to provide a satisfactory bonding surface before the succeeding layer is placed. All the rollers used on any one layer of fill shall be of the same type and same weight.
- f) The contractor shall ensure that only approved soils are used for construction of embankment.
- g) For proper bond of the embankment done in the previous season with the new embankment, the work shall be carried out as detailed below.
 - i) In case of the old bank to be extended horizontally, it shall be cut to a slope not steeper than 1 in 4 and the surface so prepared shall be scarified and made loose at least for a depth of 15cm. Necessary watering shall be done and the earth surface shall be thus prepared to receive the new embankments. The soil shall be laid in layers and compacted to the required degree of compaction to have a proper bond with the old one.
 - ii) If the old bank is to be raised vertically, vegetation shall be cleared followed by scarifying, watering and placing of the new earth layer as specified above.
 - iii) The surface which are damaged due to rain shall be made good by filling with proper soil duly compacted by tampers. A cross slope away from the centre of canal of about 1 in 80 shall be maintained throughout the rainy season to ensure proper drainage in the event of occasional rainfall. No extra or separate payment shall be made for these items of work.
- h) Settlement allowance.
 - i) The canal embankments shall be constructed to a higher elevation than that shown-on drawings at the rate of 2.5cm. per every one-meter height of bank if power driven equipment is used and 25cm/mt height if other than power driven equipment is used for compaction towards shrinkage / settlement.
 - ii) No extra or separate payment shall be made for this work as this shall be deemed to have been included in the price bid.
 - iii) Care shall be exercised that all large clods are broken and no clod bigger than 8cm rock are buried in the banks.
- i) Homogeneous Section:

The homogeneous section for embankment shall be provided as specified in the drawings. The available coarser and more pervious materials shall be placed nearby outer slopes in order to

have increasing permeability from inner to outer side. The compaction shall be carried out as per clause 6.6.2 of I.S 4701-1982.

j) Zonal Embankments:

IN Zonal sections the selected and approved soils shall be spread to the required widths of respective zones. All the zones shall be tackled simultaneously and the difference in level between zone to zone shall not be more than 150mm.

10.10 Moisture content:

- a) The initial moisture content of the material shall be determined at the source of supply (all excavations including from the borrow areas) in field laboratory test. Prior to and during compaction operations, the embankment shall have optimum moisture content required for the purpose of compaction and this moisture content required for the uniform throughout the layer, as per clause 6.6 of IS 4701-1982. In so far as practicable the moistening of the material shall be performed at the site of excavation but such moistening shall be supplemented as required by sprinkling water at the site of compaction, if necessary. Flooding shall not be permitted under any circumstances. Sprinkling of water shall be done either through a proper sprinkler tanker or using proper spray nozzles. Sprinkling straight from the water house shall not be allowed.
- b) If the earth delivered to the embankment is too wet, it shall be dried by aeration, exposure to the sun, ploughing, disc harrowing or other methods, till the moisture content is reduced to acceptable optimum for compaction. If due to wet weather, the moisture content cannot be reduced to the required optimum by the above procedure, work on compaction shall be suspended until such time the earth has dried to the optimum moisture content. For such suspension of work, no extra claim by the contractor shall be allowed.
- c) If the moisture content is not uniformly distributed throughout the layer or less than the optimum rolling shall be stopped and shall be started again only when the above conditions are satisfied. After adding the required amount of water, if found necessary, the soil shall be processed by means of harrows, rotary mixers or as otherwise approved until the layer is uniformly wet to optimum moisture content.
- d) Moisture content of each layer of soil shall be checked in accordance with IS:2720(Part-II) 1973 and unless otherwise mentioned shall be adjusted, making due allowance for evaporation losses that at any time of compaction, upto 1% +2% than the optimum moisture content in casing zones and upto +1% to -1% than the optimum moisture content in the hearting zones may be permissible. The optimum moisture content shall be determined in accordance with IS:2720(Part0-VII)1973. The above compaction tests will be conducted by the contractor and the contractor shall ensure compaction till it is satisfied that 95% of the maximum dry density at OMC is obtained.

10.11 Special Precautions:

- a) During the actual construction of any earth work, maximum use should be made of construction plant and routing of the plant should be carefully controlled to obtain uniform compaction over as wide an area as possible. Care should also be taken during the compaction operation to

shape the surface of the works to facilitate the shedding and to minimize the absorption of rain water, particular attention being given to the prevention of ponding of water. The contractor shall do this at the end of each day's work.

- b) The earth moving machinery shall not be allowed to pass over a compacted portion of the embankment beyond certain limits by varying the hauling routes and rams, this ensuring that over compaction does not take place in any particular reach.
- c) During the construction, a small transverse slope from Centre towards the edges shall be given and further in the reach when back is being raised, the works shall be tackled in continuous horizontal layers to avoid pools of water and concentration of flow of water during rains, which will cause damages, scours and rain gullies.
- d) Special precautions shall also be taken while rolling the spread soil near structures, conduit, sluice barrels, filters, rock toes at the junctions of bank connections with the structures, using hand or power tampers. It is essential that the compaction of filling should be carried out in such a manner as to avoid an unbalanced thrust on walls etc. which might displace or damage it. The equipment shall be provided with suitably shaped heads to obtain the required density.

10.12 Embankment test section:

The embankment section shall be built as directed by the Engineer-in-charge prior to starting fill operations or at an early stage of embankment construction. The test section shall be used to establish.

- i) Layer thickness of fill materials
- ii) Optimum practicable moisture content
- iii) No. of passes of sheep foot roller/ vibratory roller for effective compaction.

10.13 Refilling of key trench and consolidation:

- a) Key trench shall be back filled with impervious material of the same specifications and in the same manner as for the impervious hearting zone of the embankment of the canal. The impervious soils shall be placed in continuous and approximately horizontal layers not more than 25 sq.(loose) thick and compacted by 8 to 10 Tonne power roller under optimum moisture content.
- b) Rolling shall be done along the key trench and the roller shall be taken close to the sides of the trench.
- c) In cases where the compaction by rollers is not possible, compaction to the required density shall be achieved by such other means as specified by the Senior Manager (Civil)/Engineer-in-Charge.
- d) Each layer shall be compacted to achieve the required dry density of not less than 95% of

the maximum dry density (Proctor's density) for the type of material at optimum moisture content.

- e) Watering of material for its compaction shall have to be arranged by the contractor at his cost as the quoted rate for consolidation of Schedule 'A' is inclusive of watering.
- f) During placing and compaction of impervious soils in the key trench where dewatering is involved, the sub soil water level at every point in the key trench shall be maintained below the bottom of the earth fill until the compacted fill in the key trench at that point has reached a height of 3m. after which water level shall be maintained at least 1.5m below the top of compacted fill.
- g) The quantity for payment shall be the volume of key trench measured in cubic meters. The unit for payment shall be the cubic meters.

10.14 Compacting by other than Power Driven Equipment.

- a) This shall conform to that of embankments compacted by power driven equipment except that instead of using power drive rollers ordinary rollers driven by tillers shall be adopted for compaction. If the work is of small magnitude, no manual compaction shall be allowed except through the use of pneumatic tampers and only very occasionally hand tampers shall be used.
- b) Thickness of layer shall not exceed 150 mm before compaction (loose).
- c) Each layer shall be compacted to not less than 95% dry density (Proctor's density) at optimum moisture unless otherwise specified.
- d) Any loose soils shall be removed by trimming and bringing embankment and side slopes of canal to the section shown on the drawings. Slope compacting equipment and pneumatic equipment should be used.
- e) Measurement and rate for payment shall conform to para 3.2.14 slope compacting equipment and pneumatic tamping equipment should be used.

10.15 DOWEL BANKS.

- a) Dowel Banks shall be constructed to the dimensions, grades, slopes as shown on the drawings.
- b) Payment will not be made for construction of Dowel Banks.

10.16 Water Conditions:

- a) Embankment soils shall be placed only when the weather conditions are satisfactory to permit accurate control of the moisture content in the embankment material. Before closing work in embankment, in any continuous reach prior to setting of monsoons, the top surface shall be graded and rolled with a smooth wheeled roller to facilitate run-off away from canal. Prior to resuming work, the top surface shall be scarified and moistened or allowed to dry as necessary.

- b) The contractor shall provide suitable protection works protect the slope from erosion due to rain water. No payment whatsoever shall be made for providing such protection work and rectifying any monsoon damages.

10.17 Borrow Area Consideration:

- a) The contractor shall use only the suitable soils for formation of embankment, out of the soils excavated if they are proved to be suitable, based on Laboratory test results, and if they are within the Economic lead. Otherwise, the contractor shall borrow the soils from the borrow area after test checking the suitability of the soils for the embankments for particular embankment work.
- b) The contractor shall be allowed to borrow the soils from the fore shore areas of Reservoirs/tanks, upto MWL contour and on the sides of the canal. Where the department is having provision to borrow or exploit the soils. The contractor can avail this provision. If, for any reason the contractor is not interested to borrow the soils, from the above said areas the contractor is free to borrow the soils from any other places of his choice.
- c) The responsibility for arranging and obtaining the land for disposal of spoil and the land for borrowing or exploitation in any other way shall rest with the contractor, who shall ensure smooth and uninterrupted supply of materials/earth for the quantity required in construction during the construction period.

10.18 BORROW PITS:

- 1) The borrow pits shall not normally be more than 25M in length and 10M in width and 1m/2M depth. A clear spacing of one meter between each pit shall be left out. Each pit shall be clearly peg marked and number tags of the pits shall be maintained.
- 2) In the case of earth dams unless otherwise specified the borrow pits shall not be located within a distance of 10 times the height of the embankment on the upstream side and two times the height of the embankment on the downstream side.
- 3) The depth of the pits shall be so regulated that their bottom does not cut the hydraulic gradient line having a slope 4:1 from the top edge of the embankment.
- 4) In no case the pits shall be located within 5M from the toe of the embankment. If there are old pits in the borrow area the new pits shall be located one meter away from them.
- 5) If the contractor excavated the pits near to the toe against to the above clauses and the same is observed at any time during or after the execution of work, the contractor has to fill the same pits with the soils suitable for hearting zone of embankment and compact to 95% proctor's density at the cost of contractor.

10.19 Stripping of borrow areas:

- a) Borrow areas shall be stripped of top soil and any other objectionable materials to the required depths as ordered by the Senior Manager (Civil)/Engineer-in-Charge (Stripping operations

shall be limited only to designed borrow areas) materials from stripping shall be deposited in exhausted borrow areas in the approved adjacent area. Particular care shall be taken to exclude all organic matter from the borrow area. The cleared areas shall be maintained free of vegetable growth during the progress of work.

- b) No payment shall be made for removal of top soil on borrow area.
- c) **Moisture Control at Borrow Areas:**
- d) Borrow area watering shall be done by the Contractor in the manner specified by the Engineer-in-charge.
- e) No payment shall be made for watering the borrow area or drying the material in borrow area or on bank to reduce extra moisture content or for delay due to this.
- f) The cost for such works shall be deemed to have been included in the price bid.

10.20 CLAY BLANKETS:

- a) **Scope:** Clay blankets are made from impervious soils and are used on the beds of reservoirs or in channels or canals to reduce seepage.
- b) **Requirements:** The materials used for this purpose, shall be impermeable, free from excessive shrinkage and swelling, shall resist erosion and have adequate stability. As far as possible, G.C or S.C materials shall be used when satisfactory soils are not available, the surface shall be protected with a blanket of stable gravelly soils if so instructed by the Engineer-in-charge.
- c) **Laying:** The clay blankets shall be laid and compacted to 98% proctor density to a length and depth.
- d) **Measurement:** Dimension shall be measured to be nearest 0.01m and volume worked out to the nearest 0.01 cum.

10.21 Back filling:-

Back filling with selected materials in foundation trenches around structures and above lining key.

1) General:

- a) The type of material used for backfill, and the manner of depositing the material, shall be subject to approval of the Engineer-in-charge. As far as practicable, back fill material shall be obtained from the excavation for structures or from adjacent canal excavation or from the excavation of the other ancillary works. Back filling shall be done with approved materials after the concrete or masonry is fully set.
- b) Backfill material shall not contain stone larger than 7.5cm. size.
- c) The pervious materials (sand) with profuse watering used for back filling around the cut off wall shall be placed as shown on drawings or as directed by the Engineer-in-charge.

- d) Backfill shall not be placed against retaining walls until the retaining wall is cured adequately and is strong enough to take lateral pressure of the backfill. Trimming of the sides of excavation against which the backfill is to be laid shall be delayed until immediately prior to back filling and any excessive drying of the surface shall be conditioned properly and made adequately moist to avoid potential desiccation of the rock or partly compacted/consolidated materials.
- e) The back fill material shall not be placed against retaining walls until the retaining wall cured adequately and is strong enough to take lateral pressure of the backfill, trimming of the sides of excavation against which the backfill is to be laid shall be delayed until immediately prior to back filling and any excessive drying of the surface shall be conditioned providing adequate earth cover over pipe to prevent damaged due to loads of construction equipment.
- f) If a haul road is built over a pipe, all back fill around and over the pipe shall be placed to a uniform surface and no lumps or depressions shall be permitted at the pipe crossing.

2) **Compaction of Backfill**

- a) When compacting the soil against the steep rock, abutment walls of masonry or concrete structures, the construction surface of embankment shall be sloped away from the rock or masonry or concrete structure leaving a minimum distance of 0.6 metre and at an inclination of 3:1. Roller shall not be used close to structures as structural damage is very likely more particularly when structures have not been fully cured. The size and weight of equipment will depend on nature of material, the height and load assumed in design of structure. The backfill close to the structure upto the rolled layer shall be compacted in suitable uniform layers, using pneumatic tampers as appropriate to obtain dry density of at least 95% of proctor density. The moisture content of the earth fill placed against rock or the structure shall be on higher side of OMC by about 2% or so, to allow it to be compacted into all irregularities of the rock. Profuse watering shall be done to pervious materials (sand) before compaction as per instruction, shall be carried out with special care without claiming any extra cost.
- b) Deployment of hand tampers be restricted to rare usage that too for very small jobs.

3) **Structures on backfill:**

Where the original ground surface is below the base of the structure or below the bottom of pipe, all fill required for the structure foundation and all fill upto the bottom in the pipeshall be placed as compacted embankment. The embankment over natural ground up to pipe bottom and over the pipe shall be laid in accordance with clause 9.2.4, 9.2.5 and 9.2.6 IS:783 of 1985. The compacted back fill shall be placed in horizontal layers not exceeding 15cm, after compaction. Heavy stones shall neither be dropped on top of pipes not shall be allowed to roll down the side of the embankment against the pipes.

10.22 Inspection and Tests:

1) General:

- a) The contractor shall maintain and exercise through check on the quantity of fill material delivered to the embankment and shall arrange to obtain the data and in-situ properties of the material after compaction for comparison with design assumption. To achieve these objectives, a programme of field testing and inspection shall be planned to effect quality control
- b) Scope of testing and inspection.

Field control of fill material shall be required by visual and laboratory checks. The checks on the effectiveness of placement and compaction procedures shall be made by field density tests at prescribed intervals by the Contractor.

2) Tests

The following tests shall be carried out for determining compaction.

- a) Density moisture relation of the soil: In accordance with IS:2720(Part-VII)(1980.
- b) Density of the soil in field: In accordance with IS:2720 (Part-XXVII)1974 or IS:2720(part-XIX)1975.
- c) Moisture Content: In accordance with IS:2720(Part-II) 1973. Before compaction Materials delivered to the fill shall be visually examined and their properties estimated by way of inspection.

3) Embankments.

- I. Moisture content tests shall be carried out in the field laboratory while placing the fill materials.
- II. Moisture content shall be controlled by adding water or allowing the soil to dry.
- III. It shall be ensured that the methods of dumping, spreading and moisture conditions are such as will result in reducing segregation and/or variation of moisture content to a minimum.

4) Borrow Area.

- i. Estimation of moisture content of materials by visual examination and feel.
- iii. Different samples shall be taken for laboratory analysis in case the soil is of different characteristic.

These inspection checks shall be supplemented by sampling the materials at prescribed minimum intervals and by testing the samples in the laboratory for gradation and moisture content.

During Compaction:

It is intended that the checks in operations during compaction shall verify.

- i. That the layer thickness of the material is as specified
- ii. That the fill is compacted at least to 95% of standard proctor's Density or (Dry density at OMC) or 70% relative density as the case may be.
- iii. That no excessive rutting, waving or scaling of the fill occurs during compaction.

5) After compaction:

The condition of the fill after compaction shall be observed and recorded particularly with respect to rutting or waving. However, the properties of materials after compaction shall be determined primarily by field density tests. Routine tests on samples taken from constructed embankment shall include besides density tests, grain size distribution and Permeability.

10.23.1 Frequency of Testing:

- a) It will be necessary to carry out sampling and testing of materials before and after compaction at sufficient frequencies so that effective checks on the full operations are maintained. Testing frequencies proposed should correspond to the frequencies as mentioned in the relevant paragraphs. However, the actual frequencies shall be adjusted to suit the nature and variability of materials placed and the rate of fill placement.
- b) Testing shall be performed at frequent interval than those specified in table during initial stages of placing in each zone in order to establish control on testing techniques and also testing should be conducted at higher rates in case of special problem of control caused by such factors such as material variation, equipment performance and weather.
- c) **Compaction:**
Test location shall be chosen only through random sampling technique. Control shall not be based on the result of any other test but on the mean value of 5 to 10 density determinations. Generally, these shall be at the locations indicated below or any other areas so determined by the Engineer-in-charge in addition to these tests shall be made at the following locations.

- 1) In areas where the degree of compaction is doubtful.
- 2) In areas where embankment operations are concentrated.
- 3) For record tests at the locations of all embedded instruments. Areas of doubtful density may be detected by the inspection by Engineer-in-charge and possible location of insufficient compaction include.
 - i) The junction between areas of mechanical tamping and rolled embankment along abutment or cutoff walls.
 - ii) Areas where rollers turn during rolling operations.
 - iii) Areas where too thick layer is being compacted.
 - iv) Areas where improper water content exists in material.
 - v) Areas where less than specified number of roller passes were made.
 - vi) Areas where dirt clogged rollers were used to compact the materials.
 - vii) Areas where compacted by rollers that have possibly lost part of their ballast.
- IX) Areas where oversized rock which has been over looked is contained in the fill.
 - ix) Areas containing materials differing substantially from the average.

10.23.2 Record and Report:

Record of borrow area material and embankment placing operations shall be maintained in order to have a continuous check on the suitability and availability of full materials and quality of fill. Thus, shall be possible to have complete description of materials in any portion of embankments. The record shall be maintained on the form specified in ANNEXURE-1.

10.23.3 Field Test Data:

Records of field Test Data results should be presented in the form of statistical analysis sheets and summary sheets in order to provide control required for enforcement of statistical requirements of the specifications.

Test data summary sheets and inspection reports be used to form the basis of construction control report, which should be issued from the site at fortnightly intervals during construction season. The report would contain narrative accounts of the progress and problems of field constructions, statistical analysis of test data and photographs of the fill operations.

ANNEXURE-1**Earth work Daily Report:****Name of work:**

Date_____shift_____weather_____Inspector_____

_____Following Inspector_____Type roller equipment used

_____weight of roller

(A) EXCAVATION

1. Type of Excavator:
2. Depth of Cut.
3. Type of soil
4. Borrow pit location
5. Weather water added at borrow pit
6. Percentage of moisture content

(B) FILL CONDITIONS

1. Location of fill.
2. Elevation
3. Whether water added at the fill
4. Moisture content before rolling
5. Roller passes.

(C) TEST DATA

1. Location of Sampling point
 - (a) Chainage
 - (b) Off-set
2. Serial Number
3. Moisture content
4. Dry density (G/)
5. Plasticity needle reading (Kg/Sq.cm)
6. Quality of Earth Work rolled.

LABORATORY CHECK

1. Serial Number
2. Optimum Moisture content percent
3. Maximum dry density (Gr./CC)
4. Plasticity needle reading (kg/sq.cm)

AGENCY

C&P HEAD

(D) COMPACTION EFFICIENCY

1. Field moisture deviation from optimum
2. Percentage Compaction.

10.23 Surface Drains

This work shall consist of constructing surface drains, schedule of work shall be so arranged that the drains are completed in proper sequence with canal excavation works as necessary subsequently or no damage is caused to these works due to lack of drainage.

filter materials:

- a. Scope: Formation Surface drains shall be excavated to the specified lines, grades, levels and dimensions. The excavated soils shall be removed from the area adjoining the drains and is found suitable utilized in embankment construction. All unsuitable soils shall be disposed of as directed.
- b. The excavated bed and sides of drains shall be dressed to bring these in close conformity with the specified dimensions, levels and slopes.
- c. All works on drain constructions shall be planned and executed in proper sequence with other works as approved by Senior Manager (Civil)/Engineer-in-Charge with view to ensure adequate drainage for the area.

10.24 Rock fill in Toe of Embankments and filters:

Scope: This specification covers filters to be laid for internal drains, sandy filter blankets, filter below the riprap, horizontal and inclined filter drains, longitudinal and transverse filters around rock toe etc.

10.25.1 Filters:

i) Sand as of sand filters of specified thickness using the sand of approved quality including cost and conveyance of sand sampling, testing and laying with all leads, lifts, delifts and compaction to 70% relative density including hire and operational charges of power roller seigniorage charges and all other incidental and operational charges necessary to complete the finished item of work for filter blanket, horizontal and inclined filter drains, longitudinal and transverse filters around rock toe etc. as per drawings and as directed by the Engineer-in-charge.

10.25.2 BASE FILTER BLANKETS:

a) As and where indicated in the approved drawings, filter blanket should be laid on the base, under the riprap, below the rock toe of the embankment, underneath the cement concrete blocks in between the R.C.C. apron and curtain wall, on the downstream side of barrage, in slopes of afflux and guide bundhs and in the location as indicated in the drawing.

Inverted filter shall be constructed to the specified thickness always measured normal to the slope. Filters shall be placed in at least two different layers. The filter materials shall be clean, sound, well graded sand and gravel or screened rock fragments manufactured by stone crushers.

The filter materials used are required to satisfy the following criteria:

Piping Criteria

Its void should not allow migration of particles. For this.

$$\frac{D_{15} \text{ of Filter material}}{D_{85} \text{ of base material}} \leq 5$$

D85 of base material

D15, D85, D50 denote diameter of grain size, at which 15%, 85% and 50% respectively of material is smaller than the particular size, determined from the gradation curve.

Permeability criteria

The filter should be sufficiently more pervious than the base material so as to induce a rapid drop in gradient line or have easy drainage. For this---

$$\frac{D_{15} \text{ of Filter material}}{D_{15} \text{ base material}} \geq 5$$

D15 base material

This criteria ensures permeability of the filters to be greater than 25 times of the base material.

Gradation Criteria

The filter which satisfies the piping and permeability criteria as above may yet fail if it has excess or lack of certain sizes or is not uniformly graded. Hence the filter material should be well graded to satisfy the condition.

Co-efficient of Uniformity (CU) = $\frac{D_{60}}{D_{10}}$

D.10

> 4 (in case of aggregates)

> 6 (in case of coarse sand)

The gradation curve of the filter material should be approximately parallel with that of base material specially in the finer zone. To ensure it...

$$\frac{D_{15} \text{ of Filter material}}{D_{15} \text{ base material}} < 25$$

D15 base material

- b) The base filter materials should be well graded so as to satisfy the above-mentioned criteria. The grain size curve should be approximately parallel to that of base materials, especially in the fine range. Filter materials should not contain more than 5% of fines i.e materials finer than 0.075 mm. (Passing through sieve No.2000 IS sieve 75 micron) and fines should be cohesion less to ensure that filter does not sustain a crack. The filter should not have particles larger

than 75mm so as to minimize the segregation.

- c) D₁₅ is the size at which 15% of the total soil particles are smaller, the percentage being by weight, to be determined by mechanical analysis. D₈₅ size is that at which 85% of the total soil particles are smaller. As more than one filter layer is required, similar criteria is followed in each case, viz. the finer filter is considered as base materials for the selection of the gradation of the coarser filter.
- d) The requirement for grading of the filter shall be established by the tests conducted in the field laboratory on the basis of mechanical analysis of adjacent materials. Mechanical analysis shall be performed of all samples, which have been compacted by the methods equivalent to compaction by roller, so that the individual particles are broken to their field condition in the embankment.
- e) The thickness of each filter layer shall be less than 150mm

10.25.3 Placing of Filter:

- a) Filters shall be laid to the lines and grades and dimensions shown on the drawings.
- b) The foundation shall be cleared and stripped in accordance with specification 2.0 before laying the bottom layer of filter material.
- c) Filter material shall be laid in layer of 150mm adequately watered and compacted by required number of passes of crawler type tractor or any method approved by the Senior Manager (Civil)/Engineer-in-Charge to get dense and stable filter.
- d) Care shall be taken to ensure that materials of different layers do not get mixed both at the time of placing and during compaction. Extreme care shall be taken when placing materials to obtain a fill free from tenses, layers and streaks of segregated materials.
- d. In case of horizontal filters after being compacted earth fill materials shall be laid over it in layers of 150mm and compacted as directed by the Engineer-in-charge sheep foot roller or DRR shall not be used till earth has been laid and compacted to a thickness of 600mm. Over the filter blanket. However, the construction of earth fill in the initial 600mm thickness shall be subject to the same quality control regarding moisture content and dry density as for the rest of the embankment.
- e. In case of inclined filter, the filter shall be raised along the adjoining embankment layers and shall be properly compacted by suitable means. In order to avoid contamination of filter with adjoining earth fill material, the top of filter shall be kept lightly higher than the adjacent embankment level and any contaminated portion shall be scrapped and removed before adding the new layers.

10.25.4 Measurement

The measurement shall be in meters correct to 0.01 meter and volume shall be worked out to nearest 0.01 cubic meters.

10.25 STONE PITCHING.

Stone protection work for loose apron of the barrage bays beyond concrete cubes both in upstream and downstream and also below the cubes of upstream of barrage are to be provided as per relevant drawings. Rough stone pitching has to be provided on the river side slope of the afflux and guide bunds. The launching apron for these bunds in continuation of the revetment to abutment shall be constructed with random rubies.

10.26.1 Material for Stone pitching.

10.26.2 The pitching material shall consist of the most durable rock fragments of approved quality selected for the purpose. Stones shall be procured from the approved quarries and if required shall be subjected to inspection and approval by the Engineer-in-charge. The quality of individual stone shall be dense, sound and free from conglomerate, bands and other defects that would tend to increase their susceptibility to destruction by water and weathering action. Stones having thickness less than 50% of their maximum dimension shall not be used for pitching.

10.26.3 Size of Stone

No Stone shall be less than 0.03m³ in size. At least 15% of stones to be used for pitching shall have depth equal to the thickness of pitching. All stones to be used for apron shall have a minimum depth of 25 cm. No stones shall have any dimensions less than 20 cm.

10.26 Slope Cutting

The compacted embankment, the slope of which is to be protected with stone pitching, shall be trimmed to the lines and slopes as prescribed on the drawings or as directed by the Engineer-in charge from time to time. The earth obtained from this trimming shall be laid on top of the embankment if required or as directed by the Engineer-in-Charge.

10.27 Thickness of pitching

- (a) Pitching shall be hand placed on the water side slope of the embankment. The thickness of pitching shall be as indicated on the drawings. The thickness shall be measured normal to the slope of the embankment.
- (b) Launching apron shall be hand placed in horizontal layers and its thickness shall be as indicated on the drawings. .

10.28 Method of Placement.

- (a) Before laying the pitching or launching apron on level ground or on sides of the slope of afflux or guide bunds, the receiving surface shall be trimmed to the required slopes and profiles put by means of lines and pegs at regular intervals. Depressions shall be filled up and thoroughly compacted. Pitching on inverted filter, if any shall be started from the end and built in courses upwards. Stones shall be placed by derrick or by hand and so placed that the largest dimensions are perpendicular to the face of the slope. The large stones shall be placed in the bottom course and for use as headers for subsequent courses.
- (b) All interests between adjacent stones shall be filled with spalls if proper sizes and wedged in with hammer to ensure tight packing.

10.29 Rock fill in Toe of embankment (Rock toe)

- a) **Scope:-** Formation of Rock toe using approved quality of well graded metal & stone of size 75mm to 450mm including cost and conveyance of metal, sampling, testing laying with all leads, lifts, delfts, and at least 225mm thick rough stone dry packing to the external face including labour charges for packing, seignior age charges and all other operations necessary to complete the finished item of work as per drawings and as directed by the Engineer-in-charge.
- c) Rock fill shall consist of sound, durable and well graded broken rock obtained from approved excavation work and/or from quarries and shall be approved prior to being transported to the areas of deposition. The materials shall range in size from 75mm to 450 mm. However, no load shall contain more than 15 percent by volume of rock, fragments smaller than 75mm in size. All brush roots, or other perishable materials shall be removed from rock fill during the spreading.
- d) **Placing:**
 - i) The rock fill shall be constructed, true to the lines and grades as shown in the drawings.
 - ii) The rock fill shall be placed and packed to obtain a suitable well graded and free draining fill.
 - iii) The smaller rock fragments shall be placed adjacent to the filter of embankment and large rock fragments near the outer edge of the fill.
 - iv) The rock fill shall be placed and roughly leveled in layers not greater than one meter in thickness.
 - v) The stones shall be properly hand packed and the inter spaces shall be well filled with spalls and chips and tightly wedged to ensure firm packing so as to have dense, well graded fill with no larger voids and cavities.

- vi) Contamination of rock toe with finer material from any other zones shall be avoided.
- vii) Suitable out fall for draining out the seepage water collected in rock toe shall be provided depending upon the site conditions.

10.30 Measurement

As liner measurement shall be in meters, correct to 0.01 volume shall be worked out to nearest 0.01 cum.

10.31 Protection:

The contractor shall take all precautions necessary for the protection of the work by diversion of stream local surface drainage, rain water etc. if these are likely, to damage the work. Any damage to earth works due to any reason what so ever shall be made good by the contractor at his cost till the work is certified as completed and takeover by the Senior Manager (Civil)/Engineer-in-Charge.

10.32 Roads and Ramps.

The contractor shall construct, operation, and maintenance roads and earth ramps adjacent to the canal and structures at his own expenses. Suitable materials from excavation or borrow areas shall be placed as embankment for the roads and ramps. The width of the road shall be not less than 4.25M.

