INLAND WATERWAYS AUTHORITY OF INDIA

Noida

Development of Ship Repair Facility (Slipway) at Pandu, Guwahati, NW-2

TENDER DOCUMENT FOR CIVIL, MECHANICAL AND ELECTRICAL WORKS

TENDER No. IWAI/PR2/3(SLIPWAY)/2011-Vol-IV

INLAND WATERWAYS AUTHORITY OF INDIA
(Ministry of Shipping, Road Transport & Highways, Govt. of India)
Head Office: A-13, Sector–1,
Noida-201301 (U.P.)
Tel. No. 0120-2521664, 2521704; Fax No. 0120 – 2544041
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OCTOBER 2015

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1 TENDER ISSUE LETTER

INLAND WATERWAYS AUTHORITY OF INDIA
(Ministry of Shipping, Road Transport & Highways, Govt. of India)
Head Office: A-13, Sector–1, Noida-201301 (U.P.)

Director (P&C) Office
IWAI, Noida

No: IWAI/PR2/3(SLIPWAY)/2011-Vol-IV **Date: / /**

To

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.....
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.....

Sub: Tender document for the work of Development of Ship Repair Facility (Slipway) at Pandu, Guwahati, NW-2

Sir,

With reference to your letter cited on the above-mentioned subject, please find enclosed herewith one set of tender document for the subject work. You are requested to go through the terms and conditions carefully and also visit the site to familiarise and submit your tender as per procedure explained therein.

The last date for receipt of tender is : 09-11-15 upto 3.00 PM at IWAI, office Noida.

Issuance of tender document will not construe that such bidders are automatically considered qualified.

Yours faithfully

Director (P&C)

INLAND WATERWAYS AUTHORITY OF INDIA

(Ministry of Shipping, Road Transport & Highways, Govt. of India)
Head Office: A-13, Sector–1, Noida-201301 (U.P.)

NOTICE INVITING TENDER No. IWAI/PR2/3(SLIPWAY)/2011-Vol-IV

Name of Work: **Development of Ship Repair Facility (Slipway) at Pandu, Guwahati, NW-2 – Civil, Mechanical and Electrical Works**

1. Inland Waterways Authority of India (IWAI) invites sealed tenders in two cover system (Cover I - Technical Bid and Cover II - Financial Bid) from experienced contractors for the work of Development of Ship Repair Facility (Slipway) at Pandu, Guwahati, NW-2.

   The complete bid as per the tender documents should be placed online at https://eprocure.gov.in/eprocure/app by 15:00 hours on 09.11.15 and will be opened online on same day at 1530 hours at IWAI, A-13, Sector-1, Noida-201301.

2. **Estimated Cost of the work is as under:**

Sl. No.	Name of the work	Estimated Cost (Rs. in Crore)	EMD (Rs in lakh)	Duration of work
1.	**Development of Ship Repair Facility (Slipway) at Pandu, Guwahati, NW-2 – Civil, Mechanical and Electrical Works**	43.55	53.55	30 months

3. Date of Download start date & Time: 14-10-15, 18:00Hrs.
4. Bid Submission start date & Time: 05-11-2015, 10:00 hrs
5. Bid Closing/Document Download End Date & Time: 09-11-15 till 15.00 hours.
6. Bid Opening Date & Time: 09-11-15 at 15.30 hour.
7. Pre Bid Meeting: 28-10-2015 at 15.00 hrs. (at IWAI Head office Noida)

TERMS & CONDITIONS:-

8. The tender document can be downloaded from the IWAI's website www.iwai.nic.in and CPP Portal Website https://eprocure.gov.in/eprocure/app. Bidders participating in e-tender process are required to furnish a non-refundable Demand Draft for Rs.5,000/- (Rupees Five thousand only) towards the tender cost, obtained from any Nationalised Bank drawn in favour of 'IWAI fund' payable at Noida so as to reach to the tender inviting officer before last date and time of submission of tender and upload a copy of the same in technical bid. The Bids are to be submitted only online at https://eprocure.gov.in/eprocure/app.

9. The tenderer shall meet the following pre-qualification criteria:
   i. The tenderer shall be registered with Central Public Works Department, Railways, MES and State PWD/ Irrigation Department, Port Trust etc. or non-registered contractors having experience of working with IWAI.

ii. Tenderer shall have Permanent Account Number issued by Income Tax Deptt.

iii. Average annual financial turnover during last three years ending 31st March of the previous financial year, should be at least 100% of the cost. Experience of having successfully completed similar works i.e. construction of bridge on well foundation, ROB, river training works or similar nature of works during last 7 years ending last day of month previous to the one in which this tender is invited should be either of following :

(a) Three similar works costing not less than 40% of the estimated cost; **or**
(b) Two similar works costing not less than 60% of the estimated cost; **or**
(c) One similar work completed not less than 80% of the estimated cost

AND

One completed work of any nature {either part of (a, b or c) or a separate one} costing not less than the amount equal to 40% of the estimated cost put to tender with some Central Government Department/State Government Department/ Central Autonomous Body/State Autonomous Body/Central Public Sector Undertaking/ State Public Sector Undertaking/City Development Authority/ Municipal Corporation of City formed under any Act by Central/ State Government and published in Central/State Gazette.

Note: The successful completion of the similar work should be supported with a completion certificate issued by the department/ agency for which the work has been executed.

iv. Latest certificate of solvency from nationalized / scheduled Bank included in the second schedule of the RBI Act for not less than the 40 % of estimated cost.

v. Average annual financial turnover on construction works should be at least 100% of the estimated cost during the immediate last 3 consecutive financial years and should not have incurred any loss in more than two years during the last five years ending March of the previous financial year.

vi. The tenderer shall submit Tender Cost in the form of Demand Draft and the Earnest Money Deposit in the form of Demand Draft / Demand Draft + Bank Guarantee as prescribed before closing date and time of submission of tender. Any/ all submissions made without the Earnest Money Deposit and without the Tender Cost and/ or received after the closing date mentioned shall be rejected.

10. A pre bid meeting will be held at IWAI Head office at A-13, sector-1, Noida on 28.10.15. The bidders are advised to visit the project site prior to the pre-bid meeting by contacting the Regional Office of IWAI at Guwahati. The minute of the pre-bid meeting will form part of the tender document therefore prospective bidders are requested to essentially attend the pre-bid meeting.

11. IWAI reserves the right to accept or reject any or all tenders without assigning any reason and no correspondence shall be entertained in this regard.

Director

PART-I

2 (a). TENDER ACCEPTANCE LETTER

(To be given on Company Letter Head)

Date:

To,

The Director (P&C)
Inland Waterways Authority of India,
A-13, Sector–1,
Noida-201301 (U.P.)

Sub: Acceptance of Terms & Conditions of Tender.

Tender no.: IWAI/PR2/3(SLIPWAY)/2011-Vol-IV

Name of Tender / Work: - Development of Ship Repair Facility (Slipway) at Pandu, Guwahati, NW-2 – Civil, Mechanical and Electrical Works

Dear Sir,

1. I/ We have downloaded / obtained the tender document(s) for the above mentioned 'Tender/Work' from the web site(s) namely: www.iwai.nic.in OR https://eprocure.gov.in/eprocure/app **as per your advertisement, given in the above mentioned website(s).**

2. I / We hereby certify that I / we have read the entire terms and conditions of the tender documents from Page No. _____ to _____ (including all documents like annex(es), schedule(s), etc .,), which form part of the contract agreement and I / we shall abide hereby by the terms / conditions / clauses contained therein.

3. The minutes of the pre-bid meeting and/ or corrigendum(s) issued from time to time by your department/ organisation too have also been taken into consideration, while submitting this acceptance letter.

4. I / We hereby unconditionally accept the tender conditions of above mentioned tender document(s) / minutes of the pre-bid meeting/corrigendum(s) in its totality / entirety.

5. In case any provisions of this tender are found violated , then your department/ organisation shall without prejudice to any other right or remedy be at liberty to reject this tender/bid including the forfeiture of the full said earnest money deposit absolutely.

Yours Faithfully
(Signature of the Bidder, with Official Seal)

PART-I

3 (b). FORM OF TENDER

To,

The Director (P&C)
Inland Waterways Authority of India,
A-13, Sector–1,
Noida-201301 (U.P.)

Name of Work: Development of Ship Repair Facility (Slipway) at Pandu, Guwahati, NW-2 – Civil, Mechanical and Electrical Works

Sir,

1. Having visited the site and examined the information and instructions for submission of tender, general conditions of contract, Special Condition of contracts, Technical, General and Detailed specification, Schedules and Bill of Quantities, agreement and bank guarantee forms, etc. for the above named works, I/ We hereby tender for execution of the works referred to in the tender documents in conformity with the said Conditions of Contract, Specifications, Schedule of quantities for the sum as stated in Bill of quantities of this tender Document or such other sum as may be ascertained in accordance with the said conditions of contract.

2. I/ We undertake to complete and Deliver the whole of the works comprised in the Contract within the time as stated in the tender and also in accordance in all respects with the specifications, designs, drawings and instructions as mentioned in the tender documents.

3. I am tendering for the work and submitting the EMD in the form of demand draft and Bank Guarantee in favour of IWAI Fund payable at Noida at Nationalised / schedule bank.

4. I/ We agree to abide by this tender. I/ We agree to keep the tender open for a period of 120 days from the date of opening of price bids or extension thereto as required by the IWAI and not to make any modifications in its terms and conditions.

5. I/ We agree, if I/ we fail to keep the validity of the tender open as aforesaid or I/ we make any modifications in the terms and conditions of my/ our tender if I/ We fail to commence the execution of the works as above, I/ We shall become liable for forfeiture of my/ our Earnest money, as aforesaid and IWAI shall without any prejudice to another right or remedy, be at the liberty to forfeit the said Earnest Money absolutely otherwise the said earnest money shall be retained by IWAI towards part of security deposit to execute all the works referred to in the tender documents upon the terms and conditions contained or referred to therein and to carry out such deviations as may be ordered. Should this tender be accepted, I/ We agree to abide by and fulfill all the terms and conditions and provisions of this tender. No interest is payable on earnest money deposit and/ or security deposit.

6. I/ We have independently considered the amount of Liquidated Damages shown in the tender hereto and agree that it represents a fair estimate of the loss likely to be suffered by IWAI in the event of works not being completed in time.

7. If this tender is accepted, I/ We undertake to enter into execute at my/ our cost when called upon by the employer to do so, a contract agreement in the prescribed form. Unless and until a formal Agreement is prepared and executed this tender together with your written acceptance thereto shall constitute a binding contract.

8. If my/ our tender is accepted, I/We am/are to be jointly and severely responsible for the due performance of the Contract. I/We also declare that the firm has not been banned or blacklisted by any Govt. or its department or any Quasi Govt. agency or Public Sector Undertaking or Multilateral or International Aid Agency/Development Bank.

9. I/ We understand that you are not bound to accept the lowest or any Tender you may receive and may reject all or any tender without assigning any reason.

10. I/ We certify that the tender submitted by me, us is strictly in accordance with the terms, conditions, specifications etc. as contained in the tender document, and it is further certified that it does not contain any deviation to the aforesaid documents.

Date ……..

Signature ……
Name …….
Designation ……

duly authorized to sign & submit tender for an on behalf of (Name and address of firm)

M/s ……..
……..
Telephone No……Fax No……..

Witness :
Signature……..
Name : ……..
Occupation ……..
Address ……..
Telephone nos.

3 INSTRUCTIONS FOR SUBMISSION OF BID

INLAND WATERWAYS AUTHORITY OF INDIA
(Ministry of Shipping, Road Transport & Highways; Govt. of India)
Head Office: A-13, Sector–1, Noida-201301 (U.P.)

1. All covering letters and information to be included in the bid shall be submitted along with the bid itself.

2. This tender schedule is only for the work of "**Development of Ship Repair Facility (Slipway) at Pandu, Guwahati, NW-2"**

3. Estimated Cost of the work is as under:

   - Estimated Cost: (Rs. 43.55 Crores)

4. Tender should be submitted online at https://eprocure.gov.in/eprocure/app by 15:00 hours on 09.11.15 **in two bid system i.e.** Technical & Commercial Bid & Price Bid of offer and will be opened online on same day at 1530 hours at IWAI, A-13, Sector-1, Noida-201301.

4.1 Technical Bid:

The technical bid shall be submitted online along with scanned copy of the following documents

a) Scanned copy of the 'Tender Acceptance Letter' duly signed and stamped.
b) Scanned copy of the 'Form of Tender' duly signed and stamped.
c) Scanned copy of the demand draft for the cost of the bidding documents must be uploaded. The original demand draft is to be deposited in the office before the bid submission closing date & time.
d) Earnest Money Deposit (Demand Draft or as prescribed in clause 6 hereunder). Scanned copy must be uploaded. The original demand draft and Bank Guarantee as the case may be is to be deposited in the office before the bid submission closing date & time.
e) Registration certificate from concerned Authorities.
f) Details of experience in the form at **Annex-2** and copies of experience certificate. (Experience certificate for the works of similar nature with satisfactory performance).
g) Latest Solvency certificate for not less than Rs. 17.42 Cr issued by Nationalised / Scheduled bank, which should not be older than 3 months from the last date of bid submission.
h) Letter of Authority for signing and negotiation of tender (as the case may be).
i) Duly signed Integrity Pact (given in Part-II, General conditions)
j) Permanent Account Number (PAN) issued by Income Tax Department.
k) Audited balance sheets along with turnover, profit and loss account for the last 3 years i.e. ending March 2013, 2014 and 2015.

l) An undertaking that the bidder has, prior to submission of bid, visited the project site and is familiar with site conditions including but not limited to availability of manpower, materials, access to site and all other aspects relevant for timely execution and completion of the tendered works.

n) Details of equipments proposed to be deployed for the work including their present location and current commitments in **Annex-3**.

o) Service Tax Registration number including copy of registration certificate.

p) List of Key staff as per **Annex-4**

4.2 Price Bid:

The price bid shall be submitted online for:

(i) Schedule of Prices duly filled in the specified form.

(j) It may please be noted that this part shall not contain any terms & conditions. Any condition given in the price bid) will be a sufficient cause for rejection of bid.

5. Bidders are advised to submit quotation strictly based upon technical specification, terms and conditions contained in technical specifications, terms and conditions contained in documents and not to stipulate any deviations. Any change in this may lead to rejection of bid.

6. Earnest Money Deposit for the tendered work in the Notice inviting tender should be submitted in the following manner:

a) 100% (Rs. 53.55 Lakhs) by Demand Draft "OR"

b) Rs.20.00 Lakhs by Demand Draft and remaining Rs 33.55 Lakhs as Bank Guarantee

The Demand Draft to be drawn in favour of "IWAI-Fund" payable at Noida on any Nationalised/ Scheduled Bank of India. The Bank Guarantee submitted as EMD to be in the prescribed proforma **(Annex-1)** and valid for 120 days beyond the validity of the bid issued by Nationalised or scheduled Bank.

The original demand draft for tender fee and EMD as well as the Bank Guarantee as specified above, towards the EMD should be deposited before closing date and time of submission of bid at IWAI, A-13, Sector-1, Noida-201301. In case the EMD and tender fee does not reach the Office of Tender Inviting Authority before submission date and time of the bid, the bid is liable for rejection.

The Earnest Money of the successful Bidder submitted in the form of Demand Draft will be retained as Security Deposit and that given in the form of Bank Guarantee will be discharged when the Bidder has signed the Agreement after furnishing the required Performance Security.

The Bid Security / Earnest Money will be forfeited if the Bidder withdraws the Bid after its submission during the period of Bid validity or in the case of a successful

Bidder, if the Bidder fails within the specified time limit to sign the Agreement; and/or to furnish the required Performance Security.

7. Any annotations or accompanying documentation in the bid shall be in Hindi or English language only and in metric system. Tenders filled in any other language will be summarily rejected.

8. Bidders shall sign their proposal with the exact name of the firm to whom the bid document has been issued. The bid shall be duly signed and sealed by an authorized person of the bidder's organization as following:

8 (a) If the Tender is submitted by an individual, it shall be signed by the proprietor above his full name and full name of his firm with its current business address.

8 (b) If the Tender is submitted by the proprietary firm, it shall be signed by the proprietor above his full name and full name of his firm with its name and current business address.

8 (c) If the Tender is submitted by a firm in partnership, it shall be signed by all the partners of the firm above, their full names and current business address, or by a partner holding the power of attorney for the firm for signing the Tender in which cases a certified copy of the power of attorney shall accompany the Tender. A certified copy of the partnership deed and current business address of all the partners of the firm shall also accompany the Tender.

8 (d) If the Tender is submitted by a limited company, or a limited Corporation, it shall be 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. 'Satisfactory evidence' means the certificate of incorporation of the limited company or corporation under Indian Companies Act, 1956.

8 (e) If the Tender is submitted by a group of firms, the sponsoring firm shall be submit complete information pertaining to each firm in the group and state along with the bid as to which of the firm shall have the responsibility for tendering and for completion of the contract document and furnish evidence admissible in law in respect of the authority assigned to such firm on behalf of the group of firms for tendering and for completion of the contract document. The full information and satisfactory evidence pertaining to the participation of each member of the group of firm in the firm in the Tender shall be furnished alongwith the Tender.

8 (f) All witnesses and sureties shall be persons of status and their full names, occupations and addresses shall be stated below their signatures. All signatures affixed in each page in the tender will be dated.

9. Bidders shall clearly indicate their legal constitution and the person signing the tender shall state his capacity and also the source of his ability to bind the bidder. The power of attorney or authorization or any other document constituting adequate proof of the ability of the signatory to bind the bidder shall be annexed to the bid. The Owner may reject outright any bid unsupported by adequate proof of the signatory's authority.

10. The bid document shall be completed in all respects and shall be submitted together with the requisite information and appendices. They shall be complete and free from ambiguity, change or inter-lineation. In case IWAI requires any information/ clarification(s) from the Bidder in respect of the bid documents, the bidder shall be required to furnish the same in writing, to IWAI at the earliest where no time is specified by IWAI to furnish the same. A failure to furnish the same shall entitle IWAI to cancel/ reject the bid

11. If the space in the bid form or in the Appendices thereto is insufficient, additional pages shall be separately added. These pages shall be consecutively page numbered and shall also be signed by the Bidder.

12. Bidders should indicate at the time of quoting against this bid their full postal addresses, telephone numbers and other communication details enabling IWAI to contact the bidder in case the need so arise.

13. IWAI shall have an unqualified option under the said bid bond to claim the amount there under in the event of the Bidder failing to keep the bid valid up to the date specified or refusing to accept work or carry it out in accordance with the bid if the IWAI decides to award the Work to the Bidder.

14. The EMD shall be retained with the IWAI until finalization of tenders. Further, security deposit as per the clause of Security shall be payable by the successful bidder. If the tenderer fails to furnish the security deposit in accordance with tender conditions EMD shall be forfeited. In the event of the Bidder becoming the successful Contractor. The amount of EMD would be adjusted against the Security deposit.

15. IWAI shall, however, arrange to release the EMD in respect of unsuccessful bidders within 30 (thirty) days of placement of order to successful bidder. No interest shall be payable on EMD by IWAI.

16. The Tender Evaluation Committee (TEC) shall open the tenders in the presence of the intending tenderers who may be present at the date and time of opening informed in the bid document or subsequently. If any of the tenderer or his agent is not present at the time of opening of tender, the TEC shall, on opening of tenders of the absentee tenderer, prepare a statement of the attested and unattested corrections in the tender over their signature. Such a list shall then be binding on the absentee tenderer.

17. The successful tenderers shall be required to execute a contract agreement in the given format. In case of any refusal/ failure on the part of such successful tenderer to execute such a contract shall be deemed to be a failure on the part of such successful bidder to comply with the terms contained herein.

18. Qualification of the Bidder

18.1 This invitation for online bids is open to all reputed and resourceful contractors fulfilling the criteria given under Terms and Conditions in the Tender Notice and as regards the size / value of experience in execution of similar works during past seven years, the factor specified below shall be used to bring the value of such completed works at the level of current financial year i.e. 2015-16.

Year Before	Multiplying Factor
One ……	1.07
Two ……..	1.14
Three …….	1.21
Four ……..	1.28
Five ……..	1.35
Six ……..	1.42
Seven …….. .	1.49

19.0 Each Bidder shall submit only one online Bid for the work. A Bidder who submits more than one Bid will cause proposals with the Bidder's participation to be disqualified.

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

21.0 The bidder is expected to examine carefully all instructions, conditions of contract, contract data, terms, specifications, forms and drawings in the Bid Document. Failure to comply with the requirements of Bid Documents shall be at the bidder's own risk. Pursuant to clause 33 hereof, bids, which are not substantially responsive to the requirements of the Bid Documents, shall be rejected.

22.0 Clarification of Bidding Documents

22.1 A prospective Bidder requiring any clarification of the bidding documents may notify the Tender Inviting Authority in writing, by facsimile or email at the address indicated in the Tender Notice / Notice Inviting Tender. The tender inviting authority will respond to any request for clarification received earlier than 7 days prior to the deadline for submission of bids. Copies of the response will be forwarded to all purchasers of the bidding documents / will be uploaded to the web sites, including a description of the inquiry, but without identifying its source.

22.2 If a pre-bid meeting is to be held, the bidder or his official representative is invited to attend it. Its date, time and address are given in the NIT or will be published. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage. The bidder is requested to submit any questions in writing or by fax or e-mail so as to reach the Owner not later than one week before the meeting. Minutes of the meeting, including the text of the questions raised (without identifying the source of the enquiry) and the responses given will be uploaded. Non-attendance at the pre-bid meeting will not be a cause for disqualification of a bidder. **The minute of the pre-bid meeting would form the part of the tender document.**

23.0 Amendment of Bidding Documents :

Before the deadline for online submission of bids, the Owner may modify/amend/make addition in the bidding documents for any reason, whether at its own initiative or in response to clarification requested by a prospective bidder by issuing addenda/corrigendum. Any addendum/corrigendum/ minutes of pre bid meeting uploaded on website shall be part of the bidding documents. Corrigendum/Addendum. Minutes of pre bid meeting will be available on website. The modification /amendment / additions in the bidding document shall be binding on the prospective bidders. To give prospective bidders reasonable time in which to take a corrigendum/addendum/ minutes of pre bid meeting into account in preparing their bids, the Owner may extend, as necessary, the deadline for submission of bids.

24.0 **Bid Prices :**

The Contract shall be for the whole Works, as described, based on the cost schedule submitted by the Bidder. The bidder shall quote rates and prices for all items of the Works described in the cost schedule. All duties, taxes, royalties and other levies payable by the Contractor under the Contract, or for any other cause, shall be included in the rates, prices, and total Bid price submitted by the Bidder except for service tax which shall be reimbursed to the contractor on production of proof of payment. **The rates and prices quoted by the Bidder shall be fixed for the duration of the Contract and shall not be subject to any adjustment.** The prices shall be quoted by the bidder entirely in Indian Rupees. All payments shall be made in Indian Rupees.

25.0 **Bid Validity:** Bids shall remain valid for a period of 120 days after the last date for bid submission. A bid valid for a shorter period will be treated as non-responsive and shall be rejected.

In exceptional circumstances, prior to expiry of the original time limit, the IWAI may request the bidders to extend the period of validity for a specified additional period. The request and the bidders' responses shall be made in writing. A bidder may refuse the request without forfeiting his bid security. A bidder agreeing to the request will not be required or permitted to modify his bid, but will be required to extend the validity of his bid security.

26.0 Bidder shall submit offers that fully comply with the requirement of the bidding document including conditions of contra. Conditional offer or alternate offer will not be considered in the process of tender evaluation.

27.0 The Bidder shall submit online bid and the Bid shall be signed by a person or persons duly authorized to sign on behalf of the Bidder. All pages of the Bid shall be signed by the person or persons signing the Bid. The Bid shall contain no overwriting, alterations or additions, except those to comply with instructions issued by the Tender Inviting Authority

28.0 ***Submission of Bids:*** *The Bidder shall submit online bids. Complete online Bids (including Technical and Financial) must be received by the bid submission closing date and time. The Tender inviting Authority may extend the deadline for submission of bids by issuing an amendment, in which case all rights and obligations of the Owner and the bidders previously subject to the original deadline will then be subject to the new deadline.*

29.0 **Modification and Withdrawal of Bids:** Bidders may modify or withdraw their bids online before the deadline prescribed .Withdrawal or modification of a Bid between the deadline for submission of bids and the expiration of the original period of bid validity specified or as extended shall result in the forfeiture of the Bid security.

30.0 ***Bid Opening and Evaluation***

30.1 Online Bid opening shall be carried out in two stages. Firstly, 'Technical Bid' of all the online bids received shall be opened on the date and time mentioned. 'Financial Bid'

of those bidders whose technical bid has been determined to be responsive and on evaluation fulfills the criteria shall be opened on a subsequent date, which will be notified to such bidders.

30.2 The Owner will open the online "Technical Bid" of all the bids received in the presence of the bidders/bidders' representatives who choose to attend at the time, date and place specified. In the event of the specified date for the submission of bids being declared a holiday for the Owner, the Bids will be opened at next immediate convenient time & date which will be notified through the web site.

30.2 Bidder's names and such other details like EMD furnished, as the Owner may consider appropriate will be announced by the Owner after the opening.

30.3 After the opening of the technical bids, their evaluation will be taken up with respect to bid security, qualification and other information furnished in Technical bid. Thereafter, on fulfilling the criteria laid down in Bid Evaluation, a list will be drawn up of the responsive bids whose financial bids are eligible for consideration.

30.4 The Owner shall inform the bidders, whose technical bids are found responsive, of the date, time and place of opening of the financial bids. The bidders so informed, or their representative, may attend the online opening of financial bids.

30.5 At the time of the online opening of the 'Financial Bid', the names of the bidders whose bids were found responsive and the Bid prices, the total amount of each bid and such other details as the Owner may consider appropriate will be announced by the Owner.

31.0 Process to be Confidential

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

32.0. Clarification of Bids and Contacting the Owner

32.1 During the evaluation of the bids, the owner may, at its discretion, ask the bidder to provide any additional information/clarification in relation to its bids as may be deemed fit by the owner. The bidder shall in all cases where such request has been made by the owner, submit such information/clarification within such period and in such manner as may be specified by the owner in the request so made. In the event of failure of the bidder to furnish such additional information as may be requested by the owner, the owner may, in its sole discretion, deem such bid as non-responsive. The bidder shall not have any right to challenge the same or any claims arising from such bid being deemed non-responsive by the owner.

32.2 No bidder shall contact the owner on any matter relating to its bid from the time of the bid opening to the time the contract is awarded. Any attempt by the bidder to influence the Owner's bid evaluation, bid comparison or contract award decision may result in the rejection of his bid.

33.0 Examination of Bids and Determination of Responsiveness

During the detailed evaluation of "Technical Bids", the Owner will first determine whether each Bid (a) meets the eligibility criteria (b) has been properly signed; (c) is accompanied by the required securities; and (d) is responsive to the requirements of the bidding documents.

After the above process is completed, the technical specification/offer of the responsive bidders will be examined with respect to technical specifications provided in the tender document. Clarifications, if any, at this stage in respect of the technical parameters offered by the bidder will be sought from the bidders. Thereafter, the bids, which conform, to the terms, conditions, and specifications of the bidding documents, without material deviation or reservation will be considered as responsive for evaluation.

34.0 Evaluation of Bids

34.1 Selection of the bidder for the tendered work will be based on technical and financial evaluation.

34.2 Technical evaluation shall be based on the bidder satisfying the eligibility criteria stated in the Tender Notice AND the bidder furnishing all documents / certificates / undertakings as specified in clause 4.1 under INSTRUCTIONS FOR SUBMISSION OF BID.

34.3 Verification of the facts furnished by the bidders may be made prior to finalizing the technical evaluation

34.4 If the bidder does not fulfill the above criteria his bid shall be technically disqualified and his financial bid shall not be opened.

34.5 The evaluation of the financial bid will be based on the lowest financial offer received for the work.

35.0 Award of Contract

35.1. Subject to Clause 36, the Owner will award the Contract to the Bidder after evaluation as per Clause 34.

35.2. Owner has the right to accept any Bid and to reject any or all Bids and split the work or Increase and Decrease work. Notwithstanding Clause 35.1, the Owner also reserves the right to cancel the bidding process and reject all bids, at any time prior to the award of Contract, without thereby incurring any liability to the affected Bidder or bidders or any obligation to inform the affected Bidder or bidders of the grounds for the Owner's action.

36.0. Notification of Award and Signing of Agreement.

36.1 The bidder whose Bid has been accepted will be notified of the award by the Owner prior to expiration of the Bid validity period and this letter will be called "Letter of Acceptance" or "Work order" which will state the sum that the Owner will pay to the Contractor in consideration of the execution and completion of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price") and also the time period for completion of the works.

36.2. The notification of award will constitute the formation of the Contract, subject only to the furnishing of a performance security in accordance with the provisions of Clause 37.

36.3. The Agreement will incorporate all agreements between the Owner and the successful Bidder. It will be signed by the Owner and the successful Bidder after the performance security is furnished and within 15 days of issuance of Letter of Acceptance.

36.4 Upon the furnishing of the Performance Security by the successful Bidder, the other Bidders will be informed that their Bids have been unsuccessful.

37.0 Performance Security

37.1 Within 15 (fifteen) days of issue of the Letter of Acceptance, the successful Bidder shall deliver to the Owner a Performance Security equivalent to five percent [5%] of the Contract Price.

37.2 The performance security shall be in the form of Demand draft in favour of "IWAI Fund" payable at Delhi / Noida or an irrevocable Bank Guarantee in the name of the Owner, valid till the scheduled completion date of the works under the contract and 90 days beyond issued by a Nationalised bank / Scheduled bank in India.

37.3 Failure of the successful bidder to comply with the requirement of sub-clause 37.1 shall constitute sufficient ground for cancellation of the award and forfeiture of the bid security.

38.0 Corrupt or Fraudulent Practices

The Owner will reject a proposal for award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question and will declare the firm ineligible, either indefinitely or

for a stated period of time, to be awarded a contract with Inland Waterways Authority of India and any other agencies, if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for the contractor, or in execution.

The Owner requires the bidders/Contractors to strictly observe the laws against fraud and corruption enforced in India, namely, Prevention of Corruption Act, 1988.

39. Instructions to the Bidders for the submission of bids online through the e-Procurement Portal https://eprocure.gov.in/eprocure/app

39.1 Possession of valid Digital Signature Certificate (DSC) and enrollment/registration of the consultants/bidders on the e-procurement/e-tender portal is a prerequisite for e-tendering.

39.2 Bidder should do the enrollment in the e-Procurement site using the https://eprocure.gov.in/eprocure/app option available "Enroll Here" on the home page. Portal. Enrollment is free of charge. During enrollment/registration, the bidders should provide the correct/true information including valid email-id. All the correspondence shall be made directly with the contractors/bidders through email-id provided.

39.3 Bidder need to login to the site through their user ID/ password chosen during enrollment/registration.

39.4 Then the Digital Signature Certificate (Class II or Class III Certificates with signing key usage) issued by SIFY/TCS/ nCode/ eMudra or any Certifying Authority recognized by CCA India on eToken/ Smar Card, should be registered.

39.5 The DSC that is registered only, should be used by the bidder and should ensure safety of the same.

39.6 Contractor/Bidder may go through the tenders published on the site and download the required tender documents/schedules for the tenders he/she is interested.

39.7 After downloading / getting the tender document/schedules, the Bidder should go through them carefully and then submit the documents as asked.

39.8 If there are any clarifications, this may be obtained online through the tender site, or through the contact details. Bidder should take into account of the corrigendum published before submitting the bids online.

39.9 Bidder then logs in to the site through the secured log in by giving the user id/ password chosen during enrolment/registration and then by giving the password of the eToken/ Smart Card to access DSC.

39.10 Bidder selects the tender which he/she is interested in by using the search option and then moves it to the 'my favourites' folder.

39.11 From the favourites folder, he selects the tender to view all the details indicated.

39.12 It is construed that the bidder has read all the terms and conditions before submitting their offer. Bidder should go through the tender schedules carefully and upload the documents as asked, otherwise, the bid will be rejected.

39.13 Bidder, in advance, should get ready the bid documents to be submitted as indicated in the tender document/schedule and generally, they can be in general PDF/xls/rar/jpg formats. If there is more than one document, they can be clubbed together and can be provided in the requested format. Each document to be uploaded through online for the tenders should be less than 2 MB. If any document is more than 2MB, it can be reduced through zip/rar and the same can be uploaded, if permitted.

39.14 If there are any clarifications, this may be obtained through the site, or during the pre-bid meeting if any. Bidder should take into account the corrigendum published from time to time before submitting the online.

39.15 The Bidders can update well in advance, the documents such as certificates, annual report details etc., under My Space option and these can be selected as per tender requirements and then send along with bid documents during bid submission. This will facilitate the bid submission process faster by reducing upload time of bids.

39.16 Bidder should submit the Tender Fee/ EMD as specified in the tender. The original payment instruments should be posted/couriered/given in person to the Tender Inviting Authority within the due date as mentioned in this tender document. Scanned copy of the instrument should be uploaded as part of the offer, if asked for.

39.17 While submitting the bids online, the bidder reads the terms & conditions and accepts the same to proceed further to submit the bid packets.

39.18 The bidder has to select the payment option as offline to pay the Tender FEE/ EMD as applicable and enter details of the instruments.

39.19 The details of the DD/any other accepted instrument, physically sent, should tally with the details available in the scanned copy and the data entered during bid submission time. Otherwise submitted bid will not be acceptable.

39.20 The bidder has to digitally sign and upload the required bid documents one by one as indicated. Bidders to note that the very act of using DSC for downloading the bids and uploading their offers shall be deemed to be a confirmation that they have read all sections and pages of the bid document including General conditions of contract without any exception and have understood the entire document and are clear about the requirements of the tender requirements.

39.21 The bidder has to upload the relevant files required as indicated in the cover content. In case of any irrelevant files, the bid will be rejected.

39.22 If the price bid format is provided in a spread sheet file like BoQ_xxxx.xls, the rates offered should be entered in the allotted space only and uploaded after filling the relevant columns. The Price Bid/BOQ template must not be modified/replaced by the bidder, else the bid submitted is liable to be rejected for this tender.

39.23 The bidders are requested to submit the bids through online e-tendering system to the Tender Inviting Authority (TIA) well before the bid submission end date & time (as per Server System Clock). The TIA will not be held responsible for any sort of delay or the difficulties faced during the submission of bids online by the bidders at the eleventh hour.

39.24 After the bid submission, the acknowledgement number, given by the e-tendering system should be printed by the bidder and kept as a record of evidence for online submission of bid for the particular tender and will also act as an entry pass to participate in the bid opening date.

39.25 The bidder should ensure/see that the bid documents submitted should be free from virus and if the documents could not be opened, due to virus, during tender opening, the bid is likely /liable to be rejected.

39.26 The time settings fixed in the server side & displayed at the top of the tender site, will be valid for all actions of requesting, bid submission, bid opening etc., in the e-tender system. The bidders should follow this time during bid submission.

39.27 All the data being entered by the bidders would be encrypted using PKI encryption techniques to ensure the secrecy of the data. The data entered will not viewable by unauthorized persons during bid submission & not be viewable by any one until the time of bid opening.

39.28 Any bid document that is uploaded to the server is subjected to symmetric encryption using a system generated symmetric key. Further this key is subjected to asymmetric encryption using buyers/bid opener's public keys. Overall, the uploaded tender documents become readable only after the tender opening by the authorized bid openers.

39.29 The confidentiality of the bids is maintained since the secured Socket Layer 128 bit encryption technology is used. Data storage encryption of sensitive fields is done.

39.30 The bidder should logout of the tendering system using the normal logout option available at the top right hand corner and not by selecting the (X) exit option in the browser.

39.31 Any queries relating to the tender document and the terms and conditions contained therein should be addressed to the Tender Inviting Authority for a tender or the relevant contact person indicated in the tender.

39.32 Any queries relating to the process of online bid submission or queries relating to CPP Portal in general may be directed to the 24x7 CPP Portal Helpdesk. The contact number for the helpdesk is 1800 233 7315.

PART – II

5. GENERAL CONDITIONS.

(i) Integrity Pact

(ii) Schedules

(iii) General Conditions of Contract.

PART-II

5 GENERAL CONDITIONS

To be signed by the bidders' and same signatory competent/ authorized to sign the relevant contract on behalf of IWAI.

INTEGRITY AGREEMENT

This Integrity Agreement is made at ..... on this ..... day of 2015

BETWEEN

Chairperson, Inland Waterways Authority of India represented through ----------, Inland Waterways Authority of India, A - 13, Sec. – 1, Noida.

IWAI, (Hereinafter referred as the 'Principal/ Owner', which expression shall unless repugnant to the meaning or context hereof include its successors and permitted assigns)

AND

.....
(Name and Address of the Individual/firm/Company)
through .....(Hereinafter referred to as the
(Details of duly authorized signatory)
"Bidder/Contractor" and which expression shall unless repugnant to the meaning or context hereof include its successors and permitted assigns)

Preamble

WHEREAS the Principal / Owner has floated the Tender (NIT No. IWAI/PR2/3(SLIPWAY)/2011Vol-IV) (hereinafter referred to as "Tender/Bid") and intends to award, under laid down organizational procedure, contract for "Development of Ship Repair Facility (Slipway) at Pandu, Guwahati, NW-2" hereinafter referred to as the "Contract".

AND WHEREAS the Principal/Owner values full compliance with all relevant laws of the land, rules, regulations, economic use of resources and of fairness/transparency in its relation with its Bidder(s) and Contractor(s).

AND WHEREAS to meet the purpose aforesaid both the parties have agreed to enter into this Integrity Agreement (hereinafter referred to as "Integrity Pact" or "Pact"), the terms and conditions of which shall also be read as integral part and parcel of the Tender/Bid documents and Contract between the parties.

NOW, THEREFORE, in consideration of mutual covenants contained in this Pact, the parties hereby agree as follows and this Pact witnesses as under:

Article 1: Commitment of the Principal/Owner

1) The Principal/Owner commits itself to take all measures necessary to prevent corruption and to observe the following principles:

   (a) No employee of the Principal/Owner, personally or through any of his/her family members, will in connection with the Tender, or the execution of the Contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

   (b) The Principal/Owner will, during the Tender process, treat all Bidder(s) with equity and reason. The Principal/Owner will, in particular, before and during the Tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential / additional information through which the Bidder(s) could obtain an advantage in relation to the Tender process or the Contract execution.

   (c) The Principal/Owner shall endeavour to exclude from the Tender process any person, whose conduct in the past has been of biased nature.

2) If the Principal/Owner obtains information on the conduct of any of its employees which is a criminal offence under the Indian Penal code (IPC)/Prevention of Corruption Act, 1988 (PC Act) or is in violation of the principles herein mentioned or if there be a substantive suspicion in this regard, the Principal/Owner will inform the Chief Vigilance Officer and in addition can also initiate disciplinary actions as per its internal laid down policies and procedures.

Article 2: Commitment of the Bidder(s)/Contractor(s)

1. It is required that each Bidder/Contractor (including their respective officers, employees and agents) adhere to the highest ethical standards, and report to the IWAI all suspected acts of fraud or corruption or Coercion or Collusion of which it has knowledge or becomes aware, during the tendering process and throughout the negotiation or award of a contract.

2. The Bidder(s)/Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the Tender process and during the Contract execution:

   a) The Bidder(s)/Contractor(s) will not, directly or through any other person or firm, offer, promise or give to any of the Principal/Owner's employees involved in the tender process or execution of the contract or to any third person any material or other benefit which he/she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the Tender process or during the execution of the contract.

   b) The Bidder(s)/Contractor(s) will not enter with other Bidder(s) into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to cartelize in the bidding process.

   c) The Bidder(s)/Contractor(s) will not commit any offence under the relevant IPC/PC Act. Further the Bidder(s)/Contract(s) will not use improperly, (for the purpose of competition or personal gain), or pass on to others, any information or documents provided by the

Principal/Owner as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

d) The Bidder(s)/Contractor(s) of foreign origin shall disclose the names and addresses of agents/representatives in India, if any. Similarly Bidder(s)/Contractor(s) of Indian Nationality shall disclose names and addresses of foreign agents/representatives, if any. Either the Indian agent on behalf of the foreign principal or the foreign principal directly could bid in a tender but not both. Further, in cases where an agent participate in a tender on behalf of one manufacturer, he shall not be allowed to quote on behalf of another manufacturer along with the first manufacturer in a subsequent/parallel tender for the same item.

e) The Bidder(s)/Contractor(s) will, when presenting his bid, disclose any and all payments he has made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the Contract.

3. The Bidder(s)/Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

4. The Bidder(s)/Contractor(s) will not, directly or through any other person or firm indulge in fraudulent practice means a willful misrepresentation or omission of facts or submission of fake/forged documents in order to induce public official to act in reliance thereof, with the purpose of obtaining unjust advantage by or causing damage to justified interest of others and/or to influence the procurement process to the detriment of the Government interests.

5. The Bidder(s)/Contractor(s) will not, directly or through any other person or firm use Coercive Practices (means the act of obtaining something, compelling an action or influencing a decision through intimidation, threat or the use of force directly or indirectly, where potential or actual injury may befall upon a person, his/ her reputation or property to influence their participation in the tendering process).

Article 3: Consequences of Breach

Without prejudice to any rights that may be available to the Principal/Owner under law or the Contract or its established policies and laid down procedures, the Principal/Owner shall have the following rights in case of breach of this Integrity Pact by the Bidder(s)/Contractor(s) and the bidder/contractor accepts and undertakes to respect and uphold the Principal/Owner's absolute right:

1. If the Bidder(s)/Contractor(s), either before award or during execution of Contract has committed a transgression through a violation of Article 2 above or in any other form, such as to put his reliability or credibility in question, the Principal/Owner after giving 14 days' notice to the contractor shall have powers to disqualify the Bidder(s)/Contractor(s) from the tender process or terminate/determine the Contract, if already executed or exclude the Bidder/Contractor from future contract award processes. The imposition and duration of the exclusion will be determined by the severity of transgression and determined by the Principal/Owner. Such exclusion may be forever or for a limited period as decided by the Principal/Owner.

2. Forfeiture of EMD/Performance Guarantee/Security Deposit: If the Principal/Owner has disqualified the Bidder(s) from the tender process prior to the award of the contract or terminated/determined the contract or has accrued the right to terminate/determine the contract according to Article 3(1), the Principal/Owner apart from exercising any legal rights that may have

accrued to the Principal/Owner, may in its considered opinion forfeit the entire amount of Earnest Money Deposit, Performance Guarantee and Security Deposit of the Bidder/Contractor.

3. Criminal Liability: If the Principal/Owner obtains knowledge of conduct of a bidder or Contractor, or of an employee or a representative or an associate of a bidder or Contractor which constitutes corruption within the meaning of IPC Act, or if the Principal/Owner has substantive suspicion in this regard, the Principal/Owner will inform the same to law enforcing agencies for further investigation.

Article 4: Previous Transgression

1) The Bidder declares that no previous transgressions occurred in the last 5 years with any other Company in any country confirming to the anticorruption approach or with Central Government or State Government or any other Central/State Public Sector Enterprises in India that could justify his exclusion from the Tender process.

2) If the Bidder makes incorrect statement on this subject, he can be disqualified from the Tender process or action can be taken for banning of business dealings/ holiday listing of the Bidder/Contractor as deemed fit by the Principal/ Owner.

3) If the Bidder/Contractor can prove that he has resorted / recouped the damage caused by him and has installed a suitable corruption prevention system, the Principal/Owner may, at its own discretion, revoke the exclusion prematurely.

Article 5: Equal Treatment of all Bidders/Contractors/Subcontractors

1) The Bidder(s)/Contractor(s) undertake(s) to demand from all subcontractors a commitment in conformity with this Integrity Pact. The Bidder/Contractor shall be responsible for any violation(s) of the principles laid down in this agreement/Pact by any of its Subcontractors/ sub-vendors.

2) The Principal/Owner will enter into Pacts on identical terms as this one with all Bidders and Contractors.

3) The Principal/Owner will disqualify Bidders, who do not submit, the duly signed Pact between the Principal/Owner and the bidder, along with the Tender or violate its provisions at any stage of the Tender process, from the Tender process.

Article 6: Duration of the Pact

This Pact begins when both the parties have legally signed it. It expires for the Contractor/Vendor 12 months after the completion of work under the contract or till the continuation of defect liability period, whichever is more and for all other bidders, till the Contract has been awarded.

If any claim is made/lodged during the time, the same shall be binding and continue to be valid despite the lapse of this Pacts as specified above, unless it is discharged/determined by the Competent Authority, IWAI.

Article 7: Other Provisions

1) This Pact is subject to Indian Law, place of performance and jurisdiction is the Headquarters of the Division of the Principal/Owner, who has floated the Tender.

2) Changes and supplements need to be made in writing. Side agreements have not been made.

3) If the Contractor is a partnership or a consortium, this Pact must be signed by all the partners or by one or more partner holding power of attorney signed by all partners and consortium members. In case of a Company, the Pact must be signed by a representative duly authorized by board resolution.

4) Should one or several provisions of this Pact turn out to be invalid; the remainder of this Pact remains valid. In this case, the parties will strive to come to an agreement to their original intensions.

5) It is agreed term and condition that any dispute or difference arising between the parties with regard to the terms of this Integrity Agreement / Pact, any action taken by the Owner/Principal in accordance with this Integrity Agreement/ Pact or interpretation thereof shall not be subject to arbitration.

Article 8: LEGAL AND PRIOR RIGHTS

All rights and remedies of the parties hereto shall be in addition to all the other legal rights and remedies belonging to such parties under the Contract and/or law and the same shall be deemed to be cumulative and not alternative to such legal rights and remedies aforesaid. For the sake of brevity, both the Parties agree that this Integrity Pact will have precedence over the Tender/Contact documents with regard any of the provisions covered under this Integrity Pact.

IN WITNESS WHEREOF the parties have signed and executed this Integrity Pact at the place and date first above mentioned in the presence of following witnesses:

.....
(For and on behalf of Principal/Owner)

.....
(For and on behalf of Bidder/Contractor)

WITNESSES:

1. .....
(signature, name and address)

2. .....
(signature, name and address)

Place:

Date :

SCHEDULES

SCHEDULE 'A': Salient Features of the work.

Name of Work : Development of Ship Repair Facility (Slipway) at Pandu, Guwahati, NW-2

Estimated cost of work:The work is estimated to cost Rs. 43.55 crores
This estimate, however, is given merely as a rough guide.

(a) Earnest Money	:	Rs. 53.55 Lakhs
(b) Performance Guarantee	:	5% of tendered value.
(c) Security Deposit	:	5% of tendered value.

SCHEDULE 'B' : General Rules & Directions with reference to General Conditions of Contract: -

(i). Officer inviting tender: - Director (P&C)

(ii). Tender Accepting Authority:- INLAND WATERWAYS AUTHORITY OF INDIA

(iii). (a) Time allowed for submission of Performance Guarantee as per clause 3.1 of GCC from the date of issue of letter of acceptance:- 15 days

(b) Maximum allowable extension beyond the period provided in (iii) (a) above:- 7 days

(iv) Percentage on Cost of Materials & Labour to cover all overheads and profits:- 15%

(v) Standard Schedule of Rates:- Reference of DSR 2014/ Market Rates

(vi) Specifications to be followed:- **As per tender document**

(vii) Deviation Limit beyond which clause 16.3, 16.4, 16.5 & 16.6:- 20%

(viii) Competent authority of grant extension of time under clause 34:-

(a) Regional Director (Field), IWAI (if the amount of contract is upto 50 lakhs).
(b) Member (Technical), IWAI (if the amount of contract is upto 100 lakhs).
(c) Vice-Chairman / Chairperson, IWAI, Noida (if the cost of contract is more than 100 lakhs & up to 500 lakhs).
(d) Chairman, IWAI, Noida (if the amount of contract is more than 500 lakhs).

(ix) Competent authority to levy liquidated damages for delay under clause 35:-

(a) Regional Director (Field), IWAI (if the amount of contract is upto 50 lakhs).
(b) Regional Director/Engineer-in-Charge with the prior approval of
(a) Member (Technical), IWAI (if the amount of contract is upto 100 lakhs).
(b) Vice-Chairman / Chairperson, IWAI, Noida (if the cost of contract is more than 100 lakhs & up to 500 lakhs).
(c) Chairman, IWAI, Noida (if the amount of contract is more than 500 lakhs).

(x) Competent authority to determine the contract as per clause 36:-

(a) Regional Director (Field), IWAI (if the amount of contract is upto 50 lakhs).
(b) Member (Technical), IWAI (if the amount of contract is upto 100 lakhs).
(c) Vice-Chairman / Chairperson, IWAI, Noida (if the cost of contract is more than 100 lakhs & up to 500 lakhs).
(d) Chairman, IWAI, Noida (if the amount of contract is more than 500 lakhs).

(xi) Milestones as per table given below:
(Clause 34.5 & 34.6 shall be applicable only when the amount of the contract is more than 10 crores)

Sl. No.	Milestone	Time Allowed in days(from zero date)	Amount to be withheld in case of non-achievement of mile stone
1.	Casting and Sinking of 4 well foundations	360	In the event of not achieving the necessary physical milestone, 1.25% of the tendered value of work will be withheld for failure in achieving each mile stone subject to a maximum amount of 5%
2.	Casting and Sinking of remaining 3 well foundations	660	
3.	Main slipway, Transfer bay, Repair bay & other civil works	800	
4.	Trolley, Cradle, Winches & other electrical works	860	

(xii)	**Competent authority to reschedule the milestones as per clause 34.5:-**	Chairman, IWAI, Noida
(xiii)	**Competent authority for foreclosure of contract in full or in part due to abandonment or reduction in scope of work as per clause 31:-**	Engineer-in-Charge with the prior approval of (a) Member Technical), IWAI (if the amount of contract is upto 100 lakhs). (b) Vice-Chairman/ Chairperson, IWAI, Noida (if the cost of contract is more than 100 lakhs & up to 500 lakhs). (c) Chairman, IWAI, Noida (if the amount of contract is more than 500 lakhs).
(xiv)	**Incentive for early completion.**	**Not Applicable**

GENERAL CONDITIONS OF CONTRACT

CONTENTS

GENERAL CONDITIONS OF CONTRACT

CLAUSE-1: DEFINITIONS

In the contract, the following words & expressions shall, unless context otherwise requires, have the meaning thereby respectively assigned to them:

i) **Contract**: means the documents forming the tender and acceptance thereof and the formal agreement executed between the competent authority on behalf of the Chairman, Inland Waterways Authority of India and the contractor, together within the documents referred to therein including these conditions, the specifications, designs, drawings and instructions issued from time to time by the Engineer-in-charge and all these documents taken together shall be deemed to form one contract and shall be complementary to one another.

ii) **Contract sum**; means the amount arrived at by multiplying the quantities shown in the schedule of quantities and price by the respective item rates as allowed.

iii) **Contractor:** means the successful tenderer who is awarded the contract to perform the work covered under this tender document and shall be deemed to include the contractor's successors, executors, representatives or assign approved by the Engineer-in-charge.

(iv) **Employer** means the Chairman, Inland Waterways Authority of India and his successors.

(v) **IWAI/ Authority/ Department/ Owner** shall mean the Inland Waterways Authority of India, which invites tenders on behalf of the Chairman, IWAI and includes therein-legal representatives, successors and assigns.

(vi) **Engineer-In-Charge (EIC)** means the Engineer officer authorised to direct, supervise and be In-charge of the works for the purpose of this contract who shall supervise and be in charge of the work.

(vii) **Engineer-in-charge representative** shall mean any officer of the Authority nominated by the Engineer-in-charge for day to day supervision, checking, taking measurement, checking bills, ensuring quality control, inspecting works and other related works for completion of the project.

(viii) **Chairman**: means Chairman of Inland Waterways Authority of India.

(ix) **Chief Engineer:** means the Chief Engineer of the Authority.

(x) **Director** means the Director of the Authority, as the case may be.

(xi) **Deputy Director** means the Deputy Director of the Authority, as the case may be.

(xii) **Assistant Director** means the Asstt. Director of the Authority, as the case may be.

(xiii) **Assistant Hydrographic Surveyor** means the Assistant Hydrographic Surveyor of the Authority, as the case may be

(xiv) **Work Order** means a letter from the Authority conveying the acceptance of the tender/offer subject to such reservations as may have been stated therein.

(xv) **Day**: means a calendar day beginning and ending at mid-night.

(xvi) **Week**: means seven consecutive calendar days

(xvii) **Month**: means the one Calendar month.

(xviii) **Site:** means the waterway and / or other places through which the works are to be executed.

(xix) **Vessel**: means the vessel/craft belonging to the Contractor for carrying out the work.

(xx) **Drawings** : means the drawings referred to in the specifications and / or appended with the tender document, any modifications of such drawings approved in writing by the Engineer-in-Charge and shall also include drawings issued for actual execution of the work time to time by the Engineer-in-Charge.

(xxi) **Urgent Works**: means any urgent nature which in the opinion of the Engineer-In-Charge become necessary at the time of execution and / or during the progress of work to obviate any risk or accident or failure or to obviate any risk of damage to the vessel structure, or required to accelerate the progress of work or which becomes necessary for security or for any other reason the Engineer-in-Charge may deem expedient.

(xxii) **Work/ works**: means work / works to be executed in accordance with the contract.

(xxiii) Schedules referred to in these conditions shall mean the relevant schedules annexed to the tender papers or the standard schedule of rates of the govt. mentioned with the amendments thereto issued up to the date of receipt of the tender.

(xxiv) District specifications means the specifications followed by the State Government in the area where the work is to be executed.

xxv) Tendered value means the value of the entire work as stipulated in the letter of award.

CLAUSE-2: INTERPRETATIONS

2.1 Where the contract so requires, words imparting the singular only shall also include the plural and vice versa. Any reference to masculine gender shall whenever required include feminine gender and vice versa.

2.2 Heading and marginal notes in these General Conditions shall not be deemed to form part thereof or be taken into consideration in the interpretation of construction thereof of the contract.

CLAUSE-3: PERFORMANCE GUARANTEE

3.1 The contractor shall be required to deposit an amount equal to 5% of the tendered value of the work as performance guarantee in the form of either demand draft payable at any nationalized/schedule bank **OR** an irrevocable bank guarantee bond of any scheduled bank or State Bank of India in accordance with the form prescribed within 15 days of the issue of the work order.

3.2 Performance guarantee shall be initially valid up to the stipulated date of completion plus sixty days beyond that. In case the time for completion gets enlarged, the contractor shall get the validity of the performance guarantee extended to cover such enlarged time of the work. After recording of the completion certificate for the work by the competent authority, the performance guarantee shall be returned to the contractor without any interest.

3.3 In the event of contract being determined under the provision of any of the clauses/conditions of agreement, the performance guarantee shall be forfeited in full and shall be absolutely at the disposal of the authority.

CLAUSE- 4: SECURITY DEPOSIT

4.1 A sum @ 10% of the gross amount of the bill shall be deducted from each running bill of the contractor till the sum along with the sum already deposited as the earnest money will

amount to security deposit of 5% of the contract value of work. Bank guarantee will not be accepted as security deposit.

4.2 The total security deposit shall remain with IWAI till the defect liability period is over or the payment of the final bill payable in accordance with agreement conditions whichever is later, provided the Engineer-in-Charge is satisfied that there is no demand outstanding against the contractor.

4.3 No interest will be paid on security deposit.

4.4 If the contractor neglects to observe or fails to perform any of his obligations under the contract, it shall be lawful for the Employer/ EIC to forfeit either in whole or in part, the security deposit furnished by the contractor. However, if the contractor duly performs and completes the contract in all respects and presents in absolute "NO DEMAND CERTIFICATE" in the prescribed form, the IWAI shall refund the security deposit to the contractor after deduction of cost and expenses that the Authority may have incurred and other money including all losses and damages which the Authority is entitled to recover from the Contractor.

4.5 In case of delay in the progress of work, the Engineer- in-Charge shall issue to the contractor a memo in writing pointing out the delay in progress and calling upon the contractor to explain the causes for the delay within 3 days of receipt of the memo and 10 days from issuance of memo whichever is earlier. If the Engineer-in-Charge is not satisfied with the explanations offered, he may forfeit the security deposit and / or withhold payment of pending bills in whole or in part and/ or get the measures of rectification of progress of work accelerated to the pre-defined level at the risk and cost of the contractor.

4.6 All compensation or other sums of money payable by the contractor under the terms of the contract or any other contract or on any other account whatsoever, may be deducted from or paid by the sale of a sufficient part of his security or from the interest arising there from or from any sums which may be due or may become due to the contractor by the Authority on any account whatsoever. Also in the event of the contractor's security deposit being reduced by reasons of such deductions or sale, as aforesaid the contractor shall, within 14 days of receipt of notice of demand from the Engineer-in-Charge make good the deficit in his security deposit.

CLAUSE-5: SUFFICIENCY OF TENDER

5.1 The contractor shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his tender for the works and of the rates quoted in the schedule of Quantities and Prices which shall (except as otherwise provided in the contract) cover all his obligations under the contract and all matters and things necessary for the proper execution and completion of the works in accordance with the provisions of the contract and its operation during execution of work.

CLAUSE-6: CONTRACT DOCUMENTS

6.1 The language in which the contract documents shall be drawn up shall be English and if the said documents are written in more than one languages, the language according to which the contract is to be constructed and interpreted shall be English.

6.2 The Contractor shall be furnished free of charge certified true copy of the contract document.

6.3 A copy of the Contract Documents furnished to the Contractor as aforesaid shall be kept by the Contractor on the Site in good condition and the same shall at all reasonable time be available for inspection and use by the Engineer-in-Charge, his representatives or by other Inspecting officers of the Authority.

6.4 None of these Documents shall be used by the Contractor for any purpose other than that of this contract.

CLAUSE-7: DISCREPANCIES AND ADJUSTMENT OF ERRORS

7.1 Detailed drawings shall be followed in preference to small-scale drawings and figured dimensions in preference to scaled dimensions. The case of discrepancy between the Schedule of Quantities and prices, the Specifications and/ or the drawings, the following order of precedence shall be observed : -

(a) Description in the Schedule of Quantities and Prices.
(b) Relevant Specifications and Special Conditions, if any.
(c) Drawings.
(d) Indian Standards Specifications of BIS.

7.2 The contractor shall study and compare the drawings, specifications and other relevant information given to him by the Engineer-in-Charge and shall report in writing to the Engineer-in-Charge any discrepancy and inconsistency which he notes. The decision of the Engineer-in-Charge regarding the correct intent and meaning of the drawings and specifications shall be final and binding.

7.3 Any error in description, quantity or price in Schedule of Quantities and Prices or any omission therefrom shall not vitiate the Contract or release the Contractor from the execution of the whole or any part of the work(s) comprised therein according to drawings and specifications or from any of his obligations under the contract.

7.4 If on check there is difference in the amount worked out by contractor in the schedule of quantities and prices and General summary the same shall be adjusted in accordance with the following rules:

(a) In the event of error/discrepancy occurring in the rates written in figures and words, then the rate which corresponds with the amount worked out by the contractor shall, unless otherwise proved, be taken as correct. If the amount of an item is not worked out by the contractor or it does not correspond with the rate written either in figures or in words, then the rate quoted by the contractor in words shall be taken as correct. When the rate quoted by the contractor in figures and words tally, but the amount is not worked out correctly, the rate quoted by the contractor will, unless or otherwise proved, be taken as correct.

(b) All errors in totaling in the amount column and in carrying forward totals shall be corrected.

(c) The totals of various sections of schedule of quantities and price amended shall be carried over to the General Summary and the tendered sum amended accordingly.

The tendered sum so altered shall, for the purpose of tender, be substituted for the sum originally tendered and considered for acceptance instead of the original sum quoted by the tenderer. Any rounding off of quantities or in sections of schedule of quantities and prices or in General summary by the tenderer shall be ignored.

CLAUSE-8: DUTIES AND POWERS OF THE ENGINEER–IN-CHARGE REPRESENTATIVE

8.1 The duties of the representative of the Engineer-in-Charge are to watch and supervise the works and to test and examine any materials/ parts to be used or workmanship achieved in connection with the works.

8.2 The Engineer-in-Charge may, from time to time in writing, delegate to his representative any of the powers and authorities, vested in the Engineer-in- Charge and shall furnish to the contractor a copy of all such written delegation of powers and authorities. Any written instruction or written approval given by the representative of the Engineer-in-Charge to the contractor within the terms of such delegation shall bind the contractor and the Authority as though it has been given by the Engineer-in-Charge.

8.3 Failure of the representative of the Engineer-in-Charge to disapprove any work or materials shall be without prejudice to the power of the Engineer-in-Charge thereafter to disapprove such work or materials and to order the pulling down, removal or breaking up thereof. The contractor shall, at his own expense, again carry out such works as directed by the Engineer-in-Charge.

8.4 If the Contractor is dissatisfied with any decision of the representative of the Engineer-in-Charge, he will be entitled to refer the matter to the Engineer-in- Charge who shall thereupon confirm, reverse or vary such decision and the decision of the Engineer-in- Charge in this regard shall be final and binding on the contractor.

CLAUSE-9: ASSIGNMENT AND SUB-LETTING

The Contractor shall not sub-let, transfer or assign the whole or any part of the work under the contract. Provided that the Engineer-in-Charge may at his discretion, approve and authorize the Contractor to sub-let any part of the work, which in his opinion, is not substantial, after the contractor submits to him in writing the details of the part of the work(s) or trade proposed to be sublet, the name of the sub-contractor thereof together with his past experience in the said work/trade and the form of the proposed sub-contract. Nevertheless any such approval or authorization by the Engineer-in-Charge shall not relieve the contractor from his any or all liabilities, obligations, duties and responsibilities under the contract. The contractor shall also be fully responsible to the Authority for all the acts and omissions of the sub-contractor, his employees and agents or persons directly employed by the contractor. However, the employment of piece rate works shall not be construed as sub-letting.

CLAUSE-10: FACILITIES TO OTHER CONTRACTORS

The contractors shall, in accordance with the requirements of the work as decided by the Engineer-in-Charge, afford all reasonable facilities to other contractors engaged contemporaneously on separate contracts and for departmental labour and labour of any other agency properly authorised by Authority or any statutory body which may be employed at the site for execution of any work not included in the contract which the Authority may enter into in connection with or ancillary to the

works. In all matters of conflict of interest, the Engineer-in-Charge shall direct what compromise should be made and his decision shall be final and binding on the parties.

CLAUSE-11: CHANGE IN THE CONSTITUTION OF THE FIRM TO BE INTIMATED

Where the contractor is a partnership firm, prior approval in writing of the Engineer-in-Charge shall be obtained before any change is made in the constitution of the firm. Where the contractor is an individual or a Hindu Undivided Family business concern, such approval, as aforesaid, shall like-wise be obtained before the contractor enters into any partnership agreement where under the partnership firm would have the right to carry out the works hereby undertaken by the contractor. If prior approval as aforesaid is not obtained the contractor shall be deemed to have been assigned in contravention to Clause 36 hereof and the same action will be taken and the same consequences shall ensure as provided for in the said clause-36.

CLAUSE-12: COMMENCEMENT OF WORK

The contractor shall commence the work at the respective sites within 10 days of the issue of Letter of Award. If the contractor commits default in mobilization of resources, and equipment as aforesaid, the Engineer-in-Charge shall without prejudice to any other right or remedy be at liberty to cancel the contract and forfeit the earnest money/security deposit.

CLAUSE-13: WORKS TO BE CARRIED OUT IN ACCORDANCE WITH SPECIFICATION DRAWINGS AND ORDERS ETC.

13.1 The contractor shall execute the whole and every part of the work in the most substantial and workman like manner in strict conformity with the specifications laid down in the contract document or as may be laid down by the Engineer-in-Charge under the terms of the contract. The contractor shall also conform exactly, fully and faithfully to the designs, drawings specifications and instructions in writing in respect of the work, duly signed by the Engineer-in-Charge as may be issued from time to time.

13.2 The contractor shall be entitled to receive, on demand, in addition to the contract documents, in accordance with the provisions of contract, the documents set forth herein in respect of the work on commencement or during the performance of the contract:

(a) Specifications or revisions thereof other than standard printed specifications

(b) Explanations, instructions etc.

Such further drawings, explanation, modifications and instruction, as the Engineer-in-Charge may issue to the contractor from time to time in respect of the work shall be deemed to form integral part of the contract and the contractor shall be bound to carry out the work accordingly.

13.3 In the case of any class of work for which there is no specifications, such work shall be carried out in accordance with the Bureau of Indian Standards specifications. In case there are no such specifications in the BIS, work shall be carried out as per manufacturer's specifications, if manufacturer's specifications are also not available then as per District specifications. In case there are no such specifications as required, above the work shall be carried out in all respect in accordance with the instructions and requirements of the Engineer-in-Charge.

13.4 All instructions and orders in respect of the work shall be given by the Engineer-in-Charge in writing. However, any verbal instructions or order shall be confirmed by the Engineer-in-Charge as soon as practicable without loss of time and only such written instruction shall be deemed to be valid.

CLAUSE-14: SETTING OUT THE WORKS

The contractor shall provide all assistance and adhere to the instruction of E.I.C during the course of surveying, inspection, etc.

CLAUSE-15: URGENT WORKS

If any urgent work (in respect of which the decision of the Engineer-in-Charge shall be final and binding) becomes necessary, the contractor shall execute the same as may be directed by Engineer-in-Charge, provided the directions are in accordance and confirmatory with provisions in Clause – 8.

CLAUSE-16: DEVIATIONS, VARIATIONS, EXTENT AND PRICING

16.1 The Engineer-in-Charge shall have power (i) to make alteration in, omissions from, additions to, or substitutions for the original specifications, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work, and (ii) to omit a part of the works in case of non-availability of a portion of the site or for any other reasons and the contractor shall be bound to carry out the works in accordance with any instructions given to him in writing signed by the Engineer-in-Charge and such alterations, omissions, additions or substitutions shall form part of the contract as if originally provided therein and any altered, additional or substituted work which the contractor may be directed to do in the manner specified above as part of the works, shall be carried out by the contractor on the same conditions in all respects including price on which he agreed to do the main work except as hereafter provided.

16.2 The time for completion of the works shall, in the event of any deviations resulting in additional cost over the tendered value sum being ordered, be extended, if requested by the contractor, as follows:

(i) In the proportion which the additional cost of the altered, additional or substituted work, bears to the original tendered value plus

(ii) 20% of the time calculated in (i) above or such further additional time as may be considered reasonable by the Engineer-in-Charge.

16.3 In the case of extra item(s) (items that are completely new, and are in addition to the items contained in the contract), the contractor may within fifteen days of receipt of order or occurrence of the item(s) claim rates, supported by proper analysis, for the work and the Engineer-in-Charge shall within one month of the receipt of the claims supported by analysis, after giving consideration to the analysis of the rates submitted by the contractor, determine the rates on the basis of the market rates and the contractor shall be paid in accordance with the rates so determined.

16.4 In the case of substituted items (items that are taken up with partial substitution or in lieu of items of work in the contract), the rate for the agreement item (to be substituted) and substituted item shall also be determined in the manner as mentioned in the following para.

(a) If the market rate for the substituted item so determined is more than the market rate of the agreement item (to be substituted), the rate payable to the contractor for the substituted item shall be the rate for the agreement item (to be substituted) so increased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted).

(b) If the market rate for the substituted item so determined is less than the market rate of the agreement item (to be substituted), the rate payable to the contractor for the substituted item shall be the rate for the agreement item (to be substituted) so decreased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted).

16.5 In the case of contract items, substituted items, contract cum substituted items, which exceed the deviation limits laid down in Schedule 'B', the contractor may within fifteen days of receipt of order or occurrence of the excess, claim revision of the rates, supported by proper analysis for the work in excess of the above mentioned limits, provided that if the rates so claimed are in excess of the rates specified in the schedule of quantities, the Engineer-in-Charge shall within one month of receipt of the claims supported by analysis, after giving consideration to the analysis of the rates submitted by the contractor, determine the rates on the basis of the market rates and the contractor shall be paid in accordance with the rates so determined.

16.6 The provisions of the paragraph 16.4 above shall also apply to the decrease in the rates of items for the work in excess of the limits laid down in Schedule 'B', and the Engineer-in-Charge shall after giving notice to the contractor within one month of occurrence of the excess and after taking into consideration any reply received from him within fifteen days of the receipt of the notice, revise the rates for the work in question within one month of the expiry of the said period of fifteen days having regard to the market rates.

16.7 Under the circumstances, the contractor shall at any stage not suspend the work on account of non-settlement of rates of such Deviated/Extra/Substituted items.

CLAUSE-17: CONTRACTOR'S SUPERVISION

17.1 The contractor shall either himself supervise the execution of the works or shall appoint at his own expense, a qualified and experienced Engineer as his accredited agent approved by the Engineer-in-Charge, if contractor has himself not sufficient knowledge or experience to be capable of receiving instruction or cannot give his full attention to the works. The contractor or his agent shall be present at the site(s) and shall supervise the execution of the works with such additional assistance in each trade, as the work involved shall require and considered essential by the Engineer-in-Charge. Further the directions/instructions given by the Engineer-in-Charge to the contractor's agent shall be considered to have the same force as if these had been given to the contractor himself.

17.2 If the contractor fails to appoint a suitable agent as directed by the Engineer-in-Charge, the Engineer-in- Charge shall have full powers to suspend the execution of the works until such date as a suitable agent is appointed by the contractor and takes over the charge of supervision of the work. For any such suspension, the contractor shall be held responsible for delay so caused to the work.

CLAUSE-18: INSTRUCTIONS AND NOTICE

18.1 Except as otherwise provided in this contract, all notices to be given on behalf of the Authority and all other actions to be taken on its behalf may be given or taken by the Engineer-in-Charge or any officer for the time being entrusted with the functions, duties and powers of the Engineer-in-Charge.

18.2 All instructions, notices and communications etc. under the contract shall be given in writing and any such oral orders / instructions given shall be confirmed in writing and no such communication which is not given or confirmed in writing shall be valid.

18.3 All instructions, notices and communications shall be deemed to have been duly given or sent to the contractor, if delivered to the contractor, his authorized agent, or left at, or posted to the address given by the contractor or his authorized agent or to the last known place of abode or business of the contractor or his agent of services by post shall be deemed to have been served on the date when in the ordinary course of post these would have been delivered to him and in other cases on the day on which the same were so delivered or left.

18.4 The Engineer-in-Charge shall communicate or confirm the instructions to the contractor in respect of the execution of work through a "Site Order Book" maintained in the office of the Engineer-in-Charge and the contractor or his authorized representative shall confirm receipt of such instructions by signing the relevant entries in this book. If required by the Contractor, he shall be furnished a certified true copy of such instruction(s). The pro-forma for Site Order Book to be maintained at site is given in Annex-7.

18.5 The "Hindrance Register" shall be maintained at the site of work, where any hindrance which comes to the notice of the representative of the Engineer-in-Charge shall be recorded and immediately a report will be made to the Engineer-in-Charge within a week. The Engineer-in-Charge shall review the Hindrance Register at least once in a month. The pro-forma on which the Hindrance Register shall be maintained is given in Annex-8.

CLAUSE-19: PLANT AND EQUIPMENT

19.1 The Contractors shall provide and install all necessary plant; equipment and machinery required for the execution of the work under the contract, at his cost and shall use such methods and appliances for the purpose of all the operations connected with the work covered by the contract, which shall ensure the completion of work(s) within the specified time.

19.2 Subject to the availability of any item(s), plant, equipment and machinery the Authority at the written request of the contractor, may issue to the contractor on hire for being deployed on the work contracted for, at pre- determined rates, terms and conditions at the sole discretion of the Engineer-in-Charge.

CLAUSE-20: PATENT RIGHTS

The contractor shall indemnify the Authority, its representatives or its employees against any action, claim or proceeding relating to infringement or use of any patent or design or any alleged patent or design rights and shall pay any royalties or other charges which may be payable in respect of any article or material or part thereof included in the contract. In the event of any claim being made or action being brought against the Authority or any agent, servant or employee of the Authority in

respect of any such materials as aforesaid the contractor shall immediately be notified thereof. Provided that such indemnification shall not apply when such infringement has taken place in complying with the specific directions issued by the Authority but the contractor shall pay any royalties or other charges payable in respect of any such use, the amount so paid being reimbursement to the contractor only if the use was the result of any drawings and or specifications issued after submission of the tender.

CLAUSE-21: MATERIALS

21.1 The contractor shall at his own expenses provide / arrange all materials required for the bona-fide use on work under the contract.

21.2 All materials/parts to be provided by the contractor shall be in conformity with the specifications laid down in the contract and the contractor shall furnish from time to time proof and samples, at his own cost, the materials/parts as may be specified by the Engineer-in-Charge. Further the Engineer-in-Charge shall also have powers to have such tests, in addition to those specified in the contract, as may be required and the contractor shall provide all facilities to carry out the same. The cost of materials/parts consumed in such tests and also the expenses incurred thereon including the cost of the testing charges, shall be borne by the contractor in all cases and also where such tests which are in addition to those provided in the contract disclose that the materials are in conformity with the provisions of the contract.

21.3 The Engineer-in-Charge or his representative shall be entitled at any time to inspect and examine any materials/parts intended to be used in the works, either on the site or at factory or workshop or other place(s) where such materials are assembled, fabricated, manufactured or any place where these are lying or from where these are being obtained. For this, purpose, the contractor shall afford such facilities as may be required for such inspection and examination.

CLAUSE-22: LAWS GOVERNING THE CONTRACT

The Courts at Noida only shall have the jurisdiction for filing the award of the arbitration and for any other judicial proceedings.

CLAUSE-23: WATCH & WARD AND LIGHTING

The Contractor shall provide and maintain at his expense all lights, guards, fencing and watch & ward when and where necessary or as required by the Engineer-in-Charge for the protection of the works or for the safety and convenience of those employed on the works or the public.

CLAUSE-24: WORK DURING NIGHT OR ON SUNDAYS AND HOLIDAYS

24.1 Subject to any provisions to the contrary contained in the contract, none of the works shall be carried out during Sundays and national holidays without the permission in writing of the Engineer-in-Charge. However, when work is unavoidable or necessary for safety of life, property or works, contractor shall take necessary action immediately and advise the Engineer-in-Charge accordingly.

24.2 The Engineer-in-Charge at its discretion may, however, direct the contractor that the work may be carried out on holidays, Sundays and/or in extra shifts to ensure completion of works under the contract as scheduled.

CLAUSE-25: LABOUR

25.1 (a) The contractor shall employ labour in sufficient numbers to maintain the required rate of progress and of quality to ensure workmanship of the degree specified in the contract and to the satisfaction of the Engineer-in-Charge. The Contractor shall not employ in connection with the works any person who has not completed eighteen years of age the minimum age specified in Indian Labour Law.

(b) If any foreigner is employed by the contractor on the work within the site the later shall ensure that such foreigner possesses the necessary special permit issued by the Civil Authorities in writing and also comply with the instructions issued there-from from time to time. In the event of any lapse in this regard on the part of such foreigner the contractor shall be personally held responsible for the lapse & Authority shall not be liable in any event.

(c) The Contract is liable for cancellation if either the contractor himself or any of his employee is found to be a person who has held Class-I post under the Authority immediately before retirement and has within two years of such retirement accepted without obtaining the previous permission of the Authority or of the Chairman as the case may be and employment as contractor for, or in connection with the execution of the public works, or as an employee of such contractor. If the contract is terminated on account of the failure of the contractor to comply with the above clause, the Authority shall be entitled to recover from him such damages as may be determined by the Engineer-in-Charge with due regard to the inconvenience caused to the Authority on account of such termination without prejudice to the Authority's right to proceed against such officer.

25.2 The contractor shall furnish and deliver fortnightly to the Engineer-in-Charge, a distribution return of the number and description by trades of the works of people employed on the works. The contractor shall also submit on the 4th and 19th of every month for the period of second half of the preceding month and first half of the current month respectively to the Engineer-in-Charge, a true statement in respect of the following.

i) Any accident if occurred during the said fortnight showing the circumstances under which it happened and the extent of damage and injury caused by it and.

ii) The number of female workers who have been allowed maternity benefit as provided in the Maternity Benefit Act 1961 or Rules made thereunder and the amount paid to them.

25.3 The Contractor shall pay to labourer employed by him either directly or through sub-contractors wages not less than wages as defined in Minimum Wages Act 1948 and Contract Labour (Regulation and Abolition) Act 1970 amended from time to time and rules framed there-under and other labour laws affecting contract labour that may be brought in force from time to time.

25.4 The Contractor shall also comply with the provisions of all Acts, Laws, any Regulation or Bye Laws of any Local or other Statutory Authority applicable in relation to the execution of works such as:

i) Payment of Wages Act, 1936 (Amended)

ii) Minimum Wages Act, 1948 (Amended).

iii) The Contract Labour (Regulation & Abolition) Act, 1970 with Rules framed there under as amended.

iv) Workmen Compensation Act, 1923 as amended by Amendment Act no.65 of 1976.

v) Employer's Liability Act 1938 (Amended)

vi) Maternity Benefit Act. 1961 (Amended)

vii) The Industrial Employment (Standing orders) Act 1946 (Amended).

viii) The Industrial Disputes Act. 1947 (Amended)

ix) Payment of Bonus Act.1965 and Amended Act No. 43 of 1977 and No. 48 of 1978 and any amended thereof:

ix) The Personal Injuries (Compensation Insurance) Act 1963 and any modifications thereof and rules made thereunder from time to time. The Contractor shall take into account all the above and financial liabilities in his quoted rates and nothing extra, whatsoever, shall be payable to him on this account.

The list is indicative only, otherwise the contractor should be aware of all the Acts/Labour Laws and should follow diligently on the work. The contractor shall be fully and personally responsible for the violation of any Act/Labour Law

25.5 The Contractor shall be liable to pay his contribution and the employees contribution to the State Insurance Scheme in respect of all labour employed by him for the execution of the contract, in accordance with the provision of "the Employees State insurance Act 1948" as amended from time to time. In case the Contractor fails to submit full details of his account of labour employed and the contribution payable, the Engineer-in- Charge shall recover from the running bills the contribution amount as assessed by him. The amount so recovered shall be adjusted against the actual contribution payable for Employees State Insurance.

25.6 The Engineer-in-Charge shall on a report having been made by an inspecting officer as defined in the Contract Labour (Regulation and Abolition) Act and Rules or on his own in his capacity as Principal Employer, have the power to deduct from the amount due to the contractor any sum required for making good the loss suffered by worker(s) by reason of non-fulfillment of the conditions of the Contract for the benefit of Workers, nonpayment of wages or on account of deduction made from the wages of the workers which are not justified by the terms of the contract or non- observance of the said Act and Rules framed there under with amendments made from time to time.

25.7 The Contractor shall indemnify the Authority against any payments to be made under and for observance of the Regulation Laws, Rules as stipulated in Clause-25.4 above without prejudice to his right to claim indemnity from his sub-contractors. In the event of the contractor's failure to comply with the provisions of all the Acts/Laws stipulated in Clause-25.4 or in the event of decree or award or order against the contractor having been received from the competent authority on account of any default or breach or in connection with any of the provisions of the Acts/Laws/Rules mentioned in Sub-Clause 25.4 above, the Engineer-in-Charge without prejudice to any other right or remedy under the contract shall be empowered to deduct such

sum or sums from the Bill of the contractor or from his security deposit or from other payment due under this contract or any other contract to satisfy within a reasonable time the provisions of the various Acts/Laws/Rules/Codes as mentioned under Sub-Clause 25.4 above, on the part of the contractor under the contract on behalf of and at the expenses of the contractor and make payment and /or provide amenities/ facilities/services accordingly. In this regard, the decision of the Engineer-in-Charge shall be conclusive and binding on the contractor.

25.8 In the event or the Contractor committing a default or breach of any of the provisions of the aforesaid Contract's Labour (Regulation and Abolition) Act and Rules as amended from time to time or furnishing any information or submitting or filling any form/Register/Slip under the provisions of these Regulations which is materially incorrect then on the report of the Inspecting officer as defined in the relevant Acts and Rules as referred in Clause 25.4 above, the Contractor shall without prejudice to any other liability pay to the Authority a sum not exceeding Rs.50/- (Rs. Fifty only) as liquidated damages for every default, breach or furnishing, making, submitting, filling materially incorrect statement as may be fixed by the Engineer-in-Charge. The decision of the Engineer-in-Charge in this respect shall be final & binding.

25.9 The Contractor shall at his own expenses comply with or cause to be complied with the Provisions/ Rules provided for welfare and health of Contract Labour in the Contract Labour (Regulation and Abolition) Act and other relevant Acts and Rules framed there under or any other instructions issued by the Authority in this regard for the protection of health and for making sanitary arrangements for workers employed directly or indirectly on the works. In case the contractor fails to make arrangements as aforesaid, the Engineer-in-Charge shall be entitled to do so and recover the cost thereof from the contractor.

25.10 The Contractor shall at his own expense arrange for the safety or as required by the Engineer-in-Charge, in respect of all labour directly or indirectly employed for performance of the Works and shall provide all facilities in connection therewith. In case the contractor fails to make arrangements and provide necessary facilities as aforesaid, the Engineer-in- Charge shall be entitled to do so and recover the cost thereof from the Contractor. But this will not absolve the contractor of his responsibility or otherwise thereof.

25.11 Failure to comply with "Provisions/Rules made for Welfare and Health of Contract Labour" Safety Manual, or the provisions relating to report on accidents and grant of maternity benefits to female workers and the relevant Acts/Rules referred in clause 25.4 above shall make the contractor liable to pay to the Authority as liquidated damages an amount not exceeding Rs. 50/- for each default or materially incorrect statement. The decision of the Engineer-in-Charge in such matters based on reports from the inspecting Officers as defined in the relevant Acts and Rules as referred in clause 25.4 above shall be final and binding and deductions for recovery of such liquidated damages may be made from any amount payable to the contractor. In the event of any injury, disability or death of any workmen in or about the work employed by the contractor either directly or through his sub-contractor, contractor shall at all time indemnify and save harmless the Authority against all claims, damages and compensation under the Workmen Compensation Act. 1923 as amended from time to time or in other Law for the time being in force and Rules there-under from time to time and also against all costs, charges and expenses of any smooth action by proceedings arising out of such accidents or injury, disability or death of a workmen and against all sum or sums which may with the consent of the contractor be paid to compromise or compound any claim in this regard. If any award, decree or order is passed against the contractor for recovery of any

compensation under the Workmen Compensation Act, 1923, for any injury, disability or death of a workman by any competent court, the said sum or sums shall be deducted by the Engineer-in-Charge from any sum then due or that may become due to the contractor or from his security deposit or sale thereof in full or part under the contract or any other contract with the Authority towards fulfillment of the said decree, award or orders.

25.12 Provided always that the contractor shall have no right to claim payments/claims whatsoever on account of his compliance with his obligations under this clause and Labour Regulations.

25.13 The contractor shall not otherwise than in accordance with the statutes ordinance and Government Regulations or orders for the time being in force import, sell, give, barter or otherwise dispose of any alcoholic liquor or drugs to permit or suffer any such import, sale, gift, barter or disposal by his sub-contractor, agent or employees.

25.14 The contractor shall not give, barter or otherwise dispose of to any person or persons any arms or ammunition of any kind or permit to suffer the same as aforesaid.

25.15 The Contractor shall employ for the execution of the works only such persons as are skilled and experienced in their respective trades and Engineer-in-Charge shall be at liberty to object to and require the contractor to remove from the works any persons employed by the Contractor for the execution of the works who, in the opinion of the Engineer-in-Charge, misconduct himself or is incompetent or negligent in the proper performance of his duties. The contractor shall forthwith comply with such requisition and such person shall not be again employed upon the works without permission of the Engineer-in-Charge.

25.16 **Release of Security deposit after labour clearance**: Security deposit of the work shall not be refunded till the contractor produces a clearance certificate from the Labour Officer. As soon as the work is virtually completed, the contractor shall apply for clearance certificate to the Labour Officer under intimation to Engineer-in-Charge. The Engineer-in-Charge on the receipt of such communication shall write to Labour Officer to intimate if any complaint is pending against the contractor in respect of the work. If no complaint is pending on record till after three months after completion of work and/or no communication is received from Labour Officer to this effect till six months after the date of completion, it will be deemed to have received the clearance certificate and the security deposit will be released if otherwise due.

CLAUSE–26: MATERIALS OBTAINED FROM EXCAVATION SUCH AS COINS, FOSSILS, ETC.

26.1 Materials of any kind obtained from excavation on the site shall remain the property of the Authority and shall be disposed off as directed by the Engineer-in-Charge.

26.2 However if any of the materials thus obtained from excavation on the site is such as can be used in the execution of the work under the contract, the contractor will be allowed to use the same free of cost (except that any amount of royalty paid for in this regard by the Authority shall be recoverable from the contractor) for the aforesaid purpose provided the same is found suitable and is approved by the Engineer-in-Charge.

26.3 Fossils, coins, articles of value, structures and other remains or things of geological or archeological interest discovered on the site shall be the absolute property of the Authority. The contractor shall take reasonable precautions to prevent his labour or any other person from removing or damaging any such article or thing and shall acquaint the Engineer-in-

Charge with such discovery and carryout the Engineer-in-Charge's directions as to the disposal of the same at the expense of the Authority.

CLAUSE-27: FORCE MAJEURE

27.1 The term Force Majeure shall herein mean Riots (other than among the contractor's employees), Civil Commotion (to the extent no insurable), war (whether declared or not), invasion, act of foreign enemies, hostilation, civil war, rebellion, revolution, insurrection, military or usurped power, damage from aircraft, nuclear fission, acts of God, such as earthquake (above 7 magnitude on Richter Scale), lightning, unprecedented floods, fires not caused by contractor's negligence and other such causes over which the contractor has no control and are accepted as such by the Engineer-in-Charge, whose decision shall be final and binding. In the event of either party being rendered unable by Force Majeure to perform any obligation required to be performed by them under this contract, the relative obligation of the party affected by such Force Majeure shall be treated as suspended for the period during which such Force Majeure cause lasts, provided the party allowing that it has been rendered unable as aforesaid, thereby shall notify within 15 days of the alleged beginning and ending thereof giving full particulars and satisfactory evidence in support of such cause.

27.2 For delays arising out of Force Majeure, the bidder shall not claim extension in completion date for a period exceeding the period of delay attributable to the causes of Force Majeure and neither the Authority nor the bidder shall be liable to pay extra costs provided it is mutually established that Force Majeure conditions did actually exist.

27.3 If any of the Force Majeure conditions exists in the places of operation of the bidder even at the time of submission bid, he shall categorically specify in his bid and state whether they have been taken into consideration in their quotations.

CLAUSE-28: LIABILITY FOR DAMAGE, DEFECTS OR IMPERFECTIONS AND RECTIFICATION THEREOF

28.1 If the contractor or his labour or his sub-contractor, injure, destroy or damage, battery, solar panel, lighting system, road, fence, enclosures, water pipe, cables, buildings, drains, electricity or telephone posts, wires, trees, grass line, cultivated land in the area in which they may be working or in the area contiguous to the premises on which the work or any part of it is being executed or if any damage is caused to any item belonging to IWAI or to any person during the progress of work, the Contractor shall upon receipt of a notice in writing in that behalf from the Engineer-in-Charge, make good the same at his cost.

28.2 If it appears to the Engineer-in-Charge or his representative at any time during the progress of work or prior to the expiration of the Defects Liability period that any work has been executed with unsound, imperfect or unskilled workmanship or that any materials or articles provided by the Contractor for execution of the work are unsound or of a quality inferior to that contracted for, or otherwise not in accordance with the Contract, or that any defect, shrinkage or other faults found in the work arising out of defective design or defective/ improper materials or workmanship, the Contractor shall, upon receipt of a notice in writing in that behalf from the Engineer-in-Charge forthwith rectify or remove and reconstruct the work so specified in whole or in part, as the case may be, and/or remove the materials/articles so specified and provide other proper and suitable materials at his expense. The Defects Liability period will 1 year from date of acceptance of the project.

28.3 All damages caused by accidents or carelessness of the contractor or any of his employees or any property belonging to the Authority is wasted or is misused by the contractor or any of his employees shall be to the account of the contractor, who shall make good the loss.

CLAUSE-29: CONTRACTOR'S LIABILITY AND INSURANCE

29.1 From commencement to completion of the work(s) as a whole, the Contractor shall take full responsibility for the care thereof and for taking precautions to prevent loss or damage. He shall be liable for any damage or loss that may happen to the works or any part thereof and to the Authority's Plant, Equipment and Material (hired or issued to the Contractor) shall be in good order and condition and in conformity in every respect with the requirements of the Contract and instructions of the Engineer-in-Charge.

29.2 i) Neither party to the contract shall be liable to the other in respect of any loss or damage which may occur or arise out of "Force Majeure" to the works or any part thereof on to any material or article at site but not incorporated in the works or to any person or anything or material whatsoever or either party provided such a loss or damage could not have been foreseen or avoided by a prudent person and the either party shall bear losses and damages in respect of their respective men and materials. As such liability of either party shall include claims/ compensations of the third party also.

ii) Provided, however, in an eventuality as mentioned in sub-clause - 29.2 (i) above, the following provisions shall also have effect:

(a) The Contractor shall, as may be directed in writing by the Engineer-in-Charge proceed with the completion of the works under and in accordance with the provisions and conditions of the contract, and

(b) The Contractor shall, as may be directed in writing by the Engineer-in-charge, re-execute the works lost or damaged, remove from the site any debris and so much of the works as shall have been damaged and carry the Authority's T & P, Plant and Equipment, Material etc. to the Authority's store. The cost of such re-execution of the works, removal of damaged works and carrying of Authority's store shall be ascertained in the same manner as for deviations and this shall be ascertained in the same manner as for deviations and this shall be added to the contract sum. Provided always that the Contractor shall, at his own cost, repair and make good so much of the loss or damage as has been occasioned by any failure on his part to perform his obligations under the contract or not taking precautions to prevent loss or damage or minimise the amount of such loss or damage, Final assessment of loss or damage shall be decided by the Engineer-in-Charge and his decision shall be final and binding.

29.3 The contractor shall take special precautions to see that public places and roads adjacent to contractor's yard are not blocked at anytime either by his material or by his workmen. The roads are to be kept always clear and no equipment/materials shall be stacked.

29.4 The navigable waterways shall not be blocked by Contractor's vessels. The anchors dropped in the waterways shall be properly marked and removed after done with.

29.5 The contractor shall indemnify and keep indemnified the Authority against all losses and claims for death, injuries or damage to any person or any property whatsoever which may arise out of or in consequence of the construction and maintenance, of works during the

contract period and also against all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in respect of or in relation thereto, and such liabilities shall include claims/compensations of the third party.

29.6 (a) Before commencing execution of the work, the Contractor shall without in any way limiting his obligations and responsibilities under this condition, insure against any damage, loss or injury which may occur to any property (excluding that of the Authority but including the Authority building rented to the contractor wholly or in part and any part of which is used in part and any part of which is used by him for storing combustible materials) public liability by arising out of the carrying out of the contract. For this purpose the contractor shall take out, pay all costs and maintain throughout the period of his contract public liability with the following coverage.

i) Public liability limits for bodily injury or death not less than Rs. 1,00,000 for one person and Rs. 2,00,000 for each accident.

ii) Property liability limits for each accident not less than Rs. 1,00,000 ;

iii) The Contractor shall prove to the Engineer-in Charge from time to time that he has taken out all the insurance policies referred to above and has paid the necessary premiums for keeping the policies alive till expiry of the Defects Liability Period.

(b) The Contractor shall ensure that similar insurance policies are taken out by his sub-contractor (if any) and shall be responsible for any claims or losses to the Authority resulting from their failure to obtain adequate insurance protection in connection thereof. The Contractor shall produce or cause to be produced by his sub-contractors (if any) as the case may be, relevant, policy or policies and premium receipt as and when required by the Engineer-in-Charge.

(c) If the contractor and/or his sub- contractor (if any) shall fail to effect and keep in force the insurance referred to above or any other insurance which he/they may be required to effect under the term of the Contract then and in any such case the Authority may, without being bound to effect and keep in force any such insurance and pay such premium or premiums as may be necessary for that purpose and from time to time deduct the amount so paid by the Authority from any moneys due or which may become due to the contractor or recover the same as a debt due from the contractor.

(d) The contractor shall at his own expense arrange for the safety provisions as required in respect of the works covered under this contract as per the instruction of Engineer-in-charge. In case, the contractor fails to comply with the provisions of the safety the Engineer- in-Charge shall be entitled to and make the necessary arrangements at the risk and cost of the contractor. This will, however, not absolve the Contractor of his overall responsibility to execute the works under the contract.

CLAUSE-30: SUSPENSION OF WORKS

30.1 The contractor shall on the receipt of order of the Engineer-in-Charge (whose decision shall be final and binding on the contractor) suspend the progress of the works or any part thereof for such time or times and in such manner as the Engineer-in-Charge may consider necessary.

30.2 The suspension of the work can be done by Engineer-in-Charge for any of the following reasons:

(a) On account of any default on the part of the contractor or

(b) for proper execution of the works or part thereof for the reasons other than the default of the contractor or

(c) for the safety of the works or part thereof.

30.3 The contractor shall during the suspension period, properly protect and secure the works to the extent necessary and carry out the instructions given in that behalf by the Engineer-in-Charge.

30.4 If the suspension is ordered for the reasons under the Clause 30.2(b) and (c) above, the contractor shall be entitled to the extension of time equal to the period of every such suspension Plus 25% for the completion of the item or group of items of work for which a separate period of completion is specified in the contract and of which suspended work forms a part

CLAUSE-31: FORECLOSURE OF CONTRACT IN FULL OR IN PART DUE TO ABANDONMENT OR REDUCTION IN SCOPE OF WORK

If at any time after acceptance of the tender the Authority decides to abandon or reduce the scope of the works for reason whatsoever and hence does not require the whole or any part of the works to be carried out, the Engineer-in-Charge (with the prior approval of competent authority mentioned in scheduled 'B') shall give notice in writing to that effect to the contractor and the Contractor shall have no claim to any payment of compensation or otherwise whatsoever, on account of any profit or advantage which he might have derived from the execution of the works in full but which he could not derive in consequence of the fore closure of the whole or part of the works.

CLAUSE-32: TERMINATION OF CONTRACT ON DEATH

If the Contractor is an individual or a proprietary concern and the individual or the proprietor dies, or if the Contractor is a partnership concern and one of the partners dies, then, unless the Engineer-in-Charge is satisfied that the legal representatives of the individual contractor or of the proprietor of the proprietary concern and in the case of partnership, the surviving partners are capable of carrying out and completing the contract, the Engineer-in-Charge shall be entitled to terminate the Contract as to its incomplete part without the Authority being in anyway liable to payment of any compensation whatsoever on any account to the estate of the deceased Contractor and/or to the surviving partners of the Contractor's firm on account of termination of the Contract. The decision of the Engineer-in-Charge that the legal representatives of the deceased contractor or the surviving partners of the Contractor's firm cannot carry out and complete the works under the contract shall be final and binding on the parties. In the event of such termination, the Authority shall not hold the estate of the deceased Contractor and/or the surviving partners of the Contractor's firm liable for damages for not completing the contract. Provided that the power of the Engineer-in-Charge of such termination of contract shall be without prejudice to any other right or remedy which shall have accrued or shall accrue to him under the contract.

CLAUSE-33: CARRYING OUT PART OF WORK AT THE RISK AND COST OF THE CONTRACTOR

33.1 If the contractor

(i) At any time makes default during the currency of work or does not execute any part of the work with due diligence and continues to do so even after a notice in writing of 7 days in this respect from the Engineer-in-Charge; **or**

(ii) Commits default in complying with any of the terms and conditions of the contract and does not remedy it or takes effective steps to remedy it within 7 days even after a notice in writing is given in that behalf by the Engineer-in-Charge; **or**

(iii) Fails to complete the work (s) or items of work with individual dates of completion, on or before the date (s) so determined, and does not complete them within the period specified in the notice given in writing in that behalf by the Engineer-in-Charge.

33.2 The Engineer-in-Charge without invoking action under clause 36 may, without prejudice to any other right or remedy against the contractor which have either accrued or accrue thereafter to IWAI, by a notice in writing to take the part work/ part incomplete work of any item (s) out of his hands and shall have powers to:

(a) Take possession of the site and any materials, constructional plant, implements, stores, etc., thereon; and/ or

(b) Carry out the part work/ part incomplete work of any items (s) by any means at the risk and cost of the contractor.

33.3 The Engineer-in-Charge shall determine the amount, if any, is recoverable from the contractor for completion of the part work/ part incomplete work of any item (s) taken out of his hands and execute at the risk and cost of the contractor, the liability of contractor on account of loss or damage suffered by IWAI because of action under this clause shall not exceed 10% of the tendered value of the work.

33.4 In determining the amount, credit shall be given to the contractor with the value of work done in all respect in the same number and at the same rate as if it had been carried out by the original contractor under the terms of his contract, the value of contractor's materials taken over and incorporated in the work and use of plant and machinery belonging to the contractor. The certificate of the Engineer-in-Charge as to the value of work done shall be final and conclusive against the contractor provided always that action under this clause shall only be taken after giving notice in writing to the contractor. Provided also that if the expenses incurred by the IWAI are less than the amount payable to the contractor at his agreement rates, the difference shall not be payable to the contractor.

33.5 Any excess expenditure incurred or to be incurred by IWAI in completing the part work/ part incomplete work of any item (s) or the excess loss of damages suffered or may be suffered by IWAI as aforesaid after allowing such credit shall without prejudice to any other right or remedy available to IWAI in law or per as agreement be recovered from any money due to the contractor on any account, and if such money is insufficient, the contactor shall be called upon in writing and shall be liable to pay the same within 30 days.

33.6 If the contractor fails to pay the required sum within the aforesaid period of 30 days, the Engineer-in-Charge shall have the right to sell any or all of the contractors' unused materials, constructional plant, implements, temporary building at site etc. and adjust the proceeds of sale thereof towards the dues recoverable from the contactor under the contract and if thereafter there remains any balance outstanding, it shall be recovered in accordance with the provisions of the contract.

33.7 In the event of the above course being adopted by the Engineer-in-Charge, 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 advance on any account or with a view to the execution of the work or the performance of the contract.

CLAUSE-34: COMPLETION TIME AND EXTENSIONS

34.1 The Engineer-in-Charge will make available to the contractor the site to enable the contractor to commence & proceed with the execution of the work in accordance with agreed programme. If there is any delay in making available any area of the work or the delays mentioned in Para 34.4, the competent authority as specified in schedule 'B' on the recommendations of the Engineer-in-Charge shall grant reasonable extension of time for completion of work. However, in case of the contracts having tendered value upto Rs. 50 lakhs, if the total extension involved due to delay is upto 1/3rd of the stipulated period of completion then the Engineer-in-Charge shall decide the extension and convey the same to the contractor. But the contractor shall not claim any compensation whatsoever on this account. The completion period of the project is 900 days from date of issue of work order.

34.2 If after the award of the work the contractor commits defaults in commencing the execution of work as aforesaid, Govt. shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the earnest money & performance guarantee absolutely.

34.3 As soon as possible after the Contract is concluded, the Contractor shall submit a Time and Progress Chart get it approved by the Department. The Chart shall be prepared in direct relation to the time stated in the Contract documents for completion of items of the works. It shall indicate the forecast of the dates of commencement and completion of various trades of sections of the work.

34.4 However, if the work (s) be delayed by:-

(i) Force majeure as per clause 27, or
(ii) Abnormally bad weather, or
(iii) Serious loss or damage by fire, or
(iv) Civil commotion, local commotion of workmen, strike or lockout, affecting any of the trades employed on the work, or
(v) Delay on the part of other contractors or tradesman engaged by Engineer-in-Charge in executing work not forming part of the contract, or
(vi) Non-availability of stores, which are the responsibility of Government to supply or
(vii) Non-availability of breakdown of Tools and Plant to be supplied or supplied by Government or
(viii) Any other cause which, in the absolute discretion of the Engineer-in-Charge is beyond the Contractor's control.

Then immediately upon the happening of any such events as aforesaid, the contractor shall inform the Engineer-in-Charge accordingly, but the contractor shall nevertheless use constantly his best endeavors to prevent and/or make good the delay and shall do all that may be required in this regard. The Contractor shall also request, in writing, for extension of time, to which he may consider himself eligible under the contract, within fourteen days of the date of happening of any such events as indicated above.

34.5 In case the cost of the work is more than 10 crores than the total scope of work will be divided into milestones. The contractor shall submit a Time & Progress chart for each milestone and get it approved by the competent authority.

34.6 Request for rescheduling of Mile stones and extension of time, to be eligible for consideration, shall be made by the Contractor in writing within fourteen days of the happening of the event causing delay on the prescribed form to the competent authority as indicated in Schedule 'B'. The Contractor may also, if practicable, indicate in such a request the period for which extension is desired.

34.7 In any such case as may have arisen due to any of the events, as aforesaid, and which may have been brought out by the contractor in writing, the Competent Authority mentioned in Scheduled 'B' may give a fair and reasonable extension of time, after taking into consideration the nature of the work delayed and practicability of its execution during the period of extension.

34.8 Such extensions shall be communicated to the contractor by the Engineer-in-Charge in writing. The contractor shall not be entitled to claim any compensation or over run charges whatsoever for any extension granted.

CLAUSE-35: LIQUIDATED DAMAGES FOR DELAY

35.1 If the contractor fails to maintain the required progress in terms of clause 34 or to complete the work and clear the site on or before the date of completion as per the contract or extended date of completion, he shall, without prejudice to any other right or remedy available under the law to the authority on account of such breach, pay as agreed liquidated damages the amount calculated at the rates stipulated below.

(i)	Liquidated Damages for delay of work	@ 1.5 % per month of delay to be computed on per day basis

Provided always that the total amount of compensation for delay to be paid under this condition shall not exceed 10% of the Tendered Value of work.

The competent authority mentioned in Schedule 'B' (whose decision in writing shall be final & binding) may decide on the amount of tendered value of the work for every completed day/month (as applicable) that the progress remains below that specified in Clause 34 or that the work remains incomplete.

The amount of liquidated damages may be adjusted or set-off against any sum payable to the Contractor under this or any other contract with the authority.

35.2 In case of contracts having tendered amount more than 10 crores, if the contractor does not achieve a particular milestone mentioned in schedule 'B', or the re-scheduled milestone(s) in terms of Clause 34.6, the amount shown against that milestone shall be withheld, to be adjusted against the liquidated damages levied at the final decision on Extension of Time. With-holding of this amount on failure to achieve a milestone, shall be automatic without any notice to the contractor. However, if the contractor catches up with the progress of work on the subsequent milestone(s), the withheld amount shall be released. In case the contractor fails to make up for the delay in subsequent milestone(s), amount mentioned against each

milestone missed subsequently also shall be withheld. However, no interest, whatsoever, shall be payable on such withheld amount.

35.3 In case of contracts having tendered amount less than 10 crores, if the work remains incomplete after the stipulated date of completion, the Engineer-in-charge may withheld 10% of the tendered value of the work from the running payments of the contractor pending final decision of the competent authority mentioned in schedule 'B' on the extension of time case. If the competent authority decides to grant extension of time without levy of liquidated damages or levy part of the total liquidated damages specified above then the balance withheld amount after adjusting the amount of the liquidated damages levied by the competent authority will be refunded to the contractor.

CLAUSE-36: WHEN THE CONTRACT CAN BE DETERMINED

36.1 Subject to other provisions contained in this clause, the Engineer-in-Charge may, without prejudice to his any other rights or remedy against the contractor in respect of any delay, inferior workmanship, any claims for damages and/or any other provisions of this contract or otherwise, and whether the date of completion has or has not elapsed, by notice in writing absolutely determine the contract in any of the following cases:

(i) If the contractor having been given by the Engineer-in-Charge a notice in writing to rectify, reconstruct or replace any defective work or that the work is being performed in an inefficient or otherwise improper or unworkman like manner shall omit to comply with the requirement of such notice for a period of seven days thereafter.

(ii) If the contractor has, without reasonable cause, suspended the progress of the work or has failed to proceed with the work with due diligence so that in the opinion of the Engineer-in-Charge he will be unable to secure completion of the work by the date for completion and continues to do so after a notice in writing of seven days from the Engineer-in-Charge.

(iii) If the contractor fails to complete the work within the stipulated date or items of work with individual date of completion, if any stipulated, on or before such date(s) of completion and does not complete them within the period specified in a notice given in writing in that behalf by the Engineer-in-Charge.

(iv) If the contractor persistently neglects to carry out his obligations under the contract and/ or commits default in complying with any of the terms and conditions of the contract and does not remedy it or take effective steps to remedy it within 7 days after a notice in writing is given to him in that behalf by the Engineer-in-Charge.

(v) If the contractor shall offer or give or agree to give to any person in IWAI service or to any other person on his behalf any gift or consideration of any kind as an inducement or reward for doing or forbearing to do or for having done or forborne to do any act in relation to the obtaining or execution of contract.

(vi) If the contractor shall enter into a contract with IWAI in connection with which commission has been paid or agreed to be paid by him or to his knowledge, unless the particulars of any such commission and the terms of payment thereof have been previously disclosed in writing to the Engineer-in-Charge.

(vii) If the contractor shall obtain a contract with IWAI as a result of wrong tendering or other non-bonafide methods of competitive tendering or commits breach of integrity pact.

(viii) If the contractor being an individual, or if a firm, any partner thereof shall at any time be adjudged insolvent or have a receiving order or order for administration of his estate made against him or shall take any proceedings for liquidation or composition (other than a voluntary liquidation for the purpose of amalgamation or reconstruction) under any Insolvency Act for the time being in force or make any conveyance or assignment of his effects or composition or arrangement for the benefit of his creditors or purport so to do, or if any application be made under any Insolvency Act for the time being in force for the sequestration of his estate or if a trust deed be executed by him for benefit of his creditors.

(ix) If the contractor being a company shall pass a resolution or the court shall make an order that the company shall be wound up or if a receiver or a manager on behalf of a creditor shall be appointed or if circumstances shall arise which entitle the court or the creditor to appoint a receiver or a manager or which entitle the court to make a winding up order.

(x) If the contractor shall suffer an execution being levied on his goods and allow it to be continued for a period of 21 days.

(xi) If the contractor assigns, transfers, sublets (engagement of labour on a piece-work basis or of labour with materials not to be incorporated in the work, shall not be deemed to be subletting) or otherwise parts with or attempts to assign, transfer, sublet or otherwise parts with the entire works or any portion thereof without the prior written approval of the Engineer -in-Charge.

When the contractor has made himself liable for action under any of the cases aforesaid, the Engineer-in-Charge on behalf of the IWAI with the approval of the competent authority mentioned in schedule 'B' shall have powers:

(a) To determine the contract as aforesaid (of which termination notice in writing to the contractor under the hand of the Engineer-in-Charge shall be conclusive evidence). Upon such determination, the Earnest Money Deposit, Security Deposit already recovered and Performance Guarantee under the contract shall be liable to be forfeited and shall be absolutely at the disposal of the IWAI.

(b) After giving notice to the contractor to measure up the work of the contractor and to take such whole, or the balance or part thereof, as shall be un-executed out of his hands and to give it to another contractor to complete the work. The contractor, whose contract is determined as above, shall not be allowed to participate in the tendering process for the balance work.

In the event of above courses being adopted by the Engineer-in-Charge, the contractor shall have no claim to compensation for any loss sustained by him by reasons of his having purchased or procured any materials or entered into any engagements or made any advances on account or with a view to the execution of the work or the performance of the contract. And in case action is taken under any of the provision aforesaid, the contractor shall not be entitled to recover or be paid any sum for any work thereof or actually performed under this contract unless and until the Engineer-in-Charge has 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.

CLAUSE-37: INSPECTION AND APPROVAL

37.1 All works involving more than one process shall be subject to examination and approval at each stage thereof and the contractor shall give due notice to the Engineer-in-Charge on his authorized representative, when each stage is ready. In default of such notice, the Engineer-in-Charge shall be entitled to appraise the quality and extent thereof and the decision of the Engineer-in-Charge in this regard shall be final and binding.

37.2 No work shall be put out of view without the approval of the Engineer-in-Charge or his authorized representative and the Contractor shall afford full opportunity for examination. The contractor shall give due notice to the Engineer-in-Charge or his authorized representative whenever any such work is ready for examination and the Engineer- in-Charge or his representative shall, without unreasonable delay, unless he considers it necessary and advise the contractor accordingly, examine and measure such work. In the event of the failure or the contractor to give such notice, he shall if required by the Engineer-in-Charge, uncover such work at the contractor's expenses.

37.3 Periodic inspection will be carried out by the EIC or his representative by their vessels. The contractor can have the inspection schedules finalized with the Engineer-in-charge. Generally all attempts should be made to have joint inspection and number of inspections be not less than three in a calendar month.

CLAUSE-38: COMPLETION CERTIFICATE AND COMPLETION PLANS

38.1 The work shall be completed to the entire satisfaction of the Engineer-in-Charge and with in the specified time limit and under the terms and conditions of the contract. As soon as the work under the contractor is completed as a whole the contractor shall give notice of such completion to the Engineer-in-Charge. The Engineer-in-Charge shall inspect the work and shall satisfy himself that the work(s) has been completed in accordance with the provisions of the contract and then issue to the Contractor a certificate of completion indicating the date of completion. Should the Engineer- in-Charge notice that there are defects in the works or the works are not considered to be complete, he shall issue a notice in writing to the Contractor to rectify / replace the defective work or any part thereof or complete the work, as the case may be within such time as may be notified and after the contractor has complied with as aforesaid and gives notice of completion the Engineer-in-Charge shall inspect the work and issue the completion certificate in the same manner as aforesaid.

38.2.1 No certificate of completion shall be issued as stipulated above and no work be considered to be completed unless the contractor shall have removed from the work site and / or premises all his belongings / temporary arrangements brought / made by him for the site and / or premises in all respects and made the whole of the site and / or premises fit for immediate occupation / use to the satisfaction of the Engineer- in-Charge. If the contractor fails to comply with the above mentioned requirements on or before the date of completion of the work, the Engineer-in-Charge, may as he thinks fit and at the risk at cost of the contractor, fulfill such requirements and remove / dispose of the contractor's belongings / temporary arrangements, as aforesaid, and the contractor shall have no claim in this respect except for any sum realised by the sale of Contractor's belongings / temporary arrangements less the cost of fulfilling the said requirements and any other amount that may be due from the contractor. Should the expenditure on the aforesaid account exceed the amount realised by sale of such contractor's belongings / temporary arrangements then the contractor shall on demand pay the amount of such excess expenditure.

38.2.2 The contractor shall submit the completion plans of the work wherever required within 30 days of the completion of work. In case the contractor fails to submit completion plans as aforesaid, he shall be liable to pay a sum equivalent to 2.5% of the value of the work subject to a ceiling of Rs. 15000/- (Rupees fifteen thousand only) as may be fixed by Engineer-in-Charge concerned and in this respect the decision of the Engineer-in-Charge shall be final and binding on the contractor.

CLAUSE-39: MEASUREMENTS

39.1 The Engineer-in-charge shall, except as otherwise provided, ascertain and determine by measurement the value of work done in accordance with the contract.

39.2 Notwithstanding any provision in the relevant standard method of measurement or any general or local custom, measurement of work done under the contract shall be taken in accordance with the procedure set forth in the Technical Specifications or Schedule of Quantities under the contract. In case of items of work which are not covered by the Technical Specifications or Schedule of Quantities measurement shall be taken in accordance with the relevant standard methods of measurement laid down by the Bureau of Indian Standard.

39.3 All items having a financial value shall be entered in daily log book/ measurement book prescribed by the Authority so that the complete work performed under the contract is duly accounted.

39.4 Measurement shall be taken jointly by the Engineer-in-Charge or his authorised representative and by the contractor or his authorised representative.

39.5 Before taking measurements of any works, the Engineer-in-Charge or representative deputed by him for the purpose, shall give a reasonable notice to the Contractor. If the Contractor fails to attend or send an authorised representative for measurement after such notice or fails to countersign or to record the objection within a week from the date of taking the measurements, in such eventuality the measurements taken by the Engineer-in-Charge shall be taken to be correct and final measurements of such works.

39.6 The contractor shall, without extra charge, provide assistance with every appliance, labour and other things necessary for measurement.

39.7 Measurements shall be signed and dated by both parties each day on the Site on completion of measurement. If the contractor objects to any of the measurement recorded by the representative of the Engineer-in- Charge a note to the effect shall be made in the item objected to and such note shall be signed and dated by both parties engaged in taking the measurement. The decision of the Engineer-in-Charge on any such dispute or difference or interpretation shall be final and binding on the contractor in respect of all contract items, substituted items, extra items and deviations.

CLAUSE-40: PAYMENT ON ACCOUNT

40.1 Interim bills shall be submitted by the contractor monthly on or before the date fixed by the Engineer-in- Charge for the items of work completed. The Engineer-in-Charge shall then arrange to have the bills verified with reference to the measurements recorded in the measurement book(s).

40.2 Payment on account for amount admissible shall be made by the Engineer-in-Charge certifying the sum to which the contractor is considered entitled by way of interim payment for the work executed, after deducting therefrom the amount already paid, the security deposit and such other amounts as may be withheld, deductible or recoverable in terms of the contract.

40.3 Payment of the contractor's bills shall be made by the Authority only in Indian Rupees within 30 days from the date of submission of the bill subject to the acceptance of the Engineer-in-Charge.

40.4 Payments due to the contractor shall be made by crossed cheque by the Engineer-in-Charge or his authorised representative. Such cheques shall be issued direct to the contractor on furnishing a stamped receipt for the amount of the cheque or to his constituted attorney duly authorised to receive such payments from the EIC.

40.5 Any interim certificate given relating to work done or materials delivered may be modified or corrected by any subsequent interim certificate or by the final certificate. No certificate(s) of the Engineer-in- Charge supporting an interim payment shall itself be conclusive evidence that any work or materials to which it relates is / are in accordance with the same.

40.6 Should there be a request for extension of date of completion, pending its consideration interim payments shall continue to be made as provided herein.

40.7 TDS at the applicable rates shall be deducted at source from any payment made to the contractor against this contract.

CLAUSE-41: TAXES, DUTIES AND LEVIES ETC.

41.1 The prices shall include all the taxes, levies, cess, octroi, royalty, terminal tax, excise, or any other local, State or Central taxes as applicable/ charged by Centre or State Government or Local authorities on all materials, except service tax, that the contractor has to purchase for the performance of the contract and services, shall be payable by the contractor and the Authority will not entertain any claim for compensation whatsoever in this regard.

41.2 The rates quoted by the contractor shall be deemed to be inclusive of all such taxes, duties, levies, etc. except for service tax, which shall be indicated separately in the running account bill and final bill and will be reimbursed to the contractor on production of proof of payment.

41.3 The contractor shall also comply with the provisions of the building and other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996 and the building and other Construction Workers Welfare Cess Act, 1996 as laid down in the "Building and other Construction Workers Welfare Cess Act". The contractor shall have to pay Cess @1% of the gross value of work done by him, which shall be recovered from each running bill including final bill of the work by the EIC.The amount so deducted shall be transferred to the concerned authority.

41.4 The work contract tax as applicable shall be recovered from each running bill including final bill of the work by the EIC.The amount so deducted shall be transferred to the concerned authority.

CLAUSE-42: TAX DEDUCTION AT SOURCE

42.1 TDS at the applicable rate as per Income Tax Act/Rules shall be deducted from all the payment/advances made against the contract.

CLAUSE-43: PAYMENT OF FINAL BILL

The final bill shall be submitted by the contractor within one month from the date of completion of the work or of the date the certificate of completion furnished by the Engineer-in-Charge. No further claim in this regard unless as specified herein under shall be entertained. Payment of final bill shall be made within three months if the amount of the contract is up to Rs. 15 lakhs and six months if the value of the work exceeds Rs. 15 lakhs. If there shall be any dispute about any item or items of the work then the undisputed item or items only shall be paid within the said period of three months or six months, as the case may be. The contractor shall submit a list of the disputed items within thirty days from the disallowance thereof and if he fails to do so, his claim shall be deemed to have been fully waived and absolutely extinguished.

CLAUSE-44: OVER PAYMENTS AND UNDER PAYMENTS

44.1 Whenever any claim whatsoever for the payments of a sum of money to the Authority arises out of or under this contract against the contractor, the same may be deducted by the Authority from any sum then due or which at any time thereafter may become due to the contractor under this contract and failing that under any other contract with the Authority or from any other sum whatsoever due to the contractor from the Authority or from his security deposit, or he shall pay the claim on demand.

44.2 The Authority reserves the right to carry out post- payment audit and technical examination of the final bill including all supporting vouchers, abstracts, etc. The authority further reserves the right to enforce recovery of any over payment when detected not- withstanding the fact that the amount of the final bill may be included by one of the parties as an item of dispute before an arbitrator appointed under clause 48 of this contract and notwithstanding the fact that the amount of the final bill figures in the arbitration award.

44.3 If as a result of such audit and technical examination any over payment is discovered in respect of any work done by the contractor or alleged to have been done by him under contract, it shall be recovered by the Authority from the contractor by any of all of the methods prescribed above, and if any under payment is discovered, the amount shall be duly paid to the contractor by the Authority.

44.4 Provided that the aforesaid right of the Authority to adjust over-payment against amount due to the contractor under any other contract with the Authority shall not extend beyond the period of two years from the date of payment of the final bill or in case the final bill is a MINUS bill, from the date the amount payable by the Contractor under the MINUS final bill is communicated to the contractor.

44.5 Any sum of money due and payable to the Contractor (including the security deposit returnable to him) under the contract may be withheld or retained by way of lien by the Engineer-in-Charge or Authority against any claim of the Authority or such other person or persons in respect of payment of a sum of money arising out of or under any other contract made by the contractor with the Engineer-in-Charge or Authority or with such other person or persons. The sum of money so withheld or retained under this clause by the Engineer-in-Charge or Authority will be kept withheld or retained as such by the Engineer-in- Charge or

Authority or till his claim arising out of in the same contract or any other contract is either mutually settled or determined by the arbitrator, if the contract is governed by the arbitration clause under the clause 48 or by the competent court hereinafter provided, as the case may be, and the contractor shall have no claim for interest or damages whatsoever on this account or any other ground in respect of any sum of money withheld or retained under this clause.

CLAUSE-45: FINALITY CLAUSE

It shall be accepted as an inseparable part of the contract that in matters regarding design, materials, workmanship, removal of improper work, interpretation of the contract drawings and contract specifications, mode of procedure and the carryout out of the work the decision of the Engineer-in-Charge which shall be given in writing shall be final and binding on the contractor.

CLAUSE-46: SUM PAYABLE BY WAY OF COMPENSATION TO BE CONSIDERED IS REASONABLE WITHOUT PREFERENCE TO ACTUAL LOSS

All sum payable by way of compensation to the Authority under any of these conditions shall be considered as reasonable compensation without reference to the actual loss or damage sustained and whether or not damage shall have been sustained.

CLAUSE-47: SETTLEMENT OF DISPUTES & ARBITRATION.

47.1 Except where otherwise provided in the contract, all questions and disputes relating to the meaning of the specifications, design, drawings and instructions here-in-before mentioned and as to the quality of workmanship or materials used on the work or as to any other question, claim, right, matter or thing whatsoever in any way arising out of or relating to the contract, design, drawings, specifications, estimates, instructions, orders or these conditions or otherwise concerning the works or the execution or failure to execute the same whether arising during the progress of the work or after the cancellation, termination, completion or abandonment thereof shall be dealt with as mentioned hereinafter:

(i) If the contractor considers any work demanded of him to be outside the requirements of the contract, or disputes any drawings, record or decision given in writing by the Engineer-in-Charge on any matter in connection with or arising out of the contract or carrying out of the work, to be unacceptable, he shall promptly within 15 days of the receipt of decision from the Engineer-in-Charge request the Chief Engineer in writing through the Engineer-in-Charge for written instruction or decision. Thereupon, the Chief Engineer shall give his written instructions of the decision within a period of one month from the receipt of the contractor's letter. However, this will not be reason for the stoppage of work.

(ii) If the Chief Engineer fails to give his instructions or decision in writing within the aforesaid period or if the contractor is dissatisfied with the instruction or decision of the Chief Engineer, the contractor may, within 15 days of the receipt of Chief Engineer's decision, appeal to the Chairman, IWAI who shall afford an opportunity to the contractor to be heard, if the latter so desires, and to offer evidence in support of his appeal. The Chairman, IWAI shall give his decision within 30 days of receipt of contractor's appeal. If the contractor is still dissatisfied with his decision, the contractor shall within a period of 30 days from receipt of the decision, give notice to the

Chairman, IWAI for appointment of arbitrator on prescribed proforma as per Annex-9, failing which the said decision shall be final binding and conclusive and not referable to adjudication by the arbitrator.

47.2 Except where the decision has become final, binding and conclusive in terms of Sub Para 47.1 above, disputes or differences shall be referred for adjudication through arbitration by a sole arbitrator appointed by Chairman, IWAI.

47.3 Further, within thirty (30) days of receipt of such notice from either party, the Engineer-in-Charge of work at the time of such dispute shall send to the Contractor a panel of three persons preferably but not necessarily from the approved panel of arbitrators being maintained by Indian Council of Arbitration (ICA) and thereafter the Contractor within fifteen (15) days of receipt of such panel communicate to the Engineer-in-charge the name of one of the persons from such panel and such a person shall then be appointed as sole arbitrator by the Chairman, IWAI. However, the arbitrator so appointed shall not be an officer or the employee of Inland Waterways Authority of India.

Provided that if the Contractor fails to communicate the selection of a name out of the panel so forwarded to him by the Engineer-in-charge then after the expiry of the aforesaid stipulated period the Chairman, shall without delay select one person from the aforesaid panel and appoint him as the sole arbitrator.

47.4 The arbitrator to whom the matter is originally referred being transferred or vacating his office or being unable to act for any reason, then the Chairman IWAI shall appoint another person to act as sole arbitrator, such person shall be entitled to proceed with the reference from the stage at which it was left by the predecessor.

47.5 The award of the Arbitrator shall be final and binding. The Arbitrator shall decide in what proportion the Arbitrator's fees, as well as the cost of Arbitration proceeding shall be borne by either party.

47.6 The Arbitrator with the consent of the parties can enlarge the time, from, time-to-time to make and publish his award.

47.7 A notice of the existence in question, dispute or difference in connection with the contract unless served by either party within 30 days of the expiry of the defects liability period, failing which all rights and claim under this contract shall be deemed to have been waived and thus forfeited and absolutely barred.

47.8 The Arbitrator shall give reasons for the award if the amount of claim in dispute is Rs. 1,00,000/- and above.

47.9 The work under this Contract shall continue during Arbitration proceedings and no payments due from or payment by the Authority shall be withheld on account of such proceedings except to the extent which may be in dispute.

47.10 The Arbitration and Conciliation Act 1996 with any statutory modifications or re-enactment thereof and the rules made there under and being in force shall apply to the Arbitration proceedings under this clause.

47.11 The parties to the agreement hereby undertake to have recourse only to arbitration proceedings under for Arbitration Act 1996 and the venue of the arbitration proceeding shall be Noida/ New Delhi and the parties will not have recourse to Civil Court to settle any of their disputes arising out of this agreement except through arbitration.

NOTE: In case of contract with another Public Sector Undertaking, following Arbitration Clause shall apply: "Except as otherwise provided, in case of a contract with a public Sector Undertaking if at any time any question dispute or difference whatsoever arises between the parties upon or in relation to, or in connection with this agreement, the same shall be settled in terms of the Ministry of Industry, Department of Public Enterprises O.M No. 3/5/93-PMA dt.30.06.93 or any modifications / amendments thereof. "The arbitrator shall have the power to enlarge the term to publish the award with the consent of the parties provided always that the commencement or continuation of the arbitration proceeding shall not result in cessation or suspension of any of other rights and obligations of the parties of any payments due to them hereunder.

CLAUSE-48: CLAIMS

48.1 The contractor shall send to the Engineer-in-Charge once in every month on account giving particulars, as full and detailed as possible of all claims for any additional payment to which the contractor may consider himself entitled and of all extra work or additional work ordered in writing and which has been executed during proceeding month.

48.2 No claim for payment of any extra work or expenses will be considered which has not been included in such particulars. The Engineer-in-Charge may consider payment for any such work or expense, where admissible under the terms of the Contract.

48.3 Any claim which is not notified in two consecutive monthly statements for the two consecutive months shall be deemed to have been waived & extinguished.

CLAUSE-49: INTEREST

No interest shall be payable on account due to the contractor against final bills or any other payment due under the contract.

CLAUSE-50: POLLUTION CLEARANCE

"IWAI has not obtained any environmental clearance for construction of Slipway project. However, should any such statutory clearance be required for the execution of the project, then in that case it will be the responsibility of the contractor to obtain the same from the concerned authority i.e. State Pollution Control Board/any Central Govt or State Govt. Authority. However, the actual expenditure done by the contractor in making the payment to the concerned authority for getting clearance will be reimbursed by the IWAI on actual basis subject to the production of proof of payment."

CLAUSE-51: MOBILIZATION ADVANCE

Mobilization advance not exceeding 10% of the tendered value may be given, if requested by the contractor in writing within one month of the order to commence the work. Such advance shall be in two or more installments to be determined by the

Engineer-in- Charge at his sole discretion. The first installment of such advance shall be released by the Engineer-in-charge to the contractor on a request made by the contractor to the Engineer-in-Charge in this behalf. The second and subsequent installments shall be released by the Engineer- in- Charge only after the contractor furnishes a proof of the satisfactory utilization of the earlier installment to the entire satisfaction of the Engineer-in-Charge. Before any installment of advance is released, the contractor shall execute a Bank Guarantee Bond from Scheduled Bank for the amount equal to 110% of the amount of advance and valid for the contract period. This (Bank Guarantee from Scheduled Bank for the amount equal to 110% of the balance amount of advance) shall be kept renewed from time to time to cover the balance amount and likely period of complete recovery.

The mobilization advance above shall bear simple interest at the rate of 10 per cent per annum and shall be calculated from the date of payment to the date of recovery, both days inclusive, on the outstanding amount of advance. Recovery of such sums advanced shall be made by the deduction from the contractors bills commencing after first ten per cent of the gross value of the work is executed and paid, on pro-rata percentage basis to the gross value of the work billed beyond 10% in such a way that the entire advance is recovered by the time eighty per cent of the gross value of the contract is executed and paid, together with interest due on the entire outstanding amount up to the date of recovery of the installment.

If the circumstances are considered reasonable by the Engineer-in-Charge, the period mentioned in the above clause for request by the contractor in writing for grant of mobilization may be extended in the discretion of the Engineer-in-Charge

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PART III

6 TECHNICAL SPECIFICATIONS FOR CIVIL WORKS

6.1 SCOPE OF WORK

This is an item rate tender, based on design and drawing finalized by the INLAND WATERWAYS AUTHORITY OF INDIA, shall be inclusive of cost of labour, materials, tools and plant and specialized machinery for completing the various components of the project and all operations connected therewith, under all conditions of site, moisture, weather etc. The rate shall be inclusive of all taxes and duties such as sales tax and excise duty on materials, income tax, supply and carriage of materials (By rail, road, river, air etc.), plants and machinery, octroi, toll, royalties, incidental charges, local taxes, patent rights etc. Thus the quoted offer shall be consolidated for all components/items of work. Royalties, sales tax, VAT, contract tax, levies, local taxes, incidental charges, whenever applicable shall be paid by the contractor to the respective authorities and no claim whatsoever on this shall be entertained by the Department.

The quantities of various items of work involved have been detailed in Schedule of Quantities of this tender. The tenderer is to quote the rates for different items of work as included in the said schedule of quantities. The prices should also include the consultancy charges which may be required to be paid by the contractor for the design and fabrication of the bearings / shuttering / scaffoldings / support structure / protection works, expansion joints, any kind of temporary works, etc. for execution of the project.

The broad description of items to be constructed as part of this tender are given below:

6.1.1 Main Slipway

Wells

Five wells (caissons) of 6 m diameter with spacing of 26 m and Two wells (caissons) of 4.5 m diameter with spacing of 20 m are proposed for the foundation of the slipway. The wells of 6 m diameter and 4.5m diameter shall be founded at -32.0 m and +18.0 m respectively. The steening thickness shall be 1 m and 1.75m for 6 m diameter and 4.5 m diameter wells respectively.

Girders

Two RCC girders of size 1.2m x 3.0 m in 26m span and of size 0.8m x 2.0 m in 20m span, one under each rail is proposed. The two girders shall be cross connected by beams of size 0.65 m x 2.5 m in 26m span and of size 0.5 m x 1.5 m in 20 m span. The girders shall be supported on well foundations and shall transfer the vertical and horizontal loads to wells.

Retaining Wall

The Retaining Wall for the main slipway shall be RCC cantilevered walls 650 mm thick at the base and minimum 200 mm thick at top. Expansion joints shall be provided at every 5 m. The joints shall be filled with compressible material.

RCC Floor

RCC Floor for the main slipway shall be 750 mm thick and laid in 1 in 16 slope. The floor shall be in panels at 5 m spacing. The joints shall be filled with compressible material.

The Floor shall be laid on 100 mm thick lean concrete on a compacted granular cushion 500 mm thick with 50 mm down aggregate in layers not exceeding 150 mm.

Transfer Bay-1

22 m x 22.50 m Transfer Bay 1 shall be constructed between main slipway and parking bay. The bottom slab of the transfer bay 1 shall be 500 mm thick laid on 100 mm thick lean concrete on a compacted granular cushion 500 mm thick with 50 mm down aggregate in layers not exceeding 150 mm. The peripheral walls shall be minimum 350 mm thick RCC.

Transfer Bay-2

26 m x 33.05 m Transfer Bay 2 shall be constructed between side slipway and repair bays for smaller vessels. The bottom slab of the transfer bay 2 shall be 500 mm thick laid on 100 mm thick lean concrete on a compacted granular cushion 500 mm thick with 50 mm down aggregate in layers not exceeding 150 mm. The peripheral walls shall be minimum 200 mm thick RCC.

6.1.2 Repair Bay for Large Vessels

Columns and Footings

Partially cast columns of size 500 mm x 500 mm and completed footings exist at the site. The existing footings were found inadequate. These shall be removed and new footings, columns, beams & slabs shall be built as shown in drawings.

Beams

500 mm x 800 mm (long & cross) beams at two levels shall be built as shown in the drawing. 150 mm thick slabs where shown shall be provided.

6.1.3 Repair Bay 1 & 2 for smaller vessels

This is a RCC raft slab 25m x 4.5 m with rails as shown. The raft shall be 500 mm thick supported on 100 mm thick lean concrete on a compacted granular cushion 500 mm thick with 50 mm down aggregate in layers not exceeding 150 mm. Expansion joints shall be provided at every 5 m. The joints shall be filled with compressible material.

6.1.4 Trolley Rails

CR-100 rails conforming to IS:3443 are proposed to be used, as these match with the choosen trolley wheels.

6.1.5 Fixing Rail CR-100 on concrete

The crane rail shall be supported on a continuous 350 x 16 thick steel base plate bedded on 30 thick grout tamped in place. The bed plate shall be bolted to base concrete @ 700 mm c/c. The rail fastenings are designed to permit the rail to move longitudinally but restrain it from vertical motion.

6.1.6 Fixing Rail CR-100 on Steel Beams

The rails shall be welded to the base plate fixed on the supporting beam.

6.1.7 Slope Protection Work

Slope protection work on slopes shall consist of 1000 mm thick boulder pitching laid on filter media 200 mm thick. The stone pitching shall extend at least 30 m on either side of well foundations and shall be provided as per IRC-89-1997.

6.1.8 Winch House

A 5m X 15 m, framed RCC building is conceived. The building shall have RCC raft foundation approx. 16 m x 6m x 1m with key 1m x 1m x 15m to take the horizontal pull of 100 T, the winch capacity. The building shall be made of RCC columns, beams and slab. The walls shall be 250 mm thick brick work, plastered both inside and outside. 2 nos. rolling shutters 3m x 3m and 1 steel door 1200 x 2000 shall be provided. Two openings 1500 x 1000 shall be provided for wire ropes. Necessary ramps and steps are shown in the drawings shall be provided. The flooring shall be Kota Stone or the equivalent local stone. A 150 thick RCC slab shall be provided below the flooring. The plinth shall be filled with compacted sand. Specified waterproofing shall be provided on roof and shall be finished with brick tiles / mosaic tiles. Plinth protection shall be provided all around the building, walls inside shall be painted with oil bound distemper. The exterior wall shall be finished with water proofing paint.

6.1.9 Pump Room and Sump

A sump and pump room is provided to meet water requirement for human consumption, washing of vessel, and firefighting. 100 cum. is provided for firefighting and 20 cum. is provided for domestic use and vessel washing.

The details are shown in **Drawing I-506/PS/241.** The sump and pump room shall be of RCC construction partly below ground.

The offer quoted for the above work shall broadly include but not limited to the following main items:

6.1.9.1 General

i) Preliminary works like setting and maintenance of permanent bench marks, reference points, central line of the carriageway etc. It shall also include making adjustment in the layout if required as per the site conditions and as directed by the Engineer-in-Charge. The lay out shall be got approved from the Engineer-in-Charge before starting actual work. Existing levels of the area under the scope of work shall also be recorded. Use of total station in survey work shall be ensured.

ii) Clearing of site for construction of the work and all activities connected therewith before commencement of work to the satisfaction of the Engineer-in-Charge.

iii) Clearing of site (to the satisfaction of the Engineer-in-Charge) after completion of entire work and handing over the same to the Department.

iv) All plain and reinforced concrete shall have shutter or form liner finish (except lean concrete) and nothing extra shall be paid on this account.

v) Maintenance of all works during construction and twelve months after completion of the works. This is notwithstanding any other provision contained in the tender documents elsewhere.

vi) Protection and maintenance of existing services.

vii) Providing adequate arrangement for barricading as per typical design and as directed by the Engineer-in-Charge at all required locations viz. to cover the entire construction site including all T & P & materials. This shall include reflective signs, markings, flags, flashing lights, tool posts with GI cover sheets and flagman as directed by Engineer-in-Charge.

viii) Provision for all safety measures for traffic, pedestrian, workmen, machinery etc. as considered necessary by the Engineer-in-Charge.

ix) Dismantling of any existing old work and bituminous work, kerb stone, brick work, RCC slabs, CC footpath, old SW/RCC pipes, c.c. drain etc. including disposal of rubbish to the complete satisfaction of the Engineer-in-Charge. The dismantled materials shall be the liability / asset of the contractor.

x) Identification of services like sewer lines, water supply lines, electric and telephone cables etc. well in advance of actual execution.

xi) Making adequate arrangement for closing the manholes, wherever required, including necessary dismantling, casting concrete slabs over the closed manholes and making provisions for compressible pads (Thermocol etc.) formwork and protective slab above pads, below the well cap as per pattern approved by the Engineer-in-Charge.

xii) Making new manhole whenever required for the existing running sewer line of large diameter as per bye laws and as per directions of the Engineer-in-Charge.

xiii) Repaid / re-construction / making good damaged roads, service lines, storm water drains, water supply lines, sewer lines, electric cables, telephone cables etc. and other structures / property affected by any action / inaction and activities of the tenderer in the opinion of the Engineer-in-Charge which shall be final and binding. Such repair / reconstruction / making good the jobs shall be done as per direction of the Engineer-in-Charge.

xiv) Tenderer before submitting the tender shall discuss with the IWAI the methodology required for the work including sequence of construction, related construction technique to be followed during execution of the project and no claim whatsoever for not having first-hand knowledge in respect of scope of work shall be entertained at a later date.

xv) Any other item relevant / necessary, in the opinion of the Engineer-in-Charge, required for completing the work in all respects with all operations and works mentioned in the tender document including all quality assurance measures, testing etc., complete as specified and as per approved drawings.

xvi) All ancillary and incidental facilities required for execution of the work, e.g. labour camps, stores, offices for contractors, work shop facilities, water and ward, temporary structure for plant and machinery, water storage structure, tube wells, electric / telephone installation and charges, liaison work, protection work during execution and not included in the main items, any other item / activity contained elsewhere in the tender documents which is necessary for execution of work in the opinion of the Engineer-in-Charge shall be the sole responsibility of the Contractor and accordingly the cost of same shall be borne by the Contractor.

xvii) Pumping and bailing out water in suitable manner as directed by Engineer-in-Charge.

xviii) It is also made clear that intending tenderer should visit the site of work and physically assess the activities that are involved for completing the work, including the quantum of work besides the information supplied in the tender document. The contractor shall assess the common (to be identified by the Engineer-in-Charge) location for setting up the batching plant and fabrication work, as detailed elsewhere in the tender documents, at his own cost. No claim whatsoever shall be entertained on this account.

xix) Quality Assurance and Quality Assurance Manual

Quality Assurance (QA) shall aim at all the planned and systematic activities implemented within the Quality System and demonstrated as needed, to provide adequate confidence that the structure, as built, will fulfill the requirements. The contractor shall prepare a Quality Assurance Manual outlining policy, procedures, responsibilities, compliance, acceptance criteria and documentation keeping in view the requirements as elaborated in Q4 (extra high quality) standard of quality assurance contained in IRC:SP:47-1998 (Guide lines for quality assurance for bridge and highway works). This document shall contain the standards and criteria for acceptance of all works as defined in the scope of work elsewhere in the tender documents as well as the frequency of tests to be conducted on the raw materials and finished products to be incorporated in the work. The said manual should contain method statements for carrying out the main activities. This manual should also contain procedures for dealing with materials and products not conforming to the relevant standards and specifications. The contractor shall also make all the necessary arrangements for the documentation of the sequence of construction activities in the shape of audio visual film documentary filmed on a digital movie camera, the overall duration of such movie being limited to 30 minutes after editing as approved by the Engineer-in-Charge. It should be prepared and submitted for acceptance to the Engineer-in-Charge within 60 days of written order to commence the work. This movie shall be the absolute property of the Government of India and will not be copied or reproduced for work or otherwise without the prior permission of the Chief Engineer, IWAI.

The QA Manual should generally cover the following:

a) Identification of all parties involved in QA and their inter relationship.
b) Internal QA system of the agency.
c) Levels of cross-checking / verification in case of multiple verifications / controls, including system of inspection and audit, whatever applicable.
d) Organisation of personnel, responsibilities and lines of reporting the QA purposes.
e) Criteria for acceptance / rejection, based on the provisions of these documents.
f) Inspection at the end of defect liability period.
g) Items to be covered in maintenance manual.
h) All formats of documentation.
i) Procedures for dealing with nonconforming material and/or workmanship.

Independent parallel checks/ supervision and clarification should be carried out by one experienced agency to be approved by the Engineer-in-Charge beforehand for important, innovative and sensitive item of work as a second level entry on full scale basis. This should be carried out as extra control. The level of control should be clearly defined in the Quality Assurance Manual. The Manual should also identify the responsible parties, their functions and inter-relation between them. The applicable class of quality assurance (QA) should be Q-4 (as for extra high QA) according to IRC:SP:47-1998.

xx) Any works, other than the above essential works, which are not specifically mentioned above but are required otherwise for the completion of the work, shall be deemed to be covered under the scope of work.

Services like water supply lines, sewer lines, storm water drains, electricity lines, telephone lines over head and underground cable / structure, if any falling in the alignment of the work, (which are required to be removed or shifted in the opinion of the Engineer-in-Charge shall be removed / shifted by the department if found necessary by

the Engineer-in-Charge. Time taken for its shifting, removal, and diversion shall be accounted for towards according extension of times if it actually causes hindrance in execution as per the discretion of the Engineer-in-Charge. No claim for delay or otherwise due to above reason shall be entertained on this account.

6.2 SITE CONDITIONS

6.2.1 General

Site conditions given hereunder or elsewhere are given as guidelines by the department but the contractor shall satisfy himself regarding all aspects of site conditions and no claim will be entertained on the plea that the information supplied by the department is erroneous or insufficient.

6.2.2 Location

The site of the work is situated upstream of the Straight Bridge across river Brahmaputra on Pandu side near Guwahati which is the capital city of the state of Assam. The work pertains to construction of a Ship Repair Facility (Slipway) at Pandu, Guwahati, NW-2 in river Brahmaputra at the site mentioned above.

6.2.3 Climate Conditions

The monsoon rains in this area are quite active from April to October every year. This is for the general guidance of the tenderers and there may be variations.

6.2.4 Housing, Water Supply, Drainage and Electricity

No accommodation is available at the site of work. The contractor has to make his own arrangements for electric connection, housing, stores and field offices, accommodations for his labour and other employees etc. Contractor should visit the site and see in what manner he is able to arrange the above. Arrangement of water for drinking purpose in addition to the water required for construction work is also to be made by the contractor. Temporary electric connection may be taken by the contractor from the Assam State Electricity Board at his own cost. The department will recommend the application of the contractor without any financial or legal liability. If any royalty / rent is payable to the State Govt. or any local authority for occupation of the land at the work site, the same shall be payable by the contractor directly to such Govt. or local body, as the case may be. Nothing extra shall be payable by the Engineer-in-Charge on this account.

It shall be deemed that the contractor has satisfied himself regarding the nature and location of the work, general and local conditions and particularly these pertaining to transport, handling and availability and storage of materials, availability of labour, weather conditions at site and general ground / sub soil conditions and the tenderer has to quote.

The Engineer-in-Charge will bear no responsibility for the lack of such knowledge and also the consequence thereof to the contractor. The information and site data shown in the drawings and mentioned herein and elsewhere in these tender documents are furnished for general information and guidance only. The Engineer-in-Charge in no case shall be held responsible for the accuracy thereof or/and deductions, interpretations or conclusions drawn there from by the contractor and no claim shall be entertained whatsoever if the site conditions/information is different or otherwise incorrect as it is presumed that the

contractor has satisfied himself for all possible contingencies, situations, bottlenecks and acts of coordination which may be required between the different agencies.

In case of flooding of the site on account of rain and other cause, or any other damage whatsoever, no claim financially or otherwise shall be entertained, notwithstanding any other provisions elsewhere in the tender documents.

All mixing of concrete shall be allowed with the automatic microprocessor controlled cement concrete batch mix plants capable of producing at least 30 cubic meters of concrete per hour. Such plant shall have separate weighing scale having a least count of 0.5 kg for Cement. Each batch of concrete coming out of the drum of the mixer shall be supported by a printout showing the weights of various ingredients. The concrete will be transported to work site in transit mixers having a minimum capacity of 4 cubic meters.

6.3 DESIGN REQUIREMENTS

6.3.1 General

All drawings and designs for the temporary works and for works including expansion joints shall conform to and comply with the latest and guide lines published by the IRC including IRC:SP-33 as detailed elsewhere in these tender documents. These standards and specifications and guide lines shall be supplemented by the latest code of practice published by the Bureau of Indian Standards and codes of practice published by the Indian Railways in so far as they are applicable to the present work. These shall also deem to include all the subsequent amendments that may be recommended by the concerned authorities upto the date of receipt of the tenders. For all the works for which the contractor has to submit the designs for approval, the same shall be got prepared from the specialized consultants of repute. Use of any proprietary method of shuttering or scaffolding should be supplemented by proper design calculations for such systems for the approval for the Engineer-in-Charge.

6.3.2 Errors, Omissions and discrepancies

In case of errors, omissions and discrepancies between the scaled dimensions and those written in the drawings or between drawings and specifications, the following order of performance shall prevail:

i) Between actual scaled and written dimensions, the later shall prevail to resolve the conflict.

ii) Between the written dimensions given in the drawings and the corresponding specifications, the later shall apply,

iii) In all case of doubt or omissions or discrepancies noticed in any item of work any drawing, the decision of the Engineer-in-Charge shall be final and binding on the contractor.

6.3.3 Other Technical Requirements

Making out the center line and total station equipment stations including construction of the pillars as reference points for establishing control points to check the lines and levels shall be arranged by the contractor at his cost. He will be responsible for the correct setting out the works including correct lines and levels, positions and alignment of all the components of the work involved as defined by these tender documents. The contractor shall arrange all the instruments, materials and labour involved in setting out the works to the satisfaction of the Engineer-in-Charge.

6.4 SPECIFICATIONS FOR MATERIALS

6.4.1 General

The contractor shall at his own expense provide all materials including water and electricity required for the works.

All materials to be provided by the contractor shall be in conformity with the specifications laid down in the contract. The contractor shall ensure about their suitability to the satisfaction of the Engineer-in-Charge and nothing shall be paid extra on this account.

6.4.2 Materials

6.4.2.1 Cement

Ordinary Portland Cement of 43 Grade conforming to IS:8112, as dictated by the strength / requirements, mix design may be used for structural concrete.

6.4.2.2 Reinforcement

Only TMT reinforcing bars with a yield strength of 415 MPa and conforming to relevant specifications from main manufacturers (SAIL, TISCO, RINL and IISCO) only will be used.

6.4.2.3 Structural Steel

Structural Steel (standard quality) shall be used conforming to Grade Fe 250 as per IS:226.

6.4.2.4 Expansion Joints

Expansion joints shall be obtained from the approved manufacturers borne on the approved list of MORT&H only as detailed in the later part of this chapter. The expansion joints shall conform to and be installed as detailed in technical specifications of MORT&H 2000 (forth revision), duly supplemented by manufacturer's recommendations.

6.4.2.5 Bolts, Nuts and Screws

Bolts, nuts and screws shall be in accordance with IS:1363 and rivets shall be made of rivet bars of mild steel as per IS:1148.

6.4.3 6.4.3 Other Materials

6.4.3.1 Bitumen

Bitumen of suitable grade shall be used in the works and shall conform to IS:73.

6.4.3.2 Coarse Aggregate

Coarse aggregate shall consist of naturally occurring crushed stones. The aggregates shall be hard, strong, dense, durable, clear and free from veins and adherent coating, injurious amounts of disintegrated pieces, alkali, vegetable matter and other deleterious substances. The presence of flaky, scoriaceous and elongated pieces shall be avoided. The coarse aggregate which conform to the following requirement may only be considered for approval by the Engineer-in-Charge

- Deleterious materials: As per IS:2386 or IS:383, as applicable
- 10% Fine Value: As per CPWD Specifications 1996 with upto date correction slips.

The nominal maximum size of aggregate to be used in the concrete / RCC work shall be as follows. The other requirements for coarse aggregates shall be as per IS:383.

Item of construction			Maximum nominal size of coarse aggregate
i)	RCC Well Steining	:	40mm
ii)	Plain cement concrete	:	40mm
iii)	Well Cap (RCC)	:	20mm
iv)	Deck Slab (RCC)	:	20mm
v)	Well Plugs (Cement concrete)	:	40mm
vi)	RCC Well curb	:	20mm

The contractor shall satisfy himself that the material complies with the requirement of IS:383 and shall furnish a certificate to this effect to the Engineer-in-Charge whenever asked for. In case the aggregates tested do not comply with any requirement of the IS standards the source for the same shall be rejected. No further samples from the rejected source shall be considered for approval. The Engineer-in-Charge shall have full liberty of getting the material tested independently through recognized agency. The contractor shall supply free of charge the material required for tests. As to the expenses towards tests, provisions of para 6.4.4.6 shall apply.

6.4.3.3 Fine Aggregate

The quality, tests and acceptance criteria for the aggregate shall be same as per the CPWD Specifications mentioned herein. The fine aggregates shall conform to Zone II or Zone III (or any combination of the two), of CPWD specifications 1996 with upto date correction slips as per requirements of trial mix design as approved by Engineer-in-Charge. The decision of Engineer-in-Charge in this respect shall be final. The maximum silt content allowed shall be 6% when tested as per CPWD specifications referred above.

6.4.3.4 Water

Water to be used for mixing and curing shall be clear and free from impurities like oils, acids, alkalis, salts, sugar, organic material or other substances that may be deleterious to concrete or steel. Water quality shall conform to the specifications included in the tender documents with the maximum permissible limits for solids as given below

- Organic : 200 mg/l
- Inorganic : 3000 mg/l
- Sulphates (as SO_3) : 400 mg/l
- Chlorides (as CI) : 500 mg/l
- Suspended matter : 2000 mg/l
- pH : Not less than 6

6.4.3.5 Admixtures

No materials other than the essential ingredients, i.e. cement, aggregates and water shall ordinarily be used in the manufacture of concrete or mortar. But, the Engineer-in-Charge may permit the use of approved admixture for imparting special characteristics to the

concrete on satisfactory evidence that it does not in any way adversely affect the properties of concrete particularly its strength, volume changes, durability and has no deleterious effect on the reinforcement. Use of super plasticizer to improve workability of concrete shall conform to IS:6925. IS:9103 and ASTM C-494 Type F or any other approved standard. In case super plasticizer is to be used, the contractor shall provide manufacturer's specification, results of chemical analysis and other relevant tests. Admixtures generating hydrogen and Nitrogen etc. shall not be used. Cost of all admixtures shall be borne by the contractor and deemed to have been included in his offer.

6.4.4 Tests and Quality Control

6.4.4.1 Field Laboratory

As a guide, all mandatory tests as per CPWD Specifications 1996 (with upto date correction ships) and revised CPWD specifications 2002 for cement mortar, cement concrete and R.C.C. works shall be conducted and every effort shall be made to conduct these tests in the field laboratory at site.

The contractor shall establish field laboratory with necessary equipment to carry out tests such as grading of aggregate, fineness modules of sand, bulking of sand, silt content in sand, slump test of the concrete, preparation of concrete cubes, testing of cubes, test of cement, workability test of sheathing, test on water for chloride, SO3 etc. at the site of work. The contractor shall be required to provide at no extra cost, the appliances at site, such as weighing scale, graduated cylinders, standard sieves, thermo-meters, electric oven for drying of samples, sieve shaker, pH meter, Table vibrator, Vicat's apparatus, Lechatelier's apparatus, Flakiness plate and Elongation plate etc. in order to enable the Engineer-in-Charge to conduct field tests whenever required by him.

All the materials to be used in the work and tested in the laboratory shall comply with the requirements of relevant specification, or particular specifications as applicable or such recognized specifications as acceptable to Engineer-in-Charge in terms of this tender. The contractor shall depute a full time qualified Engineer, exclusively for supervising all the laboratory tests to the satisfaction of Engineer-in-Charge.

The contractor shall, at his own cost make all arrangements and shall provide all such facilities for carrying out the required number of tests for analysis as per the frequency of test stipulated in the contract specifications or as considered necessary by the Engineer-in-Charge. Nothing extra shall be paid for the above including the cost of materials to be tested.

The testing machines shall be recalibrated periodically to detect errors. The moulds for cubes shall be checked frequently and made to conform to specifications contained in IS:516.

6.4.4.2 Other Approved Laboratories

The tests which cannot be carried out in the field laboratory shall be conducted in the laboratory of IIT, Guwahati or any other laboratory approved by the Engineer-in-Charge at contractors cost.

The contractor or his authorized representative shall associate in collection, preparation, forwarding and testing of such samples. In case he or his authorized representative is not present or does not associate himself the Engineer-in-Charge shall do the needful for getting the samples collected and tested, the results of such tests and consequences thereof shall

be binding on the contractor. The cost of such samples including cost of transportation & testing charges shall be borne by the contractor.

6.4.4.3 Testing in Place of Manufacturers

All materials which are specified to be tested at the manufacturer's works shall satisfactorily pass the tests in presence of the representative of Engineer-in-Charge before being used in the works. In case all requisite testing facilities are not available at the manufacturer's premises, such testing shall be conducted as per provision of clause 6.4.4.2 above.

6.4.4.4 Notice to the Engineer-in-Charge

The contractor shall give not less than 7 days' notice for all tests in order that the Engineer-in-Charge may be present. Two copies of all certificates shall be supplied by the contractor to the Engineer-in-Charge for approval immediately after the completion of the tests. Test certificates shall invariably be supplied to the Engineer-in-Charge before the materials or components are used in the works, unless the Engineer-in-Charge directs otherwise.

6.4.4.5 Frequency of Testing

The frequency and testing of the materials will be as per the Quality Assurance Manual for cement concrete published by the C.P.W.D. However, if in particular case, the frequency is not mentioned in the Annexure, the decision of the Engineer-in-Charge regarding type of tests, their frequency shall be final and binding on the contractor notwithstanding any other provision elsewhere in the tender documents. No claim financially or otherwise shall be entertained on this account.

6.4.4.6 Unsuitable Materials

If at any stage of execution of work, Engineer-in-Charge feels that the particular materials are not suitable to be used in any component of the structure covered under "the scope of work" the Engineer-in-Charge may order re-testing of the materials as per relevant specifications, IS code and sound engineering practice from any approved laboratory. The cost of samples for such testing the test charges including transportation of samples shall be borne by the contractor. The rejected material either after the initial test of after re-testing, as per the case may be / shall be immediately removed from the site of work by the contractor at his own cost. If the contractor fails to remove the rejected material from the site within 48 hours (unless otherwise such time period is mentioned specifically elsewhere in tender documents), of their rejection, the Engineer-in-Charge shall be authorized to remove the same at the risk and cost of the contractor. No claim financially or otherwise shall be entertained on account of any reason whatsoever.

Any material used on work without prior inspection and testing (where testing is necessary) and approval of the Engineer-in-Charge is/are liable to be considered unauthorized, defective and not accepted by the Engineer-in-Charge shall have full powers to require removal of any of all of the materials brought at site by the contractor which are not in accordance with the contract specifications or do not conform in character of quality to samples approved by him. In case of default on the part of the contractor in removing rejected materials and any work executed with such unaccepted materials, the Engineer-in-Charge shall be at liberty to have them removed and / or dismantled by other means at the risk and cost of the contractor.

The Engineer-in-Charge shall have full powers to require other proper materials to be substituted for rejected materials and in the event of the contractor's refusing to comply, he may ask the same to be supplied by other means at the risk and cost of the contractor.

6.4.5 Storage

Department shall not provide any storages. Separate storage for adequate capacity shall be made available by the contractor.

Materials required for the work shall be stored by the contractor only at places in standard profile in the manner approved by the Engineer-in-Charge. Storage and save custody of materials shall be the responsibility of the contractor. Special care should be taken as per relevant specification for storage of bitumen etc. The contractor shall make sure that the material shall be brought in, at a time, in adequate quantities to suffice for the whole work or for at least a month's work.

The contractor shall construct suitable godowns at the site of work for storing the materials safe against damage due to sun, rain, dampness, fire theft etc. He shall also employ necessary watch and ward establishment for this purpose and no extra claim whatsoever shall be entertained on this account.

The materials which are likely to get deteriorated shall be stored under covered sheds with water proof roofs constructed on consolidated elevate platform with adequate seepage control measures as per direction and satisfaction of Engineer-in-Charge. Nothing extra shall be payable to the contractor for storing the materials safely at the site of work. The Engineer-in-Charge will prescribe the procedure for storing and stacking the important materials which the contractor must adhere to during the currency of contract work shall be as described hereunder:

i) Cement

Separate godowns shall have to be provided for different grades of cement. Each godown have a minimum capacity corresponding to one month's consumption, subject to minimum of 300 square meters (Total). The storage godowns to be provided shall be on elevated platform on consolidated ground with water proof roof and provisions of prevention of seepage.

The contractor shall procure 43 grade (conforming to IS:8112) ordinary Portland Cement, as required in the work, from reputed manufacturers of cement, having a production capacity of one million tonnes or more per annum, such as ACC, L&T, J.P. Rewa, Vikram, Shri Cement, Birla Jute, Grasim, Gujarat Ambuja and Cement Corporation of India as approved by the Ministry of Industry. Government of India, and holding license to use ISI certification mark for their product whose name shall be got approved from Engineer-in-Charge.

Supply of cement shall be taken in 50 kg, bags bearing manufacturer's name and ISI marking. Samples of cement arranged by the Contractor shall be taken by the Engineer-in-Charge and got tested in accordance with provisions of relevant BIS codes. In case test results indicate that the cement arranged by the contractor does not conform to the relevant BIS codes the same shall stand rejected and shall be removed from the site by the contractor at his own cost within a week's time of written order from the Engineer-in-Charge to do so.

The cement shall be brought at site in bulk supply of approximately 50 tonnes or as described by the Engineer-in-Charge.

The cement godown of the capacity to store a minimum of 2000 bags of cement shall be constructed by the contractor at the site of work for which no extra payment shall be made.

Double lock provision shall be made to door of the cement godown. The key of one lock shall remain with the Engineer-in-Charge or his authorized representative and the keys of the other lock shall remain with the contractor. The contractor shall be responsible for the watch and ward and safety of the cement godown. The contractor shall facilitate the inspection of the cement godown by the Engineer-in-Charge at any time.

The cement shall be got tested by Engineer-in-Charge and shall be used on work only, after test result have been received. The contractor shall supply free of charge the cement required for testing. The cost of test shall be borne by the contractor

Damaged cement shall be removed from the site immediately by the contractor on receipt of a notice in writing from the Engineer-in-Charge. If he does not do so within three days of the receipt such notice, the Engineer-in-Charge shall get it removed at the cost of contractor.

ii) Aggregates

The aggregate shall be stored in such a way as to prevent mixing with foreign materials. Different sizes of the fine or coarse aggregate shall be stored in a separate store piles sufficiently distant from each other in order to prevent intermixing the materials at the edges of the stock piles.

iii) Steel Reinforcement

Steel reinforcement shall be stored in such way as to avoid distortion and prevent deterioration by corrosion. If required the reinforcement bar shall be given a cement wash before stacking to prevent scale and rust at no extra cost.

The contractor shall procure steel reinforcement bars conforming to relevant BIS codes from main producers as approved by the Ministry of Steel. The contractor shall have to obtain and furnish test certificates to the Engineer-in-Charge in respect of all supplies of steel brought by him to the site of work. Samples shall also be taken and got tested by the Engineer-in-Charge as per the provisions in this regard in relevant BIS codes. In case the test results indicate that the steel arranged by the contractor does not conform to BIS codes, the same shall stand rejected and shall be removed from the site of work by the contractor at his cost within a week time from written orders from the Engineer-in-Charge to do so.

The steel reinforcement shall be brought to the site in bulk supply of 10 tonnes or more or as decided by the Engineer-in-Charge.

The steel reinforcement shall be stored by the contractor at site of work in such a way as to prevent distortion and corrosion and nothing extra shall be paid on this account. Bars of different sizes and lengths shall be stored separately to facilitate easy counting and checking.

For checking nominal mass, tensile strength, bend test, rebend test etc. specimen of sufficient length shall be cut from each size of the bar of random at frequency not less than that specified below:

Size of Bar	For consignment below 100 tonnes	For consignment above 100 tonnes
Under 10 mm dia bars	One sample for each 25 tonnes as part thereof	One sample for each 40 tonnes as part thereof
10 mm to 16 mm dia bars	One sample for each 35 tonnes or part thereof	One sample for each 45 tonnes or part thereof
Over 16 mm dia bars	One sample for each 45 tonnes or part thereof	One sample for each 50 tonnes or part thereof

The Contractor shall supply free of charge the steel required for testing. The cost of tests shall be borne by the Contractor.

iv) Bitumen

Materials shall be kept in the joint custody of' the contractor and the representative of the Engineer-in-Charge. No heating of bitumen in drums for any purpose whatsoever shall be allowed.

v) Explosive and Inflammable Materials

If explosives or inflammable materials are to be used for execution of the works, the contractor shall at his expense obtain such licenses as may be required for storing and using explosive and/or inflammable materials. Contractor shall at his cost locate, construct and maintain magazines if such are required for storage in accordance with the requirements of the appropriate rules in force for their use and safety.

6.4.6 Materials Found at Site of Work

Materials (other than dismantled materials) of' any kind obtained for excavation of the site shall remain the property of the Department and shall be disposed of as the Engineer- in-Charge may direct.

All fossils, coins, articles of' value or antiquity and structures or other remains or things of geological or archaeological interest discovered on the site shall be the absolute property or the department and the contractor shall take responsible precautions to prevent his workmen or any other person from removing or damaging any such articles or valuable and shall immediately upon discovery thereof and before removal, acquaint Engineer- in-Charge and obtain his directions as to the disposal of the same at the expense of department.

6.4.7 List of Approved Manufacturers / Suppliers

S. No.	MATERIAL	APPROVED MANUFACTURER / SUPPLIER
1.	Ordinary Portable Cement conforming to IS:8112	ACC, L&T, GRASIM Gujarat Ambuja, J.P. Rewa, Vikram, Shri Cement, Birla Jute, CCI or as approved by the Engineer-in-Charge.
2.	TMT Reinforcing Bars	TISCO, SAIL, RINL, IISCO
3.	Structural Steel	TISCO, SAIL, ISPAT
4.	Expansion Joints	J. Sons, METCO, METCO Industries Sanfield (India) Pvt. Ltd., Z-Tech (India) Pvt. Ltd,.Archana Structural Engineering (India) Pvt. Ltd.
5.	Bitumen	IOCL, BPCL, HPCL or any other refinery or as Approved by Engineer-in-Charge.
6.	Admixtures	FOSROC, SIKA, VAMORGANICS, Krishna Chemicals, Asian Laboratories
7.	Waterproofing System	CICO, FOSROC, SIKA
8.	Paint for structural steel work	Asian Paints, Nerolac Paints
9.	Pipes, Fittings and Valves	Tata, Supra Enterprises
10.	Epoxy Binder	FOSROC's Nitobond PC, SIKA's SIKADUR

S. No.	MATERIAL	APPROVED MANUFACTURER / SUPPLIER
11.	Retro reflective sheeting	Scoflite, Kiwalite, 3M
12.	MS Grating	Indiana

* Raw material source to be approved by the Engineer-in-Charge.

6.5 PLANT AND EQUIPMENT

6.5.1 General

No tools and plants shall be supplied by the department. The contractor shall have to make his own arrangement for all required Tools and Plants.

All constructional tools, plant and machinery provided by the contractor shall, when brought on to the site, be deemed to be exclusively intended for the construction and completion of the works and the contractor shall not remove the same or any part thereof (save for the purpose of moving it from one part of the site to another), without the consent in writing of the Engineer-in-Charge which shall not be unreasonably withheld.

6.5.2 Performance Criteria

The contractor shall ensure that the major plant and equipment proposed to be deployed on the work shall meet the specified performance criteria. The contractor shall be required to give trial runs of the equipment for establishing their capabilities to achieve the laid down specification and tolerance to the satisfaction of the Engineer-in-Charge before commencement of the work. All the equipment provided shall be of proven efficiency and shall be maintained at all times.

Following major plant and equipment essentially required for execution of work, which the Contractor has to arrange at the appropriate time:

i)	Fully automatic micro-processor controlled concrete batching and mixing plant of capacity not less than 30 cum/hour having separate weighing facility for weighing cement with least count of 0.50 kg.
ii)	Transit mixers of capacity not less than 4 cum
iii)	Mobile crane of capacity not less than 40t
iv)	Trailor 30 t capacity
v)	Jacks 30 t capacity

The type and capacity of equipment's at sl. No. (ii) to (v) are not mandatory. An alternative arrangement may also be employed by the contractor with the approval of Engineer-in-Charge.

6.6 TECHNICAL SPECIFICATIONS

6.6.1 General

All the works in general shall be executed as per nomenclature of the items given in the schedule, specifications for the materials and technical specifications, which are part of

tender document, MORT&H specifications for road and bridge work 2001 (4th revision), IRC codes (latest revision), supplemented by the relevant provision of CPWD specification 1996 with upto date correction slips and revised CPWD specifications 2002 relevant IS codes with latest revision upto the date of receipt of tenders.

6.6.2 6.6.2 Codes and Standards

Any additional standard specifications or criteria for design and construction of roads and bridges that may have been published by the IRC and in practice on the date of receipt of tenders, shall also be taken into account. In the absence of any definite provisions on any particular issue in the above mentioned specifications, the construction shall be in conformity with the sound Engineering Practice and in all such matters the decision of the Engineer-in-Charge shall be final and binding on the contractor and nothing shall be paid extra.

In case of any discrepancy or contradiction amongst the specified standards the following order of preferences shall prevail:

i) Nomenclature of the same given in Schedule of Quantities.

ii) Special conditions of the tender.

iii) Material and technical specification of the tender document.

iv) Specific provisions made in the tender document.

v) MORT & H Specifications for Road and Bridge Works 2001 (Fourth Revision).

vi) IRC Codes and guidelines will all latest corrections.

vii) IWAI specifications, 1996 upto Volume VI and Revised Specifications 2002 with upto date correction slips till date of receipt of tenders.

viii) All relevant IS codes with latest revisions upto the date of receipt of tenders.

ix) Foreign Standards and accepted practice as approved by Engineer-in-Charge.

x) Sound Engineering Practices as per directions of the Engineer-in-Charge.

6.6.3 Well Foundation Specifications

Necessary reference points shall be fixed away from the zone of blow-ups or possible settlements resulting from sinking operations. Such points shall be connected to the permanent total stations with base line on the banks. The center of the individual wells shall be marked with reference to these stations.

The distance, wherever practicable, shall be checked with the help of accurate tapes duly certified by the Inspector of Weights and Measures and precision distomat.

Reference points shall also be fixed to mark X-X axis (usually in the traffic direction) and Y-Y axis (normal to X-X axis) accurately.

A temporary benchmark near the well foundation shall also be established with reference to the nearest GTS benchmark. Arbitrary levels shall not be permitted both for execution as well as for measurements. Such benchmark shall be sufficiently away from the zone of blow-ups or possible settlement. The benchmark shall be checked regularly with reference to the permanent benchmark to be set up near the work site with reference to the GTS benchmark.

For wells, which are to be pitched in water, an earthen or sand island shall be constructed in case of water depths up to 5 meters and stable soil bed conditions. For greater depths or in fast flowing conditions where soil is too weak to sustain sand island, floating caissons shall be adopted.

The plan dimensions of the sand islands shall be such that there is a working space of at least 2 meters around the well staining. The dimensions of the sand islands shall, however, be not less than twice the plan dimension of the well or caisson. Sand islands shall be maintained to perform their function till the well is sunk to a depth below tile bed level at least equal to the prevailing depth of water. Sand island shall be protected against scour and the top level shall be sufficient above the prevailing water level to be decided by the Engineer- in-Charge so that is safe against wave action.

Floating caissons shall be fabricated out of steel of approved specifications. They should have at least 1.5 meter freeboard above water level and increased, if considered necessary, in case there is a possibility of the caisson sinking suddenly. For floating caissons, a detailed method statement for fabrication, floating and sinking shall be submitted to the Engineer-in-Charge for approval.

The contractor shall carry out the necessary modifications in the fabrication, floating and sinking of the caissons without any extra financial liability to the Engineer-in-Charge and the decision of the Engineer-in-Charge in this regard shall be final and binding. Such method statement shall include the total tonnage of steel involved, fabrication and welding specifications, list of material and plant and a description of manpower and operations required for the work. The caisson shall be tested against leakage before being moved to the site.

Stability of caissons during towing and sinking against over-turning due to water current shall be ensured.

All the preparatory works related to placing of cutting edge and well sinking at appropriate levels for wells in dry bed as well for wells to be pitched in water i.e. earth work, sand or earthen island, protecting the islands, floating caisson, if required, including providing all necessary materials, labour tools and plants etc. shall be carried out by the contractor at his cost. The cost for such works deemed to have been included in the offer and nothing extra on this account shall be payable.

6.6.3.1 Equipment

Equipment required for the construction of the well foundation shall be arranged by the contractor as directed by the Engineer-in-Charge. The suggested minimum size of the dredging bucket to be attached to the crane for well sinking shall be two cubic meters.

6.6.3.2 Cutting Edge

The cutting edge of the well shall be fabricated out of structural mild steel conforming to the relevant BIS standards. The cutting edge shall weigh not less than 40 kg per metre length and it shall be anchored properly in to the well curb as per drawings. Parts of the cutting edge shall be erected on level firm ground. Temporary supports shall be provided to facilitate erection and maintenance of the assembly in true shape. The fabrication will have to be carried out in the fabrication shop. However, “V” cuts may be provided in the horizontal portion uniformly throughout the length to facilitate cold bending. After cold bending, such “V” cuts should be closed by welding. Joints in the length of structural sections shall be fillet welded using single cover plate to ensure the requisite strength of the

original section. The cutting edge shall be laid about 30 cms above the prevailing water level.

6.6.3.3 Well Curb

The well curb may be cast-in-situ or pre-cast, as directed by the Engineer-in-Charge. Steel formwork well curb shall be fabricated in conformity with the relevant shop drawings to be got approved by the Engineer-in-Charge before-hand. The outer face of the curb shall be vertical. Steel reinforcement shall be fabricated and assembled as per approved drawings. The bottom ends of vertical bond rods shall be fixed securely to the cutting edge with check nuts or by welds. The formwork on the outer face of the well curb may be removed after 24 hours of the casting of concrete. The formwork on the inner face of the curb shall be removed after 72 hours. The concrete in the well curb shall be poured in one continuous operation.

6.6.3.4 Well Steining

The formwork for the well steining shall be fabricated from structural steel of the approved specifications. Steining built in the first lift above the well curb shall not be more than 2 meter high and in subsequent lifts it shall not exceed diameter of the well or the depth of well sunk below the adjoining bed level at any point of time. The first lift of the well shall be cast only after the well curb has been sunk partially. Construction joints in the well steining shall be left at the top of the concrete lift in the steining.

The steining of the well shall be made in one straight line from bottom to top such that if the well is tiled, the next lift of the steining will be aligned in the direction of the tilt. The work will be checked carefully with the help of the straight edges of lengths approved by the Engineer-in-Charge. Plumb bob or sprit level will not be permitted for checking the alignment. After the sinking of a particular stage of the well steining of well is complete, damaged portions of the steining, if any shall be removed before constructing the next stage. The height of the steining shall be calibrated by making at least 4 gauges (preferably in the traffic direction and in the cross direction) distributed equally on the outer periphery of the well each in the form of a 100 mm wide strip painted on the well, with every meter mark shown in black paint. The gauges shall start from zero at the bottom of the cutting edge. Marking of the gauges shall be done with a steel tape, duly certified by the inspector of Weights and Measures. After the well steining has reached the founding level, the same shall be checked for any damage and/or repairs, wherever required. In case the well does not conform to the standard and specifications even after remedial measures do not produce any meaningful result, the well shall be rejected.

6.6.3.5 Well Sinking

(a) The well shall be sunk true to the shape and level as far as possible. No well shall be placed in a pre-dredged hole. The well shall be sunk by excavating the materials uniformly from inside the dredge-hole. In the normal course, dewatering of the well shall not be permitted primarily to avoid the jumping of the well. However, if the well is to be founded into rock, de-watering may be permitted by the Engineer-in-Charge. Sinking history of the well shall be maintained by the contractor in the format given in Format 1200/I in the General Specifications for Road and Bridge works published by the Ministry of Transport and Highways. During well sinking operations, the samples of soil taken out during sinking operations shall be preserved by contractor and the same shall be handed over to the Engineer-in-Charge

(b) The wells of slipway shall be sunk simultaneously. The above aspect is deemed to have been included in the offer and nothing extra on this account shall be payable.

(c) The rates of sinking shall be considered to be inclusive, for all kinds of soil and rocks and all methods of sinking (other than pneumatic sinking) upto founding level.

(d) The depth of sinking for wells shall be measured from the level (+) 43.0 meters irrespective of the level at which the cutting edge is to be laid.

6.6.3.6 Use of Sinking Aids

(a) Kent ledge shall be placed in an orderly and safe manner on the loading platform and in such a way that it does not interfere with the excavation of the material from inside the dredge hole and it does not damage the steining of the well. The design of the loading platform shall be got approved from the Engineer-in-Charge.

(b) Water jetting may be allowed by the Engineer-in-Charge, wherever necessary.

(c) No explosive material may be used at this project site.

6.6.3.7 Inspection of Wells

The wells shall be inspected thoroughly at all stage of their sinking to see that they have not suffered any structural damage. For this purpose, properly trained and equipped divers may be employed. They may also be deployed for removal of obstructions encountered during sinking operations. They will be examined medically by a qualified doctor before undertaking diving operations. They doctor's presence may be ensured during the diving operations so as to cater to any possible emergency. The contractor shall have to ensure that lifesaving equipment is available at site, which may include oxygen cylinders. Nothing extra shall be paid on this account.

6.6.3.8 Tilt and Shifts of Well foundations

Unless otherwise specified, the tilt of the well shall not exceed 1 (horizontal) in 80 (Vertical) and the shift of the well base in any resultant direction shall not exceed 150 mm. The contractor will be required to record the tilts and shifts of the well foundations carefully in the prescribed format as contained in Appendix 1200/II of the Specifications for Road and Bridge Works herein referred to. For the purpose of recording the tilts along the two axes of the well, reduced level of the marks painted on the surface of the steining of the well shall be taken. For determination of the shift, locations of the ends of the two diameters shall be precisely measured along the two axes with reference to the fixed reference points.

Wherever tilt is noticed, the contractor shall take adequate corrective measures like placing eccentric Kenteledge, pulling strutting, anchoring or dredging unevenly and depositing dredged material unequally, putting obstacles below cutting edge and water jetting etc. before any further sinking. After correction, the dredged material shall be spread out evenly.

The contractor shall undertake the correction of tilt and shifts at his own risk and cost so as to bring the values of these two parameters within the permissible limits to the satisfaction of the Engineer-in-Charge as far as practicable if the resultant tilt/shift value of any well exceeds the specified permissible value (it should not generally exceed 1 in 50 (tilt) and 300 mm (shift)). The well so sunk shall be regarded as not conforming to specifications as it shall be treated as a sub-standard work. The contractor may produce calculations for foundation pressures and steining stresses, accounting for the actual tilt and shift. The Engineer-in-

Charge may accept such sub-standard well provided the said calculations prove that the well in question is safe. Any remedial measures to bring the stresses within safe limits like increase in the diameter of the well cap, provision of the dummy weights on the well cap etc. shall be undertaken by the contractor at his own cost without claiming any extra money beyond the terms of the agreement. The contractor shall also have to agree to the payment of the reduced rates for the sub-standard work as determined and decided by the Engineer-in-Charge and as per clause 1215(g) of the MORT&H Specifications for Road and Bridge Works.

6.6.3.9 Bottom Plug

Before bottom plug is laid in the well, it should be ensured that the well is uniformly seated at the founding level. Sending the diver down who may wear diving suit shall inspect the cutting edge of the well and he will carry a close circuit TV camera with him. Images of the cutting edge will be examined closely to check if any soil is sticking to the cutting edge and, if so, the cutting edge shall be suitably cleaned before bottom plug is laid. The contractor shall include the cost of these operations in his costing and nothing extra shall be paid on this account. For the bottom plug, concrete mix shall be designed (in dry condition) to attain the designed strength and shall contain 10% extra cement over the same mix placed dry to cater the underwater concreting. However, the total cement content shall not be less than 363 kg per cubic meter of concrete with a slump in the range of 150 to 200 mm. Admixtures of approved brand and make may be added in the prescribed dosage to impart the required characteristics of the concrete as mentioned herein. All loose material should be removed before starting the concreting. Concrete for the bottom plug shall be laid by tremie pipe. Concreting operations will be continuous for full concrete in the bottom plug till the dredged hole is filled to the required level and there after sounding shall be taken to ensure that the concrete has been laid to the required level.

Least disturbance shall be caused to water in the well while concrete is being laid in bottom plug. Concrete shall not be disturbed in any way for at least 14 days. In order to check any possible rise of the level of the bottom plug, sounding shall be taken at the close of concreting and once every day for the next 3 days. An account of the actual quantity of the concrete that has gone in the bottom plug vis-à-vis the theoretical quantity shall be maintained. The soundness of the bottom plus may be checked by dewatering the well by 5 meters below the surrounding water level and by checking the rate of the rise of the water level. The rate of rise shall be preferably less than 10 centimeters per hour. In case the rate is higher than this value, the contractor shall take the remedial measures at his own cost as per the direction of the Engineer-in-Charge.

6.6.3.10 Stand Filling

Sand filling in the well shall commence after 14 days of laying of the bottom plug. The height of the bottom plug shall be verified once again before starting the sand filling operations. Sand to be used for filling shall be free from clay, clods, vegetation, roots, boulders and shingle. Sand shall be compacted as directly by the Engineer-in-Charge and the filling operations shall be carried out to the level as shown on the approved drawings or as directed by the Engineer-in-Charge.

6.6.3.11 Tope Plug & intermediate Plug

After sand filling, the top plug shall be provided with the concrete of approved specifications as directed by the Engineer-in-Charge and as shown on the approved drawings.

6.6.3.12 Well Cap

A reinforced cement concrete well cap will be provided over the top of the steining in accordance with the approved drawing. Form work for the well cap shall be prepared as per the shape of the well cap. Concrete of approved mix shall be laid in dry condition. The bottom of the well cap be laid preferably as low as possible taking in to account the water level prevailing at the time of casting. Bond rods of the steining shall be enclosed in to the well cap.

6.6.3.13 Tolerances

The tolerances in the lift and shift of the well foundation, as specified elsewhere in these documents, shall be adhered to. For the well steining and well cap, the tolerances shall be as follows.

a) Variation in the dimension : +50 mm, -10mm
b) Misplacement from specified position in plan : 15mm
c) Surface irregularities measured with 3 meter long straight edge: 5 mm
d) Variations in the levels at the top : +25mm

6.6.4 Structural Steel Work Specifications–General

6.6.4.1 Scope of Specification

The Specification covered the scope of work of structural steel works, applicable codes of practice for structural steel work and the Specifications for the materials to be used, including steel, bolts and nuts, washers, welding etc. and the storage thereof.

6.6.4.2 Scope of Work

The scope of work for the Contractor in respect of structural steel work shall cover, but shall not be limited to the following:

A. Preparation of complete detailed fabrication drawings and erection making drawings based on the design drawings, required for all the structures covered under the scope of the contract.

B. Submittal of revised design, with calculations and detailed fabrication drawings, in case any substitution of the designed sections in required.

C. Submittal of design calculations for joint and connections to be deployed by the Contractor, along with detailed fabrication drawings.

D. Supply of the raw materials for fabrication, taking into account wastage margin, including storage and upkeep of the materials.

E. Furnishing of all materials, labour, tools and plant, and all consumable required for fabrication and supply of all necessary bolt, nuts, washers, tie roads and welding electrodes for field connections, with necessary wastage margins.

F. Fabrication of the steel work in accordance with the approved fabrication drawings, including all shop assembling, matching and making Design, manufacture / fabrication and provision of all jigs, fixings, manipulators etc. required for the fabrication.

G. Provision of shop painting and requisite site painting to all fabricated steel work, as per requirements of the related specification on the painting.

H. Suitably making building and parking for transport of all fabricated materials.

I. Preparing and furnishing detailed Bills of Materials, Drawings Office Dispatch lists, Bolt Lists and any other lists of bought out items required in connection with the fabrication and erection of the structural steel work.

J. Loading and transporting all fabricated steel work and field connection materials.

K. The Contractor shall submit, the examination by the Engineer-in-Charge, detailed particular or his proposed methods of erection of the steel work, together with complete calculations relating to strength and deflection. If the erection scheme necessitates the attachment of temporary steel work to the permanent steel work, the contractor shall submit, for approval of the Engineer-in-Charge, the methods he proposes for making good the permanent steel work after removing the temporary work. The Contractor shall also submit the design and fabrication drawings of all temporary support, staging, braces etc. required for safe erection, for approval of the Engineer-in-Charge.

L. The contractor shall provide all construction and transport equipment, tools, tackle, consumables, materials, labour and supervision required for the erection of the structural steel work.

M. Receiving, unloading, checking and moving the storage yard, storage, guarding the upkeep of fabricated steel work and other consumable materials and fasteners at site, including prompt attendance to all insurance matters, as necessary, for all fabricated steel materials arriving at site.

N. Transportation of all, fabricated structural steel materials from site storage Yard, handling, assembling, boiling, welding and satisfactory installation of all fabricated structural steel materials in proper location, according to approved erection drawings and / or as directed by the Engineer-in-Charge.

O. Setting out, aligning, plumbing, leveling, bolting, welding and securely fixing the fabricated steel structures in accordance with the erection scheme, or as directed by the Engineer-in-Charge.

P. Providing protective treatment to the erected steel structures, as per Specification.

Q. All minor modifications of the fabricated steel structure, as directed by the Engineer-in-Charge, including but not limited to the following:

   i) Removal of bends, kinks, twists etc. for parts damaged during transport and handling.

   ii) Cutting, chipping, filling, grinding etc. if required for preparation and finishing of site connections.

   iii) Reaming of holes for use of higher size bolt if required.

   iv) Welding of connections in place of bottom for which holes are either not drilled at all or wrongly drilled during fabrications. Welding in place of bolting will be permitted only at the discretion of the Engineer-in-Charge.

   v) Refabrication of parts damaged beyond repair during transport and handling or Refabrication of parts which are incorrectly fabricated.

   vi) Fabrication of parts omitted during fabrication by error, or subsequently found necessary.

vii) Drilling of holes which are either not drilled at all or are drilled in incorrect location during fabrication.

viii) Carry out tests in accordance with the related Specification.

6.6.4.3 Submittals

A. On commencement of the Project, the contractor shall submit the following:

i) Prior to the technical submittals, the contractor shall submit the proposed overall schedule for documentation such as calculations, shop/working drawings, plan/procedures and records. Submission of samples, process of fabrication / delivery / erection for the approval of Engineer-in-Charge.

ii) Complete fabrication drawings, materials lists, cutting lists, bolt lists, field welding schedules, and QC schedules, based on the design drawing furnished to him and in accordance with the approved schedule.

iii) Result of any tests, as and when conducted and as required by the Engineer-in-Charge.

iv) Manufacturer's mill test reports in respect of steel materials, bolts, nuts and electrodes, as may be applicable.

v) A detailed list of all Constructional Plant and Equipment, such as cranes, derricks, winches, welding sets, erection tools etc. their make, model present condition and location, available to the Contractor and the ones he will employ on the job to maintain the progress of work in accordance with the Contract.

vi) The total number of experienced personnel of each category, like fitters, welding, riggers etc., which he intends to deploy on the project.

B. The Contractor shall submit a detailed erection programme for completion of the work in time and in accordance with the Contract. This will show, in a proforma approved by the Engineer-in-Charge, the target programme, with details of erection proposed to be carried out in each week, details of major equipment required and an assessment of required strength of various categories of workers.

C. The Contractor shall submit complete design calculations for any alternative sections proposed by him, for approval of the Engineer-in-Charge. Use of any alternative section shall be subject to approval of the Engineer-in-Charge. However, no escalation in unit rates of work shall be allowed for such case.

6.6.4.4 Furnishing of Information

A. Drawings shall be furnished to the Contractor and all such drawings shall form part of these Specifications.

B. The Engineer-in-Charge reserves the right of make changes to the design /drawings even after release for preparation of shop drawings to reflect addition, omission and modifications in data/details and requirements. Contractor shall consider such changes as part of these Specifications and the contract, and no extra claims shall be entertained on this account.

C. Design / drawings, providing by the Engineer-in-Charge, will show as appropriate the salient dimensions, design loads, sizes of members, location of openings at various levels and other necessary information required for the preparation of fabrication drawings, designs and erection details.

D. It shall be clearly understood that the drawings of the Engineer-in-Charge are design drawings. The typical details of connections, cuts, notches, bends, etc. where shown in the design drawings are only for general guidance of the Contractor. The Contractor shall design and develop all such details based on the design forces and functional requirements.

E. In the case of variations in design drawings and specifications, the decision of the Engineer-in-Charge, shall be final. Should the Contractor, find any discrepancy in the information furnished by the Engineer-in-Charge, the same shall be immediately brought to the notice of Engineer-in-Charge for resolution. The contractor shall obtain clarification on discrepancies from Engineer-in-Charge before proceeding with the work.

F. No detailed shop drawings will be accepted for examination by the Engineer-in-Charge unless the same, have first been completely checked by the Contractor's qualified structural engineer and are accompanied by an erection plan showing the location of all pieces detailed. The contractor shall check and ensure that detailing of connections is carefully planned to obtain ease in erection of structures, including field welded connections and /or bolting.

G. No fabrication work shall be started by the contractor without having obtained approval of Engineer-in-Charge on the relevant drawings. Approval by the Engineer-in-Charge of any of the drawings shall not relieve the Contractor of his responsibility to provide correct design of connections, workmanship, fit of parts, details materials and errors on omissions of all work shown thereon. The approval of Engineer-in-Charge shall constitute approval of the size of members, dimensions and general arrangement, but shall not constitute approval of the connections between members and other details.

H. Drawings, for approval, shall be submitted by the contractor in an orderly manner commensurate with erection sequence and approved construction programme.

I. The Engineer-in-Charge shall return one copy of Contractor's drawing marked with his approval/comments. The Contractor shall furnish ten prints of all approved final drawings for field use and record purposes. The contractor shall also furnish two direct reading reproducible of each drawing, of quality not lesser than an "Autopositive", on extra thin paper capable of reproducing legible prints. These reproducible shall incorporate all modifications, field changes, substitutions etc. effected and shall reflect the status "as built". All such reproducible shall be submitted rolled (not folded) on the outside of regular mailing tubes. All such drawings will remain the property of the Engineer-in-Charge. The Engineer-in-Charge reserves the right to use them in any manner whatsoever.

J. The drawing prepared by the Contractor, and all subsequent revisions thereof shall be at the cost of the Contractor, and no separate payment shall be made for the same. Revisions shall incorporate all modifications, field changes, substitutions etc. effected. The rate / prices quoted for fabrication work shall be deemed to include the cost of such drawing work.

K. The Contractor shall give due consideration to the need of trial assemblage at shop, weight and size limitation of elements for transportation from shop of construction site, temperature variation of 25 degree centigrade between the fabrication shop and site, site measurements of the as-built dimensions and avoidance of site welding except for fixtures. All the drawings shall be prepared in metric units. The drawings should preferably be of one standard size, and the details shown therein shall be clear and legible. These drawings shall include but shall not be limited to the following.

i) Assembly drawings, giving extra sizes of the sections to be used and identification marks of the various sections.

ii) Dimensional drawings of base plans, anchorage details in foundations, foundation bolt locations etc.

iii) Complete Bills of Materials and detailed drawings of all sections including their billing weights.

iv) Shop details of temporary structures together with calculations.

v) Details shop drawings for proper co-ordination with the concrete components to which the steel members shall be connected, as required.

vi) Any other drawings or calculations that may be required for proper completion of the work and clarification of the works or substituted parts thereof.

vii) All 'as-built' drawings.

6.6.4.5 Applicable Codes of Practice

The following specifications, standards and codes are included as part of this specification. All standards, specifications, codes of practice current on the date of signing of agreement and referred to herein shall be applicable.

1.	IS:102 (1962)	Ready Mixed Paint, Brushing, Red, Lead, Non Setting, Priming
2.	IS:226 (1975)	Structural Steel (Standard quality)
3.	IS:800 (1984)	Code of Practice for General Construction in Steel
4.	IS:808 (1989)	Dimensions for Hot Rolled Steel Beam, Column, Channel and Angle Sections.
5.	IS:814 (1991)	Covered Electrodes of Manual Metal Arc Welding of Carbon & Carbon-Manganese Steel.
6.	IS:816 (1969)	Code of Practice for Use of Metal Arc Welding for General Construction in Mild Steel.
7.	IS:817 (1966)	Code of Practice for Training and Testing of Metal Arc Welders.
8.	IS:817 (Part 1) (1992)	Manual Metal Arc Welding
9.	IS:875 (1987) (Part 1 to Part 5)	Code of Practice for Design Loads.
10.	IS:919 (1993) (Part 1 & Part 2)	ISO System of Limits and Fits
11.	IS:1148 (1982)	Hot Rolled Rivet Bars (upto 40 mm) for Structural Purposes.
12.	IS:1182 (1983)	Recommended Practice for Radio Graphic Examination of Fusion Welded Butt Joints in Steel Plates.
13.	IS:1363 (1992) (Part 1 to Part 3)	Hexagon Steel Bolts, Screws and Nuts of Product grade C.
14.	IS:1364 (1992) (Part 1 to Part 5)	Hexagon Steel Bolts, Screws and Nuts of Product grades A&B.

15.	IS:1367 (1991) (Part 1 to Part 20)	Technical supply Conditions for Threaded Steel Fasteners.
16.	IS:1477 (1971) (Part 1 & Part 2)	Code of Practice for Painting of Ferrous Metals in Building.
17.	IS:1852 (1985)	Rolling and Cutting Tolerances for Hot-Rolled Steel Product.
18.	IS:1893 (1991)	Criteria for Earthquake Resistant Design of Structures.
19.	IS:1977 (1996)	Low Tensile Structural Steel (Ordinary Quality)
20.	IS:2016 (1967)	Plain Washers
21.	IS:2062 (1992)	Steel for General Structural Purposes.
22.	IS:2074 (1992)	Ready Mixed Plant, Air Drying, Red-oxide-Zinc Chrome, and Priming.
23.	IS:2595 (1978)	Code of practice for Radio Graphic Testing
24.	IS:3600 (1985) (Part 1 to Part 9)	Methods of Testing Fusion Welding Joints
25.	IS:3616 (1974)	Acceptance Tests for Wire Flux Combination for Submerged Arc Welding.
26.	IS:3658 (1981)	Code of Practice for Liquid Penetrant Flow Detection.
27.	IS:3757 (1985)	High Strength Structural Bolts.
28	IS:4353 (1995)	Recommendations for Submerged Arc Welding of Mild Steel and Low Alloy Steel.
29.	IS:4943 (1968)	Assessment of Butt and Fillet Fusion Welds in Steel Sheet, Plate and Pipe.
30.	IS:5334 (1981)	Code of Practice for Magnetic Practice Flow Detection of Welds.
31.	IS:5369 (1975)	General technical delivery requirement for steel and steel products.
32.	IS:5372 (1975)	Taper Washers for Channels.
33.	IS:5374 (1975)	Taper Washers for I-Beams.
34.	IS:6755 (1980)	Double Coil Helical Spring Washers.
35.	IS:7215 (1974)	Tolerances for fabrication of Steel Structure.
36.	IS:7318 (1974) (Part 1)	Approval Tests for Welders When Welding Procedure approval is not required – fusion welding of steel.
37.	IS:8910 (1978)	General requirements of supply of wieldable structural steel.
38.	IS:9595 (1996)	Metal Arc Welding of Carbon & Carbon – Magnese Steels.

6.6.5 Products

6.6.5.1 Materials

A. All materials to be supplied by the contractor shall conform to relevant Indian Standards or equivalent, as approved by the Engineer-in-Charge.

B. Steel materials required for the work shall be free from imperfections, mill scales, slag intrusions, laminations, pittings, rusts etc. that may impair strength, durability and appearance. All materials shall be of tested quality only. If desired by the Engineer-in-Charge, Test Certificates in respect of each consignment shall be submitted in triplicate. Whenever the materials are permitted for procurement from identified stocks, a random sample shall be tested at an approved laboratory, as directed by the Engineer-in-Charge.

6.6.5.2 Structural Steel

"Structural steel (standard quality) conforming to Fe 250 as per IS-226-1975".

6.6.5.3 Bolts and Nuts

All bolts and nuts shall conform to IS:1363 (1992), IS:1364 (1992) and IS:1367, as applicable, and unless specified otherwise, shall be hexagonal. All nuts shall conform to property class compatible with the property class of the bolt used.

6.6.5.4 Washers

Plain washers shall be made of mild steel conforming to IS:5369 (1975), unless otherwise specified. One washer shall be supplied with each bolt and, in case of special types of bolts, more than one washer as needed for the purpose shall be supplied. An additional double coil helical spring washer, conforming to IS:6755 (1980), shall be provided for bolts carrying dynamic or fluctuating loads and those in direct tension. Tapered washers, conforming to IS:5372 (1975) and IS:5374 (1975), shall be used for channels and beans respectively wherever required.

6.6.6 Storage of Materials

6.6.6.1 General

A. All materials shall be as stored as to prevent deterioration, and to ensure the preservation of their quality and fitness for the work. If required by the Engineer-in-Charge, the materials shall be stored under cover and suitably painted for the protection against weather. Any materials which has deteriorated or has been damaged shall be removed from site and replaced by new members, as directed by the Engineer-in-Charge, at no extra cost and time.

B. The steel to be used in fabrication shall be stored in separate stacks clear of the ground, section wise and lengthwise.

The storage area shall be kept clean and properly drained. Structural steel shall be so stored and handled in such a manner that members are not subjected to excessive stresses and damage. Girders and beams shall be placed in upright position. Long members shall be supported on closely spaced skids to avoid unacceptable deflection.

6.6.6.2 Yard

A. The contractor may be required to establish a suitable yard, in an approved location at site, for storing the fabricated steel structures and other materials which may be delivered to site. The yard shall have proper facilitate such as drainage and, lighting, including access for cranes, trailers and other heavy equipment.

B. The contractor shall have been deemed to have visited the site, prior to submission of his Tender to acquaint himself with the availability of land and the development necessary by way of filling, drainage, access roads, fences, sheds etc. all of which shall be carried out by the contractor at his own cost and as directed by the Engineer-in-Charge.

6.6.6.3 Covered Store

All field connection materials, paints etc. shall be stored on racks and platforms, off the ground in a properly covered building by the contractor.

6.6.7 Structural Steel Work Specification-Welded Structure

6.6.7.1 General

The Specification covers the supply, fabrication and delivery to site of welded structural steel work, including the supply of all consumables, electrodes and other materials required for fabrication and field connections of all structural steel work covered under the scope of the Specification.

6.6.7.2 Products

Ref. Specification para 7.4.6 for Structural Steel–General.

6.6.7.3 Execution

6.6.7.4 Workmanship

a) General

All workmanship shall be in accordance with the best practices in modern structural shops. Greatest accuracy shall be maintained in the manufacture of every part of the work and all similar parts shall be strictly interchangeable. The contractor shall not proceed with any welding until the Engineer-in-Charge has approved his welding plan which shall include:

- All information of welding procedures, equipment, additives and preheating during welding operation
- Details of non-destructive testing methods.
- Precautions with regard to welding shrinkage
- Possible treatment of complete welds by grinding
- Procedure and programme of welding sequence.

b) Templates

Templates used throughout the work shall be steel, or steel bushed where considered necessary by the Engineer-in-Charge. In cases where actual materials have been used as templates for drilling similar pieces, the Engineer-in-Charge shall decide whether such materials are fit to be used as parts of the finished structure.

c) Straightening

All material shall be straight and free from twists, and if necessary, before being worked, shall be straightened and/or flattened by pressure, unless require to be of curvilinear form.

d) Clearance

The clearance between fraying surface of bolted connections shall not be greater than 1mm at each end. If the separation is between 1 to 3 mm the surface should be tapered to eliminate the separation. Over 3mm separation shall be filled with filler plates.

e) Shearing, Cutting and Planning

Cutting shall be done automatically. Hand cutting may be used only exceptionally in connection with erection, if approved by the Engineer-in-Charge. In such cases the joint edges shall receive a finishing treatment with planning and grinding tools. Cutting by shearing machine may be used for plates not exceeding 10 mm in thickness provided that the plate edges be fully enclosed in a weld. Oxygen cutting may be used provided a smooth and regular surface free from cracks and notches is secured.

Chipping of angle flanges and edges of plates, wherever necessary, shall be done without damaging the parent metal. Chipped edges shall be ground to a neat finish and sharp corners and hammered rough faces shall be rounded off.

The edges and ends of the cuts / sheared flange plates, web plates of plate girders, and all cover plates and the ends of all angles tees, channels and other sections forming the flanges of plate girders, shall be planed/ground. Edge preparation of welding may be done by machine controlled flame cutting, with edge free from butts should be clean and straight. In welded girders, the top edges of all intermediate stiffeners shall be prepared and butt welded to the top flange plates, unless otherwise shown in the design drawings.

The butting surfaces at all joints of girders shall be planned so as to butt in close contact throughout the finished joint.

The ends of all built up girders and of all columns shall be faxed in an end milling machine after the members have been completely assembled. Bearing edges for girder bearing stiffeners, and column bases shall be machined.

Unless clean, square and true to shape, all flame-cut edges shall be planed. Cold sawn ends, if reasonably clean, and flame-cut ends of sections not inferior to sawn ends in appearance, need not be planned, except for butting ends.

f) Assembly

All parts assembled for welding shall be in as close contact as practicable over the whole surface and all bearing stiffener shall bear lightly at both top and bottom without being drawn or caulked.

The components parts shall be so assembled that they are neither twisted nor otherwise damaged. Specified cambers, if any, shall be provided.

All parts of bolted welded members shall be held firmly in position by means of jigs bolting or welding. No drifting of hall shall be permitted, except to draw the parts together, and no drift used shall be larger than the nominal diameter of the bolt. Drifting done during assembling shall not distort the metal or enlarge the holes.

Trial assemblies shall be carried out at the fabrication stage to ensure accuracy of workmanship. These checks shall be witnessed by the Engineer-in-Charge and such trial assemblies shall be at the cost of the Contractor.

g) Welding

- General

The welding and the welded work shall conform to IS:816 and IS:9595, unless otherwise specified. As much work as possible shall be welded in shops and the layout and sequence of operations shall be so arranged as to eliminate distortion and shrinkage stresses.

- Electrodes

All electrodes shall be kept under dry conditions. Any electrode damaged by moisture shall not be used unless it is guaranteed by the manufacturer that, when it is properly dried, there will be no detrimental effect. Any electrode which have part of its flux coating broken away or is otherwise damaged shall be rejected. Any electrode older than six (6) months from the date of manufacture shall not be used. Batch certificate for electrodes shall be submitted by the Contractor.

- Preparation of Joints

The edges shall be prepared, with an automatically controlled flame cutting torch, correctly to the shape, size and dimensions of the groove, prescribed in the design and fabrication drawings. In case of U-groove joints, the edges shall be prepared with an automatic false cutting torch in two phases, following a bevel out with a gouging pass, or by machining.

The welding surface shall be smooth, uniform and free from fins, tears, notches or any other defects, which may adversely affect welding, and shall be free of loose scale, slag, rust, grease, paint, moisture or any other foreign material.

- Welding Procedure

All welding procedures shall be submitted to the Engineer-in-Charge for approval 14 days before starting fabrication.

The welding procedures shall be arranged by the Contractor to suit the details of joints, as indicated in the drawings, and the position at which welding has to be carried out. Welding procedure inter alia shall cover the following:

a. Type and size of electrodes
b. Current and (for automatic welding) are voltage
c. Length of run per electrode, or (for automatic welding) speed of travel
d. Number and arrangement of runs in multi-run welds
e. Position of welding
f. Preparation and set-up of parts
g. Welding sequence
h. Pre or post heating
i. Any other relevant information

The welding procedures shall be so arranged that distortion and shrinkage stresses are reduced to the minimum, and that the welds meet the requirement of quality specified.

Any weld found defective shall be removed, by using either chipping hammer or gouging torch, in such a manner that parent material is not injured in any way.

- Fusion Faces and Surrounding Surfaces

Fusion faces and the surrounding surfaces within 50mm of the welds shall be free from all mill scale and free from all oil, paint or any substances which might affect the quality of the welds or impede the quality / progress of welding. These shall be free from irregularities which would interfere with the deposition of the specified size of weld or be the cause of defects.

All mill scale within 50mm of welds shall be removed prior to welding, either pickling followed by thorough power wire brushing, or by other approved methods.

In preparation or cutting of the fusion faces is necessary, the same shall be carried out by shearing, chipping, gas-cutting or flame gouging.

Where hand gas-cutting or hand-gouging is employed, the blowpipe or gouging blow pipe shall be properly guided.

- Assembly for Welding

Parts to be welded shall be properly assembled and held firmly in position by means of jigs and clamps prior to and during welding.

- Welded Girders and Other Plate Construction

Automatic submerged arc welding shall be employed for fabrication of welded girders and other plate construction, wherever specified.

- Accuracy of Fit-Up

Parts to be fillet welded shall be brought into as close contact as practicable, and the gap due to faulty workmanship or incorrect fit-up shall not exceed 1.5mm. If greater separation occurs at any position, the size of fillet weld shall be increased at such positions by the amount of the gap.

- Jigs and Manipulators

Jigs and manipulators shall be used, where practicable, and shall be designed to facilitate welding and to ensure that all welds are easily accessible to the operators.

- Ends of Butt Welded Joints

The ends of butt joints shall be welded so as to provide full throat thickness. This may be done by the use of extension pieces, cross-runs or other approved means.

- Weld Face and Reinforcement of Butt Welds

The weld face shall, at all places, be deposited projecting the surface of the parent metal. Where a flush surface is required, the surplus metal shall be dressed off.

- Testing of Butt Welds

Butt welded joints are to be 100% radio-graphically tested by the Contractor at his own cost. If such tests indicate the joints to be defective, the cost of rectification of defective welds shall also be borne by the Contractor.

- Minimum Leg Length & Throat Thickness in Fillet Welds

The minimum leg length of a fillet weld as deposited shall be not less than the specified size. In no case shall a concave weld be deposited, unless specifically permitted. Where permitted, the leg length shall be increased above that specified length, so that the resultant throat thickness is as great as would have been obtained by the deposition of a flat-faced weld of the specified leg length.

- DE Slagging

After making each run of welding, all slag shall be thoroughly removed and the surface cleaned.

- Quality of Welds

The weld metal, as deposited (including tack welds), shall be free from cracks, slag inclusions, porosity, cavities and other deposition faults. The weld metal shall be properly fused with the parent metal without under cutting or overlapping at the toes of the weld. The surface of the weld shall have a uniform consistent contour and regular appearance.

- Weather Conditions

Welding shall not be done under weather conditions which might adversely affect the efficiency of welding.

- Qualification and Testing of Welders

The Contractor shall satisfy the department that the welders are suitable for the work for which they will be employed, and shall produce evidence to the effect that welders have satisfactorily completed appropriate tests, as described in IS:817 Part 1. The Engineer-in-Charge may, at his own discretion, order periodic tests of the welders and/or of the weld produced by them. Such tests shall be at the expense of the Contractor.

- Supervision

The Contractor shall employ competent welding supervisors to ensure that the standard of workmanship and the quality of the materials comply with the requirements laid down in this Specification.

- Machining of Butts and Bases

Splices and butt joints of compression members, depending on contact for stress transmission, shall be accurately machined over the whole section. In column bases, the ends of shafts together with the attached gussets, angles, channels etc. after bolting and/or welding together as the case may be, shall be accurately machined so that the parts connected butt over the entire surface of contact. Care shall be taken that connecting angles or channels are fixed with such accuracy that they are not reduced in thickness by machining by more than 0.8 mm.

i) Strength-quality with parental metal

ii) Absence of defects

iii) Corrosion resistance of the weld shall not be less than that of parent material in an aggressive environment.

6.6.7.5 Shop Assembly

1. The steel work shall be temporarily shop assembled, as necessary, so that the accuracy of fit may be checked before dispatch. The parts shall be shop assembled with a sufficient number of parallel drifts to bring and keep the parts in place.
2. Steel parts drilled or punched with templates having steel bushes shall be similar and, as such, interchangeable, such steel work may be shop erected in part only, as agreed by the Engineer-in-Charge.

6.6.7.6 Erection Marking

1. Each fabricated member, whether assembled prior to dispatch or not so assembled, shall bear an erection mark, which will help to identify the member that its position in respect of the whole structure, to facilitate re-erection at site.
2. These erection marks shall be suitably incorporated in the shop detail and erection drawings.

6.6.8 Structural Steel Work Specification–Bolted Structure

6.6.8.1 General

6.6.8.2 Scope of Specifications

This Specifications cover the supply, fabrication and delivery to Site of Bolted structural steel work, including the supply of consumables and other materials required for fabrication and field connections of all structural steel work covered under the scope of the Specification.

6.6.8.3 Products

Ref. Specifications para 6.6.4 for structural Steel Work–General

6.6.8.4 Execution

6.6.8.5 Workmanship

a) General

All workmanship shall be in accordance with the best practice in modern structural shops. General accuracy shall be maintained in the manufacture of every part of the work and all similar parts shall be strictly interchangeable.

b) Templates

Templates used throughout the work shall be of steel, or steel bushed where considered necessary by the Engineer-in-Charge. In cases where actual material have been used as templates for drilling similar pieces, the Engineer shall decide whether such materials are fit to be used as part of the finished structure.

c) Straightening

All materials shall be straight and free from twists, and if necessary, before being worked, shall be straightened and/or flattened by pressure, unless required to be of curvilinear form.

d) Clearance

The clearance between fraying surface of bolted connections shall not be greater than 1mm at each end. If the separation is between 1 to 3 mm the surface should be tapered to eliminate the separation. Over 3 mm separation shall be filled with filler plates.

e) Shearing, Cutting and Planning

Cutting shall be done automatically. Hand cutting may be used only exceptionally in connection with erection, if approved by the Engineer-in-Charge. In such cases the joint edges shall receive a finishing treatment with planning and grinding tools. Cutting by shearing machine may be used for plates not exceeding 10mm in thickness provided that

the plate edges be fully enclosed in a weld. Oxygen cutting may be used provided a smooth and regular surface free from cracks and notches is secured.

Chipping of angle flanges and edges of plates, wherever necessary, shall be done without damaging the parent metal. Chipped edges shall be ground to a neat finish and sharp corners and hammered rough faces shall be rounded off.

The edges and ends of the cut/sheared flange plates, web plates of plate girders, and all cover plates, and the end of all angles, tees, channels and other sections forming the flanges of plate girders, shall be planed/ground.

The butting surfaces at all joints of girders shall be planned so as to butt in close contact throughout the finish joint.

The end of all built up girders of all columns shall be faced in an end milling machine after the members have been complete assembled. Bearing edges for girder bearing stiffeners and column bases shall be machined.

Unless clean, square and true to shape, all flame-cut edges shall be planed. Cold sawn end, if reasonably clean and flame-cut ends of sections not inferior to sawn ends in appearance need not be planned, except for butting ends.

f) Drilling

Holes for bolts shall be drilled to conform to Clause 10 to IS:7215 (1974). Punching of holes shall not be permitted. All holes, except as stated hereunder, shall be drilled to the required size, 3mm less in diameter and reamed thereafter to the required size. All matching holes for bolts shall register with each other so that a gauge of 0.8 mm less in diameter than the hole can pass freely thorough the members assembled for bolting, in the direction at right angle to such members.

All drilling shall be free from burrs.

No holes shall be made by gas cutting process.

g) Assembly

All parts assembled for bolting shall be in close contact over the whole surface and all bearing stiffener shall bear lightly at both top and bottom without being drawn or caulked.

The component parts shall be so assembled that they are neither twisted nor otherwise damaged. Specified cambers, if any, shall be provided.

All parts of bolted and welded members shall be held firmly in position by means of jigs or clamps while bolting or welding. No drifting of hole shall be permitted, except to draw the parts together, and no drift used shall be larger than the nominal diameter of the bolt. Drifting done during assembling shall not distort the metal or enlarge the holes.

Trial assemblies shall be carried out at the fabrication stage to ensure accuracy of workmanship and these checks shall be witnessed by the Engineer. Such trial assemblies shall be at the cost of the contractor.

h) Field Bolts

Requirements stipulated under bolting shall apply for field bolts. Field bolts, buts and washers shall be finished by the contractor in excess of the nominal number required. He shall supply the full number of bolts, nuts and washers and other necessary fittings required to complete the work, together with the additional bolts, nuts and washers totaling to 10% of the requirement subject to minimum of 10 Nos.

At the time of assembly, the surface in contact shall be free of paint or any other applied finish, oil, dirt, loose rust, loose scale, burrs and other defects which would prevent solid seating of the parts or would interfere with the development of friction between them.

If any other surface condition, including a machined surface, is specified, it shall be the responsibility of the contractor to work within the slip factor specified for the particular case.

Each bolt and nut shall be assembled with washers of appropriate shape, quality and number in cases where plane parallel surfaces are involved. Such washers shall be placed under the bolt head or the nut, whichever is to be rotated during the tightening operation. The rotated nut or bolt head shall be tightened against a surface normal to the bolt axis, the appropriate tapered washer shall be used when the surfaces are not parallel. The angle between the bolt axis and the surface under the non-rotating component. (i.e. the bolt head or the nut) shall be 90+3 degree. For angles outside these limits, a tapered washer shall be placed under the non-rotating component. Tapered washers shall be correctly positioned.

No gasket or other flexible material shall be placed between the holes. The holes in parts to be joined shall be sufficiently well aligned to permit bolts to be freely placed in position. Driving the bolts is not permitted. The nuts shall be placed so that the identification marks are clearly visible after tightening. Nuts and bolts shall always be tightened in a staggered pattern and where there are more than four bolts in any once joint, they shall be tightened from the center of the joint out-wards.

If, after final tightening, a nut or bolt is slackened off from any reason, the bolt, nut and washer or washers shall be discarded, and not used again.

i) Shop Assembly

The steel work shall be temporarily shop assembled, as necessary, so that the accuracy of fit may be checked before dispatch. The parts shall be shop assembled with a sufficient number of parallel drifts to bring and keep the parts in place.

Steel parts drilled with templates having steel bushes shall be similar and as, such, interchangeable, such steel work may be shop erected in part only, as agreed by the Engineer.

j) Erection Material

Each fabricated member, whether assembled prior to dispatch or not so assembled, shall bear an erection mark, which will help to identify the member and its position respect of the whole structure, to facilitate re-erection at Site.

These erection marks shall be suitably incorporated in the shop detail and erection drawings.

6.6.9 Structural Steel Specification–Painting Works

6.6.9.1 General

6.6.9.1.1 Scope of Specification

This specification covers the scope of painting, method for the surface preparation, application of paints and precautions to be taken for the painting of structural steel works. It covers the supply and delivery of all necessary materials, labour, scaffolding, tools, equipment and everything that is necessary for the job completion on schedule.

The following specifications, Standards and Codes are included as part of this specification. All standards, and codes of practice referred to herein shall be the current edition during the currency of the project including all applicable official amendments and revisions.

In case of discrepancy between this specification and those referred to herein, this Specification shall govern. In case of discrepancy between Contract drawings and this Specification, the Contract drawings shall govern.

a)	IS:102	Ready Mixed Plant, Brushing, Red lead, Non Setting, Priming
b)	IS:159	Ready Mixed Paint, Brushing, Acid Resisting for Protection against Acid Fumes, Colour as Required
c)	IS:341	Black Japan, Types A, B & C
d)	IS:384	Brushes, Paints and Varnishes, Flat
e)	IS:487	Brush, Paint and Varnish: i) Oval Ferrule Bound & ii) Round Ferrule Bound.
f)	IS:800	Code of Practice for General Construction in Steel
g)	IS:958	Temporary Corrosion Preventive Grease, Soft Film, Cold Application
h)	IS:1153	Temporary Corrosion Preventive Fluid, Hard Film, Solvent Deposited
i)	IS:1477	Code of Practice for Painting of Ferrous Metals in Building: Part I – Pretreatment Part II – Painting
j)	IS:1674	Temporary Corrosion Preventive Fluid, Soft Film, Solvent Deposited
k)	IS:2074	Ready Mixed Paints, Red Oxide-Zinc Chrome, Priming

6.6.9.2 Products

6.6.9.2.1 Materials

a) Paint

All paint delivered to the fabrication shop / site shall be ready mixed, in original sealed containers, as packed by the paint manufacturers, and no thinners shall be permitted.

Paint shall be stirred frequently to keep he pigment in suspension.

b) Storage of Paints

All paints shall be stored strictly in accordance with the requirements laid down by the paint manufacturers. The storage area shall be well ventilated and protected from sparks, flame, direct exposure to sun or excessive heat, preferably located in an isolated room or in a separate building.

All paint containers shall be clearly labeled to show, at the time of use, paint identification, date of manufacture, batch number, order number and special introductions in legible form. The containers shall be opened only at the time of use. Paints which have livered, gelled or otherwise deteriorated during storage, shall not be used. Paints for which the shelf life specified by the supplier has expired shall not be used.

6.6.9.3 Execution

6.6.9.3.1 Surface Preparation

a) General

All surfaces shall be cleaned of loose substances and foreign materials, e.g. dirt, rust, scale, oil, grease, welding flux etc., so that the prime coat adheres to the original metal surface. The work shall be carried out in accordance with IS:1477 (Part1). Any oil, grease, dust or foreign matter deposited on the surface, after preparation, shall be removed and care shall be taken to ensure that the surface is not contaminated with acids, alkalis or other corrosive chemicals. The primer coat shall be applied immediately after the surface preparation is completed.

Before the application of any paint, the surface to be treated shall be thoroughly cleaned and freed from all scale, lose paint, rust and other deleterious matters. Oil and grease shall be removed from the surface by washing with solvents or with a detergent solution before blast cleaning operation of metal polish with metal pellets. If any traces of oil or grease remain after blasting they shall be removed by solvent cleaning and the area will be re-blasted thereafter.

All welding areas shall be given special attention for removal of weld flux slag. Weld metal splatter, weld head oxides, weld flux fumes, silvers and other foreign objects before blasting. If deemed necessary by the Engineer-in-Charge acid washing and subsequent washing with clean water shall be used.

Any rough welding seams will have to be ground and must be inspected and approved by the Engineer-in-Charge before application of the coatings.

All structural steel to be painted shall be cleaned by blast cleaning in accordance with SA 2½ Near-White Blast cleaning. Mill scale, rust and foreign matter shall be removed to the extent that the only traces remaining are light stains in the form of spots or strips. Finally the surface shall be cleaned with a vacuum cleaner or clean, dry compressed air.

The blast cleaning shall produce a surface roughness complying with the one specified by the paint manufacturer for the primer concerned. If, cleaned surface are rusted or are contaminated with foreign material before painting is accomplished, they shall be re-cleaned by the Contractor at his expenses.

The surface shall be cleaned by impingement of abrasive materials, such as grit of cast iron, malleable iron, steel or synthetic materials, at high velocity created by clean and dry compressed air blast. Prior to application of the blast, heavy deposits of oil and grease shall be removed by solvent cleaning, and excessive surface scale removed by hand tool or power tool cleaning.

The last complete coat of paint shall be applied after structural steel erection and deck slab construction.

6.6.9.4 Mixing and Thinning

All ingredients in a paint container shall be thoroughly mixed to breakup lumps and disperse pigments, before use and during application, to maintain homogeneity. Mixing shall be mechanical, except for 20 liters or smaller containers; mixing by air bubbling is not permitted. All pigmented paints shall be strained after mixing to remove skins and other undesirable matters.

Dry pigments, pastes, tinting pastes and colours shall be mixed and/or made into paint so that all dry powders get wetted by vehicles and lumps and particles are uniformly dispersed.

Additives that are received separately, such as curing agents, catalysts, hardeners etc. shall be added to the paint as per the manufacturer's instructions. These shall be promptly used within the pot life specified by the manufacturers and unused thereafter shall be discarded.

Thinners shall not be used unless essential for proper application of the paint. Where thinners are used, they shall be added during the mixing process, and the type and quantity of thinner shall be in accordance with the instructions of the paint manufacturer.

6.6.9.5 Paint Application

a) General

Paint shall be applied in accordance with the manufacturer's recommendations, as supplemented by these specifications. The work shall generally follow IS:1477 (Part II). Prior approval of the Engineer-in-Charge shall be taken in respect of all primers and/or paints, before their use in the works.

Paint shall generally be applied by brushing, except that spraying may be used for finish coats only when brushing may damage the prime coats. Roller coat or any other method of paint application shall not be used unless specifically authorized.

Spraying shall not be adopted on red lead or zinc rich paints. Daubers may be used only when no other method is practicable for proper application in different accessible areas.

Paint shall not be applied when the ambient temperature is 10^{o}C and below, for paints which dry by chemical reaction, the temperature requirements specified by the manufacturer shall be met with. Also, paint shall not be applied in rain, wind, fog, or at relative humidity of 80% and above, or when the surface temperature is 5^{o}C below dew point, resulting in condensation of moisture. Any wet paint exposed to damaging weather conditions shall be inspected after drying, and the damaged area repainted after removal of the paint.

Each coat of paint shall be continuous, free of pores and of even film thickness, without thin spots. The film thickness shall not be so great as to detrimentally affect either the appearance or the service life of the paint.

Each coat of paint shall be allowed to dry sufficiently before application of the next coat, to avoid damages such as lifting or loss of adhesion. Undercoats having glossy surface shall be roughened by mild sand preparing to improve adhesion of subsequent coats. Successive coats of same colour shall be tinted, whenever practical, to produce contrast and help in identifying the progress of the work.

b) Brushing Application

Proper brushes shall be selected for a specific work piece. Round or oval brushes which conform to IS:487 are better suited for irregular surface, whereas, flat brushes which conform to IS:384 are convenient for large flat areas. The width of the flat brushes shall not generally exceed 125mm.

Paint shall be applied in short strokes, depositing a uniform amount of paint in each stroke, followed by brushing the paint into all surface irregularities, crevices and corners, and finally smoothening or leveling the paint film with long and high strokes at about right angles to the first short strokes. All runs and sags shall be brushed out. The brush marks left in the applied paint shall be as few as practicable.

c) Spray Application

The spraying equipment shall be compatible with the paint material, and provided with necessary gauges and controls. The equipment shall be cleaned of dirt, dried paint, foreign matter and solvent, before use.

The paint shall be applied by holding the gun perpendicular to the surface, at a suitable distance, and moved in a pattern so as to ensure deposition of a uniform wet layer of paint. All runs and sags shall be brushed out immediately. Areas not accessible to spray shall be painted by brush or dauber.

A water trap acceptable to Engineer-in-Charge shall be furnished and installed on all equipment used in spray painting.

d) Shop Painting

The specified painting system shall be followed.

Surfaces in contact during shop assembly shall not be painted. Surfaces which cannot be painted, but require protection, shall be given a rust inhibitive grease conforming to IS:958, or solvent deposited compound conforming to IS:1153 or IS:1674 or treated as specified in the drawings.

Surfaces to be in contact with concrete shall not be painted.

The shop coats shall be continuous over all edges, including ends meant for jointing at site by welding, except where the paint could be harmful to the welder or detrimental to finished welds. In such cases, no paint shall be applied within 50mm of the welding edge, and the unprotected surface shall be given a cost of corrosion inhibitive compound.

The unpainted area shall be cleaned prior to welding, the welded joint cleaned and deslagged, and immediately after, covered by the same paint as has been used for the remaining surface.

e) Protection of Paintwork

The Contractor shall provide measures as necessary to prevent damage of the work and to other property or persons from all cleaning and painting operations. Paint or paint stains which result in other unsightly appearance on surfaces not designated to be painted shall be removed or obliterated by the Contractor at his cost.

All painted surfaces that in the opinion of the Engineer-in-Charge are damaged in anyway, shall be repaired by the Contractor at his cost with materials and to a condition equal to that of the requirements specified in these Specifications. The Contractor's proposal for retreatment of areas damaged by flame cutting and welding operations should be clearly stated in the detailed painting plan to be submitted.

Upon completion of all painting operations and of any other work that would cause dust, grease or other foreign materials to be deposited upon the painted surface, the painted surface shall be thoroughly cleaned. At the time of opening of jetty's to public traffic, the painting shall be completed and the surfaces shall be undamaged and clean.

The areas of high – strength bolts shall be protected by masking tape against undercoats application at the fabrication shop. Immediately prior to erection any rust in the paint areas shall be removed by power wire brushing to a standard equivalent to SA3.

f) Site Painting

After the erection of structures at the site, the contractor shall provide the necessary treatment as per specified 'PAINTING SPECIFICATIONS'.

Surfaces which have not been shop coated, but require surface treatment shall be given necessary surface preparation and coats at Site as Specified.

Contact surfaces in bolted joints shall not be painted. Prior to assemblage in the field, the rust on joint surfaces, including those adjacent to bolt head nut and washer, shall be removed by power tools and sand-paper.

g) Precautions in Painting Work

In order to ensure that better workmanship and results in painting work, the following points shall be adhere to:

1. All paints shall be applied in accordance with the general instructions of the manufacturer.
2. No two-pack paint shall be used on the same job after the expiration of he stipulated pot life.
3. Sharp edges, fraying surface and other specifically vulnerable areas shall be carefully and properly treated.
4. Proper sealing with paint of the crevices between intermittent runs of welds shall be ensured.
5. A uniform film thickness of paint is to be ensured throughout the work.
6, As far as possible, tinted paints for successive coals of painting shall be used, in a distinct manner, so as to facilitate application and inspection.

6.6.10 Structural Steel Work--Quality Control & Testing Requirements

6.6.10.1 General

6.6.10.2 Scope of Specification

The scope of work of these specifications is to establish the norms for ensuring the required Quality Control through established testing norms of the welded structural steel work.

6.6.10.3 Codes / Standards

Relevant IS codes for tolerance and tests of welding procedures as specified in the specification for structural steel work – General.

6.6.10.4 Submittals

The Contractor shall submit the following:

Proposed overall schedule for documentation of calculations, shop drawings, plan / procedures and records, submission of procedure of fabrication.

The contractor shall himself inspect all materials, shop work and field work to satisfy the specified tolerance limits and Quality norms before the same are inspected by Engineer-in-Charge or his authorized representative.

6.6.10.5 Products

Not applicable

6.6.10.6 Execution

6.6.10.7 Tolerance

The contractor shall through appropriate planning and continuous measurements in the workshop and the erection at site, ensure that the tolerance specified below are strictly adhered to.

a) Dimensional & Weight Tolerance

The dimensional and weight tolerance for rolled shapes shall be in accordance with IS:1852. The acceptable limits of straightness for rolled or fabricated members as per IS:7215 are:

Struts and Columns: L/1000 or 10 mm whichever is smaller.

Where L is the length of finished member or such lesser length as the Engineer-in-Charge may specify.

A limit for distortion in transverse direction (δ) from the true axis of plate and box girder shall not be more than L/1000 where L is the length of diagonal of profile.

Tolerance in specified camber of members shall be 3mm in 12m length.

Tolerance in specified lengths shall be as follows:

- Column finished for contact bearing : ± 1 mm
- Other members (cols.) upto and over 10m : ± 5 mm
- Including 10 m L/2000 sub to max of : ± 8 mm
- Other members (beams) upto 12m : ± 3 mm
- Over 12 m L/4000 sub, to max : ± 5 mm

6.6.10.8 End of Members

Beam to beam and beam to column connections – where the abutting parts are to be jointed by butt welds, permissible deviation from the square ness of the end is:

Beam upto 600 mm in depth : 1.5 mm

Beam over 600 mm in depth : 1.5 mm for increase in depth of every 600 mm subjected to max of 3 mm.

Where abutting parts are to be joined by bolting through cleats or end plates, the connections require closer tolerance, permissible, deviation from the squareness of the end is:

Beams upto 600 mm in depth 1mm per 600 mm of depth subject to a max of 1.5mm.

For full bearing, two abutting ends of columns shall first be aligned to within 1. In 1000 of their combined length and then the following conditions shall be met:

1) Over atleast 80% of the bearing surface the clearance between the surfaces does not exceed 0.1 mm.
2) Over the remainder of the surfaces the clearance between the surfaces does not exceed 0.3 mm.

Where web stiffeners are designed for full bearing on either the top flange or the bottom flange or both, atleast half the stiffener shall be in positive contact with the flange. The reminder of the contact face could have a max. gap of 0.25 mm.

a) Depth of Members

Acceptable deviation from the specified overall depth as per IS:7215 are:

- Upto and including 1000 mm : 1.0 mm
- Over 1000 mm : 2.0 mm

b) Web Plates

An acceptable deviation from flatness in girder webs in the length between the stiffeners or in a length equal to the girder depth shall be :

- Upto 500 mm depth : 0.5 mm
- Over 500 mm & including 1000 mm : 1.0 mm
- Over 1000 mm : 2.0 mm

c) Flange Plates

A responsible limit for combined warpage and tilt on the flanges of a built-up member is 1/200 of the total width of flange or 2mm whichever is smaller measured with respect to centerline of flange.

Lateral deviation between centerline of web plate and centerline of flange plate at contact measured as the difference δ between diagonals of nominal length L shall not be greater than L/1000.

d) End Milling

Columns ends bearing on each other or resting on base plates and compression joints designed for bearing shall be milled true and square to ensure, proper bearing and alignment. Base plates also have their surface milled true and square.

e) Quality Control

In order to exercise proper control of the quality of the welding, Contractor shall enforce methods of control as tabulated below:

Purpose		Control Subjects	Methods of Control
1		2	3
1.	Control of welding materials and basic metal quality	Quality control of electrodes, welding wire, flux and protective gases Checking of quality and Weld-ability of the basic Metal and welded members	Weld-ability tests to determine the technological properties of materials Mechanical test of weld metal Metalographical Investigations of Welds macro-Structure and Microstructure checking of weld Metal resistance for Intercryustalline Corrosion. Study of Weld Metal solidity by physical control Methods
2.	Checking of welders qualifications	Welding of specimens for quality determination	Mechanical tests Metalographical investigations and checking of welded joints by physical control methods.
3.	Control of welded joints quality	Control of assembly accuracy and technological welding process	Checking of welding equipment conditions. Checking correctness Welding procedure. Visual examination of Welds.

f) Tests and Testing Procedures

6.6.10.9 Visual Examination

The contractor shall conduct visual examination and measurement of the external dimensions of the weld for all joints. Before examining the welded joints, areas close to it on both sides of the weld for a width not less than 20 mm shall be cleaned of slag and other impurities. Examination shall be done by a magnifying glass which has a magnification power of ten (10) and measuring instrument which has an accuracy of ±0.1 mm or by weld gauges. Welded joints shall be examined from both sides. The contractor shall examine the following during the visual checks.

i) Correctness and shape of the welded joints.

ii) Incomplete penetration of weld metal.

iii) Influx

iv) Burns

v) Unwelded craters

vi) Undercuts

vii) Cracks in welded spots and heat affected zones

viii) Porosity in welds and spot welds.

ix) Compression in welded joints as a result of electrode impact while carrying out contact welding

x) Displacement of welded element

The contractor shall document all data as per sound practices.

6.6.10.10 Dye Penetration Test

The Contractor shall carry out various mechanical tests to determine weld ability, metal alloy ability, nature of break, correct size and type of electrodes, degree of pre-heat treatment. The type, scope and sample of various mechanical tests shall be determined in agreement with the purchase. The number of tests conducted shall depend on the results obtained to satisfy the Engineer-in-Charge that the correct type and size of electrode, degree of pre-heating and post-heating and weldability of metal are being followed.

6.6.11 Structural Steel Specifications–Erection

6.6.11.1 General

6.6.11.2 Scope of Specification

The Specification covers the delivery to Site, storage and erection of structural steel work at site. This includes plant and equipment requirements, installation of fabricated steel work in position and grouting all complete as per drawings, specifications and other provisions of the contract.

6.6.11.3 Submittals

A. Ref. Specification for Structural Steel work – General

B. The contractor shall submit for approval a full description of his proposed erection method including sequence of erection, use of temporary supports, connection details,

erection camber diagram and design calculations covering various stages of erection process.

6.6.11.4 Products

Not applicable

6.6.11.5 Execution

- Delivery, Storage & Handling

  A. Before the shop assembling is dismantled, all members and sections shall be appropriately marked with paint or grooved with their identification numbers as detailed in shop drawings.

  B. The Contractor shall deliver the fabricated structural steel materials to site, with all necessary field connection materials, in such sequence as will permit the most efficient and economical performance of the erection work. As per scheduled program, the Engineer may, at his discretion prescribe or control the sequence of delivery of materials.

  C. Fabricated parts shall be handled and stacked in such a way that no damage is caused to the components. Measures shall be taken to minimize damaged to the protective treatment on the steel work. All work shall be protected from damage in transit. Particular care shall be taken to stiffen free ends, prevent permanent distortion and adequately protect all machined surfaces. All bolts, nuts, washers, screws, small plates and articles generally shall be suitably packed and identified.

- Plant and Equipment

  All erection tools and plant and equipment proposed to be used shall be efficient, dependable and in good working condition, and the suitability and adequacy of such shall be determined by the Engineer. The Contractor shall, in his tender submittal, specify the plant and equipment proposed by him for erection of structural steel work at Site.

- Storage

  Materials to be stored shall be placed on skids above the ground and shall be kept clean and properly drained. Girders and boxes shall be placed upright and shored.

- Method and Sequence of Erection

  The method and sequence of erection shall have the prior approval of the Engineer-in-Charge. The Contractor shall arrange for the most economic method and sequence consistent with the Drawings and Specifications and such information as may be furnished to him prior to the execution of the Contract. The erection of steelwork shall be planned so as to ensure safe working conditions at all times. The Contractor shall be solely responsible for enhancing the safety of his construction activities at Site.

- Assembly & Erection

  A. During erection, the members and sections shall be accurately assembled as shown on the approved shop drawings and any match marks shall be followed. The material shall be carefully handled so that no sections will be bent, broken or otherwise damaged. Hammering which will damage or distort the members shall not be done. Bearing surfaces and surfaces to be in permanent contact shall not be done. Bearing surfaces and surfaces to be in permanent contact shall be cleaned

before the members are assembled. Splices and field connections shall have one half of the holes filled with bolts and cylindrical erection pins (half bolts and half pins) before bolting with high-strength bolts. Fitting-up bolts shall be of the same nominal diameter as the high-strength bolts, and cylindrical erection pins shall be 1 mm or larger.

B. The correction of minor misfits involving harmless amounts of reaming, cutting and chipping will be considered a legitimate part of the erection. However, any error in the shop fabrication or deformation resulting from handling and transportation which prevents the proper assembling and fitting up of parts by the moderate use of drift pins or by a moderate amount of reaming and slight chipping or cutting, shall be reported immediately to the Engineer and his approval of the method of correction obtained. The contractor shall be responsible for all misfits, errors and injuries and shall make the necessary corrections and replacements.

C. The straightening of plates, angles, other shapes and built-up members, when permitted by the Engineer, shall be done by methods that will not produce fracture or other damages. Distorted members shall be straightened by mechanical means or, if approved by the Engineer, by the careful planned and supervised application of a limited amount of localized heat, each application subject to the approval of the Engineer.

D. The responsibility in respect of temporary bracing and guys shall rest with the contractor until the structure steel is located, plumbed leveled aligned and grouted within the tolerance permitted under the specifications and the permanent bracing / framing system has been installed.

E. The temporary guys, braces, false work and cribbing shall not be the property of the department and may be removed by the contractor with the approval of the Engineer without any change once the permanent framing system has been installed to the satisfaction of the Engineer in charge and when the temporary bracing guys etc. can be removed without any potential danger / damage to the erected structure.

- Setting Out

A. Positioning and leveled of all steel work, plumbing and placing of every part of the structure with accuracy shall be in accordance with the approved drawings and to the satisfaction of the engineer. The contractor shall check the position and levels of the anchor bolts etc. before concreting and ensure that they are properly secured against disturbance during pouring operations. The contractor shall remain responsible for correct Positioning and shall set proper screed bars to maintain proper level. No extra payment shall be made on this account.

B. No permanent field connection by bolting or welding shall be carried out until proper alignment and plumbing guides have been attached.

- Field Bolting

A. Bolts shall be inserted in such a way that they remain in position under gravity, even before fixing the nut. Bolted parts shall fit solidly together with assembled and shall not be separated by gaskets or any other interposed compressible materials. When assembled, all joint surfaces, including those adjacent to the washers, shall be free of scales. They shall be free of dirt, loose scales, burns and other defects that would prevent solid seating of the parts.

B. Holes for turned bolts to be inserted in the field shall be reamed in the field. All drilling and reaming for turned bolts shall be done only after the parts to be connected are assembled. Tolerance applicable in the fit of the bolts shall be in accordance with relevant Indian Standard Specifications.

C. All bolts shall be tightened to provide, when all fasteners in the joint are tight, he required minimum bolt tension as per relevant Indian Standard Specification.

D. Load indicated bolts or washers may be used, subject to the approval of the Engineer.

- Hotels, Cutting and Fitting

A. No cutting of sections, flanges, webs, cleats, rivets, bolts, welds etc. shall be done unless specifically approved and / or instructed by the Engineer-in-Charge.

B. The erector shall not cut, drill or otherwise alter the work of other trades, or his own work to accommodate other trades, unless such work is clearly certified in the Contract, or directed by the Engineer. Wherever such work is specified, the Contractor shall obtain complete information as to size, location and number of alternations, prior to carrying out any work.

- Drifting

A. Correction of minor misfits will be considered as permissible. For this, lifts drifting may be used to draw holes together and drills shall be used to enlarge holes, as necessary, to make connections. Reaming, that weakens the member or makes it impossible to fill the holes properly or to adjust accurately after reaming, shall not be allowed.

B. Any error in shop work which prevents the proper assembling and fitting of parts by moderate use of drifts pins and reamers shall immediately be called to the attention of the Engineer, and approval of the method of correction obtained. The use of gas cutting torches at the erection Site is prohibited.

- Grouting

A. The position to be grouted shall be cleaned thoroughly with compressed air jet and wetted with water, and any accumulated water shall be removed. The grouting shall be carried out under expert supervision, taking care to avoid air locks. Edges shall be finished properly. If the thickness of grout is 25mm or more, Portland cement concrete grout as specified for pocket bases, shall be used, if required by the Engineer-in-Charge or shown on the drawings.

B. Whatever method of grouting is employed, the operation shall not be carried out until the steel work has been finally leveled. Immediately before grouting, the space under steel shall be thoroughly cleaned. Where packing are to be left in place, they shall be placed such that they are completely covered with grout.

C. If required by the Engineer or specified in the drawings, certain admixtures shall be added to the grout to enhance certain desirable properties of the grout. The Contractor shall provide the required admixtures, and use them in the grout in proportions to be decided by the Engineer-in-Charge, and carry out the work in accordance with the directions of the Engineer-in-Charge.

D. All steel in foundations shall be solidly encased in Portland Cement Concrete of minimum characteristic strength at 28 days as specified in the drawings, subject to a minimum of 25 N/mm2. A minimum cover of 100 mm shall be provided to all steel work where surrounding concrete is in contact with soil.

- Painting after Erection

  A. Steelwork coated with rust inhibitor shall not be left exposed for a period exceeding 15 days otherwise such steelwork shall be re-cleaned and re-coated with such finish until encased in concrete.

  B. No steel work with shop paint shall be left exposed at Site for a period exceeding that approved by the Engineer-in-Charge.

  C. The surface required to remain unpainted at shop, shall be given a protective coating after the structure is erected, leveled, plumbed, aligned, grouted in its final position, making good any damaged shop painting and completion of any unfinished portion of the shop coat shall be progressively carried out by the contractor.

  D. Painting shall not be done in frost or foggy weather, or when humidity is such as to cause condensation on the surface to be painted. Before, commencing painting of steel which is delivered unpainted, all surfaces to be painted shall be dried and thoroughly cleaned from all loose scale and rust.

  E. All field bolts, welds and abrasions to the shop coat, and surfaces delivered unpainted from fabrication shop, shall receive the full protective treatment as specified in Table 2 of painting specifications before delivery to Site.

  F. Surfaces which will be inaccessible after field assembly, shall receive the full specified protective treatment before assembly. Bolts and fabricated steel members, which are galvanized or otherwise treated, shall not be painted.

  G. The contractor shall be responsible for any damage caused to other components of the structure including the structure. In particular, he shall take all necessary precautions to minimize concrete splash onto completed steel work or rust staining of concrete due to erected steel work and clean and/or repair all stains and other damages to completed work prior to tests on completion.

- Final Cleaning up

  Upon completion of erection, and before final acceptance of the work by the Engineer-in-Charge, the Contractor shall remove, free of cost all false work, rubbish and all temporary works, resulting from or in connection with the performance of his work.

6.6.12 Cement

6.6.12.1 General

6.6.12.2 Scope of Specification

This section of Specification covers the use of Ordinary Portland cement used in different works.

6.6.12.3 Codes and Standards

The cement used shall be of 43 grade and conform to IS:8112 and MOST Specification.

6.6.12.4 Submittals

The contractor shall submit, for approval, certified laboratory test data and/or manufacturer's certificate and data for the following items:

- Chemical and physical properties

- Initial / final setting time
- Tensile Strength Test

6.6.12.5 Products

The product dealt with under this specification is Ordinary Portland Cement of grade-43.

6.6.12.6 Execution

a) As far as possible, all cement shall be obtained from single source throughout the Contract. Cement of different types shall not be mixed with one another. Different brands of cement, or the same brand of cement from different sources, shall not be used without prior notification and approval of Engineer.

b) The cement shall be brought at site in bulk supply of not less than 50 tonnes or as decided by Engineer-in-Charge.

c) The cement shall be supplied, either packed in bags or bulk stored in silos installed for the purpose of supply. Packed cement shall be delivered to the Site in original sealed bags which shall be labeled with the weight, date of manufacture, name of manufacturer, brand and type. Cement received in torn tags shall not be used. Bags of cement which vary in weight by more than 3% shall not be accepted.

d) All cement shall be fresh when delivered and at ambient atmospheric temperature.

e) In fair faced elements, the cement used in the concrete for any complete element shall be from a single consignment. All cement for exposed concrete shall be from the same approved source and uniform in colour.

f) With each and every delivery of cement, the contractor shall provide the manufacturer's certificate that the cement conforms to the relevant Indian Standard.

Samples of cement arranged by the contractor shall be taken by the Engineer-in-Charge and got tested in accordance with provisions of relevant BIS codes. In case test results indicate that the cement arranged by the contractor does not conform to the relevant BIS Codes, the same shall stand rejected and shall be removed from the site by the contractor at his own cost within a week's time of written time of written order from the Engineer-in-Charge to do so.

g) Storage

All cement shall be stored in closed enclosure as specified.

i) Cement shall be stored on a raised floor in dry, weather proof and draught free but well ventilated shed.

ii) Cement bags shall be stacked at least 60 cm away from external walls and in stacks of not more than ten bags to avoid lumping under pressure.

iii) Cement stored during monsoons shall be completely covered in 700 gauge polythene sheet, so arranged that the flap closes on the top stack. The contractor shall ensure that protective polythene sheet is not damaged at any time during use.

iv) Cement of different types shall be stored in separate sheds or separate compartments of a shed. If different type of cement are mixed, the Engineer will have the discretion to condemn all the cement concerned.

v) Consignments of cement shall be used in order of delivery. A record shall be kept of the batch numbers of cement deliveries, in such a form that the part of the works in which the cement is used can be readily identified.

vi) The Contractor shall be responsible for the storage of cement at the site and no claim will be entertained in the event of any damage occurring to cement due to faulty storage by the contractor, or account of his negligence.

vii) Cement stored on Site, for a period longer than eight weeks, shall be tested to the satisfaction of the Engineer before it is used in the works.

viii) Cement which has deteriorated in quality, such that it no longer conforms in all respects to the requirements of this Specification, will be rejected by the Engineer and shall not be used in the works. The Contractor shall immediately remove from the Site all cement which has been so condemned.

ix) The Contractor shall make a monthly return to the Engineer-in-Charge on the date corresponding to the interim certificate date showing quantities of cement received and issued during the month and in stock at the end of the month.

6.6.13 Coarse Aggregate

6.6.13.1 General

6.6.13.2 Scope of Specifications

The scope of this Specification shall cover the stone aggregate used for reinforced cement concrete.

6.6.13.3 Submittal

Contractor shall submit for approval certified laboratory test for the following items.

- Certificate of grading
- Aggregate crushing value, impact value, abrasion value.
- Water absorption test.
- To ensure that aggregate are free from iron pyrites and other impurities.

6.6.14 Products

6.6.14.1 General

Coarse aggregate shall be obtained from natural source such as crushed stone, gravel or approved river shingles. Aggregate shall be hard, strong, dense, durable, clean and free from deleterious material.

6.6.14.2 Deleterious Material

Coarse aggregate shall be free from harmful material such as iron pyrites, coal, mica, shale, clay, alkali, organic impurities etc. The maximum limit of deleterious material, when determined in-accordance with IS:2386, are shown in **Table 6.1**.

Table 6.1 - Limits of Deleterious Material in Coarse Aggregate

Sl. No.	Deleterious substance	Percentage by Weight		Remarks
		Uncrushed Coarse Aggregate	Crushed Coarse Aggregate	When tested in-accordance with
1	2	3	4	5
i)	Coal and lignite	1.00	1.00	IS:2386 Part II
ii)	Clay lumps	1.00	1.00	IS:2386 Part II
iii)	Materials passing 75µ IS Sieve	3.00	3.00	IS:2386 Part I
iv)	Soft fragments	3.00	-	IS:2386 Part II
v)	Shale	-	-	IS:2386 Part II
vi)	Total of percentages of all deleterious materials (except mica) including Sl. No. (i) to (v) for Col. 3 and Sl. No. (i) & (ii) for Col. 4	5.00	5.00	

- Coarse aggregate obtained from crushed or broken stone shall be angular, hard, strong, dense, durable, clean and free from soft, friable, thin flat, elongated or flaky pieces. The maximum limit for flakiness index for coarse aggregate shall not exceed 35%.
- River shingle or pit gravel shall be rounded, sound, hard, clean, nonporous, suitably graded in size with or without broken fragments and free from flat particles of shale, clay silt, loam and other impurities.
- Except where it can be shown to the satisfaction of the Engineer-in-Charge that a supply of properly graded aggregate of uniform quality can be maintained over the period of the works. The grading of aggregate shall be controlled by obtaining the coarse aggregate in different sizes and blending them in correct proportions as or when required.

6.6.14.3 Grading of coarse aggregate

For any of the following nominal sieves of graded coarse aggregates, grading shall be in conformity with the requirement laid down in IS:383. Grading of coarse aggregate in-accordance with Indian Standard is given in **Table 6.2**.

Table 6.2 - Graded Coarse Aggregate

IS Sieve Designation	Percentages passing for Graded Aggregate of Nominal Size		
	40mm	20mm	12.5mm
63mm	100	-	-
40mm	95 to 100	100	-
20mm	30 to 70	95 to 100	100
12.5mm	-	-	90 to 100
10mm	10 to 35	25 to 55	40 to 85
4.75 mm	0 to 5	0 to 10	0 to 10

Coarse aggregate of different nominal sizes may be mixed at Site with other ingredients of concrete directly in the mixer.

6.6.14.4 Size of coarse aggregate

The size (maximum nominal) of coarse aggregate for concrete to be used in various components are given in **Table 6.3**.

Table 6.3 – Size of Coarse Aggregate

Components	**Maximum nominal size of coarse aggregate (mm)**
Well steining and Well plugs	40
RCC work in well curb, well cap, deck slab and wearing coat	20
Any other item	As specified by Engineer-in-Charge

Maximum nominal size of aggregate shall also be restricted to the smaller of the following

i) 10 mm less than minimum lateral clear distances between main reinforcement.

ii) 10 mm less than minimum clear cover to the reinforcements.

The proportions of the various individual sizes of aggregates shall be so adjusted that the grading produces densest mix and the grading correspondents to the maximum nominal size of adopted for the concreter mix.

6.6.14.5 Execution

i) Aggregates shall be stored on a suitable well drained raft of concrete, timber, metal or other approved material. The storage of aggregate on the ground will not be permitted.

ii) Each size of aggregate shall be stored separately in such a manner as to prevent spillage and mixing of one aggregate with an adjacent aggregate. The dividing walls of any bins shall be of sufficient height and the aggregate shall be so deposited that a distance of 300 mm shall be left between the top of the division wall and any part of aggregate stack.

iii) When stack pilling, the aggregate shall not form pyramids resulting in segregation of different size parties. The stacks shall be regular and of a height not exceeding two metres.

6.6.15 Fine Aggregate

6.6.15.1 General

6.6.15.1.1 Scope of Specifications

The scope of this specification shall cover fine aggregate like sand, stone dust as applicable for concreting, masonry work and finishes.

6.6.15.1.2 Submittals

Contractor shall submit following certificates.

- Certificate of grading

- Limit of clay and other impurities content

6.6.16 Products

6.6.16.1 General

Aggregates that passes 4.75 mm IS Sieve shall be termed as fine aggregate. Fine aggregate are obtained from natural disintegration of rock and deposition by stream or produced crushing hard stone/natural gravel. The fineness modulus of fine aggregate shall neither be less than 2.0 nor greater than 3.5.

Fine aggregate shall be free from all harmful material like clay, coal and other material which are injurious to concrete. The maximum permissible limit of deleterious material in fine aggregate are given in **Table 6.4**.

Table 6.4 - Limits of Deleterious Material in Fine Aggregate

Sl. No.	Deleterious substance	Percentage by Weight		Remarks
		Uncrushed Coarse Aggregate	Crushed Coarse Aggregate	When tested in-accordance with
1	2	3	4	5
i)	Coal and lignite	1.00	1.00	IS:2386 (Part II)
ii)	Clay lumps	1.00	1.00	IS:2386 (Part II)
iii)	Materials passing 75µ IS Sieve	3.00	15.00	IS:2386 (Part I)
iv)	Soft fragments	-	-	IS:2386 (Part II)
v)	Shale	1.00	-	IS:2386 (Part II)
vi)	Total of percentage of all deleterious materials (except mica) including Sl. No. (i) to (v) for Col. 3 and Sl. No. (i) & (ii) for Col. 4	5.00	2.00	

6.6.16.2 Grading on fine aggregate

The grading of fine aggregates shall be within the limits as given in **Table 6.5** and described in the grading zones I, II & III.

Table 6.5 - Fine Aggregate

IS Sieve Designation	Percentages by Weight passing the Sieve		
	Grading Zone–I	Grading Zone–II	Grading Zone–III
10mm	100	100	100
4.75mm	95 – 100	90 – 100	90 – 100
2.36mm	60 – 95	75 – 100	85 – 100
1.18mm	30 – 70	55 – 90	75 – 100

IS Sieve Designation	Percentages by Weight passing the Sieve		
	Grading Zone–I	Grading Zone–II	Grading Zone–III
600 micron	15 – 34	35 – 59	60 – 79
300 micron	5 – 20	8 – 30	12 – 40
150 micron	0 – 10	0 – 10	0 – 10

- For coarse sand the grading shall be determined by the method prescribed in IS:2386 Part 1 shall be within the limits of Grading Zone II or III given in Table II. When the grading falls outside the percentage limits given for sieves other than 600 micron, 300 micron and 150 micron (I.S.) sieves but not more than 5 percent, it shall be regarded as falling within this zone. The 5 percent can be excess summation on one or more sieves.
- The maximum quantity of silt as determined by the testing method prescribed in IS:2386 (Part II) shall not exceed 6 percent.
- Stone dust shall be obtained by crushing hard stone. The grading as determined by the method prescribed in IS:2386 (Part I & II). It shall be within the limits of grading Zone – II or III. The percentage of limits above for the sieves other than 600 microns and 300 micron sieves shall not be more than 5 percent and for 150 micron sieve shall not be more than 20 percent. This shall then be regarded as falling within the zone. The 5 percent shall be summation of excess on other sieves.
- Where concrete of high strength and good durability is required, fine aggregate conforming to any one of the grading zones may be used according to the concrete mix design.
- Grading of fine aggregate shall be done in accordance with IS:2386.

6.6.16.3 Execution

6.6.16.3.1 Stacking and storage of fine aggregate.

Fine aggregate shall be stacked and stored on hard and plain ground so as to prevent any clay or vegetable dust or other foreign material maxing with the fine aggregate.

6.6.16.3.2 Bulking of fine aggregate

Damp sand increase its volume (bulking) depending upon moisture content. Due compensation allowances shall be made for the bulking of sand while preparing the mixes.

6.6.17 Water

6.6.17.1 General

6.6.17.1.1 Scope of Specification

The scope of this specification shall cover water from natural sources used in works.

6.6.17.1.2 Submittal

Contractor shall submit the following for approval of the Engineer-in-Charge.

- Source of water
- Chemical content

6.6.17.2 Products

Not applicable

6.6.17.3 Execution

- Water used shall be potable and free from all deleterious material.
- Water shall be free from oil, salt acid, alkalis and other chemical and organic matter.
- If the source of water changes during the execution of work, this new source of water shall be tested to ascertain its suitability for use in works.

6.6.18 Admixtures and Additives

6.6.18.1 General

6.6.18.2 Scope of Specifications

These specifications cover the scope for use suitable admixture and additives for the production of concrete.

6.6.18.3 Submittals

i) Chemical admixtures shall conform to IS:9103 and are not to be used unless approved by the Engineer-in-Charge. In case their use is permitted, the type, amount and method of use of any admixture proposed by the Contractor shall be submitted to the Engineer-in-Charge for approval.

ii) The Contractor shall further provide the following information concerning each admixture to the Engineer-in-Charge:-

   a) Normal dosage and detrimental effects if any under dosage and over dosage.

   b) The chemical names of the main ingredients in the admixture.

   c) The chloride ion content if any expressed as a percentage by weight of admixture.

   d) Whether or not the admixture leads to entrapment of air when used in the manufacturer's recommended dosage.

   e) Where two or more admixtures are proposed to be used in any one mix, the manufacturer's written confirmation of their compatibility.

iii) In reinforced concrete, the chloride ion of any admixture used shall not exceed 2 percent by weight of the admixture as determined in accordance with Specification IS:6925 and the total chloride ion in all admixtures used in concrete mix shall not exceed 0.83 percent by weight of cement.

iv) The admixtures, when used, shall conform to IS:9103. The suitability of all admixtures shall be verified by trial mixes, if considered necessary by the Engineer-in-Charge, in addition to the evidence that may have to be led by the manufacturer in this regard.

v) The addition of calcium chloride to concrete containing embedded metal will not be permitted under any circumstances.

vi) Retarding admixture when used shall be based on lingosulphonates with due consideration to IS:2645.

vii) Waterproofing admixtures shall comply with IS:2645.

6.6.18.4 Products

i) The Contractor must obtain the approval of the Engineer-in-Charge prior to use of any chemical admixture.

i) Details of product including suppliers of catalogue shall be submitted.

6.6.18.5 Execution

Admixtures shall be allowed to be used only for increasing the workability without affecting the water cement ratio and strength of concrete with prior approval of Engineer-in-Charge. Cost of all admixtures shall be borne by the contractor and deemed to have included in his office.

6.6.19 Concrete Work

6.6.19.1 General

6.6.19.2 Scope of Specification

This section covers the requirement for furnishing of cement concrete for RCC and PCC works including material proportion batching, mixing, transportation, placing, compaction, curing and all other work required for cast in place concrete.

6.6.19.3 Submittals

The contractor shall submit the copies of the following documents to the Engineer-in-Charge for review and approval two week prior to the placing of any concrete or as required to suit the project schedule.

Material Report

Prior to start of delivery of materials required for cement concrete, the following shall be submitted by the contractor to the engineer for approval.

A. Recommended supplier and/or source of all ingredients for making concrete including cement, fine and coarse aggregate, water and additives including samples thereof.

B. Quality inspection Plan to ensure continuing quality control of ingredients by periodic sampling and reporting to the Engineer-in-Charge on the quality of material being supplied.

Mix design

A. The contractor shall design mixes for each class of concrete meeting the requirements as specified.

B. One month in advance to commencement of concreting work, the contractor shall submit proposal for mix designs and test results from approved laboratory thereof as a report for the approval of the Engineer-in-Charge.

Plant & Equipment

The contractor shall submit the proposed programme methods and details of plant and equipment to be used for batching and mixing of concrete to Engineer-in-Charge, one moth in advance prior to start of work.

Certificates

A. With each mix design, the contractor shall submit laboratory test reports on concrete cubes as well as on ingredients along with manufacturer's certificate attesting that ingredients have been taken from material to be used for actual construction work and conform to specifications for approval or the Engineer-in-Charge.

B. In case of source branch or characteristic properties of the ingredients are required to be varied during the term of contract, a revised laboratory mix design report shall be submitted the Engineer-in-Charge.

6.6.19.4 Products

6.6.19.5 Grade of Concrete

Only design mix concrete shall be used in the works for structural members as per IS:10262. The grades of concrete for various components of the permanent works shall be specified as under, unless otherwise mentioned elsewhere.

- Well plugs (with 40 mm nominal size stone aggregates) : M25
- Well steining (with 40 mm nominal size stone aggregates) : M30, M35
- Well curb, Well cap, Deck Slab (with 20 mm nominal size aggregates) : M35

6.6.19.6 Strength Requirement of Concrete

The trial mixes shall be designed to have target mean strength as 47 Mps, 42 Mpa and 36 Mpa of M-35, M-30 and M-25 grades respectively. The trial mix shall be prepared with approved aggregates, cement and water. If possible the concreting plant to be employed in the work shall be used for preparing the trial mix to simulate actual field conditions. The Engineer-in-Charge shall be at liberty to inspect the operations and the quality of materials being used by the contractor for the trial mixes. The trial mixes which do not conform to be specification shall be rejected by the Engineer-in-Charge. The trial mix shall be designed in accordance with clause 6.4 of SP-23 of BIS. Approved admixtures shall be allowed to be used only for increasing the workability and without affecting the water cement ratio as obtained by the above method. Nothing extra shall be paid for these admixture. The other parameters shall be as under:

A.	Grade of concrete	As per clause 6.6.19.5
B.	Type of cement	Ordinary Portland Cement of 43 grade conforming to IS:8112
C.	Type and maximum size of Fine and coarse aggregate	As per MORT&H Specifications 2001 (Fourth edition) if not specified elsewhere in the tender document.
D.	Workability	Corresponding to compacting factor 0.80.
E.	Maximum water cement ratio i. For RCC members ii. For PCC members	 0.40 0.45

F.	Maximum cement content i. For RCC members ii. For PCC members	 400 kg/cum 310 kg/cum
G.	Maximum cement content	500 kg/cum

Minimum ten cubes shall be prepared from each trial mix for testing compressive strength at 28 days. A minimum of 5 repeat trials are to be made out of proposed mix to establish its suitability before actual use. For any change in the basic ingredients of the concrete mix, confirmatory trial tests, as required by the Engineer-in-Charge shall have to be made by the contractor at no extra cost. Based upon the successful preliminary crushing and workability tests, the contractor shall submit mix proposals alongwith the details of admixture to the Engineer-in-Charge who shall have the right to accept any trail mix. The strength tests for concrete shall be done in accordance with IS:516. All preliminary tests, approved, etc. shall begot done in advance by the contractor to do so consequent delay in completion of the works will not entitle him for any compensation whatsoever, either financially or by way of extension of time.

Acceptance criteria for the trial mix shall be as follows:

A. Average of 10 cubes tests at 28 days shall be more than mean target strength.

B. No individual cube shall be less than 0.85 times of mean target strength.

Standard Cement Content for various mixes

A. M-35 Grade of concrete 422 kg/cum with 43 Grade Cement

B. M-30 Grade of concrete 407 kg/cum with 43 Grade Cement

C. M-25 Grade of concrete 400 kg/cum with 43 Grade Cement

The rates quoted by the contractor for various items of Reinforced Cement Concrete shall be based on the Standard Cement Content for various mixes mentioned above. On the basis of mix design and trial mixes etc., if the cement content approved by the Engineer-in-Charge is different than what is mentioned above, variation in rates/price shall be applicable.

Acceptance Specification

Random sampling and lot by lot acceptance inspection shall be made for the 28 days cube strength of concrete. Cube test results at 7 days shall be indicative of the initial strength gain only.

Lot Size

Concrete under acceptance shall be notionally divided into lots for the purpose of sampling before commencement of work. The delimitation of lots shall be determined by the following:

A. No individual lot shall be more than 30 m^3 in volume. For each lot 20 cubes are to be cast.

B. At least 20 cubes from each component of the Works shall be taken from concrete of the same grade and mix proportions cast in any day. One half of the cubes of each day shall be tested for 7 days strength and the other half for 28 days strength.

C. Different grades or mixes of concrete shall be divided into separate lots.

D. Concrete of a lot shall be used in the same identifiable unit of the Works and its components. The cube register and cube number with date shall be so decided to identify the lot and location of concrete of the lot which are represented by the sample size.

Sampling and Testing

1. Concrete for making cubes shall be taken from a batch of concrete at the point of placement according to procedure laid down in IS:1199.
2. A random sampling procedure along the progress of concrete to ensure that each of the concrete batches forming a lot under acceptance inspection has equal chance of being chosen for taking cubes shall be adopted.
3. Except for concrete in cast-in-situ Deck Slab one half of the cubes shall be tested, first at 7 days and then remaining half at 28 days for compressive strength conforming to IS:516. The 28 days test strength result for each cube shall form an item of the sample representing a lot. 7 day test strength shall only be informative and shall have no bearing on the acceptance of the lot.

For the cast-in-situ Deck Slab, one cube shall be made for each cum. of concrete poured. These shall be cured and tested for 7 days and 28 days by dividing the entire number of cubes equally. These shall be judiciously chosen so that it represents the entire batches of concrete poured.

In case the test results for deck slab arc considered adequate to meet the acceptance criteria, the Engineer-in-charge may decide to change the frequency of taking cubes from one cube per cum. of concrete to one cube per 3 cum. of concrete poured. However, under no circumstances cubes taken from each grade of concrete cast in a day shall be less than 20.

6.6.19.7 Sample Size

A sample shall represent a lot under inspection. The 28 day test strength result of a cube (x) shall be termed as an item or the sample and the number of such items (n) shall define the sample size.

Normally, a minimum sample or n= 10 shall be used for the acceptance decision for a lot. For larger lot, grouping of samples (n = 10 nos. each) shall be made starting from first sample and the last group may contain leaser number of samples (n <10). Standard deviation for each group shall be worked out first and then these are to be pooled as per SP-23-1982 of BIS to find out the standard deviation of the whole lot under inspection.

6.6.19.8 Acceptance Criteria

1. The concrete of lot under acceptance shall be deemed to comply with the requirements of the characteristic strength (fck,) if the following criteria is satisfied.

   Xn= fek+0.825 St.....(A)
   Or
   fck,+4N/mm2 whichever is greater
   Xi = fck-3N/mm2 t.....(B)

Where,

Xi = Value or any individual item of the sample i.e. 28 days test strength or any cube of the sample.

Xn= Sample mean or mean value or 'n' cube strengths of the samples. For larger lots as per clause 7.15.2.3.3 above, all samples in different group shall be taken together for working out Xn.

St= Sample standard deviation computed from 'n' individual cube strength results. For large lots as described in clause 7.15.2.3.3 above, this shall be the pooled standard deviation of the lot under inspection calculated on the basis of standard deviation of different groups of samples.

2. Both criteria 'A' and 'B' above must be satisfied simultaneously for acceptance of the concrete at full rates, satisfaction of one criteria alone will not be deemed as full compliance. In case the concrete of a lot under inspection fails to meet either criterion 'A' or 'B' individually, and/or both the criteria; it shall be deemed to be substandard and its acceptance at reduced rate or total rejection shall be governed by the provisions of para (3), (4) and (5) below as the case may be. The decision of Engineer-in-Charge in this regard shall be final and binding on the contractor for rejection and acceptance of substandard concrete.

3. When the lot under inspection fails to meet either criteria 'A' or criteria 'B' individually the lot shall be deemed as substandard liable for rejection and the contractor shall have to dismantled and re-do the corresponding components alongwith all related works as decided by the Engineer-in-Charge at no cost to the department. However, the Engineer-in-Charge shall have the discretion either to reject or accept the substandard lot at a reduced rate under following conditions.

When criteria 'B' is fulfilled but criteria 'A' is not.

1) If, $Xn \geq f_{ck}$ Amount payable shall be reduced by an amount of Rs. 7/- per MPa of f_{ck} for each cum of concrete (As for example, M-40 concrete, the reduction in rate shall be Rs. 7x40 = Rs. 280/- per Cum).

2) If, $0.9\ f_{ck} \leq Xn < f_{ck}$ Penalty as (a) above plus additional reduction by an amount of Rs. 30/- per MPa of f_{ck} for each cum of concrete multiplied by the fraction by which it is less than f_{ck} (As for example, for M-40 concrete, the total reduction in rate upto $0.9\ f_{ck}$ shall be Rs. (7x40+30x40x(1.00-0.90) or Rs. 400/- per Cum).

3) If, $Xn < 0.9\ f_{ck}$ full lot shall be rejected. If However the Engineer-in-Charge so desires, he may order for additional tests, as stipulated in para (5) below, to be carried out. All the charges in connection with these additional tests shall be borne by the contractor. If on the basis of these additional tests, the Engineer-in-Charge is satisfied about the structural adequacy of the concrete, he may accept the work at reduced rate. In such case, the reduction shall be as in sub para 'a' above plus additional reduction by an amount of Rs. 60/- per Mpa of f_{ck} for each Cum of concrete multiplied by the fraction by which it is less than $0.9\ f_{ck}$ (as for example), for M-40 concrete, the total reduction in rate upto $0.8\ f_{ck}$ shall be Rs. (7x40+30x40) (1.0-0.9) + 60x40 (0.9–0.8) or Rs. 640/- per Cum).

While working out the reduction in payment out of above conditions, the entire quantity represented by the lot shall be considered for cost adjustment. The decision of the Engineer-in-Charge shall be final and binding on the contractor.

When criteria 'A' is satisfied but criteria 'B' is not.

1) If, $0.85\ f_{ck} \leq Xi < f_{ck} - 3$ Amount payable shall be reduced by an amount of Rs. 60/- per Mpa of f_{ck} multiplied by the fraction $[(f_{ck}–3) – Xi)] / f_{ck} - 3$ for each Cum of concrete represented by 28 days test result of a single cube (As for example, for M-40 concrete, the reduction in rate upto $0.85\ f_{ck}$ shall be Rs. 60x40 [(40-3) – 0.85x40] / (40-3) or Rs. 194.60 or Rs. 195/- per Cum to be rounded off to next full rupee).

2) If, Xi < 0.85 f_{ck} Full lot shall be rejected. If however, the Engineer-in-Charge so desires, he may order for additional tests, as stipulated in para 5 below, to be carried out. All the charges in connection with this additional tests shall be borne by the contractor. If on the basis of these additional tests, the Engineer-in-charge is satisfied about the structural adequacy of the concrete, he may accept the work at reduced rates. In such case, the reduction shall be as in sub para b (1) above plus reduction by an amount of Rs120\-per Mpa of f_{ck} multiplied by the fraction by which it is less than 0.85 f_{ck} for each Cum of concrete represented by 28 days test results of a single cube. (As for example, for M-40 concrete, the reduction in rate upto 0.80 F_{ck} shall be Rs.195/- + 40 x 120 (0.85-0.80) or Rs. 435/-per Cum.

   For the purpose of quantifying the reduction applicable only 28 days cube test result shall be the basis. Each cube at 28 days test shall represent the corresponding volume of concrete on which such adjustment shall be made. As for example, say for a lot size of 30 cum. of concrete, normal sample size for 28 days test be 10 Nos. (Minimum). Thus, each of such cube shall represent 3 cum of concrete irrespective of the fact that additional 10 cubes were tested at 7 days out of the same lot. Reduction shall be affected on the basis but each of the cubes tested as 28 days shall represent 3.0 cum. of concrete of the lot.

4. When the lot under inspection fails to meet both criteria 'A' and 'B', the lot shall be deemed as substandard liable for rejection and the contractor shall have to dismantle and re-do the corresponding components alongwith all related works as decided by the Engineer-in-Charge at no cost to the department. However, the Engineer-in-Charge shall have the discretion either to reject or accept the substandard lot at a reduced rate. In such cases the conditions under para (3) above shall be applicable in full for both the criterion put together. The decision of the Engineer-in-Charge shall be final and binding on the contractor.

5. In case the lot under inspection fails to meet the criterion under para 2, 3 and 4 above, one or more of the following check tests may be carried out at the discretion of Engineer-in-Charge to satisfy the strength of concrete laid.

   a. Cutting cores as per IS:1959.

   b. Load test of structure or parts of structures.

All testing expenditure including any fees that may have to be paid to the consultant of the department arising out of such occasion, shall be borne by the contractor. The number of additional tests to be carried out shall be determined by the Engineer-in-Charge. He shall be final authority for interpreting the results of the additional tests and shall decide upon the acceptance of otherwise. His decision in this regard shall be final and binding. For payment purposes, 28 days test result of cubes shall be the basis.

6.6.20 Execution

6.6.20.1 Proportioning Concrete

In proportioning concrete the quality of both cement and aggregate shall be determined by weight. The concrete shall be weighed separately from the aggregates. Water shall either be measured by volume in calibrated tanks or weighed. All measuring equipment shall be maintained in a clean and serviceable condition. The amount of mixing water shall be adjusted to compensate or moisture content in both coarse and fine aggregates. The moisture content of aggregate shall be determined in accordance with IS:2386 (Part III). Suitable adjustment shall also be made in the weights of aggregates to allow for the variation in weight of aggregates due to variation in moisture content.

6.6.20.2 Production of Concrete

The concrete shall be produced in a central batching and mixing plant producing at least 30 Cum mixed concrete per hour. The batching plant shall be fully automatic type. A batching plant essentially consists of the following components.

- Storage bins for different sizes of aggregates and cement
- Batching equipment
- Mixers
- Control panels
- Mechanical material feeding and elevating arrangements

The compartments of storage bins shall be approximately of equal size. The cement compartment shall be centrally located in the batching plant. It shall be water-tight and provided with necessary air vent, aeration fittings for proper flow of cement, emergency cement cut off gate. The aggregate and sand shall be charged by power operated centrally revolving chute. The entire plant from mixer floor upward shall be enclosed and insulated. The batch bins shall be constructed so as to be self-cleaning during draw-down. The batch bins shall in general conform to the requirements of IS:4925.

The batching equipment shall be capable of determining and controlling the prescribed amount of various constituent materials for concrete accurately, i.e. water, cement, sand individual size of coarse aggregates etc.

6.6.20.3 Mixing Concrete

The mixer in the batching plant shall be so arranged that mixing action in the mixers can be observed from the operator's station. The mixer shall be equipped with a mechanically or electrically operated timing, signaling and metering device which will indicate and ensure completion of the required mixing period. The mixer shall have all other component as specified in IS:4925.

6.6.20.4 Transportation, placing and Compaction of Concrete

Mixed concrete from the batching plant shall be transported to the point of placement by transit mixer mounted on barges in case concrete is to be delivered at location having river water or through concrete pumps and steel closed bottom bucket capable of carrying 0.6 cum concrete. In case the concrete is proposed to be transported by transit mixer it shall not be less than 4 rev/min of the drum or greater than a speed resulting in a peripheral velocity of the drum 70m/minutes at its largest diameter. The agitating speed of the agitator shall be not less than 2 rev/min nor more than 6 rev/min of the drum. The number of revolution of the mixing drum or blades at mixing speed shall be between 70 to 100 revolutions for a uniform mix, after all ingredients, have been charged into the drum. Unless tempering water is added, all rotation after 100 revolutions shall be at agitating speed of 2 to 6 rev/min and the number of such rotations shall not exceed 250. The general construction of transit mixer and other requirement shall conform to IS:5892.

In case concrete is to be transported by pumping the conduit shall be primed by pumping a batch of mortar through the line to lubricate it. Once the pumping is started, it shall not be interrupted (if at all possible) as concrete standing idle in the line is liable to cause a plug. The operator shall ensure that some concrete is always there in the pump receiving hopper during operation. The lines shall always be maintained clean and shall be free of dents.

Except where otherwise agreed to by the Engineer-in-Charge, concrete shall be deposited in horizontal layers to a compacted depth of not more than 450 mm. Unless agreed to by the

Engineer-n-Charge, concrete shall not be dropped into place from a height exceeding 2m. In order to avoid such situation chutes, tremie pipe or closed bottom buckets shall be used. These shall be kept clean and used in such a way as to avoid segregation. Slope of the chute shall be so adjusted that concrete flows without the use of excessive quantity of water. The delivery end of chute shall be as close as possible to the point of deposit. The chute shall be thoroughly flushed with water before and after each working period and the water used for this purpose shall be discharged outside the form work. The concrete shall be compacted by using immersion type vibrators. When concrete is being continuously deposited to a uniform depth along a member, vibrator shall not be operated within one meter of free end of the advancing concrete. Every effort shall be made to keep the surface of the previously layer of concrete alive so that the succeeding layer can be amalgamated with it by the vibration process. In case the concreting in underlying has hardened to such an extent that it cannot be penetrated by the vibrator but is still fresh (that is, just after initial set), un-imposed bond shall be achieved between the top and underlying layer by first scarifying the lower layer before the new concrete is placed by systematically and thoroughly vibrating the new concrete. The points of insertion of vibrator in the concrete shall be so spaced that the range of action overlap to some extent and the freshly filled concrete is sufficiently consolidated at all locations. The spacing between the dipping positions of vibrator shall be maintained uniformly throughout the surface of concrete so that concrete is uniformly vibrated. The vibrating head shall be regularly and uniformly inserted in the concrete so that it penetrates of its own accord and shall be withdrawn slowly whilst running so as to allow redistribution of concrete in its way and allow the concrete to flow back into the hole behind the vibrator. The vibrator head shall be kept in one position till the concrete within its influence is completely consolidated. Vibration shall be continued until the coarse aggregate particle have blended into the surface but have not disappeared. The contractor shall keep one additional vibrator in serviceable condition to be used in the event of breakdown and maintenance problems.

The vibrator head shall not be brought more then 200 mm near to the form work as this may cause formation of water stagnations. The form work shall be strong and great care shall be exercised in its assembly. It shall be designed to take up increased pressure of concrete and pressure variations caused in the neighborhood of vibrating head which may result in excessive local stress on the formwork. The joints of the form work shall be made and maintained tight and close enough to prevent the squeezing out slurry or sucking in of air during vibration. The form work to receive concrete shall be cleaned and made free from standing water, dust, etc. The contractor shall keep provision for screed and shutter vibrators at site.

No concrete shall be placed in any part of the structure until the approval of Engineer has been obtained. If concrete is not started within 24 hours of the approval being given, it shall be have to be obtained again from the Engineer. Concreting shall be done continuously over the area between construction joints. Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed. When concreting has to be resumed on a surface which has hardened, it shall be roughened, swept, clean, thoroughly wetted and covered with a 13 mm thick layer of mortar composed of cement and sand in the same ratio as in the concrete mix itself. The 13 mm layer of mortar shall be freshly mixed and placed immediately before placing of new concrete.

Where concrete has not fully hardened, all latency shall be removed by scrubbing the wet surface with wire or bristle brushes. Care shall be taken to avoid dislodgement of particles of coarse aggregate. The surface shall then be thoroughly wetted, all free water removed

and then coated with neat cement grout. Particular attention shall be given to corners and close spots.

Stages of concrete for individual components shall be follows:

A. i) For plug of the well - As directed by Engineer-in-Charge
   ii) Steining stage of well - -do-
   iii) Well cap - -do-

B. For deck slab - As directed by Engineer-in-Charge

6.6.20.5 Surface Finish

The concrete of all grades shall be finished except the top of the deck slab. The faces of all fair faced concrete shall be of even colour thought free from air bubbles, honey coming, cracks or other blemishes and will be inspected by the Engineer, on report by the contractor, immediately after the form work has been struck. Concrete with surface defects larger than $1/6^{th}$ of the cover shall be rejected. The quoted rates shall deem to have included such elements and nothing extra shall be admissible.

6.6.20.6 Curing of Concrete

The requirement of curing of concrete as applicable to structural concrete and mentioned in MORT&H. Specification for road and Bridge works (Fourth revision 2001) shall be applicable.

6.6.20.7 Tolerances in Concrete Elements

Substructure

1. Variance in cross-sectional dimensions : + 10 mm, - 5 mm
2. Misplacement from specified position in plan : - 10 mm
3. Variation of levels at the top : + 10 mm
4. Variation of reduced levels of bearing areas : ± 5 mm
5. Variation from plumb over full height : ± 10 mm
6. Surface irregular measured with 3 mm straight edge
   a. All surface except bearing areas–5mm
   b. Bearing measurement–3mm

Superstructure

1. Cast In-situ Structure
   a. Variation in thickness of deck slabs: -5mm to +10mm
   b. Variation on overall depth of width: ± 5 mm
   c. Variation in overall length and link between bearings: Shall not exceed ±10mm or ±0.1% of the span length whichever is less.
   d. Permissible surface irregulation when measured with a 3m straight edge or template
      : 5mm

6.6.21 Form Work

6.6.21.1 General

6.6.21.2 Scope of Specification

This Specification shall include all temporary / permanent forms or moulds required for forming concrete which is cast-in-situ.

6.6.21.3 Code / Standards

The following Codes/Standards shall be referred to for carrying out the works:

* IRC:87
* MORT & H Specifications

- Submittal

The Contractor shall submit the following before starting the work:

* Proposals for different types of form work.
* Design, sketches and drawings of different types of form work, when required.
* Proposals for centering and supporting arrangements

6.6.22 Products

6.6.22.1 Materials for Form Work

i) Surfaces in contact with concrete (sheathing) shall be of steel or plywood, as approved by Engineer.

ii) Approved hard wood sections shall be used for frame work of shuttering boards.

iii) In cases of steel form work, standard sizes of panels, as are readily available, can be used.

- Propping and Centring

Supports used for centring shall be adjustable steel prop type, without any deformation, damage and cracks, and shall be approved by the Engineer-in-Charge.

- Formwork for Exposed Concrete

1. Formwork for exposed concrete must be fabricated from best quality new marine ply, having hardcore face of required thickness and ply.
2. When so required by the Engineer-in-Charge, the contractor shall prepare shop drawings for exposed shuttering works and obtain necessary approval from the Engineer-in-Charge before fabricating the same, well in advance of commencement of the work.
3. All joints in boards for such formwork must be carefully designed. No repair on the exposed concrete shall be accepted.
4. Construction joints shall be positioned as instructed by the Engineer-in-Charge.
5. There must not be any visible patches, stains or efflorescence in the exposed concrete.
6. Nails / screws with smooth and well-dressed heads only will be used to avoid any damage of the concrete surfaces.

7. Only non-staining form oil, or release agent shall be used, with prior approval from the Engineer-in-Charge.

6.6.23 Execution

- Prior to commencing concreting work, all supports and wedges shall be thoroughly checked and approved by Engineer-in-Charge. All supports must be truly vertical and any loose supports must be rectified and properly wedged.
- Shuttering for concrete work shall be in steel, to produce a smooth and uniform finish on the exposed surfaces. The entire responsibility of planning, designing, erection, dismantling, shifting and safety of false work lies with the contractor. Formwork shall be made out of M.S. plates with stiffeners. Planning of form work shall be got approved from the Engineer-in-Charge prior to actual mobilization and use.

All shuttering and supports shall be designed by the contractor in accordance with the loads, pressures, stresses, etc. stipulated in the "Guidelines for the design and Erection of Form work and Centering for road bridges" and relevant drawings. The contractor shall submit design calculations for strength and deflection of the form work / slaging in triplicate to the Engineer-in-Charge for approval at least 90 days before the contractor is ready to erect the same in position. The department shall got the designs vetted by the consultant of the project and any improvement to shuttering, staging and its support system as suggested by the department shall be binding of the contractor without any extra cost to the department. These suggestions shall however not absolve the contractor of his full and final responsibility towards the safety and serviceability of the staging and form work as well as men and equipment working on them during the preliminary works before concreting, during concreting and afterwards. Shuttering shall be water tight and fixed in perfect alignment and securely braced so as to be able to withstand, without any displacement, deflection or movement of any kind, the loads due to the pressure of concrete, the movement of construction personnel, materials and plant.

6.6.23.1 Pre-assembly of form work

It shall be obligatory on the part of the contractor to pre-assemble the form work for walls, slabs, crash barrier etc. on ground prior to actual use. The contractor shall arranged for all material, labour, facilities, etc. to facilitate first hand checking and carry out necessary modifications as required to make the formwork true to line, level and shape at no extra cost. However, the contractor shall be responsible for the correctness of the form work when erected in position finally. Pre-checking of form work shall not be a ground for accepting any defective and bad form work produced by the contractor.

The form work shall be load tested for the probable anticipated loads before the same is put to actual use, at the direction of Engineer-in-Charge. However, load testing of form work shall not relieve the contractor of his responsibility for safety and serviceability.

6.6.23.2 Permissible Tolerances

The formwork shall be so made as to produce a finished concrete, true to shape, lines, levels, plumb and dimensions as shown on the drawings subject to the following tolerance for in-situ casting unless otherwise specified or shown in drawings or directed by the Engineer-in-Charge.

a) Special dimension- ± 5 mm
b) Plumb - + 1 in 1000 of height
c) Levels - 3 mm (before any deflection has taken place).

The tolerances given above are specified for local aberrations in the finished concrete surface and should not be taken as tolerance for the entire structure taken as a whole or for the setting and alignment of form work, which should be as accurate as possible to the entire satisfaction of the Engineer-in-Charge. Errors if noticed in any lift/tilt of the structure after stripping of forms, shall be corrected in the subsequent work to bring back the surface of the structure to its true alignment provided always that prior approval of the Engineer-in-Charge shall be obtained in respect of acceptability of such corrective measures without affecting the component structurally or aesthetically.

All shutters of beams, slabs and like members shall be so designed and constructed that the sides may be removed without disturbing the bottom plates or supports thereto. The bottom of each shutter shall be provided with a camber approximately to the final deflection of both shutter and beam under load as determined by the Engineer-in-Charge. The supporting struts shall be adjusted and fixed in position by suitable means duly approved by the Engineer-in-Charge.

Tubular steel props, stores, bracing or similar rigid material approved by the Engineer-in-Charge shall be used for shuttering scaffolding and staging.

6.6.23.3 Preparation of Formwork before concreting

The inside surface of forms shall, except in the case of permanent formwork or where otherwise agreed to by the Engineer-in-Charge be coated with an approved material to prevent adhesion of concrete to the form work. Release agents shall be applied strictly in accordance with the manufacturer's instructions and shall not be allowed to come into connect with any reinforcement or pre-stressing tendons and anchorages. Different release agents shall not be used in form work for concrete which will be visible on the surface of finished works.

Formwork shall be tight enough to prevent any loss of cement slurry during vibrations. Immediately before concreting, all forms shall be thoroughly cleaned.

Contractor shall give the Engineer-in-Charge due notice due notice before placing any concrete in the forms to permit him to inspect and accept the false work and forms as to their strength alignment and general fitness, but such inspection shall not relieve the contractor of this responsibility for safety of men, machinery, materials and for result obtained.

6.6.23.4 Concreting of narrow members

Whenever the concreting of narrow member is required to be carried out within shutters of considerable depth, temporary openings in the sides of the shutters shall if so desired by the Engineer-in-Charge, be provided to facilitate the pouring and consolidating of the concrete. Before any concretion is commenced, shutters and centering shall be carefully examined and the space to be occupied by the concrete be thoroughly cleaned out. The concrete in such members shall be compacted using suitable vibrator as appropriate.

6.6.23.5 Removal of Shutters

The consent of the Engineer-in-Charge shall be obtained in writing in all cases before any shuttering is removed. The contractor must notify the Engineer-in-Charge well in advance to enable him to inspect the concrete, if so desires. The contractor shall record in any approved manner, the date on which the form work concrete is placed in each of the work and the date on which the form work is removed there form and have this record checked

and counter-signed by the Engineer-in-Charge. The contractor shall be responsible for the safe removal of the form work and any work showing signs of damaged through premature removal of form work or loading shall be rejected and entirely reconstructed by the contractor without any extra cost to the department. The Engineer-in-charge may, however, instruct to postponed the removal of form work if he considers it necessary and no claim whatsoever shall be entertained on this account.

Where not specifically approved the time of removal of form work (when ordinary Portland cement is used without any admixtures at an ambient temperature exceeding 10^{o}c) shall be as under:

1.	Walls, abutments & vertical faces of all structural members	-	12 to 48 hours or as decided by Engineer-in-Charge
2.	Soffit of Slabs (with props left under)	-	3 days
3.	Props (Left under slab)	-	14 days

The number of props left under, their sizes and disposition shall be such as to be able to safely to carry the full dead load of the slab, beam or such, as the case may be, together any live likely to occur during curing or further construction.

6.6.23.6 Re-use of Forms

Before re-use, all forms shall be thoroughly scrapped with sanders, cleaned, joints and planes examined and when necessary / repaired and inside surface treated as specified herein before. Formwork shall not be used / re-used if declared unfit or unserviceable by the Engineer-in-Charge. Northing extra or any claim whatsoever shall be admissible on this account.

The contractor is to make good at his own expenses any injury to the concrete work and any damage caused by, or arising from the removal and striking of shutters and supports. Notwithstanding conditions and requirements mentioned in the foregoing paragraphs the shuttering should be such that all RCC concrete work remains shutter finished as per pattern approved by the Engineer-in-Charge.

6.6.23.7 Formed Surface and Finish

All RCC members shall have shutter surfaces. Utmost care shall be taken by contractor in erection of form work for components cast in stags. Location of construction joints in between such stages shall be pre-decided and all such joints shall be treated in a manner approved by the Engineer-in-Charge so as to match with the surrounding concrete without leaving any visual aberration or bad patches and/or bands. The contractor shall be deemed to have included the cost of such operation in his quoted rates and no claim whatsoever shall be entertained at a later date.

The formed finished concrete surface shall be free from honeycomb, blemishes, holes, surface defects etc. in no case such defects shall exceed 200 mm in any direction for individual spots or the continued area of such defects shall not exceed 0.2% of the entire area of related surface. Any variation beyond this limit shall be considered as a substandard work and shall be liable for rejection. The Engineer-in-Charge shall have the option to accept the so formed concrete at a reduced rate for defects exceeding this limit provided it is structurally adequate and due matching of defecting patches is done by the contractor to the entire satisfaction of the Engineer-in-Charge.

Special care shall be taken to ensure that no stains are left on the formed concrete either from formwork or exposed reinforcement bars. Such stains shall be removed by the

contractor at no extra cost so as to match with adjoining concrete surfaces to the satisfaction of the Engineer-in-Charge.

6.6.24 Expansion Joints

6.6.24.1 Scope of Specification

This section covers specification of material, fabrication and installation of strip seal Expansion Joint.

6.6.24.2 General

a) The expansion joints shall be designed and duly got approved by the Engineer-in-Charge. It shall cater for excepted movement and rotation for the surface at the joints and provide smooth riding surface. It shall also be easy for inspection, maintenance and replacement.

b) Expansion joints shall be robust, durable, water-tight and replaceable. Site fabricated expansion joints shall be prohibited. Expansion joints shall be obtained by the Engineer-in-Charge either directly or through the contractor from approved manufacturers and be of proven type.

Expansion joint shall be provided only as per details given in approved drawings.

c) Vehicular traffic shall not be allowed over expansion joints after their construction for such period as may be determined by the Engineer-in-Charge.

6.6.24.3 Codes / Standards

IRC 83 Part II, MORT & H Specification, IS:2062, IS:3400 (Part 3).

6.6.24.4 Performance Requirement with respect to Jetty (Approach and Berthing)

The expansion joints shall :

a) Withstand the imposed load including the impact load from live load and other sources.

b) Allow expansion and contraction movement due to temperature, creep, shrinkage and structural deformations,

c) Permit relative rotation in elevation and plan due to the causes as noted above.

d) Be waterproof, deck expansion joint seals play a critical role in preventing the degradation of the structural components of the deck system. Without effective joint seals, water passes through the deck and work harmfully to corrode steel components. Rain water gathers various corroding additives from the atmosphere and also from the carriageway.

e) Ensure sealing. In case deck joints are not sealed, apart from loss of waterproofing, grit and other forms of debris may enter the joint. Debris, deposited within the joint can seriously restrict the movement instead of facilitating the same. In the case of proprietary joints being accepted the sealing shall be as specified by manufacturer.

f) Ensure long life of thorough corrosion resistance.

g) Be easy to install.

h) Be easy to maintain. Replace ability of expansion joint shall be one of the basic criteria for selection of type of expansion joint.

i) Be resistant to the materials likely to collect / spill over the deck in its normal service.

6.6.24.5 Performance Requirement with Respect to User

The expansion joints shall:

a) Provide smooth continuity at the top of the deck for riding comfort.

b) Be of skid resistant surface.

c) Be non-damaging to the tyre.

d) Make minimum noise during vehicular crossing

e) Look good aesthetically

6.6.24.6 Performance Requirement for Transition Zone

It is the zone of connection of joint assembly and the adjoining deck. The expansion joint shall:

a) Permit transfer of generated forces without getting uprooted. The purpose will not be served if the bonding is with the wearing coat only. Anchorage must be provided with the deck structural element.

b) Ensure that surface in the transition zone stays undisturbed during long term service.

6.6.24.7 Product Execution

Refer MORT&H, specifications 2001 (Fourth Revision) section 2600 for Components, Materials, Handling and Storage, Installation, Acceptance Criteria & Tests Standards of Acceptance.

6.6.25 Thermo Mechanically Treated Steel Bars

The steel used for reinforcement shall be on the following types.

a) Thermo mechanically treated steel reinforcement conforming to IS:1786-1985.

6.6.25.1 Types and Grades

Reinforcement supplied shall be following type.

a) Thermo mechanically treated steel bars designated as Fe 415.

6.6.25.2 Physical requirement and Chemical composition

These requirements shall be as per following **Table 6.6** and **Table 6.7**

Table 6.6 – Physical requirement

S.No.	M/s SAIL	M/s Tata Steel	M/s Rashtriya Ispat Nigam Ltd.	Yield Stress (0.2% proof stress) considering equivalent as per IS:1786
1.	SAIL TMT 415	TISCON TMT 42	REBARS 415	415 N/mm2

Table 6.7 – Chemical Composition

	IS 1786 FE 415	SAIL TMT ALL GRADES	TISCON	VIZAG STEEL (RINL) REBARS ALL GRADES
			TMT-42	
Carbon	0.30	0.25	0.17	0.20
Sulphur	0.06	0.05	0.045	0.04
Phosphorus	0.06	0.05	0.045	0.05
Sulphur + Phosphorus	0.11	0.10	0.090	0.09

6.6.25.3 Mechanical Properties

Thermo mechanically treated steel bars shall conform to IS:1786-1985. The physical properties for all sizes of steel bars are mentioned below in **Table 6.8**.

Table 6.8 - Mechanical Properties

	IS 1786	SAIL TMT	TISCON	VIZAG STEEL (RINL) REBARS ALL GRADES
Grade	Fe 415	415	TMT 42	Fe 415
Yield Strength	415	415	450	460
Tensile Strength	485	500	510	520
Elongation in %	14.5	22	20	20

Elongation Percent on gauge length 5.65 √ S_0 is the cross sectional area of the test piece.

6.6.25.4 Normal mass/weight

The tolerance on mass/weight for round and square bars shall be the percentage given in **Table 6.9** of the mass/weight calculated on the basis that the masses of the bar/weight of normal diameter and Standard density.

Table 6.9: Normal mass/weight

Normal Size in mm	Tolerance on the nominal mass percent	
	Batch	Individual sample@
a) Upto and including 10	± 7	- 8
b) Over 10, upto and including 16	± 5	- 6
c) Over 16	± 3	- 4

@ for individual sample plus tolerance is not specified.

6.6.25.5 Tests : Section and Preparation of Test Sample

All the tests pieces shall be selected by the Engineer-in-Charge or his authorized representative either.

a) From cutting or bars

or

b) If he so desires, from any bar after it has been cut to the required or specified and the test piece taken from part any part of it.

In neither case, the test pieces shall be detached from the bar except in the presence of the Engineer-in-Charge or his authorized representative.

The test pieces obtained in accordance with as above shall be full sections of the bars and rolled and subsequently cold worked and shall be subjected to physical tests without any further modifications. No deductions in size by machining or otherwise shall be permissible. No test piece shall be enacted or otherwise subject to heat treatment. Any straightening which a test piece may require shall be done cold.

TESTS – Following type of lab test shall be carried out

a) Tensile Tests

This shall be done as per IS:1608-1972

b) Bend Test

This shall be done as per IS:1599-1974.

c) Re-Test

This shall be done as per IS:1786-1985

d) Rebend Test

This shall be done as per IS:1786-1985

If any one of the test pieces selected fail to pass any of the tests specified above, two further samples shall be selected for testing in respect of each failure. The test pieces from both these additional samples pass, the materials represented by the test samples shall be deemed to comply with the requirement of the particular test. The test piece from either of these additional samples fail, the material represented by the test samples shall be considered as not having complied with standard.

6.6.25.6 Frequency of Test

For checking normal mass, tensile strength, bend test, re-bend test, retest etc. specimen of sufficient length shall be cut from each size of bar at random at frequency not less than that specified below:

Size of Bar	For consignment below 100 tonnes	For consignment over 100 tonnes
Under 10 mm dia	One sample for each 25 tonnes as part thereof	One sample for each 40 tonnes or part thereof
10 mm to 16 mm dia	One sample for each 35 tonnes as part thereof	One sample for each 45 tonnes as part thereof
Over 16 mm dia	One sample for each 45 tonnes as part thereof	One sample for each 50 tonnes as part thereof

6.6.25.7 Cutting, Bending and Binding

Provision of para 5.3, including all sub-paras of CPWD specification 1996 Vol.II shall be followed.

6.6.25.8 Measurement

Measurement will be done as per applicable CPWD Specifications.

6.6.26 Handrails

Handrails shall include providing, fabrication, fitting and fixing to the deck slab collapsible handrails of structural and consisting of channels, angles, flats, tree, plants etc. connecting by riveting, bolting and/or as per design, technical specifications related to structural steel work mentioned in tender document and MORT&H Specification 2001 (fourth revision). This shall include painting with two coats of lead primer conforming to IS:102 and two coats of aluminum paint conforming to IS 2339 of make brand as approved by Engineer-in-Charge.

6.6.27 Excavation and Backfilling

The Contractor shall furnish all necessary supervision, labour, materials, equipment and tools to prepare excavation, grading, filling, embankments, roadways, ditches and all other items shown on working drawings in both wet and dry conditions with all lifts and descents within a lead of three kilometers.

Before beginning excavation or filling, the Engineer and Contractor shall jointly survey and record all ground levels on the Site.

6.6.27.1 Excavation

This shall include all material other than rock including but not restricted to organic material clay, salt, slap concentrate, sand, gravel and boulder or detached pieces of rock less than 0.15 cum. in volume and any other material which does not require blasting.

Excavation for roads, pavements, concrete drains, culverts, outfalls, various foundations, etc. shall be considered under this category.

The whole of the excavation for the works shall be carried out to the widths, lengths and depths and within the lines and levels indicated on the Drawings or as directed by the Engineer. Any excavation beyond such limits or instructions shall be made good by filling with M-10 concrete or other approved materials to the required compaction, by the Contractor, at his own expense to the satisfaction of the Engineer.

The Contractor shall provide all shoring, timbering or other approved support to the sides of the excavations as may be necessary to prevent any ground movement. The Contractor shall bear all responsibility connected with such shoring including dewatering notwithstanding the Engineer's approval. Cost of all such shoring, etc. shall be deemed to be included in the rates quoted by the Contractor.

The bottom of all excavation shall be trimmed and leveled in accordance with the Drawings and compacted properly to the satisfaction of the Engineer. A bottom layer of 150 mm thick shall be left undisturbed and removed only when concrete is about to be placed in order to prevent softening or deterioration of the surface of the bottom of the excavation due to exposure

6.6.27.2 Disposal

Excavation materials deemed suitable by the Engineer for filling in other areas shall be stockpiled in required quantities in the vicinity of the excavation Sites involved at a lead of 50 m from the excavation, with the approval of the Engineer. When such excavated material is directly used for back fill without compaction, no additional unit price for filling shall be paid and the rates quote in the Bill of Quantities for excavation shall be deemed to be inclusive of stockpiling and movement within a lead of 50 meters.

Unsuitable or excess excavation material and debris shall be transported to spoil areas as approved by the Engineer. Material shall be end dumped and graded at these areas. Cost of such disposal shall be reckoned in one km unit. Distance of 0.5 km or more shall be taken as 1 km. and distance of less than 0.5 km shall be ignored. However, when the total lead is less than 0.5 km, it will not be ignored, but paid for separately in successive stages of 50 meters subject to the condition that the rate worked on this basis does not exceed the rate for initial lead of 1 km.

6.6.27.3 Backfill

Backfill shall contain no ashes, rubbish combustible or decomposable material, nor any other material which the Engineer deems unsuitable for this purpose.

All material used as backfill under structures or concrete slab or around structures or trenches and pits shall be placed in lavers not exceeding 300 mm and compacted to a minimum of 95% of Modified Proctor's Density at optimum moisture content and as directed by the Engineer. Backfilling of trenches shall not commence till the respective piping and electrical cables/conduits have been approved by the Engineer.

PART-III

7 TECHNICAL SPECIFICATIONS FOR MECHANICAL & ELECTRICAL WORKS

7.1 SCOPE OF WORK

The item rate tender, based on design and drawing finalized by the IWAI shall be inclusive of cost of labour, materials, tools and plant and specialized machinery for completing the various components of the project and all operations connected therewith, under all conditions of site, moisture, weather etc. The rate shall be inclusive of all taxes and duties such as sales tax and excise duty on materials, income tax, supply and carriage of materials (By rail, road, river, air etc.), plants and machinery, octroi, toll, royalties, incidental charges, local taxes, patent rights etc. Thus the quoted offer shall be consolidated for all components/items of work. Royalties, sales tax, VAT, contract tax, levies, local taxes, incidental charges, whenever applicable shall be paid by the contractor to the respective authorities and no claim whatsoever on this shall be entertained by the Department.

The quantities of various items of work involved have been detailed in Schedule of Quantities of this tender. The tenderer is to quote the rates for different items of work as included in the said schedule of quantities.

The offer quoted for the above work shall broadly include the supply, fabrication, installation, testing and commissioning of the following items and associated works as per the specification given in the tender of the slipway facility:

i) Electric Wire Rope Winch (Main & Auxiliary)

ii) Main Trolley

iii) Transfer Trolley

iv) Repair Bay Trolley

v) 415V MCC (LT Switchgear) inside winch house

vi) LT Power and Control Cables

vii) Cabling system complete with cable trays, supports, conduits, glands, lugs etc.

viii) Illumination system complete with Lighting Distribution Boards, Lighting transformers, Lighting Panels, Lighting fixtures, High Mast, Receptacles, Conduits, Wires, Switch boxes etc.

ix) Earthing and Lightning Protection

x) Fire Fighting System

7.2 SITE CONDITIONS

7.2.1 General

Site conditions given hereunder or elsewhere are given as guidelines by the department but the contractor shall satisfy himself regarding all aspects of site conditions and no claim will be entertained on the plea that the information supplied by the department is erroneous or insufficient.

7.2.2 Project Site Location

The site for proposed slipway is in Pandu along the river Brahmaputra in the state of Assam. It is situated just 8 km downstream of Guwahati which is one of the important cities located on the south bank of the river.

Location plan of the project site is shown in **Figure 2.1** below:

Figure 2.1: Location Plan of the Project Site

7.2.3 Compilation of Site Data from Various Reports

7.2.3.1 Rainfall

Annual rainfall in the catchment area varies widely from over 250 cm in the Assam Valley to less than 50 cm in Tibet. Rainfall in the region is negligible from November to March. The rainfall commences from April and reaches its peak towards end of May. The average annual rainfall is about 160 cm at Pandu.

7.2.3.2 Water Level

The maximum and minimum water levels observed at Pandu over a period of 2004-2014 are tabulated in **Table 2.1**. The observed Highest Flood level at Pandu is 51.46 m and lowest water level at Pandu is 40.31 m with reference to the mean sea level.

Table 2.1: Maximum and Minimum water levels observed at Pandu

		Year								
		2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
January	**Max.**	41.43	41.56	41.04	40.94	41.74	-	41.16	41.52	40.89
	Min.	41.26	41.20	40.50	40.41	41.38	-	40.52	41.10	40.38
February	**Max.**	41.26	42.33	41.11	40.79	41.78	-	40.50	41.45	40.70
	Min.	41.11	41.06	40.31	40.39	41.43	-	40.35	40.99	40.52
March	**Max.**	44.64	44.28	42.21	40.98	42.57	-	43.43	43.66	41.34
	Min.	41.06	41.75	40.92	40.51	41.43	-	40.40	40.94	40.60
April	**Max.**	45.39	45.15	-	-	42.92	-	47.26	44.13	44.24
	Min.	42.48	43.21	-	-	42.92	-	43.13	42.28	41.31
May	**Max.**	47.09	44.91	44.91	47.18	-	44.51	48.05	44.98	46.13
	Min.	43.03	43.60	44.01	44.57	-	42.61	44.16	42.94	43.19
June	**Max.**	48.21	46.84	48.70	48.34	-	45.29	48.79	46.27	48.87
	Min.	44.85	44.46	46.20	46.09	-	43.64	46.21	44.17	44.59
July	**Max.**	49.20	47.73	48.42	50.05	-	47.42	48.91	47.84	48.47
	Min.	46.88	46.02	47.24	47.16	-	45.40	48.30	45.71	47.22
August	**Max.**	47.56	47.89	47.45	50.05	-	47.78	49.39	47.79	48.16
	Min.	46.73	46.02	45.57	47.63	-	46.53	47.41	46.22	46.35
September	**Max.**	47.54	47.41	48.59	48.13	-	46.75	49.92	46.88	49.40
	Min.	45.42	44.38	45.87	46.17	-	45.05	48.09	45.21	46.18
October	**Max.**	47.64	45.39	46.15	45.92	-	46.22	-	46.58	48.23
	Min.	43.65	43.44	45.42	44.40	-	42.86	-	42.87	44.17
November	**Max.**	43.82	43.76	-	44.19	-	43.36	-	42.81	-
	Min.	42.12	42.00	-	42.62	-	42.45	-	41.65	-
December	**Max.**	42.15	41.96	-	42.56	-	41.90	-	41.63	-
	Min.	41.57	41.07	-	41.76	-	41.19	-	40.93	-

It could be observed that during the months of December to March the water levels are lowest, while during the months of April to October these are highest.

7.2.3.3 Current

From available data on river discharges, the average river velocity during the normal and flood periods has been observed to be about 1 m/s and 4 m/s respectively.

7.2.3.4 Temperature

Guwahati enjoys moderate weather with average high temperature of 29°C and average minimum is 19°C. Summer (April-May) has a maximum of 40°C and winter (October to March) has a minimum 5°C.

7.2.3.5 Housing, Water Supply, Drainage and Electricity

No accommodation is available at the site of work. The contractor has to make his own arrangements for electric connection, housing, stores and field offices, accommodations for his labour and other employees etc. Contractor should visit the site and see in what manner he is able to arrange the above. Arrangement of water for drinking purpose in addition to the water required for construction work is also to be made by the contractor. Temporary electric connection may be taken by the contractor from the Assam State Electricity Board at his own cost. The department will recommend the application of the contractor without any financial or legal liability. If any royalty / rent is payable to the State Govt. or any local authority for occupation of the land at the work site, the same shall be payable by the contractor directly to such Govt. or local body, as the case may be. Nothing extra shall be payable by the Engineer-in-Charge on this account.

It shall be deemed that the contractor has satisfied himself regarding the nature and location of the work, general and local conditions and particularly these pertaining to transport, handling and availability and storage of materials, availability of labour, weather conditions at site and general ground / sub soil conditions and the tenderer has to quote.

The Engineer-in-Charge will bear no responsibility for the lack of such knowledge and also the consequence thereof to the contractor. The information and site data shown in the drawings and mentioned herein and elsewhere in these tender documents are furnished for general information and guidance only. The Engineer-in-Charge in no case shall be held responsible for the accuracy thereof or/and deductions, interpretations or conclusions drawn there from by the contractor and no claim shall be entertained whatsoever if the site conditions/information is different or otherwise incorrect as it is presumed that the contractor has satisfied himself for all possible contingencies, situations, bottlenecks and acts of coordination which may be required between the different agencies.

In case of flooding of the site on account of rain and other cause, or any other damage whatsoever, no claim financially or otherwise shall be entertained, notwithstanding any other provisions elsewhere in the tender documents.

7.3 DESIGN REQUIREMENTS

7.3.1 General

The contractor shall work as per the drawings and designs described in the Tender document and the best current engineering practice. Particular attention should be paid to internal and external access to the electrical equipment in order to facilitate inspection, cleaning and maintenance. The contractor shall comply with latest code of practice published by the Bureau of Indian Standards as listed in the tender document. Care shall be taken so that materials and equipment supplied by contractor will be the standard

catalogued products of manufacturers regularly engaged in the manufacturer of such products and will be of the latest standard designs that conform to the specific requirements.

7.3.2 Errors, Omissions and discrepancies

In case of errors, omissions and discrepancies between technical specification, schedules and drawings the following order shall prevail:

i) MOM with contractor in reverse chronological order.

ii) Technical specifications

iii) Tender drawings

iv) Schedule of Quantities

v) Bureau of Indian Standards

vi) International Standards

vii) In all case of doubt or omissions or discrepancies noticed in any item of work any drawing, the decision of the Engineer-in-Charge shall be final and binding on the contractor.

7.3.3 Other Technical Requirements

The contractor shall arrange all the instruments, materials and labour involved in setting out the works to the satisfaction of the Engineer-in-Charge.

7.4 POWER SYSTEM DESCRIPTION

7.4.1 Electrical Power Requirement

The main requirement for electrical load shall be on account of operation of Slipway facility for electrical winches(main and auxiliary), trolleys, power for auxiliary services like fire fighting system etc.

Other required areas such as indoor lighting for winch house & pump house, high mast lighting for outdoor area will also need their share of electric power.

7.4.2 Source of Power Supply

It is assumed that the required power supply shall be made available by the client at 415V from the nearby source available in the area. The supply shall be through two numbers of 415V cables (dual supply).

7.4.3 Power distribution System

415V dual power supply received at above point shall be further connected through straight through joint and further carried upto the winch house. Within the winch house this supply shall be fed to 415V MCC(LT Switchgear).

This power from 415V MCC shall further fed to various loads such as electric winches, trolleys, lighting (winch house, high mast), welding/power sockets, fire-fighting panel/pumps etc.

The voltage for the different system shall be as under:

- Main incoming power from IWAI 415V
- Fault level at 415V 50 kA
- LT feeders from 415V MCC (for illumination etc.) 415/230V, 3/1 Ph.

The electrical distribution diagram is shown in the attached **Power Single Line Diagram**, Drawing No. **I-506/PS/261.**

7.5 EQUIPMENT TECHNICAL SPECIFICATION

7.5.1 General

All equipment to be provided by the contractor shall be in conformity with the specifications laid down in the tender. The contractor shall ensure about their suitability to the satisfaction of the Engineer-in-Charge and nothing shall be paid extra on this account.

7.5.2 Codes and Standards

The equipment to be furnished under this specification shall be in accordance with the applicable section of the latest version of the following Indian Standards and relevant IEC standard, except where modified and /or supplemented by this specification.

IS 3427	Metal-enclosed switchgear and control gear.
IS 8623	Specification for low voltage switchgear and control gear assemblies.
IS 10118	Code of Practice for Selection, Installation, and Maintenance of Switchgear & Controlgear
IS 1554	PVC insulated (heavy duty) electric cables for working voltages up to and including 1100 volts.
IS 7098 -I	Cross linked polyethylene insulated PVC sheathed cables for working voltages up to and including 1100 volts.
IS 10810	Methods of tests for cables.
IS 9974	High Pressure sodium vapour lamps.
IS 2418	Tubular fluorescent lamps for general lighting services
IS 1255	Code of practice for installation and maintenance of power cables up to and including 33kV rating
IS 732	Electrical wiring installation (system voltage not exceeding 1100 V).
IS 2309	Code of practice for the protection of building and allied structures against lightning.
IS 3043	Code of practice for earthing.

7.5.3 Electric Winch Specification

A. Main Winch

One no. of the main winch having a hauling capacity of 100 T is powered by 150 HP induction motor operating on 415, 3 Phase 50 Hz AC supply. It is of double drum type, having gearbox in centre and two drums on both side, one on left and one on right, having two hydraulic brakes at Gearbox input of rated torque and one Electro-mechanical braking on Rope Drum for extra safety. The rope winding capacity required on both drums is 300 meters.

(a) Pulling Speed

The pulling speed of the main winch shall be 4.5 m/minute.

(b) Operation

Through Pendent Push button station, placed on Winch platform.

(c) Rope Drum

Steel fabricated Drum from seamless pipe of adequate thickness, duly machined having flange at both ends with open gear reduction at one side of drum

(d) Electric Motor

A 150HP low voltage slip ring induction type motor in both TEFC (IP55) & Drip proof (IP23) construction. These motors are designed with new slip ring and brush gear arrangement for trouble free operations and long lasting brush life, slip ring are moulded in epoxy-based insulation and excellent stability in operation at high temperature and have very good anti tracking property. The input supply required is 415V AC, 50 Hz. The motor shall have 6 pole with mounting B3(foot type).

(e) Brake

The brake shall be electro-hydraulic thruster type having double brake of Dia. 500 mm x 46 kg Thruster, having torque capacity of 190 KM. Additional braking on drum is also required for extra safety.

(f) Control Panel

The Control Panel shall be dust and vermin proof with IP-65 protection. The Control Panel shall be of Steel steel construction of thickness not less than 2.0 mm. The Panel housing consist of main line contactors, Step down transformers, MCCB, Timers and relays. It shall be mounted on winch platform.

(g) Gear Box

The Gear Box shall be of helical type. It shall have four stage reduction, fine machined gears, with material gears EN 9 and Pinion EN 24 (Hardened and Tempered).

(h) Base Frame

It shall be fabricated with suitable ISMB, ISMC, reinforced with plate Stiffners and top side would be covered with Chequered plate, sitting arrangement for operator, Control Panel and resistance boxes would be mounted on top platform with provision of anchoring the foundation bolts.

(i) Testing

It shall be tested and designed at 125% safe working load.

(j) Painting

It shall be duly painted with two coats of Zinc Chromate Primer followed by two Coat of Golden Yellow Enamel Paint.

B. Auxiliary Winch

One no. Auxiliary Winch Machine with hauling of capacity of 15T with direct pull is powered by 20 HP induction motor operating on 415, 3 Phase 50 Hz AC supply. The rope winding capacity required is 250 meters.

(a) Capacity and Pulling Speed

The pulling speed of the main winch shall be 4.5 m/min.

(b) Operation

Through floor Pendent Push button station, placed on Winch platform.

(c) Rope Drum

Steel fabricated Drum from seamless pipe of adequate thickness, duly machined having flange at both ends with open gear reduction at one side of drum

(d) Electric Motor

A 20 HP low voltage slip ring induction type motor in TEFC (IP55) construction with 40% CDF. It shall have 150 starts per hour. The input supply required is 415V AC, 50 Hz.

(e) Brake

The brake shall be electro-hydraulic thruster type of Dia. 250 mm x 18 kg Thruster.

(f) Control Panel

The Control Panel shall be dust and vermin proof with IP-65 protection. The Control Panel shall be of Steel construction of thickness not less than 2.0 mm. The Panel housing consist of main line contactors, Step down transformers, MCB, Timers and relays. It shall be mounted on winch platform.

(g) Gear Box

The Gear Box shall be of helical type.

(h) Testing

It shall be tested and designed at 125% safe working load.

(i) Painting

It shall be duly painted with one coats of Zinc Chromate Primer followed by two coat of Golden Yellow Enamel Paint.

7.5.4 Wire Rope Specification

a) All wire ropes shall conform to IS:2266. The tensile strength of the wire shall be 175-190 Kg/sq.mm.

b) All wire ropes shall be pre-formed or IWRC, ordinary lay construction, unless otherwise specified.

c) The fleet of the rope shall not exceed 1 in 12 for any relative position of the sheave/drum assemblies.

d) All wire rope terminations shall be made with solid forged thimbles and splices shall be mechanical splices made with aluminium or copper ferrules.

e) Unless otherwise specified, factor of safety for wire ropes shall not be less than 6, based on the nominal breaking strength and the working tension of the rope.

7.5.5 Wire Ropes Sheave Pulley Specification

a) Wire rope sheaves shall be made of cast steel or fabricated with groove surfaces hardened to 320 BHN minimum.

b) The sheaves shall have machined grooves of uniform diameter accurately turned and finished smooth. The groove depth, contour, angle and radius shall be as per recommendations in IS:3177.

c) The diameter of the sheaves measured at the bottom of the groove shall be as per recommendation in IS:3177.

d) It is wise to specify the minimum diameter of sheave with respect to rope dia for the various rope drive reeves. IS code covers the same.

7.5.6 Trolley Specification

A. Main Trolley

The main trolley shall be driven by a winch. 6 Nos. trolleys are required to meet the operational need. The trolleys can be connected by tie rods number depending on the lengths of vessel. Each trolley shall have 8 wheels of 350 mm dia. The platform size for the main trolley shall be 5660 x 5000 mm. The construction of main trolley shall be as shown in drawings.

B. Transfer Trolley 1

The transfer trolley 1 shall be motorized driven type having geared motors on all four corners, with 1 No. of quantity. The number of wheels shall be 20 Nos. having wheel dia of 350mm. The bottom platform size for the transfer trolley shall be 7000 x 21000 mm while the upper platform size shall be 4700 x 21000 mm. The speed of the transfer trolley shall be 5 m/minute with horizontal reverse and forward directions. The construction of transfer trolley shall be as shown in drawings with actuator and jacks.

C. Transfer Trolley 2

The transfer trolley 2 shall be motorized driven type having geared motors on all four corners, with 1 No. of quantity. The number of wheels shall be 20 Nos. having wheel dia of 350mm. The platform size for the repair bay trolley shall be 7000 x 21000 mm. The speed of the repair bay trolley shall be 5 m/minute with horizontal reverse and forward directions. The construction of repair bay trolley shall be as shown in drawings.

D. Trolley Wheels

(a) The diameter and strength of each wheel shall be dependent upon the total maximum wheel load imposed by static and dynamic forces on the equipment. However, minimum wheel diameter shall be as specified elsewhere.

(b) Wheels shall have cylindrical treads with double flanges. Tread diameter and flange dimensions shall be according to IS:1136 and IS:3177 respectively.

(c) Wheels shall be of forged/cast steel. The treads shall be hardened to minimum 300 BHN. All wheels shall be tested ultrasonically and test certificates furnished to Employer.

E. Trolley Rails

CR-100 Rails conforming to IS:3443 are proposed to be used, as these match with the choosen trolley wheels.

F. Trolley Material

(a) Structural Steel

Structural Steel (standard quality) shall be used conforming to Grade Fe 250 as per IS:226.

(b) Bolts, Nuts and Screws

Bolts, nuts and screws shall be in accordance with IS:1363 and rivets shall be made of rivet bars of mild steel as per IS:1148.

G. Structural Steel Work Specifications–General

(a) Scope of Specification

The Specification covered the scope of work of structural steel works, applicable codes of practice for structural steel work and the Specifications for the materials to be used, including steel, bolts and nuts, washers, welding etc. and the storage thereof.

(b) Scope of Work

The scope of work for the Contractor in respect of structural steel work shall cover, but shall not be limited to the following:

1. Preparation of complete detailed fabrication drawings and erection making drawings based on the design drawings, required for all the structures covered under the scope of the contract.

2. Submittal of revised design, with calculations and detailed fabrication drawings, in case any substitution of the designed sections in required.

3. Submittal of design calculations for joint and connections to be deployed by the Contractor, along with detailed fabrication drawings.

4. Supply of the raw materials for fabrication, taking into account wastage margin, including storage and upkeep of the materials.

5. Furnishing of all materials, labour, tools and plant, and all consumable required for fabrication and supply of all necessary bolt, nuts, washers, tie roads and welding electrodes for field connections, with necessary wastage margins.

6. Fabrication of the steel work in accordance with the approved fabrication drawings, including all shop assembling, matching and making Design, manufacture / fabrication and provision of all jigs, fixings, manipulators etc. required for the fabrication.

7. Provision of shop painting and requisite site painting to all fabricated steel work, as per requirements of the related specification on the painting.

8. Suitably making building and parking for transport of all fabricated materials.

9. Preparing and furnishing detailed Bills of Materials, Drawings Office Dispatch lists, Bolt Lists and any other lists of bought out items required in connection with the fabrication and erection of the structural steel work.

10. Loading and transporting all fabricated steel work and field connection materials.

11. The Contractor shall submit, the examination by the Engineer-in-Charge, detailed particular or his proposed methods of erection of the steel work, together with complete calculations relating to strength and deflection. If the erection scheme necessitates the attachment of temporary steel work to the permanent steel work, the contractor shall submit, for approval of the Engineer-in-Charge, the methods he proposes for making good the permanent steel work after removing the temporary work. The Contractor shall also submit the design and fabrication drawings of all temporary support, staging, braces etc. required for safe erection, for approval of the Engineer-in-Charge.

12. The contractor shall provide all construction and transport equipment, tools, tackle, consumables, materials, labour and supervision required for the erection of the structural steel work.

13. Receiving, unloading, checking and moving the storage yard, storage, guarding the upkeep of fabricated steel work and other consumable materials and fasteners at site, including prompt attendance to all insurance matters, as necessary, for all fabricated steel materials arriving at site.

14. Transportation of all, fabricated structural steel materials from site storage Yard, handling, assembling, boiling, welding and satisfactory installation of all fabricated structural steel materials in proper location, according to approved erection drawings and / or as directed by the Engineer-in-Charge.

15. Setting out, aligning, plumbing, leveling, bolting, welding and securely fixing the fabricated steel structures in accordance with the erection scheme, or as directed by the Engineer-in-Charge.

16. Providing protective treatment to the erected steel structures, as per Specification

17. All minor modifications of the fabricated steel structure, as directed by the Engineer-in-Charge, including but not limited to the following:

    i. Removal of bends, kinks, twists etc. for parts damaged during transport and handling.

    ii. Cutting, chipping, filling, grinding etc. if required for preparation and finishing of site connections.

    iii. Reaming of holes for use of higher size bolt if required.

    iv. Welding of connections in place of bottom for which holes are either not drilled at all or wrongly drilled during fabrications. Welding in place of bolting will be permitted only at the discretion of the Engineer-in-Charge.

    v. Refabrication of damaged parts beyond repair during transport and handling or Refabrication of incorrectly fabricated parts.

vi. Fabrication of parts omitted during fabrication by error, or subsequently found necessary.

vii. Drilling of holes which are either not drilled at all or are drilled in incorrect location during fabrication.

viii. Carry out tests in accordance with the related Specification.

(c) Submittals

1. On commencement of the Project, the contractor shall submit the following:

   i. Prior to the technical submittals, the contractor shall submit the proposed overall schedule for documentation such as calculations, shop/working drawings, plan/procedures and records. Submission of samples, process of fabrication / delivery / erection for the approval of Engineer-in-Charge.

   ii. Complete fabrication drawings, materials lists, cutting lists, bolt lists, field welding schedules, and QC schedules, based on the design drawing furnished to him and in accordance with the approved schedule.

   iii. Result of any tests, as and when conducted and as required by the Engineer-in-Charge.

   iv. Manufacturer's mill test reports in respect of steel materials, bolts, nuts and electrodes, as may be applicable.

   v. A detailed list of all Constructional Plant and Equipment, such as cranes, derricks, winches, welding sets, erection tools etc. their make, model present condition and location, available to the Contractor and the ones he will employ on the job to maintain the progress of work in accordance with the Contract.

   vi. The total number of experienced personnel of each category, like fitters, welding, riggers etc., which he intends to deploy on the project.

2. The Contractor shall submit a detailed erection programme for completion of the work in time and in accordance with the Contract. This will show, in a proforma approved by the Engineer-in-Charge, the target programme, with details of erection proposed to be carried out in each week, details of major equipment required and an assessment of required strength of various categories of workers.

3. The Contractor shall submit complete design calculations for any alternative sections proposed by him, for approval of the Engineer-in-Charge. Use of any alternative section shall be subject to approval of the Engineer-in-Charge. However, no escalation in unit rates of work shall be allowed for such case.

(d) Furnishing of Information

1. Drawings shall be furnished to the Contractor and all such drawings shall form part of these Specifications.

2. The Engineer-in-Charge reserves the right of make changes to the design / drawings even after release for preparation of shop drawings to reflect addition, omission and

modifications in data/details and requirements. Contractor shall consider such changes as part of these Specifications and the contract, and no extra claims shall be entertained on this account.

3. Design / drawings, providing by the Engineer-in-Charge, will show as appropriate the salient dimensions, design loads, sizes of members, location of openings at various levels and other necessary information required for the preparation of fabrication drawings, designs and erection details.

4. It shall be clearly understood that the drawings of the Engineer-in-Charge are design drawings. The typical details of connections, cuts, notches, bends, etc. where shown in the design drawings are only for general guidance of the Contractor. The Contractor shall design and develop all such details based on the design forces and functional requirements.

5. In the case of variations in design drawings and specifications, the decision of the Engineer-in-Charge, shall be final. Should the Contractor, find any discrepancy in the information furnished by the Engineer-in-Charge, the same shall be immediately brought to the notice of Engineer-in-Charge for resolution. The contractor shall obtain clarification on discrepancies from Engineer-in-Charge before proceeding with the work.

6. No detailed shop drawings will be accepted for examination by the Engineer-in-Charge unless the same, have first been completely checked by the Contractor's qualified structural engineer and are accompanied by an erection plan showing the location of all pieces detailed. The contractor shall check and ensure that detailing of connections is carefully planned to obtain ease in erection of structures, including field welded connections and /or bolting.

7. No fabrication work shall be started by the contractor without having obtained approval of Engineer-in-Charge on the relevant drawings. Approval by the Engineer-in-Charge of any of the drawings shall not relieve the Contractor of his responsibility to provide correct design of connections, workmanship, fit of parts, details materials and errors on omissions of all work shown thereon. The approval of Engineer-in-Charge shall constitute approval of the size of members, dimensions and general arrangement, but shall not constitute approval of the connections between members and other details.

8. Drawings, for approval, shall be submitted by the contractor in an orderly manner commensurate with erection sequence and approved construction programme.

9. The Engineer-in-Charge shall return one copy of Contractor's drawing marked with his approval/comments. The Contractor shall furnish ten prints of all approved final drawings for field use and record purposes. The contractor shall also furnish two direct reading reproducible of each drawing, of quality not lesser than an "Autopositive", on extra thin paper capable of reproducing legible prints. These reproducible shall incorporate all modifications, field changes, substitutions etc. effected and shall reflect the status "as built". All such reproducible shall be submitted rolled (not folded) on the outside of regular mailing tubes. All such drawings will remain the property of the Engineer-in-Charge. The Engineer-in-Charge reserves the right to use them in any manner whatsoever.

10. The drawing prepared by the Contractor, and all subsequent revisions thereof shall be at the cost of the Contractor, and no separate payment shall be made for the same.

Revisions shall incorporate all modifications, field changes, substitutions etc. effected. The rate / prices quoted for fabrication work shall be deemed to include the cost of such drawing work.

11. The Contractor shall give due consideration to the need of trial assemblage at shop, weight and size limitation of elements for transportation from shop of construction site, temperature variation of 25 degree centigrade between the fabrication shop and site, site measurements of the as-built dimensions and avoidance of site welding except for fixtures. All the drawings shall be prepared in metric units. The drawings should preferably be of one standard size, and the details shown therein shall be clear and legible. These drawings shall include but shall not be limited to the following.

    i. Assembly drawings, giving extra sizes of the sections to be used and identification marks of the various sections.

    ii. Dimensional drawings of base plans, anchorage details in foundations, foundation bolt locations etc.

    iii. Complete Bills of Materials and detailed drawings of all sections including their billing weights.

    iv. Shop details of temporary structures together with calculations.

    v. Details shop drawings for proper co-ordination with the concrete components to which the steel members shall be connected, as required.

    vi. Any other drawings or calculations that may be required for proper completion of the work and clarification of the works or substituted parts thereof.

    vii. All 'as-built' drawings.

(e) Applicable Codes of Practice

The following specifications, standards and codes are included as part of this specification. All standards, specifications, codes of practice current on the date of signing of agreement and referred to herein shall be applicable.

Sl. No.	IS Code	Description
1.	IS:102 (1962)	Ready Mixed Paint, Brushing, Red, Lead, Non Setting, Priming
2.	IS:226 (1975)	Structural Steel (Standard quality)
3.	IS:800 (1984)	Code of Practice for General Construction in Steel
4.	IS:808 (1989)	Dimensions for Hot Rolled Steel Beam, Column, Channel and Angle Sections.
5.	IS:814 (1991)	Covered Electrodes of Manual Metal Arc Welding of Carbon & Carbon-Manganese Steel.
6.	IS:816 (1969)	Code of Practice for Use of Metal Arc Welding for General Construction in Mild Steel.
7.	IS:817 (1966)	Code of Practice for Training and Testing of Metal Arc

Sl. No.	IS Code	Description
		Welders.
8.	IS:817 (Part 1) (1992)	Manual Metal Arc Welding
9.	IS:875 (1987) (Part 1 to Part 5)	Code of Practice for Design Loads.
10.	IS:919 (1993) (Part 1 & Part 2)	ISO System of Limits and Fits
11.	IS:1148 (1982)	Hot Rolled Rivet Bars (upto 40 mm) for Structural Purposes
12.	IS:1182 (1983)	Recommended Practice for Radio Graphic Examination of Fusion Welded Butt Joints in Steel Plates.
13.	IS:1363 (1992) (Part 1 to Part 3)	Hexagon Steel Bolts, Screws and Nuts of Product grade C
14.	IS:1364 (1992) (Part 1 to Part 5)	Hexagon Steel Bolts, Screws and Nuts of Product grades A&B.
15.	IS:1367 (1991) (Part 1 to Part 20)	Technical supply Conditions for Threaded Steel Fasteners.
16.	IS:1477 (1971) (Part 1 & Part 2)	Code of Practice for Painting of Ferrous Metals in Building.
17.	IS:1852 (1985)	Rolling and Cutting Tolerances for Hot-Rolled Steel Product.
18.	IS:1893 (1991)	Criteria for Earthquake Resistant Design of Structures.
19.	IS:1977 (1996)	Low Tensile Structural Steel (Ordinary Quality)
20.	IS:2016 (1967)	Plain Washers
21.	IS:2062 (1992)	Steel for General Structural Purposes.
22.	IS:2074 (1992)	Ready Mixed Plant, Air Drying, Red-oxide-Zinc Chrome, and Priming.
23.	IS:2595 (1978)	Code of practice for Radio Graphic Testing
24.	IS:3600 (1985) (Part 1 to Part 9)	Methods of Testing Fusion Welding Joints
25.	IS:3616 (1974)	Acceptance Tests for Wire Flux Combination for Submerged Arc Welding.
26.	IS:3658 (1981)	Code of Practice for Liquid Penetrant Flow Detection.
27.	IS:3757 (1985)	High Strength Structural Bolts.
28	IS:4353 (1995)	Recommendations for Submerged Arc Welding of Mild Steel and Low Alloy Steel.
29.	IS:4943 (1968)	Assessment of Butt and Fillet Fusion Welds in Steel Sheet, Plate and Pipe.

Sl. No.	IS Code	Description
30.	IS:5334 (1981)	Code of Practice for Magnetic Practice Flow Detection of Welds.
31.	IS:5369 (1975)	General technical delivery requirement for steel and steel products.
32.	IS:5372 (1975)	Taper Washers for Channels.
33.	IS:5374 (1975)	Taper Washers for I-Beams.
34.	IS:6755 (1980)	Double Coil Helical Spring Washers.
35.	IS:7215 (1974)	Tolerances for fabrication of Steel Structure.
36.	IS:7318 (1974) (Part 1)	Approval Tests for Welders When Welding Procedure approval is not required – fusion welding of steel.
37.	IS:8910 (1978)	General requirements of supply of wieldable structural steel.
38.	IS:9595 (1996)	Metal Arc Welding of Carbon & Carbon – Magnese Steels.

H. Products

(a) Materials

1. All materials to be supplied by the contractor shall conform to relevant Indian Standards or equivalent, as approved by the Engineer-in-Charge.

2. Steel materials required for the work shall be free from imperfections, mill scales, slag intrusions, laminations, pittings, rusts etc. that may impair strength, durability and appearance. All materials shall be of tested quality only. If desired by the Engineer-in-Charge, Test Certificates in respect of each consignment shall be submitted in triplicate. Whenever the materials are permitted for procurement from identified stocks, a random sample shall be tested at an approved laboratory, as directed by the Engineer-in-Charge.

(b) Structural Steel

"Structural steel (standard quality) conforming to Fe 250 as per IS-226-1975".

(c) Bolts and Nuts

All bolts and nuts shall conform to IS:1363 (1992), IS:1364 (1992) and IS:1367, as applicable, and unless specified otherwise, shall be hexagonal. All nuts shall conform to property class compatible with the property class of the bolt used.

(d) Washers

Plain washers shall be made of mild steel conforming to IS:5369 (1975), unless otherwise specified. One washer shall be supplied with each bolt and, in case of special types of bolts, more than one washer as needed for the purpose shall be supplied. An additional double coil helical spring washer, conforming to IS:6755 (1980), shall be provided for bolts carrying dynamic or fluctuating loads and those in

direct tension. Tapered washers, conforming to IS:5372 (1975) and IS:5374 (1975), shall be used for channels and beans respectively wherever required.

I. Storage of Materials

(a) General

1. All materials shall be as stored as to prevent deterioration, and to ensure the preservation of their quality and fitness for the work. If required by the Engineer-in-Charge, the materials shall be stored under cover and suitably painted for the protection against weather. Any materials which has deteriorated or has been damaged shall be removed from site and replaced by new members, as directed by the Engineer-in-Charge, at no extra cost and time.

2. The steel to be used in fabrication shall be stored in separate stacks clear of the ground, section wise and lengthwise.

   The storage area shall be kept clean and properly drained. Structural steel shall be so stored and handled in such a manner that members are not subjected to excessive stresses and damage. Girders and beams shall be placed in upright position. Long members shall be supported on closely spaced skids to avoid unacceptable deflection.

(b) Yard

1. The contractor may be required to establish a suitable yard, in an approved location at site, for storing the fabricated steel structures and other materials which may be delivered to site. The yard shall have proper facilitate such as drainage and, lighting, including access for cranes, trailers and other heavy equipment.

2. The contractor shall have been deemed to have visited the site, prior to submission of his Tender to acquaint himself with the availability of land and the development necessary by way of filling, drainage, access roads, fences, sheds etc. all of which shall be carried out by the contractor at his own cost and as directed by the Engineer-in-Charge.

(c) Covered Store

All field connection materials, paints etc. shall be stored on racks and platforms, off the ground in a properly covered building by the contractor.

J. Structural Steel Work Specification-Welded Structure

(a) General

The Specification covers the supply, fabrication and delivery to site of welded structural steel work, including the supply of all consumables, electrodes and other materials required for fabrication and field connections of all structural steel work covered under the scope of the Specification.

(b) Products

Ref. Specification para 7.4.6 for Structural Steel–General.

(c) Execution

7.5.6.1 <u>Workmanship</u>

7.5.6.1.1 General

All workmanship shall be in accordance with the best practices in modern structural shops. Greatest accuracy shall be maintained in the manufacture of every part of the work and all similar parts shall be strictly interchangeable. The contractor shall not proceed with any welding until the Engineer-in-Charge has approved his welding plan which shall include:

- All information of welding procedures, equipment, additives and preheating during welding operation
- Details of non-destructive testing methods.
- Precautions with regard to welding shrinkage
- Possible treatment of complete welds by grinding
- Procedure and programme of welding sequence.

(i) Templates

Templates used throughout the work shall be steel, or steel bushed where considered necessary by the Engineer-in-Charge. In cases where actual materials have been used as templates for drilling similar pieces, the Engineer-in-Charge shall decide whether such materials are fit to be used as parts of the finished structure.

(ii) Straightening

All material shall be straight and free from twists, and if necessary, before being worked, shall be straightened and/or flattened by pressure, unless require to be of curvilinear form.

(iii) Clearance

The clearance between fraying surface of bolted connections shall not be greater than 1mm at each end. If the separation is between 1 to 3 mm the surface should be tapered to eliminate the separation. Over 3mm separation shall be filled with filler plates.

(iv) Shearing, Cutting and Planning

1. Cutting shall be done automatically. Hand cutting may be used only exceptionally in connection with erection, if approved by the Engineer-in-Charge. In such cases the joint edges shall receive a finishing treatment with planning and grinding tools. Cutting by shearing machine may be used for plates not exceeding 10 mm in thickness provided that the plate edges be fully enclosed in a weld. Oxygen cutting may be used provided a smooth and regular surface free from cracks and notches is secured.

2. Chipping of angle flanges and edges of plates, wherever necessary, shall be done without damaging the parent metal. Chipped edges shall be ground to a neat finish and sharp corners and hammered rough faces shall be rounded off.

3. The edges and ends of the cuts / sheared flange plates, web plates of plate girders, and all cover plates and the ends of all angles tees, channels and other sections forming the flanges of plate girders, shall be planed/ground. Edge preparation of welding may be done by machine controlled flame cutting, with edge free from butts should be clean and straight. In welded girders, the top edges of all intermediate stiffeners shall be prepared and butt welded to the top flange plates, unless otherwise shown in the design drawings.

4. The butting surfaces at all joints of girders shall be planned so as to butt in close contact throughout the finished joint.

5. The ends of all built up girders and of all columns shall be faxed in an end milling machine after the members have been completely assembled. Bearing edges for girder bearing stiffeners, and column bases shall be machined.

6. Unless clean, square and true to shape, all flame-cut edges shall be planed. Cold sawn ends, if reasonably clean, and flame-cut ends of sections not inferior to sawn ends in appearance, need not be planned, except for butting ends.

(v) Assembly

1. All parts assembled for welding shall be in as close contact as practicable over the whole surface and all bearing stiffener shall bear lightly at both top and bottom without being drawn or caulked.

2. The components parts shall be so assembled that they are neither twisted nor otherwise damaged. Specified cambers, if any, shall be provided.

3. All parts of bolted welded members shall be held firmly in position by means of jigs bolting or welding. No drifting of hall shall be permitted, except to draw the parts together, and no drift used shall be larger than the nominal diameter of the bolt. Drifting done during assembling shall not distort the metal or enlarge the holes.

4. Trial assemblies shall be carried out at the fabrication stage to ensure accuracy of workmanship. These checks shall be witnessed by the Engineer-in-Charge and such trial assemblies shall be at the cost of the Contractor.

(vi) Welding

1. General

The welding and the welded work shall conform to IS:816 and IS:9595, unless otherwise specified. As much work as possible shall be welded in shops and the layout and sequence of operations shall be so arranged as to eliminate distortion and shrinkage stresses.

2. Electrodes

All electrodes shall be kept under dry conditions. Any electrode damaged by moisture shall not be used unless it is guaranteed by the manufacturer that, when it is properly dried, there will be no detrimental effect. Any electrode which have part of its flux coating broken away or is otherwise damaged shall be rejected. Any electrode older than six (6) months from the date of manufacture shall not be used. Batch certificate for electrodes shall be submitted by the Contractor.

3. Preparation of Joints

The edges shall be prepared, with an automatically controlled flame cutting torch, correctly to the shape, size and dimensions of the groove, prescribed in the design and fabrication drawings. In case of U-groove joints, the edges shall be prepared with an automatic false cutting torch in two phases, following a bevel out with a gouging pass, or by machining.

The welding surface shall be smooth, uniform and free from fins, tears, notches or any other defects, which may adversely affect welding, and shall be free of loose scale, slag, rust, grease, paint, moisture or any other foreign material.

4. Welding Procedure

a) All welding procedures shall be submitted to the Engineer-in-Charge for approval 14 days before starting fabrication.

b) The welding procedures shall be arranged by the Contractor to suit the details of joints, as indicated in the drawings, and the position at which welding has to be carried out. Welding procedure inter alia shall cover the following:

- Type and size of electrodes
- Current and (for automatic welding) are voltage
- Length of run per electrode, or (for automatic welding) speed of travel
- Number and arrangement of runs in multi-run welds
- Position of welding
- Preparation and set-up of parts
- Welding sequence
- Pre or post heating
- Any other relevant information

c) The welding procedures shall be so arranged that distortion and shrinkage stresses are reduced to the minimum, and that the welds meet the requirement of quality specified.

d) Any weld found defective shall be removed, by using either chipping hammer or gouging torch, in such a manner that parent material is not injured in any way.

5. Fusion Faces and Surrounding Surfaces

a) Fusion faces and the surrounding surfaces within 50mm of the welds shall be free from all mill scale and free from all oil, paint or any substances which might affect the quality of the welds or impede the quality / progress of welding. These shall be free from irregularities which would interfere with the deposition of the specified size of weld or be the cause of defects.

b) All mill scale within 50mm of welds shall be removed prior to welding, either pickling followed by thorough power wire brushing, or by other approved methods.

c) In preparation or cutting of the fusion faces is necessary, the same shall be carried out by shearing, chipping, gas-cutting or flame gouging.

d) Where hand gas-cutting or hand-gouging is employed, the blowpipe or gouging blow pipe shall be properly guided.

6. Assembly for Welding

Parts to be welded shall be properly assembled and held firmly in position by means of jigs and clamps prior to and during welding.

7. Welded Girders and Other Plate Construction

Automatic submerged arc welding shall be employed for fabrication of welded girders and other plate construction, wherever specified.

8. Accuracy of Fit-Up

Parts to be fillet welded shall be brought into as close contact as practicable, and the gap due to faulty workmanship or incorrect fit-up shall not exceed 1.5mm. If greater separation occurs at any position, the size of fillet weld shall be increased at such positions by the amount of the gap.

9. Jigs and Manipulators

Jigs and manipulators shall be used, where practicable, and shall be designed to facilitate welding and to ensure that all welds are easily accessible to the operators.

10. Ends of Butt Welded Joints

The ends of butt joints shall be welded so as to provide full throat thickness. This may be done by the use of extension pieces, cross-runs or other approved means.

11. Weld Face and Reinforcement of Butt Welds

The weld face shall, at all places, be deposited projecting the surface of the parent metal. Where a flush surface is required, the surplus metal shall be dressed off.

12. Testing of Butt Welds

Butt welded joints are to be 100% radio-graphically tested by the Contractor at his own cost. If such tests indicate the joints to be defective, the cost of rectification of defective welds shall also be borne by the Contractor.

13. Minimum Leg Length & Throat Thickness in Fillet Welds

The minimum leg length of a fillet weld as deposited shall be not less than the specified size. In no case shall a concave weld be deposited, unless specifically permitted. Where permitted, the leg length shall be increased above that specified length, so that the resultant throat thickness is as great as would have been obtained by the deposition of a flat-faced weld of the specified leg length.

14. DE Slagging

After making each run of welding, all slag shall be thoroughly removed and the surface cleaned.

15. Quality of Welds

The weld metal, as deposited (including tack welds), shall be free from cracks, slag inclusions, porosity, cavities and other deposition faults. The weld metal shall be properly

fused with the parent metal without under cutting or overlapping at the toes of the weld. The surface of the weld shall have a uniform consistent contour and regular appearance.

16. Weather Conditions

Welding shall not be done under weather conditions which might adversely affect the efficiency of welding.

17. Qualification and Testing of Welders

The Contractor shall satisfy the department that the welders are suitable for the work for which they will be employed, and shall produce evidence to the effect that welders have satisfactorily completed appropriate tests, as described in IS:817 Part 1. The Engineer-in-Charge may, at his own discretion, order periodic tests of the welders and/or of the weld produced by them. Such tests shall be at the expense of the Contractor.

18. Supervision

The Contractor shall employ competent welding supervisors to ensure that the standard of workmanship and the quality of the materials comply with the requirements laid down in this Specification.

19. Machining of Butts and Bases

Splices and butt joints of compression members, depending on contact for stress transmission, shall be accurately machined over the whole section. In column bases, the ends of shafts together with the attached gussets, angles, channels etc. after bolting and/or welding together as the case may be, shall be accurately machined so that the parts connected butt over the entire surface of contact. Care shall be taken that connecting angles or channels are fixed with such accuracy that they are not reduced in thickness by machining by more than 0.8 mm.

- Strength-quality with parental metal
- Absence of defects
- Corrosion resistance of the weld shall not be less than that of parent material in an aggressive environment.

(vii) Shop Assembly

- The steel work shall be temporarily shop assembled, as necessary, so that the accuracy of fit may be checked before dispatch. The parts shall be shop assembled with a sufficient number of parallel drifts to bring and keep the parts in place.
- Steel parts drilled or punched with templates having steel bushes shall be similar and, as such, interchangeable, such steel work may be shop erected in part only, as agreed by the Engineer-in-Charge.

(viii) Erection Marking

- Each fabricated member, whether assembled prior to dispatch or not so assembled, shall bear an erection mark, which will help to identify the member that its position in respect of the whole structure, to facilitate re-erection at site.

- These erection marks shall be suitably incorporated in the shop detail and erection drawings.

7.5.7 Structural Steel Work Specification–Bolted Structure

7.5.7.1 General

7.5.7.1.1 Scope of Specifications

This Specifications cover the supply, fabrication and delivery to Site of Bolted structural steel work, including the supply of consumables and other materials required for fabrication and field connections of all structural steel work covered under the scope of the Specification.

7.5.7.1.2 Products

Ref. Specifications for structural Steel Work–General

7.5.7.1.3 Execution

7.5.7.2 Workmanship

7.5.7.2.1 General

All workmanship shall be in accordance with the best practice in modern structural shops. General accuracy shall be maintained in the manufacture of every part of the work and all similar parts shall be strictly interchangeable.

7.5.7.2.2 Templates

Templates used throughout the work shall be of steel, or steel bushed where considered necessary by the Engineer-in-Charge. In cases where actual material have been used as templates for drilling similar pieces, the Engineer shall decide whether such materials are fit to be used as part of the finished structure.

7.5.7.2.3 Straightening

All materials shall be straight and free from twists, and if necessary, before being worked, shall be straightened and/or flattened by pressure, unless required to be of curvilinear form.

(i) Clearance

The clearance between fraying surface of bolted connections shall not be greater than 1mm at each end. If the separation is between 1 to 3 mm the surface should be tapered to eliminate the separation. Over 3 mm separation shall be filled with filler plates.

(ii) Shearing, Cutting and Planning

1. Cutting shall be done automatically. Hand cutting may be used only exceptionally in connection with erection, if approved by the Engineer-in-Charge. In such cases the joint edges shall receive a finishing treatment with planning and grinding tools. Cutting by shearing machine may be used for plates not exceeding 10mm in thickness provided that the plate edges be fully enclosed in a weld. Oxygen cutting may be used provided a smooth and regular surface free from cracks and notches is secured.

2. Chipping of angle flanges and edges of plates, wherever necessary, shall be done without damaging the parent metal. Chipped edges shall be ground to a neat finish and sharp corners and hammered rough faces shall be rounded off.

3. The edges and ends of the cut/sheared flange plates, web plates of plate girders, and all cover plates, and the end of all angles, tees, channels and other sections forming the flanges of plate girders, shall be planed/ground.

4. The butting surfaces at all joints of girders shall be planned so as to butt in close contact throughout the finish joint.

5. The end of all built up girders of all columns shall be faced in an end milling machine after the members have been complete assembled. Bearing edges for girder bearing stiffeners and column bases shall be machined.

6. Unless clean, square and true to shape, all flame-cut edges shall be planed. Cold sawn end, if reasonably clean and flame-cut ends of sections not inferior to sawn ends in appearance need not be planned, except for butting ends.

(iii) Drilling

1. Holes for bolts shall be drilled to conform to Clause 10 to IS:7215 (1974). Punching of holes shall not be permitted. All holes, except as stated hereunder, shall be drilled to the required size, 3mm less in diameter and reamed thereafter to the required size. All matching holes for bolts shall register with each other so that a gauge of 0.8 mm less in diameter than the hole can pass freely thorough the members assembled for bolting, in the direction at right angle to such members.

2. All drilling shall be free from burrs.

3. No holes shall be made by gas cutting process.

(iv) Assembly

1. All parts assembled for bolting shall be in close contact over the whole surface and all bearing stiffener shall bear lightly at both top and bottom without being drawn or caulked.

2. The component parts shall be so assembled that they are neither twisted nor otherwise damaged. Specified cambers, if any, shall be provided.

3. All parts of bolted and welded members shall be held firmly in position by means of jigs or clamps while bolting or welding. No drifting of hole shall be permitted, except to draw the parts together, and no drift used shall be larger than the nominal diameter of the bolt. Drifting done during assembling shall not distort the metal or enlarge the holes.

4. Trial assemblies shall be carried out at the fabrication stage to ensure accuracy of workmanship and these checks shall be witnessed by the Engineer. Such trial assemblies shall be at the cost of the contractor.

(v) Field Bolts

1. Requirements stipulated under bolting shall apply for field bolts. Field bolts, buts and washers shall be finished by the contractor in excess of the nominal number required. He shall supply the full number of bolts, nuts and washers and other necessary fittings required to complete the work, together with the additional bolts, nuts and washers totaling to 10% of the requirement subject to minimum of 10 Nos.

2. At the time of assembly, the surface in contact shall be free of paint or any other applied finish, oil, dirt, loose rust, loose scale, burrs and other defects which would prevent solid seating of the parts or would interfere with the development of friction between them.

3. If any other surface condition, including a machined surface, is specified, it shall be the responsibility of the contractor to work within the slip factor specified for the particular case.

4. Each bolt and nut shall be assembled with washers of appropriate shape, quality and number in cases where plane parallel surfaces are involved. Such washers shall be placed under the bolt head or the nut, whichever is to be rotated during the tightening operation. The rotated nut or bolt head shall be tightened against a surface normal to the bolt axis, the appropriate tapered washer shall be used when the surfaces are not parallel. The angle between the bolt axis and the surface under the non-rotating component. (i.e. the bolt head or the nut) shall be 90+3 degree. For angles outside these limits, a tapered washer shall be placed under the non-rotating component. Tapered washers shall be correctly positioned.

5. No gasket or other flexible material shall be placed between the holes. The holes in parts to be joined shall be sufficiently well aligned to permit bolts to be freely placed in position. Driving the bolts is not permitted. The nuts shall be placed so that the identification marks are clearly visible after tightening. Nuts and bolts shall always be tightened in a staggered pattern and where there are more than four bolts in any once joint, they shall be tightened from the center of the joint out-wards.

6. If, after final tightening, a nut or bolt is slackened off from any reason, the bolt, nut and washer or washers shall be discarded, and not used again.

(vi) Shop Assembly

1. The steel work shall be temporarily shop assembled, as necessary, so that the accuracy of fit may be checked before dispatch. The parts shall be shop assembled with a sufficient number of parallel drifts to bring and keep the parts in place.

2. Steel parts drilled with templates having steel bushes shall be similar and as, such, interchangeable, such steel work may be shop erected in part only, as agreed by the Engineer.

(vii) Erection Material

1. Each fabricated member, whether assembled prior to dispatch or not so assembled, shall bear an erection mark, which will help to identify the member and its position respect of the whole structure, to facilitate re-erection at Site.

2. These erection marks shall be suitably incorporated in the shop detail and erection **drawings.**

7.5.8 Structural Steel Specification–Painting Works

7.5.8.1 General

7.5.8.1.1 Scope of Specification

This specification covers the scope of painting, method for the surface preparation, application of paints and precautions to be taken for the painting of structural steel works. It covers the supply and delivery of all necessary materials, labour, scaffolding, tools, equipment and everything that is necessary for the job completion on schedule.

The following specifications, Standards and Codes are included as part of this specification. All standards, and codes of practice referred to herein shall be the current edition during the currency of the project including all applicable official amendments and revisions.

In case of discrepancy between this specification and those referred to herein, this Specification shall govern. In case of discrepancy between Contract drawings and this Specification, the Contract drawings shall govern.

S. No.	IS Code	Description
1.	IS:102	Ready Mixed Plant, Brushing, Red lead, Non Setting, Priming
2.	IS:159	Ready Mixed Paint, Brushing, Acid Resisting for Protection against Acid Fumes, Colour as Required
3.	IS:341	Black Japan, Types A, B & C
4.	IS:384	Brushes, Paints and Varnishes, Flat
5.	IS:487	Brush, Paint and Varnish: i) Oval Ferrule Bound & ii) Round Ferrule Bound.
6.	IS:800	Code of Practice for General Construction in Steel
7.	IS:958	Temporary Corrosion Preventive Grease, Soft Film, Cold Application
8.	IS:1153	Temporary Corrosion Preventive Fluid, Hard Film, Solvent Deposited
9.	IS:1477	Code of Practice for Painting of Ferrous Metals in Building: Part I – Pretreatment Part II – Painting
10.	IS:1674	Temporary Corrosion Preventive Fluid, Soft Film, Solvent Deposited
11.	IS:2074	Ready Mixed Paints, Red Oxide-Zinc Chrome, Priming

7.5.8.2 Products

7.5.8.2.1 Materials

(i) **Paint**

1. All paint delivered to the fabrication shop / site shall be ready mixed, in original sealed containers, as packed by the paint manufacturers, and no thinners shall be permitted.

2. Paint shall be stirred frequently to keep he pigment in suspension.

(ii) Storage of Paints

1. All paints shall be stored strictly in accordance with the requirements laid down by the paint manufacturers. The storage area shall be well ventilated and protected from sparks, flame, direct exposure to sun or excessive heat, preferably located in an isolated room or in a separate building.

2. All paint containers shall be clearly labeled to show, at the time of use, paint identification, date of manufacture, batch number, order number and special introductions in legible form. The containers shall be opened only at the time of use. Paints which have livered, gelled or otherwise deteriorated during storage, shall not be used. Paints for which the shelf life specified by the supplier has expired shall not be used.

7.5.8.2.2 Execution

7.5.8.3 Surface Preparation

7.5.8.3.1 General

All surfaces shall be cleaned of loose substances and foreign materials, e.g. dirt, rust, scale, oil, grease, welding flux etc., so that the prime coat adheres to the original metal surface. The work shall be carried out in accordance with IS:1477 (Part1). Any oil, grease, dust or foreign matter deposited on the surface, after preparation, shall be removed and care shall be taken to ensure that the surface is not contaminated with acids, alkalis or other corrosive chemicals. The primer coat shall be applied immediately after the surface preparation is completed.

Before the application of any paint, the surface to be treated shall be thoroughly cleaned and freed from all scale, lose paint, rust and other deleterious matters. Oil and grease shall be removed from the surface by washing with solvents or with a detergent solution before blast cleaning operation of metal polish with metal pellets. If any traces of oil or grease remain after blasting they shall be removed by solvent cleaning and the area will be re-blasted thereafter.

All welding areas shall be given special attention for removal of weld flux slag. Weld metal splatter, weld head oxides, weld flux fumes, silvers and other foreign objects before blasting. If deemed necessary by the Engineer-in-Charge acid washing and subsequent washing with clean water shall be used.

Any rough welding seams will have to be ground and must be inspected and approved by the Engineer-in-Charge before application of the coatings.

All structural steel to be painted shall be cleaned by blast cleaning in accordance with SA 2½ Near-White Blast cleaning. Mill scale, rust and foreign matter shall be removed to the extent that the only traces remaining are light stains in the form of spots or strips. Finally the surface shall be cleaned with a vacuum cleaner or clean, dry compressed air.

The blast cleaning shall produce a surface roughness complying with the one specified by the paint manufacturer for the primer concerned. If, cleaned surface are rusted or are contaminated with foreign material before painting is accomplished, they shall be re-cleaned by the Contractor at his expenses.

The surface shall be cleaned by impingement of abrasive materials, such as grit of cast iron, malleable iron, steel or synthetic materials, at high velocity created by clean and dry compressed air blast. Prior to application of the blast, heavy deposits of oil and grease shall be removed by solvent cleaning, and excessive surface scale removed by hand tool or power tool cleaning.

The last complete coat of paint shall be applied after structural steel erection and deck slab construction.

7.5.8.4 Mixing and Thinning

1. All ingredients in a paint container shall be thoroughly mixed to breakup lumps and disperse pigments, before use and during application, to maintain homogeneity. Mixing shall be mechanical, except for 20 liters or smaller containers; mixing by air bubbling is not permitted. All pigmented paints shall be strained after mixing to remove skins and other undesirable matters.

2. Dry pigments, pastes, tinting pastes and colours shall be mixed and/or made into paint so that all dry powders get wetted by vehicles and lumps and particles are uniformly dispersed.

3. Additives that are received separately, such as curing agents, catalysts, hardeners etc. shall be added to the paint as per the manufacturer's instructions. These shall be promptly used within the pot life specified by the manufacturers and unused thereafter shall be discarded.

4. Thinners shall not be used unless essential for proper application of the paint. Where thinners are used, they shall be added during the mixing process, and the type and quantity of thinner shall be in accordance with the instructions of the paint manufacturer.

7.5.8.5 Paint Application

7.5.8.5.1 General

1. Paint shall be applied in accordance with the manufacturer's recommendations, as supplemented by these specifications. The work shall generally follow IS:1477 (Part II). Prior approval of the Engineer-in-Charge shall be taken in respect of all primers and/or paints, before their use in the works.

2. Paint shall generally be applied by brushing, except that spraying may be used for finish coats only when brushing may damage the prime coats. Roller coat or any other method of paint application shall not be used unless specifically authorized.

3. Spraying shall not be adopted on red lead or zinc rich paints. Daubers may be used only when no other method is practicable for proper application in different accessible areas.

4. Paint shall not be applied when the ambient temperature is 10^{o}C and below, for paints which dry by chemical reaction, the temperature requirements specified by the manufacturer shall be met with. Also, paint shall not be applied in rain, wind, fog, or at relative humidity of 80% and above, or when the surface temperature is 5^{o}C below dew point, resulting in condensation of moisture. Any wet paint exposed to damaging weather conditions shall be inspected after drying, and the damaged area repainted after removal of the paint.

5. Each coat of paint shall be continuous, free of pores and of even film thickness, without thin spots. The film thickness shall not be so great as to detrimentally affect either the appearance or the service life of the paint.

6. Each coat of paint shall be allowed to dry sufficiently before application of the next coat, to avoid damages such as lifting or loss of adhesion. Undercoats having glossy surface shall be roughened by mild sand preparing to improve adhesion of subsequent coats. Successive coats of same colour shall be tinted, whenever practical, to produce contrast and help in identifying the progress of the work.

7.5.8.5.2 Brushing Application

1. Proper brushes shall be selected for a specific work piece. Round or oval brushes which conform to IS:487 are better suited for irregular surface, whereas, flat brushes which conform to IS:384 are convenient for large flat areas. The width of the flat brushes shall not generally exceed 125mm.

2. Paint shall be applied in short strokes, depositing a uniform amount of paint in each stroke, followed by brushing the paint into all surface irregularities, crevices and corners, and finally smoothening or leveling the paint film with long and high strokes at about right angles to the first short strokes. All runs and sags shall be brushed out. The brush marks left in the applied paint shall be as few as practicable.

7.5.8.5.3 Spray Application

1. The spraying equipment shall be compatible with the paint material, and provided with necessary gauges and controls. The equipment shall be cleaned of dirt, dried paint, foreign matter and solvent, before use.

2. The paint shall be applied by holding the gun perpendicular to the surface, at a suitable distance, and moved in a pattern so as to ensure deposition of a uniform wet layer of paint. All runs and sags shall be brushed out immediately. Areas not accessible to spray shall be painted by brush or dauber.

3. A water trap acceptable to Engineer-in-Charge shall be furnished and installed on all equipment used in spray painting.

7.5.8.5.4 Shop Painting

1. The specified painting system shall be followed.

2. Surfaces in contact during shop assembly shall not be painted. Surfaces which cannot be painted, but require protection, shall be given a rust inhibitive grease conforming to IS:958, or solvent deposited compound conforming to IS:1153 or IS:1674 or treated as specified in the drawings.

3. Surfaces to be in contact with concrete shall not be painted.

4. The shop coats shall be continuous over all edges, including ends meant for jointing at site by welding, except where the paint could be harmful to the welder or detrimental to finished welds. In such cases, no paint shall be applied within 50mm of the welding edge, and the unprotected surface shall be given a cost of corrosion inhibitive compound.

5. The unpainted area shall be cleaned prior to welding, the welded joint cleaned and deslagged, and immediately after, covered by the same paint as has been used for the remaining surface.

7.5.8.5.5 Protection of Paintwork

1. The Contractor shall provide measures as necessary to prevent damage of the work and to other property or persons from all cleaning and painting operations. Paint or paint stains which result in other unsightly appearance on surfaces not designated to be painted shall be removed or obliterated by the Contractor at his cost.

2. All painted surfaces that in the opinion of the Engineer-in-Charge are damaged in anyway, shall be repaired by the Contractor at his cost with materials and to a condition equal to that of the requirements specified in these Specifications. The Contractor's proposal for retreatment of areas damaged by flame cutting and welding operations should be clearly stated in the detailed painting plan to be submitted.

3. Upon completion of all painting operations and of any other work that would cause dust, grease or other foreign materials to be deposited upon the painted surface, the painted surface shall be thoroughly cleaned. At the time of opening of jetty's to public traffic, the painting shall be completed and the surfaces shall be undamaged and clean.

4. The areas of high – strength bolts shall be protected by masking tape against undercoats application at the fabrication shop. Immediately prior to erection any rust in the paint areas shall be removed by power wire brushing to a standard equivalent to SA3.

7.5.8.5.6 Site Painting

1. After the erection of structures at the site, the contractor shall provide the necessary treatment as per specified 'PAINTING SPECIFICATIONS'.

2. Surfaces which have not been shop coated, but require surface treatment shall be given necessary surface preparation and coats at Site as Specified.

3. Contact surfaces in bolted joints shall not be painted. Prior to assemblage in the field, the rust on joint surfaces, including those adjacent to bolt head nut and washer, shall be removed by power tools and sand-paper.

7.5.8.5.7 Precautions in Painting Work

In order to ensure that better workmanship and results in painting work, the following points shall be adhere to:

1. All paints shall be applied in accordance with the general instructions of the manufacturer.

2. No two-pack paint shall be used on the same job after the expiration of he stipulated pot life.

3. Sharp edges, fraying surface and other specifically vulnerable areas shall be carefully and properly treated.

4. Proper sealing with paint of the crevices between intermittent runs of welds shall be ensured.

5. A uniform film thickness of paint is to be ensured throughout the work.

6. As far as possible, tinted paints for successive coals of painting shall be used, in a distinct manner, so as to facilitate application and inspection.

7.5.9 Structural Steel Work - Quality Control & Testing Requirements

7.5.9.1 General

7.5.9.1.1 Scope of Specification

The scope of work of these specifications is to establish the norms for ensuring the required Quality Control through established testing norms of the welded structural steel work.

7.5.9.1.2 Codes / Standards

Relevant IS codes for tolerance and tests of welding procedures as specified in the specification for structural steel work – General.

7.5.9.1.3 Submittals

The Contractor shall submit the following:

Proposed overall schedule for documentation of calculations, shop drawings, plan / procedures and records, submission of procedure of fabrication.

The contractor shall himself inspect all materials, shop work and field work to satisfy the specified tolerance limits and Quality norms before the same are inspected by Engineer-in-Charge or his authorized representative.

7.5.9.2 Products

Not applicable

7.5.9.3 Execution

7.5.9.3.1 Tolerance

The contractor shall through appropriate planning and continuous measurements in the workshop and the erection at site, ensure that the tolerance specified below are strictly adhered to.

7.5.9.3.2 Dimensional & Weight Tolerance

The dimensional and weight tolerance for rolled shapes shall be in accordance with IS:1852. The acceptable limits of straightness for rolled or fabricated members as per IS:7215 are:

Struts and Columns: L/1000 or 10 mm whichever is smaller.

Where L is the length of finished member or such lesser length as the Engineer-in-Charge may specify.

A limit for distortion in transverse direction (δ) from the true axis of plate and box girder shall not be more than L/1000 where L is the length of diagonal of profile.

Tolerance in specified camber of members shall be 3mm in 12m length.

Tolerance in specified lengths shall be as follows:

- Column finished for contact bearing : ± 1 mm
- Other members (cols.) upto and over 10m : ± 5 mm
- Including 10 m L/2000 sub to max of : ± 8 mm
- Other members (beams) upto 12m : ± 3 mm
- Over 12 m L/4000 sub, to max : ± 5 mm

7.5.9.3.3 End of Members

Beam to beam and beam to column connections – where the abutting parts are to be jointed by butt welds, permissible deviation from the squareness of the end is:

Beam upto 600 mm in depth : 1.5 mm

Beam over 600 mm in depth : 1.5 mm for increase in depth of every 600 mm subjected to max of 3 mm.

Where abutting parts are to be joined by bolting through cleats or end plates, the connections require closer tolerance, permissible, deviation from the squareness of the end is:

Beams upto 600 mm in depth 1mm per 600 mm of depth subject to a max of 1.5mm.

For full bearing, two abutting ends of columns shall first be aligned to within 1. In 1000 of their combined length and then the following conditions shall be met:

1) Over atleast 80% of the bearing surface the clearance between the surfaces does not exceed 0.1 mm.

2) Over the remainder of the surfaces the clearance between the surfaces does not exceed 0.3 mm.

Where web stiffeners are designed for full bearing on either the top flange or the bottom flange or both, atleast half the stiffener shall be in positive contact with the flange. The reminder of the contact face could have a max. gap of 0.25 mm.

7.5.9.3.4 Depth of Members

Acceptable deviation from the specified overall depth as per IS:7215 are:

- Upto and including 1000 mm : 1.0 mm
- Over 1000 mm : 2.0 mm

7.5.9.3.5 Web Plates

An acceptable deviation from flatness in girder webs in the length between the stiffeners or in a length equal to the girder depth shall be :

- Upto 500 mm depth : 0.5 mm
- Over 500 mm & including 1000 mm : 1.0 mm
- Over 1000 mm : 2.0 mm

7.5.9.3.6 Flange Plates

A responsible limit for combined warpage and tilt on the flanges of a built-up member is 1/200 of the total width of flange or 2mm whichever is smaller measured with respect to centerline of flange.

Lateral deviation between centerline of web plate and centerline of flange plate at contact measured as the difference δ between diagonals of nominal length L shall not be greater than L/1000.

7.5.9.3.7 End Milling

Columns ends bearing on each other or resting on base plates and compression joints designed for bearing shall be milled true and square to ensure, proper bearing and alignment. Base plates also have their surface milled true and square.

7.5.9.3.8 Quality Control

In order to exercise proper control of the quality of the welding, Contractor shall enforce methods of control as tabulated below:

Purpose		**Control Subjects**	**Methods of Control**
1		**2**	**3**
1.	Control of welding materials and basic metal quality	Quality control of electrodes, welding wire, flux and protective gases Checking of quality and Weld-ability of the basic Metal and welded members	Weld-ability tests to determine the technological properties of materials Mechanical test of weld metal Metalographical Investigations of Welds macro-Structure and Microstructure checking of weld Metal resistance for

Purpose		Control Subjects	Methods of Control
1		2	3
			Intercryustalline Corrosion. Study of Weld Metal solidity by physical control Methods
2.	Checking of welders qualifications	Welding of specimens for quality determination	Mechanical tests Metalographical investigations and checking of welded joints by physical control methods.
3.	Control of welded joints quality	Control of assembly accuracy and technological welding process	Checking of welding equipment conditions. Checking correctness Welding procedure. Visual examination of Welds.

7.5.9.4 Tests and Testing Procedures

7.5.9.4.1 Visual Examination

The contractor shall conduct visual examination and measurement of the external dimensions of the weld for all joints. Before examining the welded joints, areas close to it on both sides of the weld for a width not less than 20 mm shall be cleaned of slag and other impurities. Examination shall be done by a magnifying glass which has a magnification power of ten (10) and measuring instrument which has an accuracy of ±0.1 mm or by weld gauges. Welded joints shall be examined from both sides. The contractor shall examine the following during the visual checks.

i) Correctness and shape of the welded joints.

ii) Incomplete penetration of weld metal.

iii) Influx

iv) Burns

v) Unwelded craters

vi) Undercuts

vii) Cracks in welded spots and heat affected zones

viii) Porosity in welds and spot welds.

ix) Compression in welded joints as a result of electrode impact while carrying out contact welding

x) Displacement of welded element

The contractor shall document all data as per sound practices.

7.5.9.4.2 Dye Penetration Test

The Contractor shall carry out various mechanical tests to determine weld ability, metal alloy ability, nature of break, correct size and type of electrodes, degree of pre-heat treatment. The type, scope and sample of various mechanical tests shall be determined in agreement with the purchase. The number of tests conducted shall depend on the results obtained to satisfy the Engineer-in-Charge that the correct type and size of electrode, degree of pre-heating and post-heating and weldability of metal are being followed.

7.5.10 LT Switchgear Specification

7.5.10.1 Design and Construction

415V MCC shall be of metal enclosed, indoor, floor-mounted, free-standing type. Switchboard frames and load bearing members shall be fabricated using CRCA sheet steel of thickness not less than 2.0 mm. Doors and covers shall also be of CRCA sheet steel of thickness not less than 1.6 mm. Thickness of gland plates shall not be less than 3.0 mm for sheet steel & 4.0mm for non-magnetic material.

All switchboards shall be of dust-proof and vermin-proof construction and shall be provided with a degree of protection of IP: 54 as per IS: 13947, Part-1.All switchboards shall be of uniform height not exceeding 2450 mm. Switchboards shall be easily extendable on both sides by the addition of vertical sections after removing the end covers. Module size of switchboards shall not be less than 200mm.

Cable entry for MCCs/DBs shall be from bottom. Switchboards shall be divided into distinct vertical sections (panels), each comprising of the following compartments:

- Main busbar compartment
- Switchgear / feeder compartment
- Cable alley
- Auxiliary busbar compartment

The feeder compartment shall be sheet steel enclosed on all sides with the withdrawable units in position or removed. The front of the compartment shall be provided with the hinged single leaf door with captive screws for positive closure.All circuit-breaker panels shall be of single-front type. All single-front switchboards shall be provided with single-leaf, hinged or bolted covers at the rear. The bolts shall be of captive type. The covers shall be provided with “DANGER” labels..

All 415V circuit-breaker modules and MCC modules shall be of fully drawout type having distinct `Service’ and `Test’ positions. The equipment pertaining to a drawout type module shall be mounted on a fully withdrawable chassis, which can be drawn out without having to unscrew any wire or cable connection. Suitable arrangement with cradle / rollers and guides shall be provided for smooth movement of the chassis.

7.5.10.2 Components

7.5.10.2.1 Moulded Case Circuit Breaker (MCCB)

MCCB shall in general conform to IS: 13947 Part-2. MCCBs shall be provided with microprocessor based release for over load, short circuit and earth fault protection. The MCCB shall have breaking capacity not less than 50kA. MCCBs used for incomers and Bus

coupler shall be equipped with stored energy mechanism for electrical closing and tripping. All other MCCBs shall be manually operated. The operating handle should give a clear trip indication.

7.5.10.2.2 Contactors

Motor starter contactors shall be of air break, electromagnetic type rated for uninterrupted duty. Contactors shall be double-break, non-gravity type and their main contacts shall be silver faced. Direct-on-line contactors shall be of utilisation category AC3. Reversing starters shall comprise of Forward and Reverse contactors mechanically and electrically interlocked with each other. These contactors shall be of utilisation category AC4.The contactor shall operate satisfactorily between 85% to 110% of the rated voltage. The contactor shall not drop out at 70% of the rated voltage but shall definitely drop out at 20% of the rated voltage.

7.5.10.2.3 Instrument Transformers

The Current Transformer shall be mounted on the switchgear stationary parts. For metering separate core shall be provided. The CTs shall be of cast resin, bar primary type and of Class E or better insulation. CT secondary current shall be 1A. Accuracy class of the Current Transformer shall be Class 1 for metering. CTs for current rating less than 50A shall be 'Wound primary' type and above 50A shall be 'Bar primary' type.

Voltage Transformer shall be cast-resin, draw-out type and shall have an accuracy class of 1.0.

The bus VTs shall be housed in a separate compartment. All VTs shall have readily accessible fuse and MCBs on primary and secondary sides respectively.

7.5.10.2.4 Indicating Instruments

All indicating and integrating meters shall be digital type and flush mounted on panel front. The instruments shall be of at least 96 mm. square size and shall have an accuracy class of 1.0. All such meters shall be fed through suitable current transformers for motors rated 10kW & above.

7.5.10.2.5 Push Buttons

Push-buttons shall be of spring return, push-to-actuate type. Where specified push buttons shall be stay put type. Their contacts shall be rated to make, continuously carry and break 6 A at 110 V AC and 1 A (inductive) at 220 V DC. Push buttons shall have 2NO+2NC contacts. All push-buttons shall have two normally open and two normally closed contact, unless specified otherwise. The contact faces shall be of silver alloy. All push-buttons shall be provided with integral escutcheon plates marked with its function. All emergency push-buttons shall be stay put/latching type. To detach, master key provision shall be provided.

The color of the button shall be as follows:

- Green for motor START, breaker CLOSE
- Red for motor TRIP, breaker OPEN.
- Black for all annunciator functions, overloads reset and miscellaneous commands.

7.5.10.2.6 Indicating Lamps

Indicating lamps shall be of the panel mounting, LED type. The lamps shall have escutcheon plates marked with its function, wherever necessary. All indicating lamps shall be rated for continuous operation at 85% to 110% of their rated voltage. Low Voltage Glow Prevention (LVGP) feature shall be provided for indication lamps. Lamps shall have translucent lamp-covers of the following colours, as warranted by the application:

- Red for motor ON, breaker CLOSE.
- Green for motor OFF, breaker OPEN.
- Amber for auto trip

7.5.10.2.7 Control supply and Space Heater Supply

Each starter module of MCC shall derive 110V AC control supply through control supply transformer. The control transformers shall be of insulation class `B' or better. The sizing of control transformers shall be carried out by the contractor considering the actual load of power contactors, auxiliary contactors, indicating lamps and other equipment including remote auxiliary relays and lamps in the circuit. For space heater circuits of motor rated more than 30kW and also for panel space heater, 240V AC supply shall be provided by tapping from the incomer before the main isolating switch/breaker. . Necessary switch and MCB to isolate and distribute the supply to each panel shall be provided. For motor feeders, circuit for motor space heater shall be wired through NC contact of breaker/contactor and MCB.

Each panel of MCC/DB shall be equipped with the following as required:

- Thermostatically controlled space heater(s).
- Illumination lamp with door switch
- 5A 3pin socket with MCB protection.

7.5.10.2.8 Wiring

All switchboards shall be supplied completely wired internally upto the terminals, ready to receive external cables. All internal wiring shall be carried out with 1100 V grade, HR PVC/ XLPE insulated single core, copper conductor of minimum 2.5 sq.mm for CT circuits and 1.5 sq.mm for other circuits. All internal wiring terminations shall be made with solder less crimping type tinned copper lugs. Insulation sleeves shall be provided over the exposed parts of lugs. Engraved core identification plastic ferrules marked to correspond with panel wiring diagrams shall be fitted at both ends of each wire. Number 6 and 9 shall not be used for wire identification.

Control terminal blocks shall be of 1100 Volts grade, rated for 10 Amps and in one piece molding. It shall be complete with insulating barriers, clip-on type terminals and identification strips. Marking on terminal strip shall correspond to the terminal numbering on wiring diagrams. Terminal blocks for CT & VT secondary leads shall be provided with test links & isolating facilities. CT secondary leads shall be provided with short circuiting & earthing facilities. In all the panels at least 20% spare terminals for external connections shall be provided and these spare terminals shall be uniformly distributed on all terminal blocks.

7.5.10.2.9 Power Cable Termination

Cable termination compartment and arrangement for power cables shall be suitable for heavy duty, 1.1 kV grade, stranded aluminium conductor, PVC / XLPE insulated, armoured and FRLS PVC sheathed cables. All power cable terminals shall be of stud type and the power cable lugs shall be of tinned copper solderless crimping ring type conforming to IS:8309. All lugs shall be insulated / sleeved.

7.5.10.2.10 Nameplates and labels

MCCs, Distribution Boards, local push-button stations and local motor starters shall be provided with prominent, engraved identification plates. The module identification plate shall clearly give the feeder number and feeder designation. For single front switchboards, similar panel and board identification labels shall be provided at the rear also.

All name plates shall be of non-rusting metal or 3-ply Lamicoid, with white engraved lettering on black background. Suitable stenciled paint mark shall be provided inside the panel/module for identification of all equipment, in addition to the plastic sticker labels, if provided. These labels shall be positioned so as to be clearly visible and shall have the device number, as mentioned in the module wiring drawings.

Caution name plate “Caution Live Terminals” shall be provided at all points where the terminals are likely to remain live and isolation is possible only at remote end.

7.5.10.2.11 Busbars and Insulators

Each MCC & DB shall be provided with three phase and neutral busbars. DC distribution boards shall have two busbars. All busbars and jumper connections shall be of high conductivity aluminium of adequate size. The cross-section of the busbars shall be uniform throughout the length of switchboard . Interleaving of PCC busbar arrangement shall be envisaged.

All busbars shall be adequately supported by non-hygroscopic, non-combustible, track-resistant and high strength sheet moulded compound or equivalent type polyester fibre glass moulded insulators. All busbar joints shall be provided with high tensile steel bolts, spring washers and nuts. All copper to aluminium joints shall be provided with suitable bi-metallic washers. All busbars shall have HRPVC sleeves and colour coded.

Contact surfaces at all joints shall be silver plated or properly cleaned and anti-oxide grease applied to ensure an efficient and trouble free connection. Suitable bimetallic connectors shall be used for dissimilar metal connections.

The continuous rating of the main busbars shall be same as that of the incomer breaker, and busbar shall carry this continuous current without exceeding the temperature of 90º C. For silver plated joints, temperature shall not exceed 105°C. All horizontal and vertical busbar joints shall be covered by insulating shrouds.

7.5.10.2.12 Earthing

A copper earth bus of adequate size shall be provided at the bottom and shall extend throughout the length of switchgear. It shall be bolted to the framework of each panel and each breaker earthing contact bar. The earth bus shall be sized to withstand specified short circuit current.

All non-current carrying metal work of the switchboard shall be effectively bonded to the earth bus. All hinged doors shall be earthed through flexible earthing braid. VT and CT

secondary neutral point earthing shall be at one place only on the terminal block. All metallic cases of relays, instruments and other panel mounted equipment shall be effectively bonded to the earth bus by independent stranded copper wires of size not less than 2.5 sq. mm.

7.5.10.2.13 Local Push Button Stations

The local push buttons stations shall be with sheet steel enclosure, suitable for outdoor mounting on wall or steel structures. The local push button stations shall be dust and vermin proof and shall have a degree of protection of IP - 55 as per IS : 13947 Part-1. Local push button stations shall comprise Start/Stop push buttons as per drive control philosophy. Emergency stop Push-buttons shall be stay put/ Latching type, requiring master key for de-latching.

Unidirectional motor feeders rated less than 10kW shall be provided with the following as a minimum.

- Triple pole MCCB
- Triple pole contactor.
- Auxiliary contactors
- LOCAL/REMOTE selector switch
- Bimetallic thermal overload relay with single phasing preventor.
- Push buttons.
- Indicating lamps with coloured lenses.
- MCB for control circuit
- Interposing relays

Unidirectional motor feeders rated 10kW and up to 30kW shall be provided with the following as a minimum.

- Triple pole MCCB
- Triple pole contactor.
- Auxiliary contactors
- LOCAL/REMOTE selector switch
- Bimetallic thermal overload relay with single phasing preventor.
- Push buttons.
- Indicating lamps with coloured lenses.
- MCB for control circuit
- Current transformer for metering
- Ammeter
- Interposing relays

Unidirectional motor feeders rated above 30kW and less than 125kW shall be provided with the following as a minimum.

- Triple pole MCCB
- Triple pole contactor.
- Auxiliary contactors
- LOCAL/REMOTE selector switch
- Bimetallic thermal overload relay with single phasing preventor.
- Push buttons.
- Indicating lamps with coloured lenses.
- MCB for 240V AC space heater circuit
- MCB for control circuit
- Current transformer for metering
- Current transducer
- Ammeter
- Interposing relays

7.5.10.2.14 Distribution Boards

Distribution boards shall be metal enclosed, fixed type, compartmentalized construction.

The Distribution board frame shall be fabricated using CRCA sheet steel of thickness not less than 2.0 mm. The frames shall be enclosed by CRCA sheet steel of thickness not less than 1.6 mm.

Suitable synthetic rubber gaskets shall be provided to make boards completely dust and vermin-proof with a degree of protection of IP-54 for indoor and IP-55 for outdoor installation. The handle of incoming switch shall be mounted on the door of the board, with padlocking facility in both 'ON' and 'OFF' positions.

Cable entry facilities shall be provided with removable gland plates of suitable thickness. All incoming and outgoing cables shall be terminated on suitable terminal blocks.

7.5.11 Lighting System Specification

The lighting system shall be provided for both indoor and outdoor lighting area of the slipway facility.

7.5.11.1 Indoor Lighting

The indoor lighting is required for winch house, pump house in slipway facility. The nominal voltage of the distribution system shall be 3 phase 4 wire (415/220 ± 10% volts). The lighting intensities and the type of luminaire for winch house & pump house specified as under:

Location	Intensity of Illumination (Lux)	Type of Luminaire
Winch House, Pump House and Workshops	150	Industrial type fluorescent fixture with SS reflector and 2x36 watt fluorescent lamp

7.5.11.2 Area Lighting (High Mast)

High Mast lighting system is required for outdoor area in the slipway facility. Lighting fittings selected is of High Pressure Sodium type. The 30 m high mast shaft has three finished sections, totally hot dip galvanized and suitable for design wind velocity as per IS 875 Part 3. Other accessories for high mast include head frame, steel wire rope 6mm dia (7/19 construction) double drum winch, Galvanized lantern carriage arrangement suitable for 14 luminaires symmetrically and its control gear boxes and lightning finial with integral power tool. The lighting intensities and the type of luminaire for high mast specified as under.

Location	Intensity of Illumination (Lux)	Type of Luminaire
Outdoor	15	Non-Integral floodlight luminaire type BARNF 2x400W HPSV with two nos. 400W lamps and its control gear boxes.

It is proposed to provide 3 Nos. High masts at locations as shown in attached drawing no. **I-506/PS/251.** It is anticipated that this would provide sufficient coverage to obtain the specified illumination. The foundation of high mast shall be covered under tender document.

7.5.12 LT Power and Control Cables Specification

Power cables shall be sized to satisfy the following Criteria:

- Short circuit withstand capacity for applicable fault current and duration.
- Full load current carrying capacity under installation conditions considering Site ambient temperature & site installation (Grouping) conditions based on Manufacturer's recommendation.
- Permissible voltage drop limits under steady state/transient state as applicable.

Power cables shall withstand the fault current of the circuit for the duration not less than the max. time taken by the primary protective system to isolate the fault. Cables shall be sized for the following short circuit rating.

- Incoming cables to 415 V MCC (MCCB operated) : 50 kA for 1 sec.
- Incoming cables to 415 V MCC/DB (MCB protected) : Fuse cut-off current for 10 m.sec
- Cables from 415 V MCC to Motors : 50 kA for 0.16 sec MCCB operated
- Feeders from MCC/DB (MCB protected) : Fuse cut-off current for 10 m.sec

To maintain voltage at motor terminals /equipment end with in desirable limit, it is proposed to limit the voltage drop in the cables with in the following limits:

- Steady state Voltage drop (Continuous running condition) : 2.5%

- Transient state voltage drop (During Motor Starting) : 10 %

All cables shall be suitable for laying on racks, in ducts, trenches with chances of flooding by water and shall also be suitable for directly buried installation. All the cables shall be flame retardant low smoke (FRLS) type designed to withstand mechanical, electrical and thermal stresses developed under steady state and transient operating conditions.

Power cables shall be XLPE insulated. Control cables shall be PVC insulated. PVC insulation shall be suitable for continuous conductor temperature of 70°C and short circuit conductor temperature of 160°deg.C. XLPE insulation shall be suitable for continuous conductor temperature of 90°C and short circuit conductor temperature of 250°C.

The cable cores shall be laid up with fillers between the cores wherever necessary. All the cables shall have distinct extruded PVC inner sheath.

For single core armoured cables, armouring shall be of aluminium wire. For multicore armoured cables, armouring shall be of galvanised steel strip/wire as per applicable IS.

Outer sheath shall be of PVC black in colour having following FRLS properties.

- Oxygen index of not less than 29.
- Acid gas emission of max. 20%
- Smoke density of not more than 60%

The cables shall meet flammability test as per IEEE – 383.

All the cables shall be protected against rodent and termite attack. Necessary chemicals shall be added in to the PVC compound of the outer sheath.

7.5.12.1 CONSTRUCTION

7.5.12.1.1 LV Power cables

LV Power cables shall be of 1.1 kV grade, XLPE insulated, PVC inner sheathed (extruded), armoured, FRLS PVC outer sheathed, compacted aluminium conductor conforming to IS: 7098 Part-I.

7.5.12.1.2 Control cables

Control cables shall be of 1.1 kV grade, multicore, PVC insulated, PVC inner sheathed, armoured, FRLS PVC outer sheathed stranded copper conductor conforming to IS:1554 Part-I. Up to 5 cores it shall be colour coded and above 5 cores shall be numbered.

7.5.12.1.3 Cable identification system

In addition to manufacturer's identification on cables as per IS, following marking shall also be embossed over outer sheath.

- Cable size and voltage grade.
- Word `FRLS' at every 5 metre.
- Sequential marking of length of the cable in meters at every one metre.

The embossing shall be progressive, automatic, in line and marking shall be legible and indelible.

7.5.12.1.4 Cable drums

Cables shall be supplied in wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with waterproof layer. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/rubber caps, secured by `U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS 10418.

7.5.12.1.5 Testing and Inspection

Cables offered shall be of type tested and proven type. Type test certificates for test conducted earlier on similar rating shall be furnished. Routine tests, Acceptance tests and all special tests for FRLS properties shall be carried out for all the cables as per applicable standards. The sample shall be drawn at the rate of one per type and size for every lot offered for inspection.

7.5.12.1.6 Special Tests

The following tests as applicable to FRLS sheathed cables shall be conducted as type tests on each size of each lot.

a. Oxygen index test
b. Temperature index test
c. Acid gas generation during fire
d. Smoke generation test under fire
e. Under fire conditions for bunched cables as per IEEE std. 383 / 74

7.5.13 Earthing System Specification

Earthing system is required for winch house, pump house and rails. Earthing shall be carried out as per IS-3043. Earthing conductor shall be buried at a depth of not less than 600 mm from FGL. For multicore cables, cable screen/armour shall be earthed at both the ends. For Single core cables, cable screen/armour shall be earthed at one end at preferably at Switchgear end only. Metallic frame of all electrical equipment inside winch house shall be earthed by two separate and distinct connections to earthing system. The ground conductor connections shall be welded except at the equipment end, where the connections are bolted.

The size of GI earth bus and earth wires shall be as follows:

Rail Earthing	75 x 8 mm GI strip
Main Earthing grid	75 x 8 mm GI strip
Riser upto ground level	75 x 8 mm GI strip
MCC Panel	40 x 6 mm GI strip
High Mast earthing	25 x 6 mm GI strip
Lighting Panels, Distribution Boards	25 x 6 mm GI strip
Junction boxes, Gland earthing, Lighting fixutres, 15A switch sockets	12/8 SWG wire

7.5.14 Lightning Protection System Specification

Lightning protection system shall be provided for the winch house & pump house building covered under the Scope as per the provisions contained in the latest issues of Indian Electricity Rules and IS 2309.

Lightning protection system shall comprise air terminations down conductors, test links, earth terminations & earth electrodes.

Material for lightning protection conductor shall be as follows:

- 50 x 6 mm Galvanised steel strip for Horizontal Air termination & Down Conductors
- 20 mm dia 1000 mm long Galvanised steel rod for Vertical air termination
- 40 mm dia 3 m long Mild Steel rod with earth pit for Earth termination

Air termination network consist of vertical or horizontal conductors or combination of both. Down conductors should follow the most direct path possible between the air terminal network and the earth termination network. The down conductors should be arranged as evenly as practicable around the outside walls of the structure. Each down conductor shall be provided with a test link for testing. An earth electrode with treated earth pit shall be connected to each down conductor.

7.5.14.1 Testing and Inspection

Equipment offered shall be of type tested and proven type. Type test certificates for test conducted earlier on similar rating shall be furnished. Routine tests shall be carried out for all the equipment as per applicable standards.

7.5.15 Fire Fighting System Specification

7.5.15.1 Introduction

The Fire Protection Philosophy is based on Loss Prevention and Control. If fire breaks out, it must be controlled / extinguished as quickly as possible to minimize the loss to life and property & to prevent further spread of fire. The firefighting system inside Slipway facility is generally designed as per TAC stipulation. Firefighting is to be done by hydrant system considering the occupancy classification as light hazard.

7.5.15.2 Codes and Standards

The entire Fire Protection & Detection system will be designed and installed as per regulations of Tariff Advisory Committee (TAC)/Indian Standards (IS), For areas not covered or inadequately covered by TAC/IS, the system shall be in accordance with the requirements of the National Fire Protection Association (NFPA) Codes,

The specific codes / standards followed for the design of the system are as below:

- Fire protection Manual of TAC
- NFPA Standard

7.5.15.3 Description of System

In general, the Fire Protection System provided for the entire proposed areas explained earlier comprises the following systems:

- Water based fire extinguishing systems
- Hand Appliances

7.5.15.4 Water Based Fire Extinguishing Systems

7.5.15.4.1 Source of Water

The source of water requirement for the Hydrant system & domestic use shall be drawn from the reservoir of capacity 120 m^3 provided to cater the firefighting & Slipway facility system with required pressure and flow.

7.5.15.4.2 Water Reservoir

The effective capacity of static storage exclusively reserved for hydrant service tank shall be 100 m^3 and remaining 20 m^3 for domestic tank with not less than 1 hr. aggregate pumping capacity. The General Arrangement drawing for water reservoir and pump house as shown in drawing No. **I-506/PS/241**.

7.5.15.4.3 Pumping System

As per the TAC guidelines for light hazard area the capacity of pumps shall be as follows:

1. One (1) Main Pump (Electric) of capacity 96m^3/hr of delivery pressure 7.0 kg/cm^2
2. One (1) Main Pump (Diesel) of capacity 96m^3/hr of delivery pressure 7.0kg/cm^2
3. One (1) Jockey Pump of capacity 10.8m^3/hr of delivery pressure 8.0 kg/cm^2

Pumps shall be capable of furnishing not less than 150% of rated capacity at a head of less than 65% of the rated head. The shut-off head shall not exceed 120% of rated head the case of horizontal pumps and 140% in the case of vertical turbine type pumps.

7.5.15.4.4 Hydrant system

Hydrant system shall be provided to cover all the following proposed area:

1. Repairing Bay
2. Parking bay
3. Main & Side Slipway
4. Transfer Bay

The hydrant system will consist of a network of underground piping, size varying from 150mm dia to 80mm dia, installed around areas/ equipments to be protected with hydrant vaJves, hoses, hose cabinets, coupling, branch pipe & nozzles. The fire water supply shall be tee-off from the fire water main distribution system. Internal Hydrants are not provided for the bays as the same are protected by outer hydrants having reach of within 50m. There shall be 5 single headed Hydrants to protect the above mentioned area as shown in drawing no. **I-506/PS/263**.

Hose pipes of suitable lengths fitted with standard accessories like hose coupling, branch pipes and nozzles shall be located in 'HOSE HOUSES'

All hydrant pipelines shall be laid underground and if required through RCC trenches with removable covers. The pipeline routed in RCC trenches shall be provided with coating and

wrapping and trench be filled up with sand as per TAC requirements. Road or Pipe trench crossing be through RCC Hume pipes of appropriate pressure class and the pipelines shall be provided with cement lining & coating and wrapping for corrosion protection.

7.5.15.4.5 Hand Appliances

Hand appliances comprise Fire extinguishers.

The minimum number of fire extinguishers needed to protect a property shall be determined as per Class A of TAC procedure.

Fire Extinguishers shall be provided in following area:

1. Pump house
2. Winch House

Due to electrical equipments in both the rooms. Dry Powder Extinguisher 2 nos. of sufficient capacity shall be provided in each room.

7.5.15.4.6 Piping

a. Piping for all fire protection systems shall generally be laid underground except in locations such as road/rail crossings or in main plant areas where it may not be feasible to route over-ground. At rail/road crossings, fire water pipes shall be laid inside Hume pipes of suitable ratings.

b. The main isolation valves shall be butterfly valves as per IS: 13095.

c. Mild steel as per IS: 1239 (Part-I) medium grade (up to 150 NB) & as per IS: 3589 Gr Fe410 (above 200 NB) or equivalent and galvanized, as per IS: 4736 for pipes normally empty and periodically charged with water.

d. Pipe protection shall be as follows:

   - To prevent soil corrosion buried pipes shall be properly protected.
   - Over ground pipes shall be provided with red oxide· zinc two coat of phosphate primer and three coats of synthetic enamel finish paints.

e. Minimum pipe thickness shall be 6 mm for 200.

f. Strainer area shall be atleast 4 times the cross section at the pipe end. Strainer shall be of 30SWG & 30 mesh and pressure drop across the strainer at design flow shall be limited to 10 MWC in clean condition. Strainer wire shall be SS (A1S1316).

g. All valves shall be as per applicable IS/BS codes & approved by TAC for specific fire protection system and shall be provided with locking arrangement in open or close condition.

h. All the flanges and counter flanges shall conform to ANSI B 16.5 C11S0.

i. Strainer Body as per IS: 2062 (tested).

j. Pipe fittings

- Unless otherwise specified all elbows/bends shall be long radius type.

- The material shall conform to ASTM A 234 Gr WPB or ASTM A 105 or equivalent and dimensional standard conforming to ANSI B 16.11 (socket & threaded type), ANSI B 16.9 (for butt welded fittings) and ANSI B 16.5 (for flanges and flanged fittings) as the case may be. Further galvanized malleable cast iron fittings as per IS: 1879 in cast iron fittings as per BS 1641 are also acceptable.

- The fittings shall be galvanized as per IS: 4736 for galvanized pipe application. In case of branching connections from GI mains for spray piping network, socket may be welded for more than two pipe reduction instead of standard tees.

- Fabricated fittings shall not be acceptable upto pipe size to 300 mm NB. For sizes 350mm and above, fittings may be fabricated as per BS: 2633/BS: 534.

k. Welding of galvanized iron pipes/fittings would be permitted provided the same is carried out by means of special electrodes suitable for the above application and the same shall be approved by the Owner. After, welding welded portions shall be applied with three coats of zinc silicate treatment/rich paint over one coat of suitable primer.

l. The yard piping shall be provided with strategically located isolation valves to enable maintenance of defective section of fire water mains and also to achieve maximum pressure at the remotest hydrant at the time of fire.

m. The entire pipe network shall be hydraulically designed in such a way that the velocity of water in any section does not exceed 5m/s at any segment of pipe line.

7.5.15.5 <u>Design Requirements of Hydrants System</u>

a. As per TAC guidelines, engineering workshop is classified as light hazard category and the system shall be designed accordingly.

b. Each loop in the extended hydrant system shall be interconnected for better reliability of the system.

c. Hose pipes of suitable lengths along with standard accessories like branch pipes, nozzles, spanners etc. shall be provided. These shall be kept in the hose house. Each internal hydrant valve shall be provided in hose box with glass front containing hose pipes, branch pipes and nozzles, etc.

d. The hydrant network shall be so designed to ensure the availability of 3.5kg/cm^2 pressure at the remotest point (as per TAC) in the system with hydrant pump discharging rated head and capacity. The velocity in the hydrant main shall not exceed 5.0m/s

e. The general design of hydrant valve shall conform to IS: 5920 and the material of construction shall be stainless steel as per IS: 6529.

f. An isolation valve shall be provided in feeder and terminal pipes serving three or more hydrants or water monitors or in case the terminal length is 15 meters or more with a single hydrant valve.

g. Each of the landing valves and external hydrant valves shall be provided with hose box. Each hose box shall contain required hoses, branch pipes, nozzles, spanner etc. as per TAC rules.

h. In other areas required hoses, branch pipes, nozzles, spanner etc shall be grouped and kept in separate hose boxes at strategic location for serving yard hydrants as per TAC rules.

i. Each main shall be terminated with an isolation valve and a blind flange at all the corners to enable future expansion/modification by the client.

7.5.15.6 Material Specification

S. No.	Description	Specification
1.0	**Gate Valve**	
	Type	Non - rising spindle type
	Sizes	80NB to 200NB
	Rating	PN 1.6
	End connection	Flanged and drilled to ANSI 150# B16.5
	Code / Standard	IS:14846
	Material of construction	
	• Body	CI IS:210 Gr. FG-260
	• Bonnet	CI IS:210 Gr. FG-260
	• Stem	SS to ANSI-410
	• Disc	CI IS:210 Gr. FG-260
	Testing	As per IS: 14846
	Test Pressure	Body – 24 kg/cm^2
	Approval	ISI Marked/ TAC Approved
2.0	**Butterfly Valve**	
	Type	Wafer upto 300NB
	Sizes	80NB to 200NB
	Rating	PN 1.6
	End connection	Flanged and drilled to ANSI 150# B16.5
	Code / Standard	IS:5155
	Material of construction	
	• Body	CI as per IS:210 Gr. FG-260
	• Shaft	SS ASTM-D-279 Type 304
	• Seat Ring	SS ASTM-D-279 Type 304

S. No.	Description	Specification
	• Disc	CI as per IS:210 Gr. FG-260
	• Shaft Bearing	Leaded Bronze self-lubricated (BS:1400 LB)
	• Gland Packing	Impregnated teflon
	• Seal	Nitrile rubber
	Testing	AWWA-C 504
	Test Pressure	Body - 24 kg/em' Seat - 16 kg/em'
	Approval	ISI Marked/ TAC Approved
3.0	**Hydrant Valve**	
	Type	Single headed, female oblique type
	Code/ Standard	IS : 5290 Type A
	End Connection	
	Inlet	Flanged and drilled to ANSI 150# B 16.5
	Outlet	Female instantaneous coupling with spring lock
	Sizes	63mm
	Flow	DDE
	Testing	As per IS : 5290
	Test Pressure	Body - 21 kg/cm^2, Seat - 14 Kg/cm^2
	Working Pressure	8 kg/cm^2
	Design Pressure	9 kg/cm^2
	Material of construction	
	• Body	SS-304
	• Stop Valve	
	• Seat	
	• Spindle	
	• Hand Wheel	C.I as per IS :210 Gr, FG-260
	• Column Pipe	Mild steel
	Approval	IS Marked/TAC approval
4.0	**Branch Pipe & Nozzle**	
	Size	63 N B with 20 N B nozzle
	Nozzle Type	Hexagonal, detachable
	Code / Standard	IS: 903-1995

S. No.	Description	Specification
	Material of construction	
	Branch pipe / nozzle	SS ANSI-304 & Gun metal grade LTB-2 IS:318
	Diffuser	SS-304 & construction as per IS-2871
	Fog nozzle	SS-304 & construction as per IS-952
	Spanner	Steel of grade C-40 to 15:1570 (Part 5) Chromium or zinc plated
	Testing	As per IS : 903
	Approval	ISI marked/ TAC approved
5.0	**Hose coupling**	
	Type	Instantaneous male and female
	Size	65mm NB
	Code/ Standard	IS :903
	Material of construction	
	Female half coupling	SS ANSI-304
	Male half coupling	
	Testing	As per IS: 903
	Approval	ISI marked/ TAC approved
6.0	**Fire Hose**	
	Type	Impregnated woven jacketed
	Size	65mm
	Code / Standard	IS-636 type-II
	Length	2 x 15m for external hydrant
	End fittings	Instantaneous spring lock type coupling of SS
	Approval	ISI marked/ TAC approved
	Hose cabinet	
	Type	Fabricated out of 16 G MS sheet
	Size	Approx. 800 x 600 x 250
	Mounting	Pedestal mounted for external hydrant
	Special requirement	-
	Accessories	-
7.0	**Pumps**	
	Main Pump (Electric)	

S. No.	Description	Specification
	Quantity	1
	Application	Main Pump (Electric)
	Type of Pump	Horizontal End Suction
	Model No.	-
	Stage	Single
	Liquid	Water
	Specific Gravity	1.0
	Temperature ° C	Ambient
	Flow (m^3/hour)	96
	Differential Head at Casing Flange (mwc.)	70
	Efficiency %	75
	Pump RPM	2900
	KW/RPM	37/2900
	Diesel Engine (HP)/RPM	-
	Suction Size (mm) min.	100
	Del. Size (mm) Min.	80
	Impeller Type	Closed
	NPSH R m	4.0
	Shaft Sealing	Gland Packed
	Material of Construction	
	Casing	Cast Iron
	Impeller	Ni-Bronze
	Shaft	EN-8
	Shaft Sleeve	SS-410
	Base Plate	M.S Fabricated
	Main Pump (Diesel)	
	Quantity	1
	Application	Main Pump (Diesel)
	Type of Pump	Horizontal End Suction
	Model No.	-
	Stage	Single
	Liquid	Water
	Specific Gravity	1.0

S. No.	Description	Specification
	Temperature ° C	Ambient
	Flow (m^3/hour)	96
	Differential Head at Casing Flange (mwc.)	70
	Efficiency %	80
	Pump RPM	1800 (Approx.)
	KW/RPM	-
	Diesel Engine (HP)/RPM	44/1800
	Fuel consumption	3.8 ltr per HP
	Noise level after silencer (db at 1.0m)	-
	Suction Size (mm) min.	80
	Del. Size (mm) Min.	50
	Impeller Type	Closed
	NPSH R m	4.0
	Shaft Sealing	Gland Packed
	Major Dimensions	-
	Size and location of Day Tank	-
	Material Of Construction	-
	Casing	Cast Iron
	Impeller	Ni-Bronze
	Shaft	EN-8
	Shaft Sleeve	SS-410
	Base Plate	M.S Fabricated
	Jockey Pump	
	Quantity	1
	Application	Jockey Pump Electric
	Type of Pump	Horizontal Multi Stage Pump
	Model No.	-
	Stage	Four
	Liquid	Water
	Specific Gravity	1.0
	Temperature ° C	Ambient
	Flow (m^3/hour)	10.8

S. No.	Description	Specification
	Differential Head at Casing Flange (mwc.)	80
	Efficiency %	70
	Pump RPM	2900
	KW/RPM	5.5/2900
	Suction Size (mm) min.	50
	Del. Size (mm) Min.	40
	Impeller Type	Closed
	NPSH R m	Flooded
	Shaft Sealing	Gland Packed
	Material Of Construction	
	Casing	Cast Iron
	Impeller	Ni-Bronze
	Shaft	EN-8
	Shaft Sleeve	SS-410
	Base Plate	M.S Fabricated
	Pipes	
	Material and Design Pressure	Carbon Steel at 8kg/cm^2
	Pipe diameter, Thickness	150NB Sch 10
	Method of jointing	-
	Hydraulic test pressure	As per Testing standard

7.5.16 List of Approved Makes

S. No.	Equipment / Component	Approved Makes
1.	Electric Winch	BHT (Bhagirath Heavy Tramission) / EKR (E. Krishna Rao)/Kumar Machine Tools/Anusha Enterprises
2.	Trolley	BHT (Bhagirath Heavy Tramission) / Mannschaft Ingenieure (India) Pvt. Ltd.
3.	LT Switchgear	ABB/Siemens/Schneider/L&T/Vidyut Control
4.	LT Power cables	KEI/Polycab/Havells/Gloster/KEC
5.	Lighting fixture	Bajaj/Philips
6.	MCCB/MCB/ELCB/MPCB	Siemens/L&T/ABB/Schneider
7.	Contactors	Siemens/L&T/ABB/Schneider

S. No.	Equipment / Component	Approved Makes
8.	Indicating Lamps	Siemens/Schneider/Teknic/Kaycee
9.	Push button & Push button set	Siemens/Schneider/Teknic/Rishabh
10.	Meters(digital) MFM	Conzerv/L&T/Secure
11.	Selector Switch	Siemens/Schneider/Kaycee/Salzer
12.	Timer	Siemens/L&T/Selectron/Schneider
13.	Panel CT/PT (Cast resin type)	Siemens/Schneider/Kappa/Pragati/Jyoti/Mehru
14.	Plugs & Sockets	Havells/Legrand/Hensel
15.	High mast	Bajaj/CGL
16.	Pipes	Jindal/Ratnamani/Apex/Swastik
17.	Valves	BDK/Fouress/Pecovalve/AVK/Forbes Marshall
18.	Pumps	KBL/Flowserve/Max Flow
19.	Fire Hydrant	HD Fire/Minimax/Pyro/Tyco
20.	Fire Extinguisher	Minimax/Nohmi Bosai/Cease Fire

8 PART IV - ANNEXURES

Annex –I

BANK GUARANTEE PROFORMA FOR FURNISHING

EARNEST MONEY DEPOSIT

To

The Chairman
Inland Waterways Authority of India
A – 13, Sector – 1,
Noida – 201 301.

In consideration for the Chairman, Inland Waterways Authority of India hereinafter called "the Authority" having invited tenders for the work of Development of Ship Repair Facility (Slipway) at Pandu, Guwahati, NW-2 vide Tender Notice No: IWAI/PR2/3(SLIPWAY)/2011-Vol-IV and …….. hereinafter called "the Tenderer" for the earnest participation in the tender is required to furnish a Bank Guarantee for Rs……. (Rupees…….) towards Earnest Money Deposit, at the request of……. (Tenderer), We (Bank) do hereby undertake to pay to the Authority an amount not exceeding Rs…… against any loss or damage caused to or suffered, or would be caused to or suffered by the Authority by reason of any breach of the said Tender's terms or conditions by the .....(tenderer).

2. We……. do hereby undertake to pay the amount due and payable under this Guarantee without any demur, merely on a demand from the Authority stating that the amount claimed is due by way of loss or damage caused to or would be caused to or suffered by the authority by reason of breach by the said ..... (tenderer) of any of the terms or conditions contained in the said Tender. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs……..

3. We undertake to pay the authority any money so demanded notwithstanding any dispute or disputes raised by the..... (Tenderer) in any suit or proceeding pending before any court or Tribunal relating thereto liability under this present being absolute and unequivocal. The payment so made by us under this Bond shall be valid discharge of our liability for payment there under and the ..... (Tenderer) shall have no claim against us for making such payment.

4. We, ……. further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the finalisation of the tender process and that it shall continue to be enforceable till all the dues of the Authority under or by virtue of the invited tender have been fully and its claim satisfied or discharge or till…..... Certify that the terms and conditions of the said Tender have been fully and properly carried out by the said .....Tenderer and accordingly discharges this

Guarantee after…….. months from the date of ..... unless a demand or claim under this Guarantee is served in writing on the bank but before the expiry of the said period of ……. months in which case it shall be enforceable against the bank notwithstanding the fact that the same is enforced after the expiry of the said period of …….. months.

5. We,…….further agree with the Authority that the Authority shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Tender or to postpone for any time or from time to time any of the powers exercisable by the Authority against the said Tenderer and to forbear or enforce any of the terms and conditions relating to the said Tender and we shall not be relived from our liability by reason of any such variation, or extension being granted to the said Tender or for any forbearance, act or omission on the part of the Authority or any indulgence by the Authority to the said Tenderer or by any such matter or thing whatsoever which under the law relating to sureties would, but for the provision, have effect of so relieving us.

6. It shall not be necessary for the Authority to proceed against the Tenderer before proceeding against the Bank and the Guarantee herein contained shall be enforceable against the Bank notwithstanding any security which the Authority may have obtained or obtain from the Tenderer at the time when proceedings are taken against the Bank hereunder be outstanding or unrealized.

7. Notwithstanding anything contained herein above, our liability under the guarantee is restricted to Rs…… and shall remain in force until……. Unless a claim or suit under this guarantee is filed with us on or before…… ALL OUR RIGHTS UNDER THE GUARANTEE SHALL BE FORFEITED and the bank shall be relieved and discharged from all liabilities therein.

8. This Guarantee will not be discharged due to the change in the constitution of the Bank or the Tenderer.

9. We, ……. lastly undertake not to revoke this Guarantee during its currency except with the previous consent of the Authority in writing.

Dated the ……date of……..201…
for……
(indicate the name of Bank)

Signature……..
Name of the Officer…….
(in Block Capitals)
Designation of
Code No……..

Name of the Bank and Branch.

Annex-2

DETAILS OF PAST EXPERIENCE OF CONTRACTOR
FOR SIMILAR WORKS

S. No.	Name & location of project	Value (Rs lakhs)	Particulars of client	Duration of contract			Details of activities
				Date of Commencement	Scheduled completion date	Actual completion date	

Note: (i) Bidder to enclose copies of completion certificates issued by the owner.

Annex-3

CONCURRENT COMMITMENTS OF THE BIDDER

S. No.	Full Postal Address of Client & Name of officer-in-charge	Description of the work	Value of contract	Date of commence-ment of work	Scheduled comple-tion period	Average comple-tion as on date	Expected date of completion	Remarks if any

Annex-4

List of key personnel proposed to be deployed by Contractor

S. No.	Name	Designation	Qualification / Experience

Annex-5

AGREEMENT FORMAT

This agreement made on _____day_____year_____between the Inland Waterways Authority of India (hereinafter called the `IWAI' which expression shall unless excluded by or repugnant, to the context, be deemed to include heir, successors in office) on one part and M/S_____(hereinafter called the 'CONTRACTOR' which expression, shall unless excluded by repugnant to the context be deemed to include his heirs, executors, Administrators, representatives and assigns of successors in office) on the other part.

WHEREAS THE IWAI desirous of undertaking the works_____ _____

WHEREAS the contractor has offered to execute and complete such works and whereas IWAI has accepted the tender of the contractor and WHEREAS the contractor has furnished _____
as security for the due fulfillment for all the conditions of this contract.

NOW IN THIS AGREEMENT WITNESSTH AS FOLLOWS

In this agreement words and expression shall have the same meaning as are respectively as assigned to them in the conditions of contract hereinafter referred to:

The following documents shall be deemed to form and be read and construed as part of this agreement VIZ.

i) (a) Notice Inviting Tenders
(b) Tender form
(c) Warranty

ii) Information & instruction for Tenders

iii) (a) Schedule : Bill of Quantity
(b) Annexure

iv) General Conditions of Contract

v) Technical specifications and Special Conditions of Contract

The contract agreement has been compiled by the IWAI from the original tender documents and all the correspondences from the tendering stage till acceptance. In the event of any difference arising from the completion of the contract, the original tender documents, contractor's offer, minutes of meetings and correspondence between the party ended vide letter No._____ may be referred to by either party. These documents shall take precedence over the compiled documents.

The contractor hereby covenants with the IWAI to complete and maintain the "Works" in conformity in all respect, with the provisions of the agreement.

The IWAI hereby covenants to pay the contractor in consideration of such completion of works, the contract price at the time and in the manner prescribed by the contract.

IN WITNESS WHEREOF the parties hereunto have set their hands and seals on the day year first written.

For and on behalf of *(Inland Waterways Authority of India)*	For and on behalf of *Contractor*
Signature _____	*Signature* _____
Name &Designation _____	*Name & Designation* _____
Stamp	*Stamp*
Witness:	Witness:
1) Signature _____	1) Signature _____
2) Name & Designation_____	2) Name & Designation_____

Annex –6

BANK GUARANTEE PROFORMA FOR FURNISHING PERFORMANCE GUARANTEE

To

The Chairman
Inland Waterways Authority of India
A-13, Sector-1
Noida - 201301

1. In consideration for the Chairman, Inland Waterways Authority of India hereinafter called 'the Authority" having agreed, under the terms and conditions of the Agreement dated ……. . made between…….. and …for the due fulfillment of the said Agreement by the Contractor of the terms and conditions contained in the said Agreement, on production of Bank Guarantee for Rs…….. (Rupees…….) at the request of……. Contractor(s), We (Bank) do hereby undertake to pay to the Authority an amount not exceeding Rs…… against any loss or damage caused to or suffered, or would be caused to or suffered by the Authority by reason of any breach of the said Contractor(s) of any of the terms or conditions contained in the said Agreement.

2. We……. do hereby undertake to pay the amount due and payable under this Guarantee without any demur, merely on a demand from the Authority stating that the amount claimed is due by way of loss or damage caused to or would be caused to or suffered by the authority by reason of breach by the said contractor(s) of any of the terms or conditions contained in the said Agreement or by reason of the contractor(s)'s failure to perform the said Agreement,. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs……..

3. We undertake to pay the authority any money so demanded notwithstanding any dispute or disputes raised by the contractor(s) / suppliers(s) in any suit or proceeding pending before any court or Tribunal relating thereto liability under this present being absolute and unequivocal.

The payment so made by us under this Bond shall be valid discharge of our liability for payment there under and the contractor(s) / supplier(s) shall have no claim against us for making such payment.

4. We, ……. further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Agreement and that it shall continue to be enforceable till all the dues of the Authority under or by virtue of the said Agreement have been fully and its claim satisfied or discharge or till…….. Certify that the terms and conditions of the said Agreement have been fully and properly carried out by the said Contactor(s) and accordingly discharges this Guarantee after…….. years from the date of completion of the said contract unless a demand or claim under this Guarantee is served in writing on the bank but before the expiry of the said period of ……. years in which case it shall be enforceable against the bank notwithstanding the fact that the same is enforced after the expiry of the said period of …….. years.

10. We,……..further agree with the Authority that the Authority shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Agreement or to extend time of performance by the said

Contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the Authority against the said Contactor(s) and to forbear or enforce any of the terms and conditions relating to the said Agreement and we shall not be relived from our liability by reason of any such variation, or extension being granted to the said Contractor(s) or for any forbearance, act or omission on the part of the Authority or any indulgence by the Authority to the said Contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would, but for the provision, have effect of so relieving us.

11. It shall not be necessary for the Authority to proceed against the Contractor before proceeding against the Bank and the Guarantee herein contained shall be enforceable against the Bank notwithstanding any security which the Authority may have obtained or obtain from the Contactor shall at the time when proceedings are taken against the Bank hereunder be outstanding or unrealized.

12. Notwithstanding anything contained herein above our liability under the guarantee is restricted to Rs……. and shall remain in force until……. Unless a claim or suit under this guarantee is filed with us on or before…… ALL OUR RIGHTS UNDER THE GUARANTEE SHALL BE FORFEITED and the bank shall be relieved and discharged from all liabilities therein.

13. This Guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s) / supplier(s).

14. We,……. lastly undertake not to revoke this Guarantee during its currency except with the previous consent of the Authority in writing.

Dated the ……date of……..2015

for……

(indicate the name of Bank)

Signature……..

Name of the Officer…….

(in Block Capitals)

Designation of

Code No……..

Name of the Bank and Branch.

ANNEX-7

SAMPLE FORM FOR SITE ORDERS BOOK
Reference Clause No. 18.4

Name of work …….. Date of commencement/ period for completion……..……..

Sl. No.	Date	Remarks of the Inspecting Officer or Contractor	Action taken and by whom	Remarks
1	2	3	4	5

ANNEX-8

PROFORMA FOR HINDRANCE REGISTER
Reference Clause No. 18.5

S. No.	Nature of hindrance	Items of work that could not be due executed to this hindrance	Date of start of hindranc e	Signature of Representative of EIC	Date of removal of hindrance	Over-lapping period, if any	Net hindrance in days	Weightage of this hindrance	Net effective days of hindrance	Remarks of Engineer-in-Charge
1	2	3	4	5	6	7	8	9	10	11

ANNEX-9

Notice for appointment of Arbitrator
[Refer Clause 47]

To

The Chairman
Inland Waterways Authority of India
A-13, Sector-1
Noida - 201301

Dear Sir,

In terms of clause 47 of the agreement, particulars of which are given below, I/we hereby give notice to you to appoint an arbitrator for settlement of disputed mentioned below:

1. Name of applicant
2. Whether applicant is Individual/Prop. Firm/Partnership Firm/Ltd. Co.
3. Full address of the applicant
4. Name of the work and contract number in which arbitration sought
5. Name of the Division which entered into contract
6. Contract amount in the work
7. Date of contract
8. Date of imitation of work
9. Stipulated date of completion of work
10. Actual date of completion of work (if completed)
11. Total number of claims made
12. Total amount claimed
13. Date of intimation of final bill (if work is completed)
14. Date of payment of final bill (if work is completed)
15. Amount of final bill (if work is completed)
16. Date of request made to Chief Engineer for decision
17. Date of receipt of Chief Engineer's decision
18. Date of appeal made to Chairman, IWAI
19. Date of receipt of the decision of Chairman, IWAI

Specimen signatures of the applicant
(only the person/authority who
signed the contract should sign)

I/We certify that the information given above is true to the best of my/our knowledge. I/We enclose following documents.

1. Statement of claims with amount of claims
2.
3.

Yours faithfully

(Signatures)

Copy in duplicate to:

1. The Regional Director, IWAI

ANNEX-10

PROFORMA OF BANK GUARANTEE FOR

MOBILIZATION ADVANCE

To,

The Chairman,
IWAI,
Noida.

In consideration of the Authority (Inland Waterways Authority of India) acting through its Chairman which expression shall unless repugnant to the subject or context include his successor and assigns) having agreed under the terms and conditions of Contract No……..,dated…….made between……and the Authority in connection with ……..(hereinafter called "the said Contract") to make at the request of the Contractor a lump sum mobilization advance of Rs……(Rupees……)for utilizing it for the purpose of the Contract on his furnishing a guarantee acceptable to the Authority, we the …… Bank Ltd. (hereinafter referred to as "the said Bank") having our registered office at …….. do hereby guarantee the due recovery by the Authority of the said mobilization advance with interest thereon as provided according to the terms and conditions of the Contract. We ……..do hereby undertake to pay the amount due and payable under this Guarantee without any demur, merely on a demand from the Authority stating that the amount claimed is due to the Authority under the said Agreement. Any such demand made on the ……shall be conclusive as regards the amount due and payable by the ……..under this guarantee and the …….agree that the liability of the …….to pay the Authority the amount so demanded shall be absolute and unconditional notwithstanding any dispute or disputes raised by the Contractor and notwithstanding any legal proceeding pending in any Court or Tribunal relating thereto. However, our liability under this Guarantee shall be restricted to an amount not exceeding Rs…….(Rupees……).

2. We ……Bank Ltd. further agree that the Authority shall be the sole judge of and as to whether the said Contractor has not utilized the said mobilization advance or any part thereof for the purpose of the contract and the extent of loss or damage caused to or suffered by the Authority on account of the said mobilization advance together with interest now being recovered in full and the decision of the Authority that the said Contractor has not utilized the said mobilization advance or any part thereof for the purpose of the Contract and as to the amount or amounts of loss or damages caused to or suffered by the Authority shall be final and binding on us.

We, the said Bank further agree that the Guarantee herein contained shall remain in full force and effect during the period that would-be taken for the performance of the said Contract and till the said mobilization advance with interest has been fully recovered and its claims satisfied or discharged and till ……certify that the said mobilization advance with interest has been fully recovered from the said Contractor, and accordingly discharges this Guarantee subject, however, that the Authority shall have no claims under this Guarantee after…….years from the date of completion of the said

Contract, as the case may be, unless a notice of the claim under this Guarantee has been served on the bank, before the expiry of the said period of ……..years in which case the same shall be enforceable against the bank notwithstanding the fact that the same is enforced after the expiry of the said period of …….years.

The Authority shall have the fullest liberty without affecting in any way the liability of the Bank under this Guarantee or indemnity, from time to time to vary any of the terms and conditions of the said contract or the mobilization advance or to extend time of performance by the said Contractor or to postpone for any time and from time to time any of the powers exercisable by it against the said Contractor and either to enforce or for bear from enforcing any of terms and conditions governing the said Contract or the mobilization advance or securities available to the Authority and the said bank shall not be released from its liability under these presents by any exercise by the Authority of the liberty with reference to the matters aforesaid or by reasons of time being given to the said Contractor or any other forbearance, act or omission on the part of the Authority or any indulgence by the Authority to the said Contractor or of any other matter or thing whatsoever which under the law relating to sureties would but for this provision have the effect of so releasing the Bank from its such liability.

It shall not be necessary for the Authority to proceed against the Contractor before proceeding against the Bank and the Guarantee herein contained shall be enforceable against the bank notwithstanding any security which the Authority may have obtained or obtain from the Contractor shall at the time when proceedings are taken against the Bank hereunder be outstanding or unrealized .

We, the said Bank lastly undertake not to revoke this Guarantee during its currency except with the previous consent of the Authority in writing and agree that any change in the constitution of the said Contractor or the said bank shall not discharge our liability hereunder.

Dated this……day of…….20……

For and on behalf of the Bank……..(Name and Designation)

The above Guarantee is accepted by the Inland Waterways Authority of India

For and on behalf of Inland Waterways Authority of India

Dated……..(name and Designation)

PART VI

9 PREAMBLE AND BILL OF QUANTITIES

9.1 GENERAL

This Bill of Quantities must be read with the Drawings, Conditions of Contract and the Specifications, and the Contractor shall be deemed to have examined the Drawings, Specifications, and Conditions of Contract and to have acquainted himself with the detailed descriptions of the Works to be done, and the way in which they are to be carried out.

Notwithstanding that the work has been sectionalised every part of it shall be deemed to be supplementary to and complementary of every other part and shall be read with it or into it so far as it may be practicable to do so.

The detailed descriptions of work and materials given in the Specifications are not necessarily repeated in the Bill of Quantities.

The quantities given in the Bill of Quantities are approximate only and are given to provide a common basis for tendering. Payment will be made according to the actual quantities of work ordered and carried out, as measured by the Engineer and valued at the rates and prices quoted in the Bill of Quantities.

The Contractor shall be deemed to have visited the Site before preparing his tender and to have examined for himself the conditions under which the work will proceed and all other matters affecting the carrying out of the works and cost thereof.

9.2 RATES AND PRICES TO BE INCLUSIVE

Rates and prices set against items are to be the all-inclusive value of the finished work shown on the Drawings and/or described in the Specification or which can reasonably be inferred therefrom and are to cover the cost of provision of plant, labour, supervision, materials, erection, insurance, maintenance, overheads and profits and every incidental and contingent cost and charges whatsoever including all taxes and duties such as sales tax, excise duty and general tax and every kind of temporary work executed or used in connection therewith (except those items in respect of which provision has been separately made in the Bill of Quantities) and all the Contractor's obligations under the Contract and all matters and things necessary for the proper completion and maintenance of the Works.

The Specifications are intended to cover the supply of material and the execution of all work necessary to complete the works. Should there be any details of construction or material which have not been referred to in the Specifications or in the Bill of Quantities and Drawings, but the necessity for which may reasonably be implied or inferred there from, or which are usual or essential to the completion of all works in all trades, the same shall be deemed to be included in the rates and prices named by the Contractor in the Bill of Quantities. The rates or prices are to cover the item as described in the Bill of Quantities and if there is inconsistency in the description between the Bill of Quantities, Specifications or Drawings, the description in the Bill of Quantities shall prevail.

Each individual item in the Bill of Quantities is to be priced. If any items are not priced it is to be indicated under which item or items the value of the work has been included. Items, the prices of which are the same, shall not be bracketed. If the Contractor omits to price an

item, the cost of the work of such item will be held to be spread over and included in the prices given for other items. He is not to mark items "Included" when the rate is asked for.

9.3 UNDERWATER AND TIDAL WORKS

The Contractor shall be deemed to have ascertained for himself the extent to which the work has to be carried out underwater or in tidal conditions and his rates and prices shall include for all cost and charge whatsoever arising out of such working.

9.4 METHOD OF MEASUREMENT

9.4.1 Standard Method

Unless stated or billed otherwise, quantities shall be measured in accordance with IS:1200, except as stated herein, and are net as they are finished and fixed in the Works. The rates and prices shall include whatever allowance is considered by the Contractor to be necessary for waste, working area, construction slopes, batters, etc.

9.4.2 Excavation

Excavation shall be measured net to lines and levels indicated in the Drawings and as specified under relevant clause of Technical Specifications.

9.4.3 Concrete

Concrete will be measured as the net volume shown on the Drawings and ordered by the Engineer but no deduction will be made for chamfers smaller than 50 sq.cm. sectional area, reinforcement or prestressing cables, bolt holes or fittings required to be built in unless larger than 0.1 sq.m. sectional area, and 0.03 cu.m. in volume. No extra volume will be measured for splays or fillets smaller than 50 sq.cm. sectional area.

The rates for concrete shall include for all labour, plant and material, depositing, compacting and forming construction joints, stop ends, hacking joints and building in fittings including pipes under 200 mm dia conduits and bolts except where specifically billed.

In case of concrete in piles, concrete actually consumed upto the limit of theoretical volume obtained as per the cross section of piles shown on the drawings shall be paid.

9.4.4 Shuttering

The term shuttering is to be taken to include centering, formwork and the like, necessary to support concrete during deposition by suitable means as approved by the Engineer. The contact surface of the shuttering shall be reasonably smooth and free from irregularities with the joints sufficiently tight to prevent leakage and which will produce a reasonable smooth surface to concrete.

Unless otherwise stated, shuttering will be measured as the areas of the finished structure which requires to be supported during the deposition of the concrete but no deduction will be made for holes less than 0.10 sq.m. Shuttering to secondary beams will be measured upto the sides of main beams but no deduction will be made from the shuttering of the main beam where the secondary beam intersects it. Shuttering to beam which intersect with stanchion casings or columns will be measured upto them on all sides. No deduction will be made from shuttering to stanchion or column casings at these intersections.

The rates affixed to shuttering shall include for the cost of necessary bearers and other supports, thoroughly watering or oiling of inner faces, for all fillets, chamfers and splayed edges, upto 50 mm x 50 mm recesses / notchings, raking and circular cutting, allowance for overlaps, passings at angles, battens strutting, bolting, wedging, casting, striking and removing all fins formed between the boards and panels, filling air holes with cement mortar (1:1 1/2) and rubbing down any defective surfaces with a carborundum block and washing perfectly clean. The rates for shuttering shall also include for cutting and fitting formwork round projecting members, pipes and reinforcements.

Shuttering required for recesses / notchings larger than 50 mm x 50 mm and for pockets larger than 50 mm x 50 mm x 50 mm shall be measured under the relevant general items for shuttering.

9.4.5 Reinforcement

Steel reinforcement will be measured by weight supplied and fixed in accordance with Drawings and Specifications the weight of reinforcement bars - whether plain, deformed or ribbed etc. of various diameters will be calculated in accordance with Table 1 of IS:1732 'Dimensions for Round and Square Steel Bars for Structural and General Engineering Purposes'. The rates shall include for cutting and waste, straightening short and long lengths, bending, fixing, rolling margin and the provision of spacer bars or support, binding wire, saddles, forks and all dense concrete spacer blocks, etc., including preparing bending schedules from the Drawings. But laps provided in the reinforcements according to the Drawings and approved by the Engineer shall be paid for.

9.4.6 Precast Concrete Units

The precast concrete units will be measured net as shown on the detailed Drawings. No deductions will be made for the following:

i) Rebates and grooves smaller than 100 sq.cm. sectional area;

ii) Chamfers smaller than 50 sq.cm. sectional areas;

iii) Openings smaller than 0.1 sq.m.;

iv) Holes or cavities smaller than 0.03 cu.m.

The rates and prices for precast concrete shall be inclusive of costs of shuttering, providing holes and handling, etc. all complete.

9.4.7 Steel and Iron Works

9.4.7.1 <u>Weight Computation</u>

a) The weight of steel and iron work where used as a basis for payment will be the computed weight based on the values given in Indian Standards or approved equivalent.

b) In arriving at the computed weight of any iron and steel work no allowance will be made for rolling margin nor for the weight of oil, paint or other protective coatings.

c) No deduction will be made for bolt holes and the like.

d) No account will be taken of the weight of any weld metal.

e) Subject to Clauses (b) to (d) above steel plates will be measured net as fixed.

f) In computing the weight of any steel joist, channel, angle or similar section no deduction will be made for notched, chamfered or splayed ends.

g) The weight of all bolts, nuts and washers will be excluded in computing the weight of steel and iron work. Permanent bolts nuts and washers and the like will be measured separately by weight, the quantity being the weight actually fixed in the work.

9.4.7.2 Fabrication and Erection

Except where specifically stated otherwise in the item descriptions the rates affixed to items of structural steelwork and steel and iron work shall include for fabrication in all respects in accordance with the Specifications, the Engineer's tests and inspection at the maker's works, marking, delivery at the Contractor's yard and erecting including provision of all necessary service bolts, stagings, plants and tackle of whatever kind required.

9.4.8 Galvanised

The following steel and iron works are to be galvanised as described in the Bill of Quantities.

a) Steel inserts/embedded parts in concrete.

b) Bolts, nuts and washers.

c) All steel accessories required to fix crane rails.

d) Steel gratings.

9.4.9 Rails

Rails shall be measured net as fixed.

Rails are to be sand blasted and epoxy painted according to the specification. The rate affixed to the ` rail fixing' item shall include the cost of supply, fabrication and installation in lines and levels including cutting and drilling holes and the epoxy treatment according to the specification.

9.5 PROVISIONAL SUMS

No expenditure shall be undertaken by the Contractor against Provisional Sums except on the written order of the Engineer.

9.6 CURRENCY

All monetary reference herein and the Bill of Quantities shall be priced in Indian Rupee Currency.

9.7 ABBREVIATIONS

The following abbreviations are used in the Specifications and Bill of Quantities:

IS	:	Indian Standard
BS	:	British Standard
Qty.	:	quantity
mm	:	millimetres

cm	:	centimetres
M,m	:	metres
LM	:	linear metre
LS	:	lump sum
Rs.	:	rupees
P.	:	paise
No.	:	number
do	:	ditto
MS	:	mild steel
PS	:	provisional sum
T	:	tonnes
Kg	:	kilogrammes
RC	:	reinforced concrete
EO	:	extraover (previous sum unless specified otherwise)
PC	:	precast concrete (reinforced unless specified otherwise).
sq.m.	:	square metre
sq.cm.	:	square centimetres
cu.cm.	:	cubic centimetres
YST	:	yield stress
dia	:	diameter
wt.	:	weight
Drg.No.	:	drawing number
max.	:	maximum
min.	:	minimum
approx.	:	approximately
n.o.e.	:	not exceeding
incl.	:	including
circ	:	circular
NB	:	nominal bore
conc	:	concrete
MS	:	mild steel
CI	:	cast iron

9.8 UNIT RATES PREVAIL

In case of any arithmetical errors in the extensions (quantity x unit rates) in the Bill of Quantities, the unit rates and not the quoted amount shall prevail.