TENDER DOCUMENT

NEW MANGALORE PORT AUTHORITY

CIVIL ENGINEERING DEPARTMENT

NIT No. CIVIL/CE(C)/EE(C)/41/2024-25

E-Tender Event No 2024_NMPT_830162_1

Tender for

"ANNUAL MAINTENANCE OF RESIDENTIAL & NON-RESIDENTIAL BUILDINGS ON THE EAST OF NH-66 IN NMPA FOR THE YEAR 2024-25

THROUGH E-TENDERING MODE

Tender Amount	:	Rs. 78,25,432/-
E.M.D.	:	Rs. 1,84,700/-
Tender Fee	:	Rs. 1,120/-(Including GST @ 12%)

TENDER DOCUMENT

NEW MANGALORE PORT AUTHORITY

CIVIL ENGINEERING DEPARTMENT

Tender for

"ANNUAL MAINTENANCE OF RESIDENTIAL & NON-RESIDENTIAL BUILDINGS ON THE EAST OF NH-66 IN NMPA FOR THE YEAR 2024-25"

Volume - 1

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NEW MANGALORE PORT AUTHORITY

PANAMBUR, MANGALORE -575010

NIT No: CIVIL/CE(C)/EE(C)/41/2024-25 Date: 10-10-2024

TENDER ID: 2024_NMPT_830162_1

i) NOTICE INVITING TENDER

(Through E-Procurement only)

E-Tenders are invited by New Mangalore Port Authority, Panambur, Mangalore-575010 through https://www.eprocure.gov.in/eprocure/app of CPP portal from the reputed Contractor fulfilling the Minimum Eligibility Criteria stipulated in this notice in two cover bidding procedure for the work of "Annual maintenance of Residential & Non-residential buildings on the East of NH-66 in NMPA for the year 2024-25

Minimum Eligibility Criteria:

a) The tenderers must have experience of having successfully or substantially completed *similar works during last 7 (seven) years ending last day of month previous to the one in which applications are invited shall be either of the following

At least Three similar completed works costing not less than the amount equal to Rs. 31.31 Lakhs each (excluding GST)

or

At least Two similar completed works costing not less than the amount equal to Rs. 39.13 Lakhs each (excluding GST)

or

At least One similar completed works costing not less than the amount equal to Rs. 62.61 Lakhs (excluding GST)

Note 1: *Similar work(s) means "any civil Construction works or Renovation works or Repair works"”

Note 2: Documentary evidence for successful completion of the work shall be furnished along with work order and work completion certificate.

Note 3: Substantial completion shall be based on 80 (eighty) per cent (value wise) or more works completed under the contract. Certificate for 'substantial completion' of project/work/asset should contain two parts. Part -I shall contain 'financial value of work done' and part-II shall contain 'certificate of functional completion of project/work/asset'.

b) Average Financial turnover of the tenderer over the last three financial years 2021-22, 2022-23 and 2023-24 shall be at least Rs.23.48 Lakhs.

The financial capacity of bidders would be evaluated considering the works in hand at NMPA on the due date of submission of bid. The port would deduct the turnover required for execution of work in hand at NMPA from the average

financial turnover of the bidder. The remaining net financial turnover of the bidder will be considered for eligibility criteria. The financial capacity to be 3.33 times of the average financial turnover of last three years of the bidder minus works in hand at NMPA. The bidder must fill the annexure-6.

c) The tenderer shall submit a copy of valid ESIC & EPF registration certificate along with the tender.

Pertinent information is given in the following table:

i)	Estimated Amount put to Tender	Rs 78,25,432/- (excluding GST)
ii)	Earnest Money Deposit (EMD)	Rs. 1,84,700/- (Rupees One Lakh EightyFour Thousand Seven Hundred Only.) The EMD shall be in the form of Insurance Surety Bonds, Account Payee Demand draft, Fixed Deposit Receipt, Bankers Cheque, or shall be paid by RTGS in favour of F.A. & C.A.O., NMPA. Scanned copy should be uploaded along with bid. The benefit of Exemption of EMD to all Micro and small enterprises (MSE) will allowed. Shall upload with their offer, the proof of their being MSE registered with district industries center (DIC) or Khadhi and village industries commission or Khadhi and Industries board (KVIV) or Coir board or National Small Industries Corporation (NSIC) or Directorate of handicrafts and handlooms or Udyam Registration Certificate or any other body specified by Ministry of MSME.
iii)	Cost of Tender (Tender fee)	Rs. 1,120/- (Rupees One Thousand One Hundred Twenty Only) Payment of Tender fee by NEFT in favour of F.A. & C.A.O., NMPA. Scanned copy should be uploaded along with bid. Scanned copy should be uploaded along with bid. The benefit of Exemption of Tender Fees to all Micro and small enterprises (MSE) registered with district industries center (DIC) or Khadhi and village industries commission or Khadhi and Industries board (KVIV) or Coir board or National Small Industries Corporation (NSIC) or Directorate of handicrafts and handlooms or any other

		body specified by Ministry of MSME, will be considered.
iv)	Document download start date and time	10-10-2024 at 15.00 HRS
v)	Seek clarification start date and time	NA
vi)	Seek clarification end date and time	NA
vii)	Bid submission start date and time	24-10-2024 at 10.00 HRS
vii)	Bid submission closing date and time	31-10-2024 at 15.00 HRS
ix)	Date & time of opening of Cover -I : Technical Part - II : Financial	 04-11-2024 at 15.30 HRS Shall be communicated separately.
x)	Completion period	12 (Twelve) Months including monsoon
xi)	Validity of Tender	90 days from the date of closing of online submission of e-tender.

Tenderer shall have to pay the prescribed cost of tender i.e., Rs. 1120/-(Rupees One Thousand One Hundred Twenty Only) by NEFT in favour of F.A. & C.A.O., NMPA.

NMPA Bank Details.

1. Name of the Bank: State Bank of India, Panambur, Mangalore - 575 010.
2. Bank A/C No. 10205649448
3. IFSC Code: SBIN0002249
4. MICR Code: 575002011

Contact Nos. 0824-2887306 / 2887308 and 0824- 2407493

Email id:bhagyalaxmi.b@nmpt.gov.in and chiefengineer@nmpt.gov.inAmendments / further information etc. pertaining to the tender, if any shall be uploaded only on websites https://www.eprocure.gov.in/eprocure/app of CPP portal, may have to be referred by the prospective Tenderer from time to time.

-sd-

Executive Engineer (Civil)

NEW MANGALORE PORT AUTHORITY

PANAMBUR, MANGALORE -575010
NIT No: CIVIL/CE(C)/EE(C)/41/2024-25
E-Tender event No. 2024_NMPT_830162_1

ii) INSTRUCTIONS TO TENDERERS

A. Instructions for E-Tendering

INSTRUCTION TO E-TENDERING

1. SPECIAL INSTRUCTIONS TO THE BIDDERS FOR THE E-SUBMISSION OF THE BIDS ONLINE THROUGH THIS E-PROCUREMENT PORTAL

This is an e-procurement event of NMPA. The e-procurement service provider is https://www.eprocure.gov.in/eprocure/app of CPP portal. You are requested to read the terms & conditions of this tender before submitting your online tender. Tenderers who do not comply with the conditions with documentary proof (wherever required) will not qualify in the Tender.

1. Bidder should do Online Enrolment in the Portal using the option Click Here to Enroll available in the Home Page. Then the Digital Signature enrollment has to be done with the e-token, after logging into the portal.
2. Bidder then logs into the portal giving user id / password chosen during enrollment.
3. The e-token that is registered should be used by the bidder and should not be misused by others.
4. DSC once mapped to an account cannot be remapped to any other account. It can only be inactivated.
5. The Bidders can update well in advance, the documents such as certificates, purchase order details etc., under My Documents option and these can be selected as per tender requirements and then attached along with bid documents during bid submission. This will ensure lesser upload of bid documents.
6. After downloading / getting the tender schedules, the Bidder should go through them carefully and then submit the documents as per the tender document; otherwise, the bid will be rejected.
7. The BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevant columns, else the bidder is liable to be rejected for that tender. Bidders are allowed to enter the Bidder Name and Values only.
8. If there are any clarifications, this may be obtained online through the e-Procurement Portal, or through the contact details given in the tender

document. Bidder should take into account of the corrigendum published before submitting the bids online on the portal or on www.newmangaloreport.gov.in Bidder, in advance, should prepare the bid documents to be submitted as indicated in the tender schedule and they should be in PDF formats.

9. Bidder should arrange for the EMD and tender fee as specified in the tender. The benefit of Exemption of EMD and Tender Fees to all Micro and small enterprises (MSE) registered with district industries center (DIC) or Khadhi and village industries commission or Khadhi and Industries board (KVIV) or Coir board or National Small Industries Corporation (NSIC) or Directorate of handicrafts and handlooms or Udyam Registration Certificate or any other body specified by Ministry of MSME, will be considered. Necessary document should be submitted along with Technical Bid. The bidders who avail exemption from payment of EMD, shall submit "Bid Security Declaration" in the prescribed format as per Annexure 14, accepting that if they withdraw or modify their bids during period of validity etc., they will be suspended for the time specified in the tender document.
10. The bidder should read the terms and conditions and accepts the same to proceed further to submit the bids.
11. The bidder has to submit the tender document(s) online well in advance before the prescribed time to avoid any delay or problem during the bid submission process.
12. There is no limit on the size of the file uploaded at the server end. However, the upload is decided on the Memory available at the Client System as well as the Network bandwidth available at the client side at that point of time. In order to reduce the file size, bidders are suggested to scan the documents in 75-100 DPI so that the clarity is maintained and the size of file gets reduced. This will help in quick uploading even at very low bandwidth speeds.
13. It is important to note that, the bidder has to click on the Freeze Bid Button, to ensure that, he/she completes the Bid Submission Process. Bids, which are not frozen, are considered as Incomplete/Invalid bids and are not considered for evaluation purposes.
14. The Tender Inviting Authority (TIA) will not be held responsible for any sort of delay or the difficulties faced during the submission of bids online by the bidders due to local issues.
15. The bidder may submit the bid documents online mode only, through this portal. Offline documents will not be handled through this system.
16. At the time of freezing the bid, the e-Procurement system will give a successful bid updating message after uploading all the bid documents

submitted and then a bid summary will be shown with the bid no., date & time of submission of the bid with all other relevant details. The documents submitted by the bidders will be digitally signed using the e-token of the bidder and then submitted.

17. After the bid submission, the bid summary has to be printed and kept as an acknowledgement as a token of the submission of the bid. The bid summary will act as a proof of bid submission for a tender floated and will also act as an entry point to participate in the bid opening event.
18. Successful bid submission from the system means, the bids as uploaded by the bidder is received and stored in the system. System does not certify for its correctness.
19. The bidder should 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 liable to be rejected.
20. The time that is displayed from the server clock at the top of the tender Portal, will be valid for all actions of requesting bid submission, bid opening etc., in the e-Procurement portal. The Time followed in this portal is as per Indian Standard Time (IST) which is GMT+5:30. The bidders should adhere to this time during bid submission.
21. The bidders are requested to submit the bids through online e-Procurement system to the Tender Inviting Authority (TIA) well before the bid submission end date and time (as per Server System Clock).
22. Tender form Fee and EMD shall be submitted with the Part I- Technical BID. BID submitted without fees, as mentioned above will not be considered for evaluation and shall be rejected summarily. The benefit of Exemption of EMD to all Micro and small enterprises (MSE) will be considered. The bidders shall upload with their offer, the proof of their being MSE registered with district industries center (DIC) or Khadhi and village industries commission or Khadhi and Industries board (KVIV) or Coir board or National Small Industries Corporation (NSIC) or Directorate of handicrafts and handlooms or Udyam Registration Certificate or any other body specified by Ministry of MSME. The bidders who avail exemption from payment of EMD, shall submit "Bid Security Declaration" in the prescribed format as per Annexure 14, accepting that if they withdraw or modify their bids during period of validity etc., they will be suspended for the time specified in the tender document.
23. The bidder/tenderer/contractor shall file the applicable returns with Tax departments in time and submit the same as documentary proof.

24. The bidder/tenderer/contractor shall file the applicable returns with Tax departments in time and submit the same as documentary proof.
25. The GST applicable shall be shown as a separate line items in the Tax invoices to avail in put credit to Port.

2. Cover – I Details (Technical)

The following documents shall be uploaded online only.

1. Scanned copy of NEFT Payment details for cost of tender or exemption certificate
2. Scanned copy of RTGS/NEFT Payment details for EMD (bid security) / documentary evidence for exemption of EMD. The original document to be submitted by post or by hand immediately after the closing date for submission of online e-tender)
3. Scanned copy of documents as per Annexure 1 to 13 of section I(iii) of volume-I. The Original power of attorney i.e. Annexure 2 to be submitted by post or by hand immediately after the closing date for submission of online e-tender. However, such Power of Attorney would not be required if the bid is signed by an authorized partner or Director (on the Board of Directors) of the bidder, in case the bidder is a partnership firm or limited liability partnership or public limited.
4. Scanned copy of valid Pan card, PF, ESI and GST Registration certificate.
5. List of Ongoing works in hand at NMPA should be indicated in the prescribed form
6. Scanned copy of Form of Tender as per Section VI(iii) of volume -III
7. Technical bid document – Cover I (Volume I to Volume III) along with amendments and clarifications if any.

3. Cover – II Detail (Finance)

PRICE BID (Bill Of Quantities)

Price should be quoted in the BOQ template available in the portal. The BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevant columns, else the bidder is liable to be rejected for that tender. The Bidder shall fill in the rate for each items in the Bill of Quantities through CPP e-portal. Bidders are allowed to enter the Bidder Name and Values only.

Any indication of 'Quoted price' in the online technical bid documents shall lead to rejection of the bid outright.

The price bid submitted through e-portal mode only will be taken up for the purpose for evaluation.

4. Opening of bids

A. Part I Techno-Commercial bid will be opened electronically on specified

date and time as given in the NIT. Bidder(s) can witness electronic opening of bid.

B. Part II Price bid will be opened electronically of only those bidder(s) whose Part I Techno-Commercial Bid is found to be Techno-Commercially acceptable by NMPA. Such bidder(s) will be intimated, the date of opening of Part II Price bid, through valid email confirmed by them.

Note: The tenderers are advised to offer their best possible rates. There would generally be no negotiations hence most competitive prices may be quoted while submitting the price bid. However in case the lowest rate appears to be reasonable taking into account the prevailing market conditions, the work may be awarded to the lowest bidder and if the rate is still considered high, action as per prevailing instructions / guidelines shall be taken. All entries in the tender should be entered in online Technical & Commercial Formats without any ambiguity.

5. Evaluation process:

A proposal shall be considered responsive if –

a. It is received by the proposed Due Date and Time.
b. It is signed.
c. It contains the information and documents as required in the Tender Document.
d. It contains information in formats specified in the Tender Document.
e. It mentions the validity period as set out in the document.
f. It provides the information in reasonable detail. The Port Authority reserves the right to determine whether the information has been provided in reasonable detail.
g. There are no significant inconsistencies between the proposal and the supporting documents.
h. The Technical qualification conforms to as specified in the qualification criteria.
i. A Tender that is substantially responsive is one that conforms to the preceding requirements without material deviation or reservation. A material deviation or reservation is one (1) which affects in any substantial way, the scope, quality, or performance of the Tenderer or (2) which limits in any substantial way, inconsistent with the Tender document, or (3) whose rectification would affect unfairly the competitive position of other Qualified Applicant presenting substantially responsive bids.
j. The Port Authority reserves the right to reject any tender which in its opinion is non-responsive and no request for alteration, modification, substitution or withdrawal shall be entertained by the Port Authority in

respect of such Tenders.

k. The Port Authority would have the right to review the Technical Qualification and seek clarifications wherever necessary.

l. Since the tender involves selection based on pre-qualification criteria and technical specification, the Chief Engineer will examine and seek clarification if any and list out the firms, which are found technically suitable and Cover-II Price Bid of such tenderers only will be opened and EMD will be returned to the unsuccessful tenderers

m. The date and time will be intimated to tenderers whose offers are found suitable and Cover – II of such tenderers will be opened on the specified date and time

n. The cost of stamping Agreement must be borne by the successful Tenderer

o. The Fax/E-Mail offers will be treated as defective, invalid and rejected. Only detailed complete offers received through online prior to closing time and date of the tenders will be taken as valid.

B. Instructions To Tenderers (General)

1. Introduction:

This work essentially comprises of "Annual maintenance of Residential & Non-residential buildings on the East of NH-66 in NMPA for the year 2024-25"

2. Applicants:

Contractors who wish to bid for the tender for the contract work should download the tender document. The successful bidder will be expected to complete the works by the intended completion date specified in the Contract document.

3. Invitation for Bids:

The online Invitation for Bids is open to all eligible bidders meeting the eligibility criteria. The bidders may submit bids for the works detailed in the NIT through e-tender mode only.

4. Purchase of Tender Documents:

Tender document can be downloaded from NMPA website www.newmangaloreport.gov.in,www.tender.gov.in&https://www.eprocure.gov.in/eprocure/app of CPP portal

5. One Bid per Bidder:

Each bidder shall submit only one bid for one package. Bidder who submits or participates in more than one Bid will cause all the proposals with the

Bidder's participation to be disqualified.

6. Cost of Bidding:

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

7. Site visit:

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

8. Content of Bidding Documents:

Tender Document will consist of:

Volume I	Section I	Notice Inviting Tenders Instructions to Tenderers Annexure (1 to 13)
	Section II	Form of Agreement
	Section III	Conditions of Contract: Part A - E: General Conditions Conditions of Contract : Part F: Special Conditions Contract Data Form of Securities (A & B) Appendix – I and Appendix - II
Volume II	Section IV	Technical Specifications
	Section V	Drawings
Volume III	Section VI	Preamble Bill of Quantities For of tender
	Section VII	Schedules (A & B)

Any indication of "Quoted price" in the technical bid, shall lead to rejection of the bid outright. For evaluation purpose the uploaded offer documents will be treated as authentic and final. No hard copy shall be submitted, upload the entire document on the CPP portal only.

9. Clarification of the Bidding Documents:

The Tenderers are advised to examine the Tender Document carefully and if there be or appear to be any ambiguity or discrepancy in the documents, or any clarifications needed on the Tender Documents; these shall be referred to the Chief Engineer (Civil) in writing, so as to reach before seek clarification end date and time. It is to be noted that queries asked after due date and time will not be answered. Employer's clarifications shall be furnished in the CPP e-portal or shall be issued a corrigendum in the web site without identifying the source.

A provision is made in the CPP e-portal for seeking clarification online during the date mentioned in the NIT. The bidders can ask queries if any during the period through online. The queries of the bidders shall be answered online or a separate consolidated list of queries and clarifications shall be uploaded in web sites.

10. Amendment of Bidding Documents:

Any modification of the tender documents as a result of any ambiguity shall be shall be made exclusively through the issue of an Addendum. Any addendum thus issued shall be part of the tender documents and will be uploaded in CPP e-portal and Port website to all the bidders. Prospective bidders shall acknowledge receipt of each addendum to the Employer. Such addenda will be numbered and it shall be submitted by the Tenderers as part of Part I of their bid. The Addendum can also be downloaded from NMPA official website from 'Ongoing Project link'. The responsibility of downloading such addendum / amendment from NMPA website and CPP e-portal fully lies with the bidder

11. Preparation of bids:

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

12. Minimum Eligibility Criteria:

a) The tenderers must have experience of having successfully or substantially completed *similar works during last 7 (seven) years ending last day of month previous to the one in which applications are invited shall be either of the following

At least Three similar completed works costing not less than the amount equal to Rs. 31.31 Lakhs each (excluding GST)

or

At least Two similar completed works costing not less than the amount equal to Rs. 39.13 Lakhs each (excluding GST)

or

At least One similar completed works costing not less than the amount equal to Rs. 62.61 Lakhs (excluding GST)

Note 1: *Similar work(s) means **“"any civil Construction works or Renovation works or Repair works"”**

Note 2: Documentary evidence for successful completion of the work shall be furnished along with work order and work completion certificate.

Note 3: Substantial completion shall be based on 80 (eighty) per cent (value wise) or more works completed under the contract. Certificate for ‘substantial completion’ of project/work/asset should contain two parts. Part -I shall contain ‘financial value of work done’ and part-II shall contain ‘certificate of functional completion of project/work/asset’.

b) Average Financial turnover of the tenderer over the last three financial years 2021-22, 2022-23 and 2023-24 shall be at least Rs.23.48 Lakhs.

c) The tenderer shall submit a copy of valid ESIC & EPF registration certificate along with the tender.

The financial capacity of bidders would be evaluated considering the works in hand at NMPA on the due date of submission of bid. The port would deduct the turnover required for execution of work in hand at NMPA from the average financial turnover of the bidder. The remaining net financial turnover of the bidder will be considered for eligibility criteria. The financial capacity to be 3.33 times of the average financial turnover of last three years of the bidder minus works in hand at NMPA. The bidder must fill the annexure-6.

In case the average turnover is Rs. 3.00crores, the financial capacity of the contractor will considered as (3x3.333) Rs.10.00crores.

The turnover means sales/ contract receipts excluding taxes other income shall not be considered for calculation of turnover

Copy of the work order, Client’s satisfactory work completion Certificate, along with any other documentary proof certifying the date of completion, brief description of the project and project completion cost shall be submitted in support of the assignments performed and claimed by the tenderer to fulfill the eligibility criteria for qualification. Work completion certificate issued by a private organization shall be considered, only if Tax Deducted at Source Certificate with respect to referred work, issued by Competent Authority is enclosed along with the tender. In case work executed on subcontract, only approved or authorized subcontract shall

be considered for eligible assignment.

A statement duly certified by the Chartered accountant showing the average annual Financial Turnover over the last 3 financial years duly indicating UDIN shall be submitted.

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

i. made misleading or false representations in the forms, statements, affidavits and attachments submitted in proof of the qualification requirements; and/ or;
ii. Records of poor performance during the last five years, as on the date of application, such as abandoning the work, rescission of the contract for reasons which are attributable to non-performance of the contractor, inordinate delays in completion, consistent history of litigation resulting in awards against the contractor or any of the constituents, or financial failure due to bankruptcy, and so on. The rescission of a contract of venture JV on account of reasons other than nonperformance, such as the most experienced partner (major partner) of JV pulling out;
iii. On account of currency of debarment by any Government agency.

13. Bid Prices:

The contract shall be for the whole works as described in based on the priced Bill of Quantities submitted through CPP e-portal by the Bidder .The Bidder shall fill rate in the Bill of Quantities through CPP e-portal. Items for which no rate or price is entered will not be paid for by the Employer when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities

14. Currencies of Bid and Payment:

The Unit rates and the prices shall be quoted by the bidder entirely in Indian Rupees

15. Bid Validity:

Bids shall remain valid for a period not less than ninety days (90 days) after the last date for online bid submission. A bid valid for a shorter period shall be rejected by the Employer as non-responsive.

In exceptional circumstances, prior to expiry of the original bid validity period, the Employer may request that the bidders may extend the period of validity for a specified additional period. The request and the bidders' responses shall be made in writing or by cable. A bidder agreeing to the request will not be

permitted to modify his bid and also shall submit an extension for EMD, if it is in the form of Bank Guarantee

16. Bid Security / EMD:

i. The EMD shall be in the form of Insurance Surety Bonds, Account Payee Demand draft, Fixed Deposit Receipt, Bankers Cheque or shall be paid by RTGS/NEFT in favour of Financial Adviser & Chief Accounts Officer, New Mangalore Port Authority, Mangalore

NMPA Bank Details.

1. Name of the Bank: State Bank of India, Panambur, Mangalore - 10.
2. Bank A/C No. 10205649448
3. IFSC Code: SBIN0002249
4. MICR Code: 575002011.

The Techno Commercial Bid shall be accompanied by the RTGS/NEFT deposit details towards Earnest Money Deposit of Rs. 184700/- (Rupees One Lakh EightyFour Thousand Seven Hundred Only) as stipulated in the tender. The tender without EMD shall be treated invalid.

ii. The benefit of Exemption of EMD to all Micro and small enterprises (MSE) will allowed. Shall upload with their offer, the proof of their being MSE registered with district industries center (DIC) or Khadhi and village industries commission or Khadhi and Industries board (KVIV) or Coir board or National Small Industries Corporation (NSIC) or Directorate of handicrafts and handlooms or Udyam Registration Certificate or any other body specified by Ministry of MSME.

iii. The bidders who avail exemption from payment of EMD, shall submit "Bid Security Declaration" in the prescribed form as per Annexure 14, accepting that if they withdraw or modify their bids during period of validity etc., they will be suspended for the time specified in the tender document.

iv. In the event of Bidder withdrawing his Bid before the expiry of tender validity period of 90 days from the last date for online bid submission, the tender shall be cancelled and EMD shall be forfeited.

v. The Earnest Money Deposit of unsuccessful bidder shall be returned without interest on conclusion of contract. The Earnest Money Deposit of the successful bidder shall be refunded (without interest) after he has signed the agreement and furnished required performance security.

vi. The Bid Security of a successful bidder will be forfeited in the following cases:

a) If the bidder withdraws his Tender during the period of bid validity.

b) In case of a successful tenderer fails

i) to commence the work, apart forfeiture of other claims

ii) within the specified time limit to sign the Agreement or furnish the required Performance Security. In the event of forfeiting the EMD / SD / LD and while imposing penalty GST as applicable will be collected.

17. No Alternative Proposals by Bidders:

Bidders shall submit offers that comply with the requirements of the bidding documents, including the basic technical design as indicated in the drawing and specifications. Alternatives will not be considered.

18. Format and Signing of Bid:

The Bid shall be in online mode. The Bid shall contain no alterations or additions, except those comply with instructions issued by the Employer

19. Bid Submission:

Tender document including quoted bid price have to be submitted online only through CPP Portal before deadline for online submission of bid.

For evaluation purpose the uploaded offer documents will be treated as authentic and final.

The Tender shall be submitted in Two Bids.

I. Technical Bid: Shall contain the following.
   i) Techno Commercial Bid: Shall contain all the documents. Techno Commercial Bid should not contain Price Bid. "Disclosure/indication of Price in the Techno Commercial Bid shall render the tender disqualified and rejected.
   ii) The details of payment of EARNEST MONEY DEPOSIT for Rs. 184700/- (Rupees One Lakh EightyFour Thousand Seven Hundred Only)
   iii) Transaction details of payment towards the COST OF TENDER Fee: Rs. 1120/-(Rupees One Thousand One Hundred Twenty Only) (To be paid by RTGS/NEFT to NMPA Bank Account).
   iv) List of Ongoing works in hand at NMPA should be indicated in the prescribed form.

II. FINANCIAL BID: shall contain only the Price. The Bidder shall fill the excess or less in percentage in the Bill of Quantities

III. LAST DATE FOR SUBMISSION OF ONLINE TENDER: is as per the date mentioned in the NIT

NMPA may at its sole discretion reserves the right to extend the date for receipt of Bid. Bid after the aforesaid time and date or the extended time and date, if any, shall not be accepted by the portal.

The following details pertaining to Techno Commercial Bid shall be

uploaded online.

a) Letter of Submission- Covering letter (vide Annexure – 1)

b) Power of Attorney in favour of signatory/s to the Tender, duly authenticated public notary (vide Annexure -2) (Original power of attorney ie. Annexure 2 to be submitted by post or by hand so as to reach the Executive Engineer (Civil) immediately after the closing date for submission of online e-tender). However, such Power of Attorney would not be required if the bid is signed by an authorized partner or Director (on the Board of Directors) of the bidder, in case the bidder is a partnership firm or limited liability partnership or public limited.

c) Organization Details (vide Annexure-3)

d) Details of "Minimum eligibility criteria" as per Clause 12 of instruction to Tenderers and certificates (Client Certificates / work completion certificates or any other documentary evidences with respect to the eligibility work) (vide Annexure-4) of condition of contract. The following specific instruction may be noted ;

   i) Bidders are expected to provide information in respect of Eligible Assignments in this Section. The assignments cited must comply with the criteria specified in Clause No. 12 (a) for "Minimum eligibility".

   ii) A separate sheet should be filled for each of the eligible assignments.

   iii) the details are to be supplemented by documentary proof from the respective client for having carried out such assignment duly certified by client's completion certificates and work orders etc.

e) A statement duly certified by Chartered Accountant with UDIN showing Average Financial turnover of the tenderer over the last three financial years (vide Annexure-5) with balance sheet.

f) List of Ongoing works in hand at NMPA should be indicated in the prescribed form (Annexure 6).

g) A list of Plant and equipment proposed to be engaged for work. (vide Annexure-7) The equipment indicated in the Annexure -7 will form part of contract agreement and as such the bidders are requested to indicate the availability of the equipment at site at what stage of the construction period the equipment would made available.

h) A declaration to the effect that (vide Annexure -8):-

   a. All details regarding construction plant and machinery, temporary work and personnel for site organization considered necessary and sufficient for the work have been furnished in the Annexure to Conditions of Contract in Volume I and that such

plant, temporary works and personnel for site organization will be available at appropriate time of relevant works for which the equipment have been proposed at site till the completion of the respective work.

b. No conditions are incorporated in the financial bid. In case any conditions are specified in the financial bid, the tender will be rejected summarily without making any further reference to the bidder.

c. We have not made any payment or illegal gratification to any persons/ authority connected with the bid process so as to influence the bid process and have not committed any offence under PC Act in connection with the bid.

d. We disclose with that we have made / not made payments or propose to be made to any intermediaries (agents) etc in connection with the bid.

e. We have not been barred by the [Central/ State] Government, or any entity controlled by it, from participating in any project and the bar subsist as on the due date of Tender.

i) NEFT Payment details towards cost of tender.

j) RTGS/NEFT Payment details towards EMD / documentary evidence of exemption of EMD.

k) Tenderer should submit copy of Permanent Account Number. (PAN), ESI, PF and GST Registration (GSTIN) Number along with certificates issued by the authority as applicable

20. Deadline for Submission of the Bids:

i) The completed bid shall be submitted in the electronic form by the date and time mentioned in NIT only through CPP e-portal.

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

iii) Price should be quoted in CPP e-portal. Any indication of 'Quoted price' in the online technical bid documents shall lead to rejection of the bid outright. For evaluation purpose the uploaded offer documents will be treated as authentic and final. No hard copy shall be submitted for reference purpose. The bid submitted through e-tendering mode only will be taken up for the purpose for evaluation.

iv) The uploaded Port Tender Document will be treated as authentic tender and if any discrepancy is noticed at any stage between the Port's tender

document and the one submitted/uploaded by the tenderer, the conditions mentioned in the Port's uploaded document shall prevail. Besides, the tenderer shall be liable for legal action for the lapses.

21. Late Bids:

The tenderer should ensure that their tender is received online at NMPA before the deadline prescribed in Clause 20

The time that is displayed from the server clock at the top of the CPP e-portal, will be valid for all actions of requesting bid submission, bid opening etc., The bidders should adhere to this time during bid submission.

22. Modification and Withdrawal of Bids:

i) Bidders may modify the offers by deleting their already freezed bids in online only through CPP e-portal (after submission of bid) and resubmit/upload the revised offer before the deadline prescribed in Clause 20.

ii) No bid shall be withdrawn and resubmitted through CPP e-portal by the bidder after the deadline for submission of bids.

iii) Withdrawal of a Bid between the deadline for submission of bids and the expiration of the original period of bid validity specified in Clause 15 may result in the forfeiture of the Bid Security pursuant to Clause 16.

iv) Bidders may only modify the prices and other required details of their Bids by Resubmitting Bid only in accordance with this clause through CPP e-portal.

23. Bid Opening - Technical Bid:

a. On the due date and time as specified in Clause 20, the Employer will On the due date and time as specified in Clause 20, the Employer will first open Techno Commercial bids of all bids received online in presence of the Bidders or their representatives who choose to attend. In the event of specified date for bid opening is declared as holiday by the Employer, the bid will be opened at the appointed time and location on the next working day.

b. In the first instance the Techno Commercial Bid containing the RTGS/NEFT payment details of EMD & Cost of tender document will be verified. If EMD and Tender Fee is in line with the Tender Condition there after the Techno Commercial Bid will be considered for evaluation.The benefit of Exemption of EMD to all Micro and small enterprises (MSE) will allowed. Shall upload with their offer, the proof of their being MSE registered with district industries center (DIC) or Khadhi and village

industries commission or Khadhi and Industries board (KVIV) or Coir board or National Small Industries Corporation (NSIC) or Directorate of handicrafts and handlooms or Udyam Registration Certificate or any other body specified by Ministry of MSME.

c. If all Bidders have submitted unconditional Bids together with requisite Bid security, then all Bidders will be so informed then and there. If any Bid contains any deviation from the Bids documents and / or if the same does not contains Bid security in the manner prescribed in the Bid documents, then that Bid will be rejected and the Bidder informed accordingly.

24. Bid Opening – Financial Bid:

The date and time of opening of price bid (cover-II) shall be intimated to the qualified bidders based on the evaluation of the technical bid. The price bid (cover-II) of such eligible bidders shall be opened on the specified date and time.

If bidder withdraws his tender after opening of price bid the bidder will be disqualified for participating in NMPA tender for a period of two years.

25. Clarification of Bids:

To assist in the examination and comparison of Bids, the Employer may, at his discretion, ask any Bidder for clarification of his Bid, including breakdown of unit rates. The request for clarification and the response shall be in writing, but no change in the price or substance of the Bid shall be sought, offered, or permitted.

No Bidder shall contact the Employer on any matter relating to his bid from the time of the bid opening to the time the contract is awarded. If the Bidder wishes to bring additional information to the notice of the Employer, he should do so in writing.

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

Employer reserves the right to reject any Bid, if the Bidder does not provide the clarification sought for by the Employer, within the time specified by the Employer, for proper evaluation of the Bid.

The employer may proceed to evaluate the bid by construing the particulars requiring clarification to the best of its understanding, and the bidder shall be barred from subsequently questioning such interpretation of the employer.

26. Examination of Bids and Determination of Responsiveness:

Prior to detailed evaluation of Bids, NMPA will determine whether each Bid

a) has been properly signed by an authorised signatory (accredited

representative) holding Power of Attorney in his favour. The Power of Attorney shall interalia include a provision to bind the Bidder to settlement of disputes clause;

b) is accompanied by the requisite Bid security and;

c) meets the eligibility criteria as defined in Clause 12.

d) is responsive to the requirements of the Bidding documents.

A responsive Bid is one which conforms to all the terms, conditions and specification of the Bidding documents, without material deviation or reservation. A material deviation or reservation is one

i. which affects in any substantial way the scope, quality or performance of the Works;

ii. which limits in any substantial way, the Employer's rights or the Bidder's obligations under the Contract; or

iii. whose rectification would affect unfairly the competitive position of other Bidders presenting responsive Bids.

The tenderer shall submit a certificate in the tender schedule in the Technical Bid that he has not incorporated any conditions in the Financial Bid and in case any conditions are specified in the financial bid his tender will be rejected without making any further reference to him.

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

27. Correction of Errors: (Not Applicable)

28. Evaluation and Comparison of Bids:

The Employer will evaluate and compare only the Bids determined to be responsive in accordance with Clause 26. In evaluating the Bids, the Employer will determine for each Bid the evaluated Bid Price by adjusting the Bid Price as follows:

a) making appropriate adjustments to reflect discounts or other price modifications offered in accordance with Clause 22.

29. Alteration of tender documents:

No alteration shall be made in any of the tender documents or in the Bill of Quantities and the tender shall comply strictly with the terms and conditions of the tender document. The Employer may however ask any tenderer for clarifications of his tender if required. Nevertheless, no tenderer will be permitted to alter his tender price after opening of the tender.

30. Alternative conditions and Proposal:

The Tenderer shall note that alternative or qualifying tender conditions, or alternative design proposal for whole or part of the work will not be acceptable. Tenders containing any qualifying conditions or even Bidder's clarifications in any form will be treated as non-responsive and will run the risk of rejection. Part II: Price Bid of such Bidder's will not be opened.

31. Award of Contract:

The Employer will award the Contract to the bidder whose bid has been determined to be responsive to the bidding documents and who has offered the lowest evaluated bid price, provided that such bidder has been determined to be

a) Eligible in accordance with the provisions of Clause 12, and
b) Qualified in accordance with the provisions of Clause 12.

32. Notification of Award:

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

ii) 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 33.

iii) The Agreement will also incorporate all correspondence exchanged between the employer and the successful bidder. Within 21 days of receipt of Letter of Acceptance, the successful bidder will furnish the performance security and sign the Agreement with the Employer. The contractor shall make 10 copies of the Agreement and submit to the employer within 7 days following the date of signing of Agreement. The work shall not be commenced without signing contract agreement.

33. Release of Bid Security / EMD:

The Earnest Money Deposit of unsuccessful bidder shall be returned (in case of BG) or refunded without interest by RTGS/NEFT on conclusion of Contract. The Earnest Money Deposit of the successful bidder shall be refunded (without interest) after he has signed the agreement and furnished required

performance security.

34. Performance Security:

i) Within 21 days of receipt of the Letter of Acceptance, the successful Bidder shall deliver to the Employer a Performance Security in the form in the form of Insurance Surety Bonds, Account Payee Demand draft, Fixed Deposit Receipt from a commercial bank, remittance by RTGS or Bank Guarantee (BG) or for an amount equivalent to 5% of the Contract price (Contract price including GST), as applicable rounded off to the nearest 1000.

ii) If the performance security is provided by the successful Bidder in the form of a Bank Guarantee, it shall be issued by a Nationalized /Scheduled Indian bank having its branch at Mangalore acceptable by NMPA and cashable at Mangalore. The BG shall be issued in favor of FA&CAO, New Mangalore Port Authority in the Format enclosed in Volume I as Annexure-A.

35. Fraud and Corrupt Practices:

The bidder and their respective officers, employees, agents and advisers shall observe the highest standard of ethics during the Selection Process. Notwithstanding anything to the contrary contained in this document, the Port shall reject the tender without being liable in any manner whatsoever to the bidder, if it determines that the bidder has, directly or indirectly or through an agent, engaged in corrupt practice, fraudulent practice, coercive practice, undesirable practice or restrictive practice (collectively the "Prohibited Practices") in the Selection Process. In such an event, the Port shall, without prejudice to its any other rights or remedies, forfeit and appropriate the Bid Security or Performance Security, as the case may be, as mutually agreed genuine pre-estimated compensation and damages payable to the Port for, inter alia, time, cost and effort of the Authority, in regard to the Tender, including consideration and evaluation of such Bidder's Proposal. Such Bidder shall not be eligible to participate in any tender or RFP issued by the Authority during a period of 2 (two) years from the date such Bidder is found by the Authority to have directly or through an agent, engaged or indulged in any corrupt practice, fraudulent practice, coercive practice, undesirable practice or restrictive practice, as the case may be.

For the purposes of this Clause, the following terms shall have the meaning hereinafter respectively assigned to them:

(a) "corrupt practice" means

i) the offering, giving, receiving, or soliciting, directly or indirectly, of

anything of value to influence the action of any person connected with the Selection Process (for avoidance of doubt, offering of employment to or employing or engaging in any manner whatsoever, directly or indirectly, any official of the Authority who is or has been associated in any manner, directly or indirectly with the Selection Process or the LOA or has dealt with matters concerning the Agreement or arising there from, before or after the execution thereof, at any time prior to the expiry of one year from the date such official resigns or retires from or otherwise ceases to be in the service of the Authority, shall be deemed to constitute influencing the actions of a person connected with the Selection Process; or

ii) engaging in any manner whatsoever, whether during the Selection Process or after the issue of the LOA or after the execution of the Agreement, as the case may be, any person in respect of any matter relating to the Project or the LOA or the Agreement, who at any time has been or is a legal, financial or technical consultant/ adviser of the Authority in relation to any matter concerning the Project;

(b) "fraudulent practice" means a misrepresentation or omission of facts or disclosure of incomplete facts, in order to influence the Selection Process;

(c) "coercive practice" means impairing or harming or threatening to impair or harm, directly or indirectly, any persons or property to influence any person's participation or action in the Selection Process;

(d) "undesirable practice" means

i) establishing contact with any person connected with or employed or engaged by the Authority with the objective of canvassing, lobbying or in any manner influencing or attempting to influence the Selection Process; or

ii) having a Conflict of Interest; and

(e) "restrictive practice" means forming a cartel or arriving at any understanding or arrangement among Applicants with the objective of restricting or manipulating a full and fair competition in the Selection Process.

36. Rejection of Tender:

Any Tender not conforming to the foregoing instructions will not be considered. The Employer does not bind himself to accept the lowest or any tender and has the right to reject any tender without assigning any reason thereof. No representation whatsoever will be entertained on this account.

37. Additional Information:

The "Instructions to Tenderers" shall not form part of the Contract. They are intended only to aid the Tenderers in the preparation of their tender.

38. Compliance of Local Content as per Make in India Policy:

Bidder shall comply with DPIIT Order No. P-45021/2/2017-PP(B-II) dtd. 16-09-2020 in respect of Local Content and furnish an undertaking in the prescribed format as per Annexure 13, to that effect, failing which, the bid may be liable for cancellation.

Annexure – 1

LETTER OF SUBMISSION - COVERING LETTER
(ON THE LETTER HEAD OF THE BIDDER)

Date:

To

The Executive Engineer (Civil),

New Mangalore Port Authority,

Administration Building,

Panambur, Mangalore – 575 010

Sir,

Sub: The work of "Annual maintenance of Residential & Non-residential buildings on the East of NH-66 in NMPA for the year 2024-25 Being duly authorized to represent and act on behalf of …… (Hereinafter referred to as "the Bidder") and having reviewed and fully understood all of the requirements of the bid document and information provided, the undersigned hereby apply for the project referred above.

We are submitting our Bid enclosing the following, with the details as per the requirements of the Bid Document, for your evaluation.

i. Tender Document along with Addendum No ----,
ii. Power of Attorney - (Annexure - 2)
iii. Organization Details - (Annexure - 3)
iv. Details to fulfill the "Minimum Eligibility Criteria" and certificates - (Annexure 4)
v. Average Financial turnover over the last three financial year - (Annexure 5)
vi. List of ongoing works at New Mangalore Port Authority (Annexure 6)
vii. List of plant and equipment – (Annexure - 7)
viii. Declaration – (Annexure – 8)
ix. Bid Security / EMD Paid by RTGS/NEFT vide UTR No……dtd. ……. of (name and address of the branch).
x. Banker's Details – Annexure 10 & 11
xi. Indemnity Bond as per Annexure 12, Compliance to make in India as per Annexure 13, Bid security Declaration as per Annexure 14.
xii. Tender fee paid by NEFT vide vide UTR No……dtd. ……. of (name and address of the branch).
xiii. Copy of valid ESI, PF &GST Registration certificate.

Signature
(Authorised Signatory)

Annexure – 2

ON STAMP PAPER of Rs 100/-

"ANNUAL MAINTENANCE OF RESIDENTIAL & NON-RESIDENTIAL BUILDINGS ON THE EAST OF NH-66 IN NMPA FOR THE YEAR 2024-25--

FORMAT OF POWER OF ATTORNEY (in original)

In favour of signatory/s to the Tender, duly authenticated by Notary Public.

POWER OF ATTORNEY IN FAVOUR OF ---------- (Name, Designation, Company name)

TO ALL TO WHOM THESE PRESENTS shall come, I, (Name & address of the authorized person to sub-delegate/delegate powers, delegated on him by the Board of Directors) do hereby sub-delegate/delegate, in terms of the powers delegated to me by the Board of Directors, ---------- (name of the Co.) to Shri ---------- (name, designation & address of the Attorney) the following:

NOW KNOW YE AND THOSE PRESENTS that I, (Name & address of the authorized person to sub-delegate/delegate powers, delegated on him by the Board of Directors), do hereby authorize and empower Shri ---------- (name, designation & address of the Attorney) to do severally amongst others, for the purpose of carrying on our business, the following:

a) To represent lawfully the (name of the Co.) for obtaining bid/tender documents, prepare, sign, execute and submit tenders for execution of (Name of work)or any other works incidental to such construction works.
b) To discuss the technical and financial matters, negotiate and accept prices and take decisions regarding terms and conditions and sign agreements and contracts and also to bind the (name of the Co.) to the arbitration clause included in the contract.
c) For all or any of the purposes here of to sign and deliver or otherwise execute such deed or deeds, transfer or transfers, endorsement or endorsements and to perform such other acts, matters, things as the Attorney shall consider requisite or advisable as full and effectively as the Company could do, if present and acting there.

I, (Name & address of the authorized person to sub-delegate/delegate powers, delegated on him by the Board of Directors) in terms of the powers delegated to me by the Board of Directors of (name of the Co.), do hereby agree that all acts, deeds and things done by the said Attorney by virtue of this power of attorney, shall be construed as acts, deeds and things done by the Company.

I, (Name & address of the authorized person to sub-delegate/delegate powers,

delegated on him by the Board of Directors), further undertake to ratify and confirm whatever our said attorney shall do or cause to be done for the Company, the said Company, in the premises, by virtue of the powers hereby given.

WHEREAS, this sub-delegation is signed and delivered to Shri ---------- (name & designation of the Attorney), on this _____ day of _____, 20____ (Two thousand _____).

WHEREAS, even though this sub-delegation is signed on this _____ day of _____ 20_____ (Two thousand _____), will have effect from the date he signs and receives this delegation.

IN WITNESS WHEREOF, I, (Name & address of the authorized person to sub-delegate/delegate powers, delegated on him by the Board of Directors) has, this _____ day of _____ 20_____ (Two thousand _____) set my hands and subscribed my signature unto this instrument.

SIGNED AND DELIVERED ON
_____ BY

(Name of authorized person to delegate powers)

WITNESS:

SIGNED AND RECEIVED ON
_____ BY
(Name & designation of Attorney)

Annexure – 3

"ANNUAL MAINTENANCE OF RESIDENTIAL & NON-RESIDENTIAL BUILDINGS ON THE EAST OF NH-66 IN NMPA FOR THE YEAR 2024-25--

ORGANIZATION DETAILS

CONTACT No.:
NAME OF APPLICANT:

1. Name of the Owner:
2. Address:
   Telephone No. :
   Fax No.
3. Description of Applicant
   (for e.g. General, Civil Engineering
   Contract or Joint Venture/Consortium etc.)

4. Registration and Classification of Contractors:
5. Name and address of bankers:
6. Number of years of experience as a general contractor:-
   In own Country:
   Internationally:
7. Number of years of experience as a sub-contractor:
   Name and Address of partners or associated companies to be involved in the project and whether Parent/Subsidiary/other:

8. Name and address of any associates knowledgeable in the procedures of customs, immigration and local experience in various aspect of the project etc.
9. Name and address of the companies / Sub-contractors who will be involved in the execution of works, namely:

Signature
(Authorised Signatory)

Annexure – 4

NEW MANGALORE PORT AUTHORITY

"ANNUAL MAINTENANCE OF RESIDENTIAL & NON-RESIDENTIAL BUILDINGS ON THE EAST OF NH-66 IN NMPA FOR THE YEAR 2024-25Tenderer shall furnish Details of "eligibility works experience" as per Clause 12(a) of Minimum Eligible Criteria (MEC) of Instruction to Tenderer and certificates in the following format (Client Certificates/work completion certificates or any other documentary evidences with respect to the eligibility work)

ELIGIBLE ASSIGNMENT DETAILS FOR MEC

Assignment Number:

Sl. No.	Description	Bidder to fill up the details here
1	Name and Address of the Client	
2	Title of the Eligible Assignment	
3	Date of completion of the Eligible Assignment	
4	Project Cost	
5	Reference No of the enclosed work order	
6	Reference No of the enclosed Client work Completion Certificate	
7	Reference No of any other documentary evidence; if enclosed.	
8	Name, telephone no, telefax no and email address of the client's representative	
9	Description and Scope of Work	

Signature

(Authorised Signatory)

Certificate from the Statutory Auditor

This is to certify that the information contained in Column 4 above is correct as per the accounts of the Applicant and/ or the clients.

(Signature, name and designation of the authorised signatory)

Date: Name and seal of the audit firm:

In case the Applicant does not have a statutory auditor, it shall provide the certificate from its chartered accountant that ordinarily audits the annual accounts of the Applicant.

Instructions:

i. Bidders are expected to provide information in respect of Eligible Assignments in this Section. The assignments cited must comply with the criteria specified Clause No. 12.0(a) Minimum eligibility of the "Instructions to Tenderers".
ii. A separate sheet should be filled for each of the eligible assignments.
iii. The details are to be supplemented by documentary proof (Work order and work completion certificate) from the respective client for having carried out such

assignment duly certified by clients.

Annexure – 5

NEW MANGALORE PORT AUTHORITY
"ANNUAL MAINTENANCE OF RESIDENTIAL & NON-RESIDENTIAL BUILDINGS ON THE EAST OF NH-66 IN NMPA FOR THE YEAR 2024-25FINANCIAL CAPABLITY

(A) Net worth & Average Annual Turnover of the Bidder

Net Worth	Turnover			
Year 1 2023-24	Year 1 2023-24	Year 2 2022-23	Year 3 2021-22	Average

Instructions:

Net Worth = (Subscribed and Paid-up Equity + Reserves) - (Revaluation reserves + Miscellaneous expenditure not written off + depreciation not provided for). Year 1 will be the Financial Year 2023-24. Year 2 shall be the year immediately preceding Year 1 and Year 3 shall be the year immediately preceding Year 2. The Bidder shall provide audited Annual Reports as required under this Bid Document.
Net worth & Annual turnover of the bidder shall be submitted duly verified by Charted Accountant or Competent Authority.
(B) (Here specify proposed sources of credit line to meet the Cash flow demand for the work)

Source of Credit line	Amount

There should be a letter from the Bank mentioning that line of credit offered is specifically for this work/contract.
NOTE: If the Tenderer intends to meet the "Cash Flow Demand" for the project through their internal resources without availing the loan of credit, a specific mention to be made to this effect and proof for such resources shall be enclosed.

Certified by C.A Signature
(Authorised Signatory)
UDIN :

Annexure – 6

NEW MANGALORE PORT AUTHORITY
""ANNUAL MAINTENANCE OF RESIDENTIAL & NON-RESIDENTIAL BUILDINGS ON THE EAST OF NH-66 IN NMPA FOR THE YEAR 2024-25

LIST OF ONGOING WORKS IN HAND AT NEW MANGALORE PORT

The Tenderer shall furnish in the format given below details of works being carried out by him at the time of bidding in New Mangalore Port

Sl.No.	Name of work	Work order No. and Date	Value of Work Order in Rs.	Average annual financial turnover as per MEC for the work

Contractor

Annexure – 6A (Not applicable)

NEW MANGALORE PORT AUTHORITY
"ANNUAL MAINTENANCE OF RESIDENTIAL & NON-RESIDENTIAL BUILDINGS ON THE EAST OF NH-66 IN NMPA FOR THE YEAR 2024-25
DETAILS OF PROPOSED APPROACH & METHODOLOGY

Bidder shall furnish a detailed method statement (Technical Note) for carrying out of the works, along with a construction programme showing sequence of operation and the time frame for various segments of temporary and permanent works.

Signature
(Authorised Signatory)

Annexure – 7

NEW MANGALORE PORT AUTHORITY

"ANNUAL MAINTENANCE OF RESIDENTIAL & NON-RESIDENTIAL BUILDINGS ON THE EAST OF NH-66 IN NMPA FOR THE YEAR 2024-25--

PLANT AND EQUIPMENT PROPOSED FOR THE WORK

Please indicate the main plant and equipment considered to be necessary for undertaking the work and whether this plant is ready in ownership or will be purchased or hired.

Description of equipment	Requirement no. / capacity	Owned / leased / to be procured	Nos / capacity	Age / condition	Remarks (from whom to be purchased)	At what stage of contract period the equipment will be available

Note: The equipment indicated in the above statement will form part of contract agreement and as such the bidders are requested to indicate the availability of the equipment at site and at what stage of the construction period in a separate column.

Signature

(Authorised Signatory)

Annexure – 8

NEW MANGALORE PORT AUTHORITY
"ANNUAL MAINTENANCE OF RESIDENTIAL & NON-RESIDENTIAL BUILDINGS ON THE EAST OF NH-66 IN NMPA FOR THE YEAR 2024-25
DECLARATION

We M/s. (Name & address of the bidder) hereby declare that:-

i. I have read the tender document Vol. I (Section I to III) Vol.II (Section IV and V) and Vol.III (Section V and VII) and agreed to the terms and conditions mentioned therein.
ii. All details regarding construction plant, temporary work and personnel for site organisation considered necessary and sufficient for the work have been furnished in the Annexures to Conditions of Contract in Volume I and that such plant, temporary works and personnel for site organisation will be available at the site till the completion of the respective work.
iii. No conditions are incorporated in the financial bid. In case any conditions are specified in the financial bid, the tender will be rejected summarily without making any further reference to the bidder.
iv. We have not made any payment or illegal gratification to any persons/ authority connected with the bid process so as to influence the bid process and have not committed any offence under PC Act in connection with the bid.
v. We shall undertake that, the Employer i.e. NMPA is indemnified against all damages or compensation payable at Law in respect of or in consequence of any accident or injury to any workman or other person in the employment of the Contractor or Sub-Contractor against all claims, demands, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto and the Employer shall be at liberty to deduct or adjust from the Contactor's bills an amount that Employer may be called upon to pay towards claims, demands, proceedings, costs, charges and expenses Whatsoever in respect of or in relation to any accident or injury referred to above without any reference to the Contractor.
vi. We shall comply with all the Central State and Municipal Laws and Rules and we shall be solely responsible for complying with the provisions of the Contract Labour (Regulations & Abolition) Act, 1970 & the contract labour (Regulation & Abolition) Karnataka Rules 1974 and rules there under and the enactments that may be applicable including ESI Act, the payment of wages act, Provident Fund Act, the Minimum Wages Act, the Factory's Act. The Workmen Compensation Act or any other applicable legislation and the Municipal by-laws or other

statutory Rules and Regulations whatsoever in force if these are applicable. Any obligations finding or othenrvise missed under any statutory enactments, rules & regulations there under shall be the responsibility of the Contractor and the NMPA will take no responsibility for the same. The Contractor should take Workmen's Compensation Policy for his Workers, who are not covered under ESI and submit the same to the EIC immediately after commencement of the work.

vii. We undertake that, we are liable to pay all Statutory Compensation to the Labourers/persons engaged by him for the satisfactory execution of the works. lf any claim is made against New Mangalore Port Authority on this work, the Port Authority shall have the right to deduct the same from the bill amount payable to the contractor after verification of the validity and if admissible as per rules

viii. We have not been barred by the [Central/ State] Government, or any entity controlled by it, from participating in any project and the bar subsist as on the due date of Tender.

ix. *We disclose with that we have made / not made payments or propose to be made to any intermediaries (agents) etc in connection with the bid.

* Note: Delete whichever is not applicable.

Signature
(Authorised Signatory)

Annexure-9

BID SECURITY (BANK GUARANTEE) (Not applicable to this contract)

WHEREAS, _____ [Name of Bidder] (hereinafter called "the Bidder") has submitted his bid dated_____ [date] for the Annual maintenance of Residential & Non-residential buildings on the East of NH-66 in NMPA for the year 2024-25(hereinafter called "the Bid").

KNOW ALL PEOPLE by these presents that We _____ [name of bank] of _____ (name of country) having our registered office at _____ (hereinafter called "the Bank") are bound unto The Board of New Mangalore Port Authority, a body constituted under Major Port Authority Act 2021 (hereinafter called "the Employer") in the sum of Rs. 184700/- (Rupees One Lakh EightyFour Thousand Seven Hundred Only.)

i* for which payment well and truly to be made to the said Employer the Bank binds itself, his successors and assigns by these presents.

SEALED with the Common Seal of the said Bank this _____ day of _____ 2024

THE CONDITIONS of these obligations are:

(1) If after Bid opening the Bidder withdraws his Bid during the period of bid validity specified in the Form of Bid;

or

(2) If the Bidder having been notified of the acceptance of his Bid by the Employer during the period of bid validity:

(a) fails or refuses to execute the Form of Agreement in accordance with the Instructions to Bidders, if required; or

(b) fails or refuses to furnish the Performance Security, in accordance with the Instructions to Bidders, or

(c) does not accept the correction of the Bid Price pursuant to Clause 27;

We undertake to pay to the Employer up to the above amount upon receipt of his first written demand, without the Employer having to substantiate his demand, provided that in his demand the Employer will note that the amount claimed by him is due to him owing to the occurrence of one or any of the three conditions, specifying the occurred condition or conditions.

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

Notwithstanding anything mentioned above,

Our liability against this guarantee is restricted to Rs. 184700/- (Rupees One Lakh EightyFour Thousand Seven Hundred Only.) and unless a claim in writing is lodged with us within 3 months of the date of expiry or the extended date of expiry of this

guarantee all our liabilities under this guarantee shall stand discharges.

IN WITNESS WHEREOF this guarantee has been duly executed on this ..... day of 2024

DATE_____ SIGNATURE OF THE BANK_____

WITNESS_____SEAL_____

_____

_____

[Signature, name and address]

_____ _____ _____ _____

_____ _____

i*The Bidder should insert the amount of the guarantee in words and figures denominated in Indian Rupees. This figure should be the same as shown in Clause 16 of the Instructions to Bidders.

ii*30 days after the end of the validity period of the Bid.

Annexure-10

DETAILS OF THE PARTY OPTING FOR REFUND OF EMD THROUGH E-PAYMENT SYSTEM FROM NEW MANGALORE PORT AUTHORITY

Name of the Party :

Bank A/c No :

Account type : (Savings / Current / Overdraft)

Bank Name :

Branch :

IFSC Code Number : (11 digit code)

Centre (Location) :

FAX No. :

E-Mail ID : (For forwarding information of remittance)

Mobile No :

Signature of the Party

Annexure-11

FORMAT FOR FURNISHING BANK INFORMATION FOR e-PAYMENT

1	Name and full address of the beneficiary	
2	Credit Account No. (Should be full 14 digit)	
3	Account Type (SB or CA or OD)	
4	Name of the Bank	
5	Branch (Full address with telephone No.)	
6	IFSC Code Number (11 digit)	
7	MICR code (Should be 9 digit)	
8	Telephone/Mobile/Fax No. of the beneficiary	Telephone: Mobile : Fax :
9	Photostat copy of a Cheque	

Signature of the party with seal

Verified the details furnished by the party and it is ascertained that the information furnished are in full shape as required. Xerox copy of a Cheque is also enclosed.

Signature of the HOD/HOO with seal

Annexure-12

Indemnity Bond

(To be furnished in Stamp paper not less than Rs.100 e-Stamp paper)

This deed of indemnity is executed by ..... herein after referred to as 'Indemnifier' which expression shall unless repugnant to the context or meaning thereof, include its successors, Administrator, representatives and assignees in favour of New Mangalore Port Authority, Panambur, Mangalore 575010, herein after referred to as 'Indemnified' which expression shall unless repugnant to the context or meaning thereof include its representatives and assignees witnesses as to.

Whereas the indemnified herein as awarded to the indemnifier herein a Tender/Contract or for ..... on terms and conditions set out interalia in the work order No..... valued at Rs.....

AND Whereas, the clauses No..... of the above mentioned work order provides for indemnifying the indemnified by the indemnifier for any accident, damage or compensation payable to any workmen or other person in the employment of the contractor or any sub contractor during the period of tender/contract.

AND Whereas, the Indemnifier hereby irrevocably agrees to indemnify the indemnified against all damages or compensation payable at law in respect of or in consequence of any accident or injury to any workmen or other person in the employment of the contractor or sub-contractor against all claims, demands, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto and the indemnified shall be at liberty to deduct or adjust from the bills payable to the indemnifier by the indemnified for an amount that the indemnified may be called upon to pay towards claims, demands, proceedings, costs, charges and expenses whatsoever in respect of or in relation to any accident or injury referred to above without any reference to the indemnifier.

The Indemnifier shall comply with all the Central State and Muncipal Laws and Rules and shall be solely responsible for complying with the provisions of the Contract Labour (Regulations & Abolition) Act, 1970 & the contract labour (Regulation & Abolition) Karnataka Rules 1974 and rules there under and the enactments that may be applicable including ESI Act, the payment of wages act, Provident Fund Act, the Minimum Wages Act, the Factory's Act, the Workmen Compensation Act or any other applicable legislation and the Muncipal by-laws or other statutory Rules and

Regulations whatsoever in force if these are applicable. Any obligations finding or otherwise missed under any statutory enactments rules & regulations there under shall be the responsibility of the Indemnifier and the Indemnified will have no responsibility for the same. The Indemnifier shall obtain Workmen's Compensation Policy for his workers, who are not covered under ESI and submit the same to the ESIC immediately after commencement of the work.

The Indemnifier is liable to pay all Statutory Compensation to the Labourers / persons engaged by him for the satisfactory execution of the works. If any claim is made against Indemnified arising out of this work, the Port shall have the right to deduct the same from the bill amount payable to the Indemnifier after verification of the validity and if admissible as per rules.

The Indemnifier shall ensure the use of PPE such as helmets, safety shoes, nose masks, hand gloves, safety harness or any other equipment as required depending on nature of work by his staff at site.

In addition to complying of the above, the Indemnifier hereby undertakes to indemnify the indemnified against any unforeseen incidents / accidents, which may lead to fatality including death, permanent/ partial disablement, injury, financial loss, legal issues or any other etc of the labourers / workmen's/ staffs of the contractor / sub-contractor for which the indemnified and its officers / representation are in no way responsible.

For.....

INDEMINIFIER

(Signature with Name and Designation)

Company Seal

Station:

Date:

Annexure-13

Format for Self Certification under Preference to "MAKE IN INDIA" Policy

(Refer Clause No. 38 of ITT)

CERTIFICATE

In line with Government Public Procurement Order No. P-45021/2/2017-PP(B-II) dtd. 16-09-2020, as amended from time to time and as applicable on the date of submission of tender, we hereby certify that we M/s_____ (name of the Bidder) are local supplier meeting the requirement of minimum Local content (50%) as defined in above orders for the material against Tender NIT No_____ for the work of _____

_____

_____

__

Details of location at which local value addition will be made is as follows:

--- ---

We also understand, false declarations will be in breach of the Code of Integrity under Rule 175(1)(i)(h) of the General Financial Rule for which for which a bidder or its successors can be debarred for up two years as per Rule 151 (iii) of the General Financial Rules along with such other actions as may be permissible under law. Seal and Signature of Authorized Signatory

Signature of the Bidder

Date :

Place :

Annexure-14

BID SECURITY DECLARATION FORM

Date: [insert date (as day, month and year)]

NIT No: CIVIL/CE(C)/EE(C)/41/2024-25 dtd. 10-10-2024 TENDER ID: 2024_NMPT_830162_1

Name of Work : Annual maintenance of Residential & Non-residential buildings on the East of NH-66 in NMPA for the year 2024-25To:

The Executive Engineer (Civil)

New Mangalore Port Authority,

NMPA, Panambur – 575 010

I/We. The undersigned, declare that:

I/We understand that, according to your conditions, bids must be supported by a Bid security declaration

I/We accept that we will automatically be disqualified from bidding for any contract with New Mangalore Port Trust for a period of 2 (two) years starting from the date of notification from the Employer, if the undertaking of the affidavit submitted by us or our constituents in pursuance to any of the declarations of Letter of Technical Bid or Letter of Price Bid submitted by us are found to be false at any stage during the process of bid evaluation; or

I am / We are in a breach of any obligation(s) under the bid conditions, because I/We

a) have withdrawn / modified / amended, impairs or derogates from the bid, my / our Bid during the period of bid validity specified in the form of Bid; or

b) do not accept the correction of errors in accordance with the Instructions to Bidders; or

c) having been notified of the acceptance of our Bid by the employer during the period of bid validity,

   i. fail or refuse to execute the contract, if required; or

   ii. fail or refuse to furnish the Performance Security, in accordance with the Instructions to Bidders; or

iii. fail or refuse to furnish a domestic preference security, if required.

I/We understand this Bid Security Declaration shall cease to be valid if I am/we are not the successful Bidder, upon the earlier of

i. the receipt of your notification of the name of the successful Bidder; or

ii. 28 (Twenty eight) days after the expiration of the validity of my/our Bid

Signed: [insert signature of person whose name and capacity are shown]

In the capacity of [insert legal capacity of person signing the Bid-Securing Declaration]

Name: [insert complete name of person signing the Bid-security Declaration]

Duly authorized to sign the bid for and behalf of [insert complete name of the Bidder]

Dated on _____ day of _____, _____ [insert date of Signing]

Signature of the Bidder

Corporate seal [where appropriate]

SECTION - II

iii) FORM OF AGREEMENT

THIS AGREEMENT made the _____ day of _____ 20___ BETWEEN New Mangalore Port Authority (hereinafter called "the Employer") of the one part and _____ _____ _____ _____

(hereinafter called "the Contractor") of the other part WHEREAS the Employer is desirous that certain works should be executed by the Contractor, Viz---------- and has accepted a Tender by the Contractor for the execution and Completion of such works and the remedying of any defects therein at a contract price of Rs .....

NOW THIS AGREEMENT WITNESSETH as follows:

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

2. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz.-
   a) The Letter of Acceptance;
   b) The Said Tender (Technical Bid);
   c) The Conditions of Contract (Parts I and II)
   d) The Specifications;
   e) The Drawings;
   f) The Bill of Quantities and
   g) The Addenda
   h) Letters exchanged between the Employer and the Tenderer up to the issue of Letter of Acceptance as separately listed and annexed here to.

3. In consideration of the payments to be made by the Employer to the contractor as hereinafter mentioned the Contractor hereby covenants with the Employer to execute and complete the works and remedy any defects therein in conformity in all respect with the provisions of the Contract.

4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the works and the remedying of defects therein the Contract Price or and such other sum as may become payable under the Provisions of the Contract at the times and in the manner prescribed by the

Contract.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed the day and year first above written in accordance with their respective laws.

This document contains ..... pages in all. This agreement is assigned No. CEA ..... /20XX-XX.

The Common Seal of

_____

_____

was hereunto affixed in the presence of :

SECTION - III

iv) CONDITIONS OF CONTRACT

A. General

1. Definitions

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

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

Compensation Events are those defined in Clause 44.

The Completion Date is the date of completion of the Works as certified by the Engineer or his nominee in accordance with Sub Clause 54

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

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

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

The Contractor's Bid is the completed Bidding documents submitted by the Contractor to the Employer.

The Contract Price is the price stated in the letter of acceptance and thereafter as adjusted in accordance with the provisions of the Contract.

Days are calendar days, months are calendar months.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

A Variation is an instruction given by the Engineer or his nominee which varies the Works.

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

The Trained Work Person are those employed / proposed to be employed by the Contractor at the Project Site, who have participated and are in possession of a valid Competency Certificate through a programme run under the auspices of a University, State Technical Board, Ministry of Government of India.

2. Interpretation

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

2.2 If sectional completion is specified in the Contract Data, references in the

Conditions of Contract to the Works, the Completion Date, and the Intended Completion Date apply to any Section of the Works (other than references to the Completion Date and Intended Completion date for the whole of the Works).

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

(1) Agreement
(2) Letter of Acceptance and notice to proceed with works
(3) Contractor's Bid
(4) Contract Data
(5) Conditions of Contract including Special Conditions of Contract
(6) Specifications
(7) Drawings
(8) Bill of quantities and
(9) any other documents listed in the Contract Data as forming part of the Contract.

3. Language and Law

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

4. Engineer or his nominee's Decisions

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

5. Delegation

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

6. Communications

Communications between parties which are referred to in the conditions are effective only when in writing. A notice shall be effective only when it is delivered (in terms of Indian Contract Act 1872).

7. Contract Agreement

A suitable form is annexed as "FORM OF AGREEMENT" to the Contract Document. Upon signing the Contract Agreement, the Contractor shall make 10 copies of Contract Documents in hardbound cover which shall cover documents

used in Contract/Agreement and provide the same to the Employer at no extra cost.

Data made available by the Employer in accordance with provisions of the Condition of Contract shall be deemed to include data listed elsewhere in the Contract and open for inspection at the office of the Deputy Chief Engineer (Civil) of the New Mangalore Port Authority (by prior appointment with the Engineer). The work shall not be commenced without signing contract agreement.

8. Subcontracting

8.1 The Contractor may subcontract with the approval of the Engineer or his nominee but may not assign the Contract without the approval of the Employer in writing. Subcontracting does not alter the Contractor's obligations.

Other Contractors

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

9. Personnel

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

9.2 If the Engineer or his nominee asks the contractor to remove a person who is a member of the contractor's staff of his work force stating the reasons, the contractor shall ensure that the person leaves the site within seven days and has no further connections with the work in the contract.

10. Employer's and Contractor's Risks

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

11. Employer's Risks

11.1 The Employers risks are

a) in so far as they directly affect the execution of the Works in the country where the Permanent Works are to be executed:
   i) war and hostilities (whether war be declared or not), invasion, act of foreign enemies;
   ii) rebellion, revolution, insurrection, or military or usurped power, or civil war;
   iii) ionizing radiations, or contamination by radioactivity from any nuclear fuel, or from any nuclear waste, from the combustion of nuclear fuel, radioactive toxic explosive or other hazardous properties of any explosive nuclear assembly or nuclear component thereof;
   iv) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds; and
   v) riot, commotion or disorder, unless solely restricted to the employees of the Contractor or of his Subcontractors and arising from the conduct of the Works;
   vi) Unforeseen Rains (Rains if any; during the period other than the Monsoon period as stated in the Tender), floods, tornadoes, earthquakes and landslides.

b) loss or damage due to the use or occupation by the Employer of any Section or part of the Permanent Works, except as may be provided for in the Contract;

c) loss or damage to the extent that it is due to the design of the Works, other than any part of the design provided by the Contractor or for which the Contractor is responsible; and

d) any operation of the forces of nature (in so far as it occurs on the Site) which an experienced contractor:
   i) could not have reasonably foreseen, or
   ii) could reasonably have foreseen, but against which he could not reasonably have taken at least one of the following measures:
      A) prevent loss or damage to physical property from occurring by taking appropriate measures, or
      B) insure against.

12. Contractor's Risks

12.1 All risks of loss of or damage to physical property and of personal injury and death which arise during and in consequence of the performance of the

Contract other than the excepted risks are the responsibility of the Contractor.

13. Insurance

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

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

b) loss of or damage to Equipment;

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

d) personal injury or death.

13.2 Policies and certificates for insurance shall be delivered by the contractor to the Engineer or his nominee for the Engineer or his nominee's approval before the start date. All such insurances shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.

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

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

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

14. Site Investigation Reports

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

15. Queries about the Contract Data

The Engineer or his nominee will clarify queries on the Contract Data.

16. Contractor to Construct the Works

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

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

The Contractor may commence execution of the works on the Start Date and

shall carry out the works in accordance with the program submitted by the contractor as updated with the approval of the Engineer or his nominee, and complete them by the Intended Completion Date.

18. Approval by the Engineer or his nominee

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

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

18.3 The Engineer or his nominee's Approval shall not alter the contractor's responsibility for design of the Temporary Works.

18.4 All Drawings prepared by the contractor for the execution of the temporary or permanent Works, are subject to prior approval by the Engineer or his nominee before their use.

19. Safety

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

20. Discoveries

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

21. Possession of the Site

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

22. Access to the Site

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

23. Instructions

The Contractor shall carry out all instructions of the Engineer or his nominee which comply with the applicable laws where the Site is located.

24. Disputes

If the Contractor believes that a decision taken by the Engineer or his nominee was either outside the authority given to the Engineer or his nominee by the Contract or that the decision was wrongly taken, the decision shall be referred to the Dispute Review Board (DRB) within 28 days of the notification of the Engineer or his nominee's decision.

25. Settlement of Disputes

25.1 If a dispute of any kind whatsoever arises between the Employer and the Contractor in connection with, or arising out of the Contract or the execution of the Works, whether during the execution of the Works or after their completion and whether before or after repudiation or after termination of the Contract, including any disagreement by either party with any action, inaction, opinion, instruction, determination, certificate or valuation of the Engineer or his nominee, the matter in dispute shall, in the first place be referred to the Disputes Review Board [DRB] established pursuant to Appendix 1 hereto.

Unless the Contract has already been repudiated or terminated or frustrated the Contractor shall in every case, continue to proceed with the Works with all due diligence and the Contractor and the Employer shall give effect forthwith to every decision of the Engineer or his nominee unless and until the same shall be revised, as hereinafter provided, in a Dispute Review Board Recommendation / Arbitral Award.

25.2 Arbitration

Any dispute in respect of in respect of contracts where party is dissatisfied by the Dispute Review Board's (DRB) decision shall be decided by arbitration as set forth below:

i) A dispute with contractor shall be finally settled by arbitration in accordance with the Indian Arbitration and Conciliation Act, 1996, or any statutory amendment thereof. The arbitral tribunal shall consist of 3 arbitrators, one each to be appointed by the Employer and the contractor, and the third to be appointed by the mutual consent of both the arbitrators, failing which by making a reference to CIDC-SIAC Arbitration Center from their panel.

ii) Neither party shall be limited in the proceedings before such arbitrators to the evidence or arguments already put before the Engineer or his nominee or the Board, as the case may be, for the purpose of obtaining said recommendations/decision. No such recommendations/decision shall disqualify the Engineer or his nominee or any of the members of the Board, as the case may be, from being called as a witness and giving

evidence before the arbitrators or any matter whatsoever relevant to the dispute.

iii) The reference to arbitration shall proceed notwithstanding that the works shall not then be or be alleged to be complete, provided always that the obligations of the Employer, the Engineer or his nominee and the Contractor shall not be altered by reason of the arbitration being conducted during the progress of the works. Neither party shall be entitled to suspend the works to which the dispute relates, and payment to the Contractor shall be continued to be made as provided by the contract.

iv) If one of the parties fails to appoint its arbitrators in pursuance of sub-clause [i], within 14 days after receipt of the notice of the appointment of its arbitrator by the other party, then President/Chairman of the nominated Institution shall appoint arbitrator within 14 days of the receipt of the request by the nominated institution. A certified copy of the President's/ Chairman's order, making such an appointment shall be furnished to both the parties.

v) Arbitration proceedings shall be held at Mangalore, and the language of the arbitration proceedings and that of all documents and communications between the parties shall be 'English

vi) The Arbitration shall be conducted by the experts from the panel of CIDCSIAC Arbitration Center.

vii) The decision of the majority of arbitrators shall be final and binding upon both parties. The expenses of the arbitrators as determined by the arbitrators shall be shared equally by the Employer and the Contractor. However, the expenses incurred by each party in connection with the preparation, presentation, etc. of its case prior to, during and after the arbitration proceedings shall be borne by each party itself.

viii) All arbitration awards shall be in writing and shall state the reasons for the award.

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

26. Replacement of Conciliator (Deleted)

B. TIME CONTROL

27. Program

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

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

27.3 The Contractor shall submit to the Engineer on the first day of each week or such longer period as the Engineer may from time to time direct, a progress report in an approved form showing up-to-date total progress, progress achieved against planned progress, during the previous week and progress forecast for the following week for all important items in each section or portion of the Works, in relation with the approved Program.

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

28. Revised Program

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

29. Extension of the Intended Completion Date

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

29.2 The Engineer or his nominee shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Engineer or his nominee for a decision upon the effect of a

Compensation Event or Variation and submitting full supporting information. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay by this failure shall not be considered in assessing the new Intended Completion Date.

30. Delays Ordered by the Engineer or his nominee

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

31. Management Meetings

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

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

32. Early Warning

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

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

C. QUALITY CONTROL

33. Identify Defects

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

34. Tests

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

35. Defect Liability

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

35.2 Every time notice of a Defect is given, the Contractor shall correct the notified defect within the length of time specified by the Engineer or his nominee's notice. To the intent that the works shall, at or as soon as practicable after the expiration of the Defects Liability Period, be delivered to the Employer in the condition required by the Contract, fair wear and tear excepted, to the satisfaction of the Engineer, the Contractor shall :

(a) Complete the work, if any, outstanding on the date stated in the Taking-Over Certificate within the date to be intimated by the engineer and

(b) execute all such work of amendment, reconstruction, and remedying defects, shrinkages or other faults as the Engineer may, during the Defects Liability Period or within 14 days after its expiration, as a result of an inspection made by or on behalf of the Engineer prior to its expiration, instruct the Contractor to execute.

35.3 Cost of Remedying Defects

All work referred to in Sub-Clause 35.2 shall be executed by the contractor at his own cost if the necessity thereof is, in the opinion of the Engineer, due to:

a) The use of materials, Plant or workmanship not in accordance with the Contract, or

b) Where the Contractor is responsible for the design of part of the Permanent Works, any fault in such design, or the neglect or failure on the part of the Contractor to comply with any obligation, expressed or implied, on the Contractor's part under the Contract.

35.4 Defects Liability Certificate

The Contract shall not be considered as completed until a Defects Liability Certificate shall have been signed by the Engineer and delivered to the Employer, with a copy to the Contractor, stating the date on which the Contractor shall have completed his obligations to execute and complete the Works and remedy any defects therein to the Engineer's satisfaction. The Defects Liability Certificate shall be given by the Engineer within 28 days after the expiration of the Defects Liability Period, or, if different defects liability periods shall become applicable to different Sections or parts of the Permanent Works, the expiration of the latest such period, or as soon thereafter as any works instructed, pursuant to Clauses 35, have been completed to the satisfaction of the Engineer.

35.5 Unfulfilled Obligations

Notwithstanding the issue of the Defects Liability Certificate the Contractor and the Employer shall remain liable for the fulfillment of any obligation incurred under the provisions of the Contract prior to the issue of the Defects Liability Certificate which remains unperformed at the time such Defects Liability Certificate is issued and, for the purposes of determining the nature and extent of any such obligation, the Contract shall be deemed to remain in force between the parties to the Contract.

36. Uncorrected Defects.

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

D. COST CONTROL

37. Bill of Quantities

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

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

38. Changes in the Quantities

38.1 If the final quantity of the work done differs from the quantity in the Bill of Quantities for the particular item by more than +25 % provided the change exceeds +10% of initial Contract Price, the Engineer or his nominee shall adjust the rate(s), to allow for the change.

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

38.3 If requested by the Engineer or his nominee where the quoted rate(s) of any item(s) is abnormally high, the Contractor shall provide the Engineer or his nominee with a detailed cost breakdown of such rate in the Bill of Quantities.

39. Variations

39.1 The Engineer shall make any variation of the form, quality or quantity of the Works or any part thereof that may, in his opinion, be necessary and for that purpose, or if for any other reason it shall, in his opinion, be appropriate, he shall have the authority to instruct the Contractor to do and the Contractor shall do any of the following:

a) increase or decrease the quantity of any work included in the Contract,
b) omit any such work,
c) change the character or quality or kind of any such work,
d) change the levels, lines, position and dimension of any part of the Works,
e) execute additional work of any kind necessary for the completion of the Works,
f) change any specified sequence or timing of construction of any part of the Works.

No such variation shall in any way vitiate or invalidate the Contract, by the effect, if any, of all such variations shall be valued in accordance with Clause 40. Provided that where the issue of an instruction to vary the

works is necessitated by some default of or breach of contract by the contractor or for which he is responsible, any additional cost attributable to such default shall be borne by the contractor. All Variations shall be included in updated Programs produced by the contractor.

39.2 Instructions for Variations

The Contractor shall not make any such variation without an instruction of the Engineer. Provided that no instruction shall be required for increase or decrease in the quantity of any work where such increase or decrease is not the result of an instruction given under this clause, but is the result of the quantities exceeding or being less than those stated in the Bill of Quantities.

40. Payments for Variations

40.1 Variation permitted shall not exceed +25% in quantity of each individual item, and +10% of the total contract price. Within 14 days of the date of instruction for executing varied work, extra work or substitution, and before the commencement of such work, notice shall be given either (a) by the contractor to the Employer of his intention to claim extra payment or a varied rate or price, or (b) by the Employer to the contractor of his intention to vary rate or price.

40.2 For items not existing in the Bill of Quantities or substitution to items in the Bill of Quantities, rate payable should be determined by methods given below and in the order given below:

i) Rates and prices in Contract, if applicable plus escalation as per contract.

ii) Rates and prices in the Schedule of Rates applicable to the Contract plus ruling percentage.

iii) Market rates of materials and labor, hire charges of plant and machinery used, plus 10% for overheads and profits of contractor.

40.3 For items in the Bill of Quantities but where quantities have increased beyond the variation limits, the rate payable for quantity in excess of the quantity in the Bill of Quantity plus the permissible variation should be:

i) Rates and prices in contract, if reasonable plus escalation, failing which (ii) and (iii) below will apply

ii) Rates and prices in the schedule of Rates applicable to the contract plus ruling percentage.

iii) Market rates of material and labor, hire charges of plant and machinery used plus 10% for overheads and profits of contractor.

40.4 If there is delay in the Employer and the Contractor coming to an agreement on the rate of an extra item, rates as proposed by the Employer

shall be payable provisionally till such time as the rates are finally determined or till date mutually agreed.

40.5 If the Engineer or his nominee decides that the urgency of varying the work prevent a quotation being given and considers not delaying the work, no quotation shall be given and the Variation shall be treated as a Compensation Event.

41. Cash flow forecasts

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

42. Payment Certificates

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

42.2 The Engineer or his nominee shall check the Contractors' monthly statement within 14 days and certify the amount to be paid to the Contractor after taking into account any credit or debit for the month in question in respect of materials for the works in the relevant amounts and under conditions set forth in sub-clause 51.6 of the Contract Data (Secured Advance).

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

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

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

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

43. Payments

43.1 Bills /Tax invoice shall be prepared and submitted by the Contractor. Joint measurements shall be taken continuously and need not be connected with billing stage. System of 4 copies of measurements, one each for Contractor, Employer and Engineer or his nominee, and signed by both Contractor and Employer shall be followed.

43.2 75% of bill amount shall be paid within 14 days of submission of the bill. Balance amount of the verified bill shall be paid within 28 days of the submission of the bill.

43.3 Contractor shall submit final Bill within 60 days of issue of defects liability certificate. Client's Engineer or his nominee shall check the bill within 60 days after its receipt and return the bill to Contractor for corrections, if any. 50% of undisputed amount shall be paid to the Contractor at the stage of returning the bill.

43.4 The contractor should re-submit the bill, with corrections within 30 days of its return by the Engineer or his nominee. The re-submitted bill shall be checked and paid within 60 days of its receipt.

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

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

44. Compensation Events

44.1 The following mutually agreed Compensation Events unless they are caused by the Contractor would be applicable:

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

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

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

(d) The Engineer or his nominee instructs the Contractor to uncover or to carry out additional tests upon work which is then found to have

no Defects.

(e) The Engineer or his nominee unreasonably does not approve for a subcontract to be let.

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

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

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

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

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

Whenever any compensation event occurs, the contractor will notify the employer, within 14 days and provide a forecast cost of the compensation event.

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

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

45. Tax

45.1 The rates quoted by the Contractor to be inclusive of Taxes if any excluding GST that the Contractor will have to pay for the performance of this Contract. The Employer will perform such duties in regard to the deduction of such taxes at sources as per applicable law. Any new Taxes, levies, duties imposed after signing the Contract shall be reimbursed by

the employer on production of documentary evidence.

The GST shall be quoted separately in tax invoice.

The Contractor shall file the applicable returns with tax department in time and submit the same as documentary evidence.

46. Currencies

46.1 All payments shall be made in Indian Rupees unless specifically mentioned.

47. Price Adjustment. (Not Applicable)

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

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

(b) The price adjustment shall be determined during each quarter from the mutually agreed formula given in the contract data based on the following premises.

I (A) Formula for Labour Component

V1	=	0.85	x	(R-C)	x	K1 / 100	x	I – I0 / I0

Where V1 = Amount of variation payable for a value R of work done.

R = Value of work done during the period under consideration.

C = Cost of Cement & steel calculated on star rates for quantity as per design, incorporated in to the work during the period under consideration to be taken from II A and II B.

K1 = Percentage of Labour Component to be taken as 25%.

I0 = Basic Consumer Price Index for Bangalore Centre (Base 2001 = 100) for industrial workers declared as per the Labour Bureau, Ministry of Labour & Employment, Government of India as prevailing on the Base Date (28 days prior to the latest date for submission of the Bid).

I = Average Consumer Price Index for Bangalore Centre (Base 2001 = 100) for industrial workers declared by the Labour Bureau, Ministry of Labour & Employment, Government of India for the period in which the value R of work is

done. If the period covered by a bill does not coincide with a calendar month, then weighted time average for the period will be taken for I.

I (B) Formula for Balance Material Component (excluding cement, steel).

$$V2 = 0.85 \times (R-C) \times \frac{K2}{100} \times \frac{M - M0}{M0}$$

Where V2 = Amount of variation payable for a value R of work done on account of material.

R = Value of work done during the period under consideration.

C = Cost of Cement and steel at Star rate calculated on star rates for quantity as per design, incorporated in to the work during the period under consideration to be taken from II A and II B.

K2 = Percentage of Material Component to be taken as 70%.

M0= Wholesale price index for all commodities prepared by the office of Economic Advisor, Ministry of Industry, Government of India as prevailing on the Base Date (28 days prior to the latest date for submission of the Bid).

M = Average wholesale price index for all commodities prepared by the office of Economic Advisor, Ministry of Industry, Government of India, during the period under consideration. If the period covered by a bill does not coincide with a calendar month, then weighted time average for the period will be taken for M.

I (C) Formula for Petrol, Oil and Lubricant (POL) Component

$$V3 = 0.85 \times (R-C) \times \frac{K3}{100} \times \frac{P - P0}{P0}$$

Where V3 = Amount of variation payable for a value R of work done on account of POL component.

R= Value of work done during the period under consideration.

C = Cost of Cement & steel calculated on star rates for quantity as per design/specification, incorporated in to the work during the period under consideration to be taken from II A and II B .

K3 = Percentage of POL Component to be taken as 5%.

P0= The price (average of the prices declared by IOC/HPCL/BPCL) of HSD for Mangalore on the Base Date (28 days prior to the latest date for submission of the Bid).

P = Average Price (average of the prices declared by IOC/HPCL/BPCL) of HSD-

RSP (Rs/litre) for Mangalore during the period under consideration.

After removal of actual cost of cement & steel for B above, price adjustment for the cost of cement and steel will be made as follows:

Price Adjustment

(II) (A) For Cement

$$Pc = Rc \times Qcc \times \frac{Ic - I0c}{I0c}$$

Where Pc = Price adjustment for cement

R c= Rate per MT of cement prevailing on the Base Date (28 days prior to the latest date for submission of the Bid) i.e. Star Rate.

Ic = Average Index for cement published by the Reserve Bank of India (source: office of the economic advisor, Ministry of commerce & Industry Government of India) under "Index numbers of Wholesale Prices by Group and Sub-Groups (Monthly data) under Group (1) – Non Metallic Mineral Products Sub-Group (C) – Cement and Lime, " or Monthly whole sale price index published by the office of economic advisor, government of India under cement & Lime forming the base forming the base of calculation for index of wholesale prices during the period under consideration.

Ioc = Index for cement published by the Reserve Bank of India (source: office of the economic advisor, Ministry of commerce & Industry Government of India) under Index numbers of Wholesale Prices by Group and Sub-Group (Monthly data) under Group (1) – Non Metallic Mineral Products Sub-Group (C) – Cement & Lime or Monthly whole sale price index published by the office of economic advisor, government of India under cement & Lime forming the base of calculation for index of wholesale prices on the date 28 days preceding the latest date prescribed for the receipt of the Bid.

Qcc= Quantity in MT of cement as per design incorporated in to the work during the period under consideration.

II (B) For Steel

$$Ps = Rs \times Qsc \times \frac{Is - I0s}{I0s}$$

Where Ps = Price adjustment for steel

Rs= Rate per MT of steel prevailing on the Base Date (28 days prior to the latest date for submission of the Bid). i.e. Star rate.

Is = Average Index for iron and steel published by the Reserve Bank of India

(source: office of the economic advisor, Ministry of commerce & Industry Government of India) under "Index numbers of Wholesale Prices by Group and Sub-Groups (Monthly data) under Group (J) – Basic Metals, Alloys & Metal Products, Sub-Group (a) Ferrous metals – (a1) Iron & Semis" or Monthly whole sale price index published by the office of economic advisor, government of India under Iron & Semis forming the base of calculation for index of wholesale prices during the period under consideration.

a. Ios = Average Index for Iron and Steel published by the Reserve Bank of India (source: office of the economic advisor, Ministry of commerce & Industry Government of India) under "Index numbers of Wholesale Prices by Group and Sub-Groups (Monthly data) under Group (J) – Basic Metals, Alloys & Metal Products, Sub-Group (a) Ferrous metals – (a1) Iron & Semis" or Monthly whole sale price index published by the office of economic advisor, government of India under Iron & Semis forming the base forming the base of calculation for index of prices on the date 28 days preceding the latest date prescribed for the receipt of the Bid.

   Qsc = Quantity in MT of steel as per design incorporated in to the work during the period under consideration.

   Notes:

   (i) The quantities of cement and steel considered for working out price variation shall be certified by the Engineer based on approved designs and as consumed in the work excluding wastage.

   (ii) The time for completion of the contract shall mean the period commencing from the date of the commencement of the contract and ending on the date when the time allowed for the work specified expires, taking into consideration the extension of time, if any, for completion of the work granted by the Engineer under the relevant clause or the conditions of contract in cases other than those where such extension is necessitated on account of default of the contractor. The decision of the Engineer as regards the time of completion of the contract shall be final, conclusive and binding on the contractor, where compensation for delay is levied on the contractor on account of delay in completion or inadequate progress under the relevant contract provision the escalation amount for the balance work from the date of levy of such compensation shall be worked out as follows:

   Indices I, M, P, Ic, & Is will be pegged to the levels corresponding to the date from which such compensation for delay is levied.

b. Pegged indices as well as actual indices prevailing at the time of calculation of escalation for the period under consideration will be compared and lower

of the two will be taken for calculating actual escalation amount.

(iii) Price variation shall be calculated in accordance with the formulae mentioned at (I)(A)(B) above, separately for labour, material and POL components, as well as for price adjustment for cement and steel in accordance with formulae mentioned at (II) (A) and(B) above. The relevant websites for ascertaining the various indices are as follows:
http://www.iocl.com/Products/HighSpeedDiesel.aspx
http://rbidocs.rbi.org.in/rdocs/Bulletin/PDFs/38T_BUL110610.pdf
http://labourbureau.gov.in/indtab.pdfindiabudget.nic.in/es2006-07/chapt2007/tab53.pdf
http://www.eaindustry.nic.in/default.html
http://labourbureau.nic.in/indnum.htm

(iv) The price variation under clause 47.1 shall not be payable for the extra items required to be executed during the progress of the work and where the rates payable for the extra items have been fixed as per the current market rates provided under Clause of General Conditions of Contract or mutually agreed.

(v) The clause No.47.1 is operative both ways, i.e. if the price variation in the said Wholesale Price Index for all commodities, Consumer Price Index (New Series) or price of HSD of Bangalore or cost of cement or steel or bitumen is on the plus side, payment on account of the price variation shall be allowed to the Contractor and if it is on the negative side, the NMPA shall be entitled to recover the same from the contractor and the amount shall be deductible from the Contractor's bill for the respective period in which there are fluctuation.

(vi) In order to facilitate computation of price variation to be made under clause 47.1 the contractor shall keep such books of accounts and other documents as are necessary. The contractor shall allow inspection of the same by an Engineer or his nominee and shall at the request of the Engineer may require true copies of any document so kept and such other information as the Engineer may require for verification.

(vii) Calculation of Price Variation and Price Adjustment amount at the time of preparation of interim and final bill will be based on confirm indices and the prices of the POL products and bitumen products declared by IOC/BPCL/HPCL.

(viii) Save and except for what is provided in the foregoing clause, nothing herein shall be construed to entitle the contractor to reimbursement of any increase in the price of materials or in the wages of labour occurring at any time and for any reason whatsoever, including the

imposition of any tax, duty or fee or an increase in the price of any petroleum product, coal, electricity or water effected by or under the order of the Central Government of a State Government.

(ix) The basic price (star rate) will be fixed as per the prevailing rate at the time of invitation of the tender before 28 days from date of submission of the tenders.

(x) The mobilization and de-mobilization shall not be considered for calculation of Price Variations and the price variation for the items quoted on Lump sum basis shall not be payable .

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

47.3 Subsequent Legislation

If, after the date 28 (Twenty eight) days prior to the date for submission of tenders for the contract there occur changes to any National or Statute Stature, Ordinance or Decree or other Law or any regulation or bye law of any local or other duly constituted authority or introduction of any such state statute, Ordinance, Decree, Law, regulation or bye law which causes additional or reduced cost to the contractor in execution of the contract, such additional or reduced cost shall, after due consultation with the Employer and the contractor be determined by the Engineer or his nominee and shall be added to or deducted from the contract price and the Engineer or his nominee shall notify the contractor accordingly with a copy to the Employer.

48. Retention

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

48.2 Retention Money shall be deducted at the rate of 10% from first Running Bill onwards subject to a max. of 5% of the contract price (Contract price including GST). Retention money shall be refunded after completion of defect liability period along with performance security.

49. Liquidated Damages

49A In case of delay in completion of the contract, liquidated damages (L.D) may be levied at the rate of half per cent (½%) of the contract price per week of delay, or part thereof subject to a maximum of 10 per cent of the

contract price.

49A(i) The Employer, if satisfied, that the works can be completed by the contractor within a reasonable time after the specified time for completion, may allow further extension of time at its discretion with or without the levy of L.D. In the event of extension granted being with L.D, the Employer will be entitled without prejudice to any other right or remedy available in that behalf, to recover from the contractor as agreed damages equivalent to half per cent (½%) of the contract value of the works for each week or part of the week subject to the ceiling defined in sub-Clause 49 A. In the event of forfeiting the LD/EMD/SD performance guaranty and while imposing penalty GST at applicable rate is applicable.

49A(ii) The Employer, if not satisfied that the works can be completed by the contractor, and in the event of failure on the part of the contractor to complete work within further extension of time allowed as aforesaid, shall be entitled, without prejudice to any other right, or remedy available in that behalf, to rescind the contract.

49A(iii) The Employer, if not satisfied with the progress of the contract and in the event of failure of the contractor to recoup the delays in the mutually agreed time frame, shall be entitled to terminate the contract.

49A(iv) In the event of such termination of the contract as described in clauses 49A(ii) or 49A(iii) or both the Employer shall be entitled to recover L.D. up to ten per cent (10%) of the contract value and forfeit the security deposit made by the contractor besides getting the work completed by other means at the risk and cost of the contractor.

49A(v) In case Part / portions of the work can be commissioned and the Port operates the portion for commercial purposes, the rate of LD will be restricted to the uncompleted value of work, the maximum LD being on the entire contract value.

50. Nominated Subcontractors

All specialists, merchants, tradesmen and others executing any work or supplying any good, materials, Plant or services for which provisional Sums are included in the Contract, who may have been or be nominated or selected or approved by the Employer or the Engineer, and all persons to whom by virtue of the provisions of the Contract, the Contractor is required to subcontract shall, in the execution of such work or the supply of such goods, materials, Plant or services, be deemed to be subcontractors to the Contractor and are referred to in this Contract as "Nominated Subcontractors".

51. Advance payment (not applicable)

The Employer shall make the following advance payments:

51.1 Mobilization Advance shall be paid up to 10% of Contract price, payable in two equal installments. The first installment shall be paid after mobilization has started and next installment shall be paid after satisfactory utilisation of earlier advance.

51.2 Construction / installation equipment Advance shall be paid up to 5% of Contract price, limited to 90% of assessed cost of machinery.

51.3 Mobilization Advance and Construction Equipment Advance shall be paid at SBI PLR + 2% p.a. (as on date of payment) interest rate at the discretion of the employer and against Bank Guarantee for Mobilization Advance and against hypothecation of Construction Equipment to the Employer.

51.4 Equipment advance will be paid in two or more installments. First installment shall be paid after Construction Equipment has arrived at the site and next installment shall be paid after satisfactory utilization of earlier advance (s).

51.5 Recovery of Mobilization and Construction Equipment advance will start when 15% of the work is executed and recovery of total advance should be completed by the time 80% of the original Contract work is executed.

51.6 Secured Advance:The Engineer or his nominee shall make advance payment in respect of materials and plant brought to site but not yet incorporated and installed in the Works in accordance with conditions stipulated in the Contract Data.

75% of cost of materials and plant brought to site for incorporation into the works only shall be paid as Secured Advance. Materials which are of perishable nature should be adequately insured.

52. Securities

52.1 Security deposit shall consist of two parts

a) Performance security to be submitted at award of the work

b) Retention Money to be recovered from Running Bills.

52.2 The Security Deposit at 10% of the Contract amount including GST of which 5% of contract price should be submitted as Bank Guarantee within 21 days of receipt of letter of acceptance and balance 5% recovered as retention money from running bills. Recovery of 5% of retention money shall commence from the first RA bill onwards @ 10% for each bill. The retention money shall be refunded after completion of defect liability period. The performance Bank Guarantee will be released after completion of defect liability period.

53. Removal of Craft or Plant which has sunk (not applicable to this contract)

The Contractor shall forthwith and with dispatch at his own cost raise and remove any craft or plant (floating or otherwise) belonging to him or to any sub-contractor employed by him (including also any plant which is held by the Contractor or any sub-contractor under agreement for hire or hire-purchase) which may be sunk in the course of the construction completion or maintenance of the Works or otherwise deal with the same as the Engineer may direct or until the same shall be raised and removed, the contractor shall set al such buoys and display at night such lights and do all such things for the safety of navigation as may be required by the Engineer or by Employer. In the event of the Contractor not carrying out his obligation imposed upon him by this clause the Employer may provide buoy and light such sunken craft or plant and raise and remove the same (without prejudice to the right of the Employer to hold the Contractor liable under General Conditions) and the Contractor shall refund to the Employer all costs incurred in connection therewith.

Contractor's Temporary Moorings

Should the Contractor need, in connection with implementing the Works, to provide temporary moorings for his craft he may be allowed to do so in location and manner approved by the Engineer subject to all necessary permissions being first obtained by the Contractor from the authorities concerned. The Contractor shall not lay his temporary moorings such as to interfere with the port traffic and such moorings shall be removed if and when required by the Employer.

54. Cost of Repairs

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

E. FINISHING THE CONTRACT

55. Completion

After completion of the work, the contractor will serve a written notice to the Engineer or his nominee/Employer to this effect. The Engineer or his nominee/Employer upon receipt of this notice shall conduct a complete joint survey of the work within 7 days and prepare a defects list jointly. The defects pointed out by the Engineer or his nominee/Employer would be rectified by the contractor within 14 days and thereafter acceptance report be signed jointly by the contractor and the Employer. This joint acceptance report shall be treated as 'Completion Certificate'.

56. Taking Over

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

57. Final Account

The Contractor shall supply to the Engineer or his nominee a detailed account of the total amount that the Contractor considers payable under the Contract before the end of the Defects Liability Period. The Engineer or his nominee shall issue a Defects Liability Certificate and certify any final payment that is due to the Contractor within 60 days of receiving the Contractor's account if it is correct and complete. If it is not, the Engineer or his nominee shall issue within 15 days a schedule that states the scope of the corrections or additions that are necessary for the correction and certify payment of 50% of the undisputed amount to the contractor. If the Final Account is still unsatisfactory after it has been resubmitted the Engineer or his nominee shall decide on the amount payable to the Contractor and issue a payment certificate, within 60 days of receiving the Contractor's revised account.

58. Submission of 'As built Drawings'

"As built" Drawings are required to be submitted by the Contractor and shall be supplied by them by the dates stated in the Contract Data. If the Contractor does not supply the Drawings and/or manuals by the dates stated in the Contract Data, or they do not receive the Engineer or his nominee's approval, the Engineer or his nominee shall withhold the amount stated in the Contract Data from payments due to the Contractor.

59. Termination

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

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

(a) The Contractor stops work for 28 days when no stoppage of work

is shown on the current Program and the stoppage has not been authorized by the Engineer or his nominee.

(b) The Engineer or his nominee instructs the Contractor to delay the progress of the Works and the instruction is not withdrawn within 28 days.

(c) The Employer or the Contractor becomes bankrupt or goes into liquidation other than for a reconstruction restructure or amalgamation.

(d) a payment certified by the Engineer or his nominee is not paid by the Employer to the Contractor within 50 days of the date of the Engineer or his nominee's certificate:

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

(f) The Contractor does not maintain a security which is required.

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

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

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

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

59.4 Notwithstanding the above, the Employer may terminate the Contract for convenience subject to payment of compensation to the contractor including loss of profit on uncompleted works. Loss of profit shall be calculated on the same basis as adopted for calculation of

extra/additional items.

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

60. Payment upon Termination

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

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

61. Property

All materials on the Site, Plant, Equipment, Temporary Works and Works for which payment has been made to the contractor by the Employer, are deemed to be the property of the Employer, if the Contract is terminated because of a Contractor's default.

62. Release from Performance

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

F. SPECIAL CONDITIONS OF CONTRACT

The conditions of contract shall be the general conditions of contract in Section-III (v) as modified or added by the following condition of special conditions as provided in Section – III(vi) herein, which shall be read and construed with the general condition in Section – 3 A to E as if they were incorporated therein. In so far as any of the condition of the special conditions may conflict or be in consisting with any of general conditions of in Section -3F- Special condition of the contract shall prevail.

63. Labour

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

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

64. Compliance with labour regulations

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

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

65. Safety, Security and Protection of the Environment.

Subject and without prejudice to any other provision of the Contract, the Contractor shall take all reasonable precautions:

(a) In connection with underground water resources (including percolating water) to prevent

(i) Any interference with the supply to or abstraction from such sources

(ii) Pollution of the water so as to affect adversely the quality thereof.

(b) All works shall be carried out without unreasonable noise and disturbance. The Contractor shall indemnify the Employer from and against any liability for damages on account of noise or other disturbance created while or in carrying out the work and from and against all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in regard or in relation to such liability.

(c) The Contractor at his own cost shall make such provisions for lighting of Works, Temporary Works, Materials and Plant and shall provide all such marks and lights as may be required by the Employer or the Engineer or any other authority having jurisdiction over the Site together with all labour stores and services required for their efficient working and use at any time, day or night.

The Contractor shall also provide at his own cost every description of watching and maintenance required in connection with the foregoing, and all other services for protecting and securing all places dangerous whether to Contractor's workmen or to other persons until the Works are handed over to the Employer, or till such time when the Engineer decides that such services are no longer required.

All lights provided by the Contractor shall be placed or screened such as not to interfere with any navigation lights or with any traffic or signal lights of any local or other authority.

66. Insurance of Works and Contractor's Equipment

The Insurance shall be issued by Nationalized Insurance Company from its Mangalore Branch which has been determined by the Contractor to be acceptable to the Employer.

The contractor shall at his own costs and expenses obtain and shall cause any subcontractor to obtain such insurance as may be necessary to cover the liability of the contractor or as the case may be of such subcontractor in

respect of personal injuries and death arising out of or in the course of or caused during the execution of the works for a minimum amount of Rs. 25 lakhs and shall produce or cause any such subcontractor to produce for inspection the relevant policy or policies together with receipt for the premium paid under such policy/policies as and when required by the Employer.

i. The Employer (NMPA) shall not be liable for any accident, damage or compensation payable to any workman or other person in the employment of the Contractor or any Subcontractor.
ii. Employer Liability Insurance: The Contractor shall indemnify and keep indemnified the Employer i.e. NMPA against all damages or compensation payable at Law in respect of or in consequence of any accident or injury to any workman or other person in the employment of the Contractor or Sub-Contractor against all claims, demands, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto and the Employer shall be at liberty to deduct or adjust from the Contactor's bills an amount that Employer may be called upon to pay towards claims, demands, proceedings, costs, charges and expenses Whatsoever in respect of or in relation to any accident or injury referred to above without any reference to the Contractor.
iii. The Contractor shall comply with all the Central State and Municipal Laws and Rules and shall be solely responsible for complying with the provisions of the Contract Labour (Regulations & Abolition) Act, 1970 & the contract labour (Regulation & Abolition) Karnataka Rules 1974 and rules there under and the enactments that may be applicable including ESI Act, the payment of wages act, Provident Fund Act, the Minimum Wages Act, the Factory's Act. The Workmen Compensation Act or any other applicable legislation and the Municipal by-laws or other statutory Rules and Regulations whatsoever in force if these are applicable. Any obligations finding or otherwise missed under any statutory enactments, rules & regulations there under shall be the responsibility of the Contractor and the NMPA will take no responsibility for the same. The Contractor should take Workmen's Compensation Policy for his Workers, who are not covered under ESI and submit the same to the EIC immediately after commencement of the work.
iv. The Contractor is liable to pay all Statutory Compensation to the Labourers/persons engaged by him for the satisfactory execution of the works. lf any claim is made against New Mangalore Port Authority on this work, the Port Authority shall have the right to deduct the same from the bill amount payable to the contractor after verification of the validity and if admissible as per rules.
v. PERSONAL PROTECTIVE EQUIPMENTS The Contractor shall ensure the use of PPE such as helmets, safety shoes, nose masks, hand gloves, Safety Harness or any other equipment as required depending on nature of work by his staff at site.

67. War Risks Insurance

If the Contractor receives instructions from the Employer to insure against war risks, such insurance if normally available shall be effected, at the cost of the Employer, with the Insurance Company acceptable to the Employer and shall be in the joint names of the Employer and the Contractor.

68. Royalty

Except where otherwise stated, the contractor shall pay to the authority all tonnage and other royalties, rent and other payments or compensation if any, for getting stone, sand, gravel, clay or other materials by him and his subordinates and his subcontractors and required for the works, at the rates and such conditions as notified by the State Government. The applicable rates for royalty is enclosed as Schedule-A in Volume –III. The contractor should submit the Mineral Dispatch Permit (MDP) in original for the quantity executed by the contractor for the requisite quantity of material incorporated in works for which MDP is issued by the authorized supplier. If contractor fails to submit the MDP in original the amount equal to 5 times the royalty charges shall be deducted from the contractor's bills as per prevailing orders issued by the Authority.

69. Transport of Contractor's Equipment or Temporary Works

If it is found necessary for the Contractor to move one or more loads of heavy constructional plant or equipment materials or pre-constructed units or parts of units of work over roads, highways or bridges on which such oversized and over weight items are not normally allowed to be moved, the Contractor shall obtain prior permission from the concerned authorities. Payments for complying with the requirements, if any, for protection of or strengthening of the roads, highways or bridges shall be deemed to be included in his contract price.

70. Transport of Materials or Plant

The contractor shall save harmless and indemnify the Employer in respect of all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of or in relation to any claim made by the concerned authorities in respect of damage or injury to roads, highways or bridges. In case of failure of the Contractor to settle such claims and in case the Employer is held responsible for payment to the authorities, then the Employer shall settle the claim and the Employer's expenses in this regard, as certified by the Engineer, may be deducted by the Employer from any money due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly with a copy to the Employer.

71. Labor Laws & Regulations

The Contractor shall at all times during the continuance of the Contract comply fully with all existing Acts, regulations and bye-laws including all statutory amendments and re-enactment of State or Central Govt. and other local authorities and any other enactments and act that may be passed in future either by the State or the Central Govt. or local authority, including Indian Workmen's Compensation Act, Contract Labour (Regulation And Abolition) Act 1970 and Equal Remuneration Act 1976, Employees' State Insurance Act, 1948, Factories Act, Minimum Wages Act, Provident Fund Regulations. Employees' Provident Fund Act and schemes made under the same Act, Health and Sanitary Arrangements for Workmen, Insurance and other benefits and shall keep the Employer indemnified in case any action is commenced for contravention by the Contractor. If the Employer is caused to pay or reimburse any amounts as may be necessary to cause or observe, or for non-observance of the provisions stipulated here-forth on the part of the Contractor, the Engineer shall have the right to recover from the Contractor any sum required estimated to be required for making good the loss or damage suffered by the Employer. The Tenderers must have valid ESI and PF registration and shall maintain the records prescribed under ESI Regulations and PF Act & make the contribution towards ESI and PF in respect of persons employed by the Contractor. These contributions on the part of Employer paid by the contractor shall be reimbursed by the Engineer –in –charge to the contractor on actual basis. The contractor shall make available such records for inspection by ESI and PF authorities during inspection and furnish the copies of such records to the employer regularly. The EPF and ESI contribution on the part of the employer in respect of this contract shall be paid by the contractor. These contributions on the part of Employer paid by the contractor shall be reimbursed by the Engineer –in –charge to the contractor on actual basis. The minimum wages applicable for Mangalore City is enclosed as Schedule – B in Volume – III.

71.1. Accident Prevention/Safety Officer

The Contractor shall have on his staff on site an officer dealing with all matters regarding safety and protection against, accidents of all staff and labour. This officer shall be qualified for this work and shall have the authority to issue instructions and shall take protective measures to prevent accidents.

71.2 Disorderly Conduct

The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst his staff and labour and for the preservation of peace and protection of Persons and

property in the neighborhood of the Works from the same.

71.3 Health and Safety

Due precautions shall be taken by the Contractor, and at his own cost, to ensure the safety of his staff and labour and, in collaboration with and to the requirements of the local health authorities, to ensure that medical staff, first aid equipment and stores, sick bay and suitable ambulance services are available at the camps, housing and on the site at all times throughout the period of the Contract and that suitable arrangements are made for the prevention of epidemics and for all necessary welfare and hygiene requirements.

71.4 Supply of Water

The Contractor shall, so far as is reasonably practicable, having regard to local conditions provide on the Site, to the satisfaction of the Engineer's Representative, an adequate supply of drinking and other water for the use of the Contractor's staff and work people.

71.5 Alcoholic Liquor or Drugs

The Contractor shall not, otherwise than in accordance with the Statues, Ordinances and Government Regulations or Orders for the time being in force, import, sell, give, barter or otherwise dispose of any alcoholic liquor, or drugs or permit or suffer any such importation, sale, and gift, barter disposal by his sub-contractions agents or employees.

71.6 Arms and Ammunition

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

71.7 Festivals and Religious Customs

The Contractor shall in all dealings with labour in his employment have due regard to all recognized festivals, days of rest and religious or other customs.

71.8 Epidemics

In the event of any outbreak of illness of an epidemic nature, the Contractor shall comply with and carry out such regulations, orders and requirements as may be made by the Govt., or the local medical or sanitary authorities for the purpose of dealing with and overcoming the same.

71.9 Employment of Person in the Service of Others

The Contractor shall not recruit or attempt to recruit his staff and labour from amongst persons in the service of the Employer or other agencies engaged for any works of the Employer.

71.10 Housing for Labour

Save in so far as the Contract otherwise provides, the Contractor shall provide and maintain such accommodation and amenities as he may consider necessary for all his staff and labour employed for the purposes of or in connection with the Contract, including all fencing water supply (both for drinking and other purposes), electricity supply, sanitation, cook houses fire prevention and fire-fighting equipment, **crèche for children** of his staff and labour employed for the purposes, furniture other requirements in connection with such accommodation or amenities. On completion of the Contract, unless otherwise agreed with the Employer, the temporary camps/housing provided by the Contractor shall be removed and the site reinstated to its original condition, all to the approval of the Engineer. The land for construction of labour camps shall be allotted outside the security area to the extent available and such area allotted for labour camps will be charged a ground rent at TAMP approved rates depending upon the location. The ground rent is liable for change as per the prevailing TAMP rates from time to time during the currency of the contract.

71.11 Fair Wages, Records, Inspection

The Contractor shall pay the labourers engaged by him on the work not less than a fair wage which expression shall mean whether for time or piecework the respective rates of wages as fixed by the Public Works Department as fair wages for Dakshina Kannada District payable to the different categories of labourers of those notified under the Minimum Wages Act.

The Contractor shall maintain records of Wages and other remuneration paid to his employee in such form as may be convenient and to the requirements of the Employer/Engineer and the Labour Enforcement Officer (Central), Ministry of Labour, Govt. of India, or such other authorized person appointed by the Central Govt. The Contractor shall allow inspection of the aforesaid Wage Records and Wage Slips to the Engineer and to any of his workers or to his agent at a convenient time and place after due notice is received, or to any other person authorized by him on his behalf.

71.12 Reporting of Accidents

The Contractor shall report to the Engineer details of any accident as soon as possible after its occurrence. In the case of any fatality or serious accident, the Contractor shall, in addition, notify the local police authorities immediately by the available means.

71.13 Observance by Sub-Contractors

The Contractor shall be responsible for observance by his sub-contractors of the foregoing provisions.

71.14 Port Entry Permission(Not applicable to this contract)

The Contractor shall submit prior application for Port entry passes to the concerned Port authority for his Materials, labours and the staffs engaged in the works. The Contractor has to get the vehicle and labour RIFD based passes for the entry inside the wharf area based on prevailing rates.

71.15 Site - Protected Area (Not applicable to this contract)

The Site of Work is a protected area. Entry to the Port premises is regulated by entry passes. These passes will be issued by the Central Industrial Security Force or any other authority authorized by the Employer. The Contractor should furnish a list of person for whom the passes are to be issued to the Engineer and arrange to obtain the passes from the appropriate authority, based on the recommendation of the Engineer and abide by the Rules of the New Mangalore Port Authority with regard to entry etc. For the entry of trucks and other vehicles also, the Contractor should obtain necessary permits.

The Contractor shall retain the original passes obtained by them in respect of their labour and staffs engaged in the Works and produce the same to the Engineer as and when called for. It should not be either destroyed or allowed to be taken by the labour/staff after its use.

The entry and exit of construction equipment, Plants, construction materials etc., into the Port premises is also regulated by Gate passes. These gate passes will be issued by the Engineer and the Contractor shall produce the same at the security Gate during the entry and exit of the materials. The duplicate copy of the inward pass shall be retained by the Contractor and shall be produced at the Gate during the exit of the materials along with the outward gate pass.

72. Life Saving Appliances and First Aid

The Contractor shall provide and maintain upon the Works sufficient proper and efficient lifesaving appliances and first aid equipment to the approval of the Engineer. The appliances and equipment shall be available for use at all times.

73. Diving Operations (Not Applicable)

a) Any diving work shall be carried out in accordance with the Diving Operations Regulations of the Government of India.

b) Before any diving work is undertaken the Contractor shall supply the Engineer or his representative with two copies of the Code of signals to

be employed and is to have a copy of such Code Prominently displayed on the craft or structure from which the operations take place

74. Bribes

If the Contractor, or any of his Subcontractors, agents or servants gives or offers to give to any person any bribe, gift, gratuity or commission as an inducement or reward for doing or forbearing to do any action in relation to the Contract or any other contract with the Employer, or for showing or forbearing to show favour or disfavor to any person in relation to the Contract or to any other contract with the Employer, then the Employer may enter upon the Site and the works and terminate the employment of the Contractor and the provisions of Clause 63 hereof shall apply as if such entry and termination had been made pursuant to that Clause.

The bidders shall give an undertaking that they have not made any payment or illegal gratification to any person/authority connected with the bid process so as to influence the bid process and have not committed any offence under the PC Act in connection with the bid.

The bidders shall disclose any payments made or proposed to be made to any intermediaries (agents etc) in connection with the bid.

75. Details to be Confidential

The Contractor shall treat the details of the contract as private and confidential, save insofar as may be necessary for the purposes thereof, and shall not publish or disclose the same or any particulars thereof in any trade or technical paper of elsewhere without the previous consent in writing of the employer. If any dispute arises as to the necessity of any publication or disclosure for the purpose of the Contract the same shall be referred to the decision of the Employer whose award shall be final.

76. Contractor's Temporary works, office, etc.

76.1 The Contractor shall submit to the Engineer for his approval not less than 15 days before commencement of erection of any part of Temporary Works, drawings and detailed proposals for the method of construction of Temporary works such as office, store, false work and temporary platforms etc. which he intends to construct for the execution of the contract and no such work shall be constructed before obtaining the written approval of Chief Engineer. These temporary works, office, store etc. shall be erected at or near the work area subject to approval of the Employer and the land space for the same will be allotted free of ground rent to the extent available. The Contractor shall obtain permission for any Temporary Works and would ensure that during execution of

works the statutory requirements of the concerned authorities such as New Mangalore Port Authority, Police, Customs, etc. would be complied with.

76.2 Submission of Reports, Returns, etc.

All reports, statements, returns, drawings, diagrams etc. which the Contractor is required to submit to the Engineer during the progress of the Works, shall be furnished in triplicate without any additional cost.

77. Water Supply

Water to the extent available will be supplied to the Contractor at a fixed point on the main water supply line within the Port area. The plumbing connection and extension of necessary supply pipeline to the working area shall be arranged by the Contractor at his own cost. The Contractor shall also provide a water meter at his cost for metering the quantity of water used. Charges for the consumption of the water will be paid by the Contractor to the Employer at theprevailingrate notified time to time during the currency of the Contract. For non-supply of water at any stage port will not be responsible and the Contractor shall not have any claim whatever for loss or damage.

78. Power Supply

The Electricity connection for lighting, welding and other mechanical works to the extent available will be made available by the Employer within the Port area. Drawing of power lines etc. from the available point of supply of power to the actual work site either by overhead lines or underground cables shall be arranged by the contractor at his cost. The temporary lines and connections by the Contractor shall be approved by the Engineer's representative before availing power. The Contractor shall provide Trivector Meter to read consumption in units, power demand and power factor.

The Contractor shall indicate his requirement of power to the Engineer within 15 days from the date of the letter of acceptance of the tender. If the power requirement is more than 50 KW, the Contractor has to avail the power supply at 11 KV and install his own transformer of suitable capacity and work carried out as per IE Rules & Regulations as approved by the CEA. The Contractor shall pay to the Employer, the power charges as per the prevailing Tariff schedule of MESCOM in force during the work of the Contractor with applicable demand charges and security deposit along with departmental charges @ 23.75% of the bill amount. The Contractor shall also pay the connection and disconnection charges as applicable.

The Contractor shall ensure that the power factor of the system does not fall below 0.90 at any time and shall provide at his cost required capacity capacitors bank to maintain the Power Factor of all power loads. If the capacity of the capacitor found less than stipulated as per regulation during inspection, surcharge at Rs. 0.03 per unit will be levied. The contractor shall pay refundable Security Deposit before availing the power supply.

The Contractor shall submit a complete drawing of the power points, wiring, diagram indicating all electrical loads, earthing etc. in complete shape along with the completion report. The Trivector Meter provided is calibrated either by M/s. MESCOM or NITK, Surathkal, and such a Certificate to be produced. For non supply of power at any stage port will not be responsible and the Contractor shall not have any claim whatever for loss or damage.

79. Taxes and Duties

79.1 The Contractor shall pay tax if any, and other levies as applicable from time to time. GST at applicable rate shall be shown separate line items in the tax invoice.

79.2 Sales / Turnover Tax on Works Contract **(DELETED)**

79.3 Income Tax

The Contractor and his staff shall be responsible for payment of all personal income taxes to the concerned authorities as per the law in force from time to time. Deduction of Income Tax shall be made by the Employer from each certificate of payment to the contractor at the rate of 2% plus surcharge or such other rates as may be specified by the Central Government from time to time, on the gross amount of the Contractor's bill for payment.

79.4 Goods and Service Tax

The contractor shall not include GST component in rate. The GST shall be paid to the contractor separately as applicable. The contractor shall submit running account bills indicating GST separately as applicable. The Contractor shall be responsible for the payment of GST applicable, to the GST authority.

80. Price Adjustment (not applicable to this contract)

The following clause shall be read in continuation to clause no. 47 of GCC. The sanction towards the compensation for escalation or deduction on account of de-escalation and the amount thus sanctioned will be included in the next running account bill or final bill as the case may be. The cost of work for which escalation/de-escalation is applicable / deductible shall be worked out as per cl. 32.8.6.1., CPWD works manual, 2003.

The cost of work for which escalation/de-escalation is applicable / deductible shall be worked out as below:

(a) Gross value of work done up to this quarter (A)
(b) Gross value of work done up to the last quarter (B)
(c) Gross value of work done since previous quarter (a) – (b) (C)
(d) Full assessed value of SA fresh paid in this quarter (D)
(e) Full assessed value of SA recovered in this quarter (E)
(f) Full assessed value of SA for which escalation is payable in this quarter (d) – (e) (F)
(g) Advance payment made during the quarter (G)
(h) Advance payment recovered during the quarter (H)
(i) Advance payment for which escalation is payable in this quarter (g)– (h) (I)
(j) EI paid based on prevailing M/R during the quarter (J)

$$X = C \pm F \pm I - J$$

$$Y = 0.85\ X$$

(k) Less cost of materials supplied by the department & recovered during the quarter (K)
(l) Less cost of services tendered at fixed charges & recovered during the quarter (L)
(m) Cost of work for which escalation/de-escalation is applicable W=Y – (K + L)

81. Noise and Disturbance

All works shall be carried out without unreasonable noise and disturbance. The Contractor shall indemnify the Employer from and against any liability for damages on account of noise or other disturbance created while or in carrying out the work and from and against all claims demands proceedings damages costs charges and expenses whatsoever in regard or in relation to such liability.

82. Safety Code

Necessary Indian Safety regulations for the safety purpose shall be adhered to by the contractor and he will be held responsible for any violations of the same. The set of such conditions (regulation) is available with NMPA and the contractor is required to go through it before tendering.
Besides the above, the Contractor shall also scrupulously adhere to and observe the following safety codes:
The Contractor has to provide sufficient barricades to site of work so that traffic plying nearby should not damage the recently concreted work. In case of any damage on account of above, the entire responsibility will remain with contractor and nothing extra will be paid on this account.
Suitable and strong scaffolds should be provided for the workmen for all work that cannot be safely done from ground. No portable single ladder shall be over 8 meters in length.

Hoisting machines and tackles used in the works including their attachments, and supports shall be in perfect condition as per stipulations of the relevant Rules. The ropes used for hoisting or lowering materials or as means or suspension shall be of durable quality and adequate strength and free from defects.

The excavated material shall no be placed within 1.5 meters of the edge of the trench or half of the depth of the trench, whichever is more. All trenches and excavation shall be provided with necessary fencing to lighting. Every opening in the floor of a building or in a working platform shall be provided with suitable fence to prevent the fall of persons or materials. No floor, roof or other parts of the structure shall be so overloaded with debris or materials as to render it unsafe.

Workers employed on mixing and handling materials such cement, cement mortar, concrete, lime mortar and asphalt shall be provided with protective footwear and rubber hand gloves and thin cloth for covering face and head.

Those engaged in welding work shall be provided with welder protective eye shield and glove.

All safety rules shall be strictly followed while working on live electrical systems or installations as stipulated in the relevant Rules.

83. Port Authority Rules

The Contractor shall observe the Conservancy Rules relating to the harbour and shall always take such necessary additional steps to keep the harbour waters free of noxious or unhygienic matters coming from his works as are required by the Employer. Under no circumstances shall inflammable materials be allowed to spill into the harbour waters.

The Contractor shall always observe and comply with the working rules and regulations of the Port Authority in force or as issued from time to time.

84. Execution of work

The contractor shall be required to execute the work in such a way so as not to cause any damage, hindrance or interference with port activities going on in the area or nearby. He should not also deposit the materials at such places which may cause inconvenience to the public and the work going on in the nearby area The Contractor shall have to make good all damages done by him to the structures nearby while executing the work and no extra payment shall be made to him on that account.

All the materials required to be used in the work shall have to be got approved from the Engineer-in-Charge before stacking at the site of work. Barricading, including proper lighting arrangement in the night at the required places shall

have to be provided by the contractor at his own cost, including necessary arrangements for proper movement of traffic by carefully maintained approaches and road diversions with suitable sign boards for indications of road signs etc. as directed by the Engineer-in-Charge.

Details of every consignment of materials delivered to site shall be provided to the engineer – in – charge and brought to his notice in advance. The materials shall be used for consumption only after the approval of the engineer – in – charge. The brand of materials along with relevant test certificates shall be submitted for approval prior to commencement of work. No change in brand is permitted for reasons whatsoever.

85. Customs Duty

Being Port Development Project, Customs Duty shall be applicable as per project import chapter 9801.00 read with Notification 17-2001, serial No. 38 (vi) and Notification 42-96 amended by 21-2000 of customs tariff, Government of India.

Customs Duty leviable shall be paid directly by the Contractor to the Customs Authorities, Government of India. The Employer shall reimburse this amount upon submission of documentary evidence in original for the proof of payment of such Customs Duty. The reimbursement of such amount towards Customs Duty shall be limited to the Ceiling amount quoted by the Contractor in the Bill of Quantities as above. If the Contractor incurs Customs Duty Levy less than the said Ceiling Amount, the reimbursement by the Employer shall be limited to the documented cost of Customs Duty levies actually paid to the Customs Authorities, Government of India. If the Actual Customs Duty levies paid by the Contractor exceeds the said Ceiling Amount, then the reimbursement by the Employer shall be limited to the Ceiling Amount. The reimbursement of the Customs Duty will be limited only to the Imported Materials listed in “Preamble and Bill of Quantities”, BOQ No.__. During the execution of the Works, if it necessitates for expeditious completion of the Works, Contractor may resort to import of any of the materials not listed aforesaid, with the approval of the Employer. However, the aggregate amount of Customs Duty to be reimbursed shall not exceed the lump sum amount offered in the Priced Bill of Quantities.

It shall be the responsibility of the Contractor to provide the requisite particulars and documents to the customs and other Government authorities and get the Imported Materials cleared and transported in time. The Contractor shall be fully responsible for port and Customs clearance including stevedoring, handling, unloading, loading, storage, inland transportation, if any of materials, equipments and plant to storage godowns, yards, sites etc.

The contractor shall be fully responsible for any delays, penalties charges and losses if any in this regard.

The Employer shall upon request from the Contractor along with necessary details, provide recommendatory letter(s) for Imported Materials at concession rate or Customs Duty as applicable. However, the responsibility for obtaining such concession rate of customs duty shall be that of the Contractor.

It shall be the responsibility of the Contractor to check the latest position on Customs duty levies applicable and the Employer does not accept any liability on the account. For bill of Lading, the "Consignee" for permanent materials to be incorporated into the Works will be the New Mangalore Port Authority. The Contractor will be "Notify Party". Notwithstanding the above, obtaining "Essentiality Certificate" (if any), payment of deposit (if any) towards Customs Duty, etc. shall be the responsibility of the Contractor.

The Contractor shall give an undertaking follows:

a) Being the ultimate Employer of the materials to be imported and incorporated into the works covered under the Tender _____ _____ _____ we request New Mangalore Port Authority to be consignee in the matter of permanent materials to be imported by us at our cost (covering payments of materials by letter of credit) including freight, insurances, taxes and any other charges whatsoever payable in connection with the import and its incorporation into the work.

b) We hereby confirm, in the event of New Mangalore Port Authority becoming consignee, it will not absolve us from any of the obligations, and will not alter the payment terms under the Contract No. SCB II/ 2009 dated …….. between …….. (*the Contractor*) and New Mangalore Port Authority.

c) New Mangalore Port Authority becoming a consignee is a matter of convenience and we undertake to abide by all the obligations, responsibilities etc. as if we are our self a consignee.

d) In respect of nay consequences arising out of New Mangalore Port Authority becoming the consignee we hereby unequivocally and irrevocably agree to indemnify New Mangalore Port Authority for such consequences.

e) We also undertake and confirm to obtained all permits and licenses etc. at our own cost. New Mangalore Port Authority's responsibilities in this regard will be the same as under the said contract and limited to issuing required recommendatory letters for obtaining such permits and licenses.

f) This undertaking does not in anyway vitiate our contractual liabilities and obligations cast upon us by Contract No. SCB II/ 2009 dated ..... between .....(*the Contractor*) and New Mangalore Port Authority.

86. Drawings & Designs (Not applicable to this contract)

(a) General details of the works are shown on the drawings accompanying this tender document. The Engineer will supply to the Contractor from time to time during the progress of the works such further working drawings as will be necessary in his opinion for the proper and adequate execution and maintenance of the Works in accordance with the Engineer's designs and/or any modification thereof as decided by the Engineer and the Contractor shall carry out the work in accordance with the said working drawings. Two sets of such working drawings will be issued. If the Contractor requires more sets he will have to make his own arrangement at his cost. Residual Design, Detailing & Engineering: - The Engineer to the project has done the detailed design and engineering for the subject tender. During execution of the work the residual design, detailing and engineering, if needed, is to be carried out by the contractor at no extra cost to the Employer. For equipment/ Installations detailed drawings need to be produced by the contractor at no extra cost to the Employer. The contractor shall also get approved such design, detailing & engineering from the Engineer.

(b) In the event of the Contractor proposing any alteration/modification to the Engineer's design, detail, method of construction, he shall at his own expenses prepare and submit for approval of the Engineer copies in duplicate (in the first instance) of detailed working drawings which may be required for such alteration/modification and at the same time call the attention of the Engineer to any alternative detail or modification of the contract drawings which the Contractor may wish to make at least 30 days prior to the commencement of the work or part of the work to which such drawings relate. The contractor shall at the same time, if so required by the Engineer, furnish calculation sheets in duplicate relating to the strength and anticipated deflections in respect of such altered/modified works. The Engineer will, after any such alteration which he may approve, record on the copies as amended his approval and will return one copy of the drawings and calculation sheets to the contractor, who shall carryout the work in accordance therewith. The contractor shall forward to the Engineer three additional copies of the working drawings and calculation sheets as approved in additions to these working drawings and calculation sheets as approved. In addition to these working drawings are also to be submitted (the same procedure as in the

ease of the contractor) in respect of any work proposed to be executed by sub-contractors. The approval of the Engineer of all or any of the calculation sheets, drawings shall not relieve the contractor of responsibility in connection with the execution of the altered/modified or subcontractor's work.

(c) Submission of 'As built Drawings'

"As built" Drawings are required to be submitted by the Contractor and shall be supplied by them by the dates stated in the Contract Data. If the Contractor does not supply the Drawings and/or manuals by the dates stated in the Contract Data, or they do not receive the Engineer or his nominee's approval, the Engineer or his nominee shall withhold the amount stated in the Contract Data from payments due to the Contractor.

87. Monsoon Period

Monsoon period will be reckoned from 1st June to 30th September.

88. Progress Report

The following reports shall be submitted for review; as an input to the Management meeting to be held as per Clause No 31 of Conditions of Contract.

88.1 Daily reports

The contractor shall submit daily report indicating daily activities, weather condition, actual manpower, equipment and the prominent materials available and arriving to site. The contractor shall submit the daily report format to the Department for prior approval.

88.2 Monthly Reports

Monthly progress reports shall be prepared by the Contractor and submitted to the Engineer in triplicate. The first report shall cover the period up to the end of the first calendar month following the Commencement Date. Reports shall be submitted monthly thereafter, each within 7days after the last day of the period to which it relates. Reporting shall continue until the Contractor has completed all work, which is known to be outstanding at the completion date, stated in the Taking-Over Certificate for the Works.

Each report shall include:

Charts and detailed descriptions of progress, including each stage of design (if any), Contractor's Documents, procurement, manufacture, delivery to Site, construction, erection and testing; and including these stages for work by each Sub-Contractor,

Photographs in hardcopy & digital copy and videography in two sets showing the various stages of progress on the Site monthly;

For the supply of manufactured items, the name of the manufacturer,

manufacture location, percentage progress, and the actual or expected dates of:
Commencement of manufacture,
Contractor's/Engineer's inspections,
Tests,
Shipment and arrival at the Site;
Copies of quality assurance documents, test results and certificates of Materials;
Safety statistics, including details of any hazardous incidents and activities relating to environmental aspects and public relations; and
Comparisons of actual and planned progress, with details of any events or circumstances which may jeopardize the completion In accordance with the Contract, and the measures being (or to be) adopted to overcome delays.

89. Completion Documents

To treat that the work has been completed and issue a final payment certificate, the following documents will be deemed to form the completion documents:

i. The Technical documents according to which the work was carried out.
ii. Certificates of final levels and dimensions as set out for various works.
iii. Certificates of tests performed for various works.

90. Facilities / Services to be provided at the site (Not Applicable)

After the issue of Engineer's notice to commence, the Contractor shall as soon as possible, make available of the following facilities for the staff of the Engineer at the Site of Work, all to the approval of the Engineer or his Representative and the Contract Price shall be deemed to be inclusive of the provision for these facilities:

Provide and maintain, throughout the period of Contract, one no of Office accommodation at site office / Porta cabin measuring not less than 4m x 5m. each, with electricity and water supply and adequate ventilation for the sole use of Engineer's Representative, his staff.

Provide and maintain suitable furniture for the office, including: Tables with two lockable drawers and chairs, Almirah with shelves and necessary electrical fittings.

Provide and maintain, throughout the period of Contract, a Toilet along with washroom facilities with electricity and water supply and adequate ventilation for the sole use of Engineer's Representative, his staff.

Desk top Computers of latest configuration with printers and all other necessary accessories, internet and loaded with the latest version of software like M.S. Office, AutoCAD etc. with windows operating system.

One photocopying machine capable of Black & White copying / Scanning A4 & A3 size of paper, with auto feed of papers (Source to be copied) along with

sorting facilities.

The contractor shall make available during the currency of contract all the Survey instruments and various measuring devices necessary for the execution of the project.

A lock and four (4) keys for the office room. There shall be no spare keys in the possession of any person other than Engineer's Representative.

91. Payments

The Clause No. 43 payments shall be replaced as follows

i. The Contractor has to submit the bill within 7 days of joint measurement taken along with the concerned Engineer. The Engineer has to ensure that joint measurement to be completed within 7 days of completing of part work / running work. The concerned Engineer i/c shall check and make entries into bill/M.B within 10 days of submission of the interim bill and submit to Executive Engineer/ Superintending Engineer (Civil). The Executive Engineer/ Superintending Engineer (Civil) shall check the bills and after certification of the quantities as per manual shall forward to the Finance Department within 3 working days. The Contractor and Assistant Engineer both jointly complete the measurements, if Contractor due to any reason does not attend/avoid joint survey/measurements the Executive Engineer shall give notice to the contractor to be present at the site for joint measurement within 7 days' notice. If the contractor fails to attend the joint measurement second notice shall be issued to the contractor to attend the joint measurement within 3 days failure to attend the site for joint measurement the Assistant Engineer and AEE or EE would record the reason and complete the measurements in a transparent manner departmentally and submit the bill. Bills shall be prepared and submitted by the Contractor. Joint measurements shall be taken continuously and need not be connected with billing stage. System of 4 copies of measurements, one each for Contractor, Employer and Engineer or his nominee, and signed by both Contractor and Employer shall be followed.

ii. Interim of bill amount will be paid within 14 days of submission of the bill.

iii. Contractor shall submit final Bill within 60 days from the date of completion of work and the same will be paid by the Port within 30 days from the date of submission

iv. The payment will be made to the contractor after deducting any dues payable to the Port statutory authorities etc

v. If an amount certified is increased in a later certificate as a result of an award by the DRB or an Arbitrator, the Contractor shall be paid interest upon the delayed payment as set out in this clause. Interest shall be

calculated from the date upon which the increased amount would have been certified in the absence of dispute.

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

92. Retention

The Clause No. 48 Retention shall be replaced as follows

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

Retention Money shall be deducted at 10% from Running Bills subject to a max. of 5% of the contract price plus Goods Service tax applicable. Retention money shall be refunded after issue of No defects certificate.

93. Submission of statutory documents

The successful bidder, within 7 days from the date of work order, shall submit self-attested copy of statutory documents such PAN card, GST registration certificate, ESI registration certificate, EPF registration certificate, Labour Identification Number (LIN) and any other documents required for successful completion of work.

G. SALIENT FEATURES OF SOME MAJOR LAWS APPLICABLE TO ESTABLISHMENTS ENGAGED IN CONSTRUCTION WORK

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

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

(c) Employees P.F and Miscellaneous Provision Act 1952: The Act Provides for monthly contributions by the employer and workers @ 13.61% and 12% respectively. The benefits payable under the Act are:

  (i) Pension to family pension on retirement or death, as the case may be.
  (ii) Deposit linked insurance on the death in harness of the worker.
  (iii) Payment of P.F accumulation on retirement/death etc.

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

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

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

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

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

i) Payment of Bonus Act 1965: The Act is applicable to all establishments employing 20 or more employees. The Act provides for payments of annual bonus subject to a minimum of 8.33% of wages and maximum of 20% of wages to employees

drawing Rs. 3500/- per month or less. The bonus to be paid to employees getting Rs. 2500/- per month or above up to Rs. 3500/- per month shall be worked out by taking wages as Rs. 2500/- per month only. The Act does not apply to certain establishments. The newly set-up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20 to 10 for the purpose of applicability of this Act.

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

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

v) CONTRACT DATA

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

Sl. No.	Description	Reference Cl. No.
1	The following documents are also part of the Contract	
	The Schedule of other contractors	(8)
	The Schedule of Key personnel	(9)
2	The above insertions should correspond to the information provided in the Invitation of Bids.	
3	The Employer is	(1)
	New Mangalore Port Authority, Panambur, Mangalore – 575010	
	Name of Authorized Representative:	
	Name : Chairman, New Mangalore Port Authority, Panambur, Mangalore – 575010	
4	The Engineer is	
	Name : Chief Engineer (C), New Mangalore Port Authority, Panambur, Mangalore- 57501010	
	Name of Nominee is	
	Name : Superintending Engineer (CI) Civil Engineering Department, NMPA, Panambur, Mangalore- 575010	
5	The name and identification number of the Contract is	
	Name of Contract :- "Annual maintenance of Residential & Non-residential buildings on the East of NH-66 in NMPA for the year 2024-25" Tender no: CIVIL/DyCE(C)/EE(C)/41/2024-25	(1)
6	The works consist of Annual maintenance of Residential & Non-residential buildings on the East of NH-66 in NMPA for the year 2024-25.	(1)

<table>
<tr><td>Sl. No.</td><td>Description</td><td>Reference Cl. No.</td></tr>
<tr><td>7</td><td>The start date shall be
15 days from the date of Issue of Letter of Acceptance. However the work shall be commenced only after signing contract agreement</td><td>Conditions of contract A-General 1.Definitions</td></tr>
<tr><td>8</td><td>The Contract Price is the price stated in the letter of acceptance and thereafter as adjusted in accordance with the provisions of the Contract. However payment will be made as per actual work done accordance with the contract provisions.</td><td>1.Definitions</td></tr>
<tr><td>9</td><td>The Intended completion Date for the whole of the Work is 12 (Twelve) Months including monsoon with the following milestones:</td><td>(17,28)</td></tr>
<tr><td>10</td><td>Milestone dates:
<table><tr><td>Physical works to be completed</td><td>Period from the date of commencement of work</td></tr><tr><td colspan="2">Milestones dates shall be provided to the Contractor by the Executive Engineer executing the work ,for completion of the work as per the scheduled date.</td></tr><tr><td colspan="2"></td></tr></table></td><td></td></tr>
<tr><td>11</td><td>The following shall form part of the Contract Document:
(1) Form of Agreement
(2) Letter of Acceptance
(3) Contractor’s Bid
(4) Contract Data
(5) Conditions of Contract including Special Conditions of Contract
(6) Specifications
(7) Drawings
(8) Bill of quantities and
(9) Any other documents listed in the Contract Data as forming part of the Contract.
(10) Correspondence exchanged after the opening of the Bid and before the issue of Letter of Acceptance by which the Condition of Contract are amended, varied or modified in any way by mutual consent (to be enumerated).</td><td>(2.3)</td></tr>
<tr><td>12</td><td>The Contractor shall submit a Program for the Works within</td><td>(27)</td></tr>
</table>

Sl. No.	Description	Reference Cl. No.
	14 days of delivery of the letter of Acceptance. (Not applicable to this contract)	
13	The site possession date The site will be handed over immediately after issue of Letter of acceptance and the site is free from encumbrances.	(21)
14	The site is located at Panambur in NMP area and is defined in drawing No. 5/361/MTC-I/01-LP	
15	The Defects Liability Period is Nil.	(35)
16	The minimum insurance cover for physical property, injury and death is Rs. 5,00,000/- (Rupees five Lakhs) per occurrence with the number of occurrences limited to four. After each occurrence, contractor will pay additional premium necessary to make insurance valid for four occurrences always.	(13)
17	The following events shall also be Compensation Events: The Employer terminates the contract for his convenience.	(44)
18	The period between Programme updates shall be 30 days.	(27)
19	The amount to be withheld for late submission of an updated Programme shall be Rs. 25,000/-.	(27)
20	The Penalty for the delay in submission of the Performance guarantee shall be at the rate of 0.25% of the amount of performance guarantee for each week or part of the week for the number of weeks delayed beyond the stipulated date of submission.	(52.2) 34.1
21	The language of the Contract documents is English.	(3)
22	The law, which applies to the Contract, is the law of Union of India.	(3)
23	The currency of the Contract is Indian Rupees.	(46)
24	Fees and types of reimbursable expenses to be paid to the Dispute Review Board as per actual and equally shared by both the parties.	(25)
25	The Dispute Review Board shall be constituted after signing of the agreement on mutually agreed terms.(Appendix 1). (Not applicable to this contract)	(25)
26	Price Adjustment (deleted)	(47) (80)
27	The proportion of payments retained (retention money) shall	(48)

Sl. No.	Description	Reference Cl. No.
	be 10% of total tax invoice value from each running bill subject to a maximum of 5% of the contract price (Contract price including GST) as applicable.	
28	The maximum amount of liquidated damages for the whole of the works is 10 % of the contract price plus taxes and duties. The half per cent (½%) per week L.D is applicable for delay period of $\frac{1}{3}$ of contract period and thereafter 10% L.D is applicable. (Not applicable to this contract)	[49]
29	Clause No. 49A (v) deleted.	
30	Advance payment is not applicable to this contract	[51]
31	Repayment of secured advance: deleted	(51.6)
32	The Securities shall be for the following minimum amounts equivalent as a percentage of the Contract Price.	(52)
33	Performance Security in the form of Bank guarantee for 5% of contract price (Contract price including GST)	(52.2)
34	The standard form of Performance Security acceptable to the Employer shall be an unconditional Bank Guarantee of the type as presented in Section III (iv) of the Bidding Documents.	Annexure-A

vi) FORM OF SECURITIES

Acceptable forms of securities are annexed. Bidders should not complete the Performance Security form at this time. Only the successful Bidder will be required to provide Performance and Advance Payment Securities in accordance with one of the forms, or in a similar form acceptable to the Employer.

Annexure A: Performance Bank Guarantee

Annexure B: Bank Guarantee for Advance Payment (not applicable)

Annexure A

PERFORMANCE BANK GUARANTEE

To: _____ [name of Employer]
_____ [address of Employer]
WHEREAS_____ [name and address of Contractor] (hereinafter called "the Contractor") has undertaken, in pursuance of Contract _____ No._____ dated_____ to execute _____ _____ [name of Contract and brief description of Works] (hereinafter called "the Contract").
AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract;
AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee;
NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of _____ [amount of guarantee]1 _____ [In words], such sum being payable in the types and proportions of currencies in which the Contract Price is payable, and we undertake to pay you, upon your first written demand, and without cavil or argument, any sum or sums within the limits of _____ [amount of guarantee]1 as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.
We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.
We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed there under or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.
This guarantee shall be valid until 28 days from the date of expiry of the Defects Liability Period.
Notwithstanding anything mentioned above,
Our liability against this guarantee is restricted to Rs..... (Rupees ..... only) and unless a claim in writing is lodged with us within 3 months of the date of expiry or the extended date of expiry of this guarantee all our liabilities under this guarantee shall stand discharges.

IN WITNESS WHEREOF this guarantee has been duly executed on this ..... day of

……..

Signature and seal of the guarantor _____
Name of Bank _____
Address_____Date_____
_____

1 An amount shall be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract and denominated in Indian Rupees.

NEW MANGALORE PORT TRUST
Panambur, Mangalore

"Annual maintenance of Residential & Non-residential buildings on the East of NH-66 in NMPA for the year 2024-25"

TENDER DOCUMENT
Volume - II

NEW MANGALORE PORT TRUST

CIVIL ENGINEERING DEPARTMENT

Tender no: CIVIL/CE(C)/EE(C)/**41/2024-25**

Tender for

"Annual maintenance of Residential & Non-residential buildings on the East of NH-66 in NMPA for the year 2024-25"

Volume I	Section I	i) Notice Inviting Tenders i) Instructions to Tenderers ii) Annexure (1 to 12)
	Section II	i) Form of Agreement
	Section III	i) Conditions of Contract: Part A - E: General Conditions ii) Conditions of Contract : Part F: Special Conditions iii) Contract Data iv) Form of Securities (A & B) v) Appendix – I and Appendix - II
Volume II	Section IV	i) Technical Specifications
	Section V	ii) Drawings
Volume III	Section VI	i) Preamble ii) Bill of Quantities iii) For of tender
	Section VII	i) Schedules (A & B)

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SECTION IV

TECHNICAL SPECIFICATIONS

A. GENERAL

1. INTRODUCTION

The intent of this technical specification covers construction of all civil works as covered in the scope of contract as per drawings supplied by Owner.

All civil works shall be carried out as per design / drawings standardized by the Consultant / Owner and the specification provided by the Consultant / Owner. All standard drawings are enclosed with the tender documents. In case any item is not covered under specification then the same shall be carried out as per CPWD specification and applicable Standards and Codes. Any item for which specification is not provided herein and is not covered under CPWD specification shall be executed as per manufacturer guidelines. All materials shall be of best quality conforming to relevant Standards and Codes. In case of any conflict between Standards / Code and Technical Specification, the provisions of Technical Specification shall prevail, and the Engineer's decision on interpretation shall be final.

The Contractor shall furnish all labor, tools, equipment, materials, temporary works, constructional plant and machinery, fuel supply, transportation and all other incidental items not shown or specified but as may be required for complete performance of the Works in accordance with drawings, specifications and direction of Owner.

Excavated earth is to be disposed from site as instructed, only into approved landfill areas and dump yard. The cost of excavation to include for necessary lead and lift as specified.

All materials including cement, reinforcement steel and structural steel etc. shall be arranged by the Contractor. All testing required shall be arranged by the Contractor at his own cost. The contractor shall execute the work as per the standard Field Quality Plan (FQP) of NMPA.

The bidder shall fully apprise himself of the prevailing conditions at the proposed site, climatic conditions including monsoon patterns, local conditions and site specific parameters and shall include for all such conditions and contingent measures in the bid, including those which may not have been specifically brought out in the specifications.

Level and date of concreting shall be marked on the building from outside at every floor level with proper paint, etc.

All levels and survey work shall be measured by total station and electronic level machine at all floors and places.

Brief Description of Works

The scope of work is defined in the Notice Inviting Tender. The Contractor shall provide all necessary materials, equipment and labour etc. for the execution and maintenance of the work till completion.

The work shall be executed in accordance with the specification stipulated in the Bill of Quantity and other bidding documents read along with CPWD (Central Public Works Department) specifications for civil works and IS codes with up-to-date revisions. For non-schedule items specification as given along with tender document and similar items of CPWD shall be applicable.

The list of references for civil works are CPWD specifications, relevant IS codes and best practices.

For deep excavations, necessary shoring is to be done, the design of which will be provided by the contractor, after assessing site and soil conditions, and work only to be commenced on site after the same is duly approved by NMPA. Any approval if required from the Mineral department or any other statutory body that has jurisdiction on such excavations has to be obtained by the contractor.
All earth used for back filling should be of approved quality.
Portland Cement of IS 269:2015 shall be used for all cement & concrete works. This will supersede other specifications of cement to be used for the works.
For ready mixed cement concrete, in addition to the CPWD specification, the following also to be noted:
The cost towards cement quantity reduced from the specified quantity in the item due to mixing of fly ash shall be deducted as per relevant BOQ item. The design mix shall be submitted to Engineer in Charge for approval.
All hard ware fittings shall be of best quality and shall be selected as per the Instructions of Engineer in Charge.
Site location, Boundaries and Possession
The location and boundaries of the Site are shown on the Drawing. No. 5/361/MTC-I/01-LP The Contractor shall confine his activities strictly to the allotted site area(s) and shall not allow his personnel to trespass upon any other areas occupied by the Employer.
1.4 Site Datum and Base Lines
A base line shall be established within the working area by the Contractor. The base line shall be referenced to the site co-ordinate system (based on the Local Coordinates of New Mangalore Port). This bench mark and base line will be the basis for the setting-out for all the Works. The main levels and lines for each portion of the Works shall be established from the bench mark and base line by the Contractor.
1.5 Site Conditions
1.5.1 Location of Work
As per enclosed location plan. 5/361/MTC-I/01-LP
1.5.2 Climate
The climate at Mangalore is tropical with high humidity and a maximum shade temperature of 36°C. The average annual rainfall is approximately 3330 mm and concentrated in the south-west monsoon months of June, July, August and September during which period the average rainfall is as much as 82% of the total annual rainfall.
1.5.3 Wind
The wind in the monsoon months of June, July and August are predominantly from south-west and west with a maximum intensity of 5 on the Beaufort Scale. The winds in the remaining months of the year are predominantly from the north-west and the maximum intensity during this period is also of 5 on the Beaufort Scale.
1.5.4 Cyclones
Even though Mangalore is within the cyclonic area of storms originating in the Arabian Sea and those that enter across the Indian Peninsula from Bay of Bengal, cyclones are not as severe or frequent as in the Bay of Bengal. The maximum wind speed so far recorded in cyclonic storm, generally does not exceed 62 kmph (16.9 m/sec.) except one during 1965 when the maximum speed recorded was 97 kmph (26.9 m/sec.)
1.5.5 Visibility
Thirty year period observations conducted by the Indian Meteorological Department reveal that poor visibility (visibility less than 4 Kms) is encountered for about 10

days in the south-west monsoon period. The maximum number of foggy days in a year is only 3.

1.5.6 Site Preparation

The Contractor shall furnish all necessary supervision, labour, materials, equipment and tools for Site Preparation, clearing and all other works. Clearing shall mean to completely demolish, remove and dispose with all leads, lifts and descents from the area marked, trees, bushes, deadfalls, embedded logs, dislodged roots, stumps, snogs, boulders, mounds, existing structures and other objectionable materials. The areas required to be cleared shall consist of the work Site, ditches, borrow pits, diversions and all other areas necessary for the construction work as directed by the Engineer-in-Charge.

Before any Temporary Works are commenced, the Contractor shall submit his proposal along with complete drawings of all Temporary Work, he may require for the execution of the Works in advance to the Engineer for approval. The Contractor shall also submit his calculations relating to the design of temporary works, strength, etc. if required by the Engineer and shall carry out the modifications that the Engineer may require of such temporary works at Contractor's own cost. The Contractor shall be solely responsible for the stability and safety of all Temporary Work.

It will be the responsibility of the Contractor to make timely procurement of all materials and mobilize all essential equipment for both Temporary and Permanent Works.

1.6 Site Information

The detailed drawing of the construction site for adaptation of methodology for the construction. However, on account of this change in the geographical profile of site, no extra cost for additional arrangement required to be made will be paid for.

1.7 The Nature of Soil Profile

The site comprises of ordinary soil. The details furnished herein are only for the information/guidelines of the tenderers and the successful contractor shall not claim for any deviation in the actual subsoil profile encountered at site.

1.8 Records

Complete records of all operations connected with the work shall be kept by the Contractor. The Contractor shall submit to the Engineer-in-charge for approval his proposal of the manner of presentation of these records. Three copies of all such records shall be furnished to the Engineer-in-charge on completion of each test or operation.

2. SPECIAL CONDITION OF CONTRACT

1. The scope of work is to maintain the residential and non residential buildings east of N.H 66 including all such repair works that may require or instructed by the department from time to time and also Cleaning the various type Inspection chambers, manholes and sewer lines.
2. The contractor or his representative and Engineer or supervisor, appointed by the contractor, should be available at site premises during working time, to receive instructions from the departmental staff and he should maintain necessary registers as directed by the department for the works carried out.
3. The contractor has to deploy following labours daily to carryout day to day repair works :-

i.	Engineer	-	1 No
ii.	Masons	-	2 Nos.
iii.	Carpenter	-	2 Nos.
iv.	Helpers	-	7 Nos.
v.	Fabricator / 1. Painter / 2. Plumber (as per Requirement)	-	1 No
vi.	Technical Supervisors		1 No.

The contractor shall maintain an attendance register for the verification and signature of the engineer-in-charge on daily basis. If the Contractor fails to deploy the above stipulated worker, an amount of Rs.500/- per day will be deducted from the 4th day of absence till returning of labour or deploying alternate labour.

The contractor may require to deploy more number of labours in addition to the above minimum requirement, depending upon the work load.

4. The cleaning of man holes should be carried out by machinery only. No manual cleaning will be allowed.
5. The contractor has to attend the repair works immediately on instructions of the departmental staff. The work has to be carried out to the entire satisfaction of the department whose decision is final and binding in this respect.

6. All tools and plants such as broom sticks, spades, pickaxe, sickles, bucket, baskets wheel barrow cobra vipers, including any machinery required for the work should be brought by the contractor at his own cost.
7. A labour register should be kept at work site BM subdivision site office and this register should signed by the contractor for the numbers of labours deployed for item of work done.
8. A complaint register is maintained for entry of various complaints pertaining to the colony maintenance which needs to be attended by the AMC contractor by deploying the required resources. The contractor shall ensure that 85% of the total complaint received is attended at the end of every month failing which an amount of 500/- will be deducted for each percentage short fall for the particular month. The contractor has to submit the copy of the attendance register signed by the workers deployed for the work along with each running bill in addition to the other documents required to be submitted
9. Contractor should provide 1 No of Mini tempo about 2 ton capacity on daily basis for transport of materials and other resources, failing which an amount of Rs.500/- per day will be deducted from the R.A bill.

B. Works.

1. EARTHWORK

2.1. Classification of soils - The earthwork shall be classified under the following categories and measured separately for each category, unless otherwise specified.

The material to be excavated shall be classified as follows: -

2.1.1. Ordinary or soft soil - Generally any soil which yields to ordinary application of pick axes, shovels or any other ordinary digging implements, such as organic soil, turf, gravel, sand, sandy soil, silt, clay, loam, mud, red earth, 'sudde', black cotton soil, soft shale, loose moorum and all soils having soil dry density less than 1.80 gm/cc. (IS: 1498-1970) copy enclosed vie Annexure 2-A.1, removal of gravel and/or any modular material having diameter in any one direction not exceeding 75 mm occurring in such strata etc.

2.3 Types of excavation

2.3.1 Surface excavation - Excavation exceeding 1.5 m in width and 10 sq. m on plan but not exceeding 30 cm in depth in all types of soils and rocks shall be described as surface excavation.

Measurements - The length and breadth shall be measured with steel tape correct to the nearest cm and the area worked to the nearest two places of decimal in square meters.

2.3.2 Rough excavation and filling - Excavation for obtaining earth from borrow pits, cutting hillside slopes etc., shall be described as rough excavation. Wherever filling is to be done, the earth from excavation shall be directly used for filling and no payment for double handling of earth shall be admissible. Filling of excavated earth shall be done as specified, in case of hill side cutting, where the excavated materials are thrown down the hill slopes; payment for filling excavated earth shall not be admissible.

2.3.3. Excavation over area (All kinds of soils) - This shall comprise :a) Excavation exceeding 1.5 m in width and 10 sq. m. on plan and exceeding 30 cm in depth.

b) Excavation for basement, water tanks etc.

c) Excavation in trenches exceeding 1.5 m in width and 10 sq. m. on plan.

2.3.4 Excavation over area (ordinary / hard rock) - This shall comprise:

a) Excavation exceeding 1.5 m in width and 10 sq. m. on plan and exceeding 30 cm in depth, .b) Excavation for basements, water tanks etc, c) Excavation in trenches exceeding 1.5 m in width and 10 sq. m. on plan.

2.3.5 Excavation in trenches for foundations and drains (all kinds of soils) - This shall comprise excavation not exceeding 1.5 m in width or 10 sq. m. on plan and to any depth in trenches (excluding trenches for pipes, cables, conduits etc.

2.3.6 Excavation in trenches for foundation and drains (ordinary / hard rock) - This shall comprise excavation not exceeding 1.5 m in width or 10 sq. m. on plan and to any depth in trenches (excluding trenches for pipes, cables, conduits etc.)

2.3.7 Excavation in trenches for pipes, cables etc. refilling - This shall comprise excavation not exceeding 1.5 mts. In width or 10 sq. m. in plan and to any depth in trenches for pipes, cables etc. and returning the excavated material to fill the trenches after pipes, cables etc. are laid, their joints tested, passed and disposal of surplus excavated material up to 50 m lead.

2.3.8 Width of trench - a) Up to one meter depth, the authorised width of trench for excavation shall be arrived at by adding 25 cm to the external diameter of pipe (not socket/collar) cable, conduit etc. Where a pipe is laid on concrete bed/cushioning layer, the authorised width shall be the external diameter of the pipe (not socket/collar) plus 25 cm or the width of concrete bed/cushioning layer whichever is more.

b) For depths exceeding one meter, an allowance of 5 cm per meter of depth for each side of the trench shall be added to the authorised width (that is external diameter of pipe plus 25 cm) for excavation. This allowance shall apply to the entire depth of the trench. In firm soils the sides of the trenches shall be kept vertical up to a depth of 2 meters from the bottom. For depths greater than 2 meters, the excavation profiles shall be widened by allowing steps of 50 cm on either side after every two meters from bottom.

c) Where more than one pipe, cable, conduit etc. are laid, the diameter shall be reckoned as the horizontal distance from outside to outside of the outermost pipes, cable, conduit etc.

d) Where the soil is soft, loose or slushy, width of trench shall be suitably increased or side sloped or the soil shored up as directed by the engineer. It shall be the responsibility of the contractor to take complete instructions in writing from the engineer regarding increase in the width of trench, sloping or shoring to be done for excavation in soft, loose or slushy soils.

2.4 SPECIFICATIONS FOR PROTECTION DURING EXCAVATION.

Excavation where directed by the engineer shall be securely fenced and provided with proper caution signs, conspicuously displayed during the day and properly illuminated with red lights during the night to avoid accidents.

The contractor shall take adequate protective measures to see that the excavation operations do not damage the adjoining structures or dislocate the services. Water supply pipes, sluice valve chambers, sewerage pipes, manholes, drainage pipes & chambers, communication cables, power supply cables etc. met within the course of excavation shall be properly supported and adequately protected, so that these services remain functional.

Excavation shall not be carried out below the foundation level of the adjacent buildings until underpinning; shoring etc. is done as per the directions of the engineer for which payment shall be made separately.

2.6 SPECIFICATIONS FOR SITE CLEARANCE

Before the earth work is started, the area coming under cutting and filling shall be cleared of shrubs, rank vegetation, grass, brushwood, trees and saplings of girth up to 30 cm measured at a height of one meter above ground level and rubbish removed up to a distance of 50 meters outside the periphery of the area under clearance. The roots of tress and saplings shall be removed to a depth of 60 cm below ground level or 30 cm below formation level or 15 cm below subgrade level, whichever is lower, and the holes, or hollows filled up with the earth, rammed and leveled.

The trees of girth above 30 cm measured at a height of one meter above ground shall be cut only after permission of the engineer is obtained in writing. The roots of tress shall also be removed. Payment for cutting such trees and removing the roots shall be made separately.

Existing Structures and service such as old buildings, culverts, fencing, water supply pipe lines, sewers, power cables, communication cables, drainage pipes, etc. within or adjacent to the area if required to be diverted/removed, shall be diverted/dismantled as per directions of the engineer and payment for such diversion/dismantling works shall be made separately.

In case of archaeological monuments within or adjacent to the area, the contractor shall provide necessary fencing all-round such monuments as per the directions of the engineer and protect the same properly during execution of works. Payment for providing fencing shall be made separately.

2.7. SPECIFICATIONS FOR SETTING OUT AND MAKING PROFILES

A masonry pillar to serve as a bench mark will be erected at a suitable point in the area, which is visible from the largest area. This bench mark shall be constructed as per Fig.1 and connected with the standard bench mark as approved by the engineer. Necessary profiles with strings stretched on pegs, bamboos etc shall be made to indicate the correct formation levels before the work is started. The contractor shall supply labour and material for constructing bench mark, setting and making profiles and connecting bench mark with the standard bench mark at his own cost. The pegs, bamboos etc and the benchmark shall be maintained by the contractor at his own cost during the excavation to check the profiles.

The ground levels shall be taken at 5 to 15 meters intervals (as directed by the engineer) in uniformly sloping ground and at closer intervals where local

mounds, pits or undulations are met with. The ground levels shall be recorded in field books and plotted on plans. The plans shall be drawn to a scale of 5 metres to one cm or any other suitable scale decided by the engineer. North direction line and position of benchmark shall invariably be shown on the plans. These plans shall be signed by the contractor and the engineer or their authorised representatives before the earthwork is started. The labour required for taking levels shall be supplied by the contractor at his own cost.

2. CONCRETE WORKS:-

4.0 The concrete can be designed in grades denoting by volumetric proportion of the constituents' characteristic compressive strength. The concrete by volumetric proportion or nominal mix concrete of the constituents as well as Design Mix denoting compressive strength as detailed in this section.

4.1. Materials.

4.1.1 Water, cement, lime, fine aggregate or sand, surkhi, cinder and fly ash shall be as specified in Section 0.

4.1.2 Coarse aggregate

4.1.2.1. General - Aggregate most of which is retained on 4.75 mm IS Sieve and contains only as much fine material as is permitted in IS 383 for various sizes and grading is known as coarse aggregate. Coarse aggregate shall be specified as stone aggregate, gravel or brick aggregate and it shall be obtained from approved / authorised sources

a) Stone aggregate -It shall consist of naturally occurring (uncrushed, crushed or broken) stones. It shall be hard, strong, dense, durable and clean. It shall be free from veins, adherent coating, and injurious amounts of disintegrated pieces, alkali, vegetable matter and other deleterious substances. It shall be roughly cubical in shape. Flaky and elongated pieces shall be avoided. It shall conform to IS: 383 unless otherwise specified.

b) Gravel - It shall consists of naturally occurring (uncrushed, crushed or broken) river bed shingle or pit gravel. It shall be sound, hard and clean. It shall be free from flat particles of shale or similar laminated material, powdered clay, silt, and loam adherent coating, alkali vegetable, matter and other deleterious substances. Pit gravel shall be washed if it contains soil materials adhering to it. These shall soil materials soil materials adhering to it. These shall conform to IS: 383 unless otherwise specified.

c) Brick aggregate - Brick aggregate shall be obtained by breaking well burnt or over burnt dense bricks / brick bats. They shall be homogenous in texture, roughly cubical in shape and clean. They shall be free from unburnt

clay particles. Soluble salt, silt, adherent coating of soil vegetable matter and other deleterious substances. Such aggregate should not contain more than one percent of sulphate and should not absorb more than 10% of their own mass of water, when used in cement concrete and 20% when used in lime concrete. It shall conform to IS: 383 unless otherwise specified.

d) Lightweight aggregates such as sintered fly ash aggregate may also be used provided the engineer is satisfied with the data on the proportion of concrete made with them.

4.1.2.2. Deleterious material - Course aggregate shall not contain any deleterious material, such as pyrites, coal, lignite, shale or similar laminates material, clay, alkali, soft fragments, sea shells and organic impurities in such quantity as to affect the strength or durability of the concrete. Coarse aggregate to be used for reinforced cement concrete shall not contain any material liable to

the steel reinforcement. Aggregates which are chemically reactive with alkali of cement shall not be used. The maximum quantity of deleterious material shall not more than five per cent of the weight of coarse aggregate when determined in accordance with IS: 2386 part II.

4.1.2.3. Size and grading

(i) Stone aggregate and gravel - It shall be either graded or single sized as specified. Normal size and grading shall be as under --

(a) Nominal sizes of graded stone aggregate or gravel shall be 40, 20, 16, or 12.5 mm as specified. For any one of the nominal sizes, the proportion of other sizes shall be in accordance with Table 1.

Table 1 -Graded stone aggregate or gravel

IS Sieve Designation	Percentage passing (by weight) for nominal size of			
	40 mm	20 mm	16 mm	12.5 mm
75 mm	100	-	-	-
37.5 mm	95 to 100	100	-	-
19 mm	-	95 to 100	100	100
16 mm	-	-	90 to 100	-
11.2 mm	-	-	-	90 to 100
9.5 mm	10 to 35	25 to 55	30 to 70	40 to 85
4.75 mm	0 to 5	0 to 10	0 to 10	0 to 10
2.36 mm	-	-	-	-

Concrete work

(b). Normal sizes of single sized stone aggregate or gravel shall be 63, 40, 20, 16, 12.5 or 10 mm as specified. For any one of the nominal sizes the

proportion of other sizes shall be in accordance with Table 2.

Table 2 -Single sized (ungraded) stone aggregate or gravel

IS Sieve Designation	Percentage passing (by weight) for nominal size of					
	63 mm	40 mm	20 mm	16 mm	12.5 mm	10 mm
75 mm	100	-	-	-	-	-
63 mm	85-100	100	-	-	-	-
37.5 mm	0-30	85-100	100	-	-	-
19 mm	0-5	-20	85-100	100	-	-
16 mm	-	-	-	-85-100	100	-
11.2 mm	-	-	-	-	85-100	100
9.5	-	0-5	0-20	0-30	0-45	85-
100						
4.75 mm	-	-	0-5	0-5	0-10	0-20
2.36 mm	-	-	-	-	-	0-5

c). When stone aggregate or gravel brought to site is single sized (ungraded), it shall be mixed with single sizes aggregate of different sizes in the proportion to be determined by field tests to obtain graded aggregate of specified nominal size. For the required nominal size, the proportion of other sizes in mixed aggregate shall be in accordance with Table 1. Recommended proportions by volume for mixing of different sizes of single size (ungraded) aggregate to obtain the required nominal size of graded aggregate are given in Table 3.

Table 3 -Single sized (ungraded) stone aggregate or gravel

Cement Concrete	Nominal size of graded aggregate required	Parts of single size aggregate of size				
		50 mm	40 mm	20 mm	12.5 mm	10 mm
1: 6:12	63	9	-	3	-	-
1: 6: 12	40	-	9	3	-	-
1: 5: 10	63	7 ½	-	2 ½	-	-
1: 5: 10	40	-	7 ½	2 ½	-	-
1: 4: 8	63	6	-	2	-	-
1: 4: 8	40	-	6	2	-	-
1: 3: 6	63	4 ½	-	1 ½	-	-
1: 3: 6	40	-	4 ½	1 ½	-	-
1: 3:6	20	-	-	4 ½	-	-

1: 2: 4	40	-	2 ½	1	-	½
1: 2: 4	20	-	-	3	-	1
1: 2: 4	12.5	-	-	-	3	-
1: 1 ½ : 3	20	-	-	2	-	1

Note-(i) The proportions indicated in Table 3 above are by volume when considered necessary, these proportions may be varied marginally by engineer after making sieve analysis of aggregate brought to site for obtaining required graded aggregate. No adjustments in rate shall be made for any variation in the proportions so ordered by the engineer. If single size coarse aggregates are not premixed at site to obtain the graded coarse aggregate required for mix, the volume of single size aggregates required for the mix shall be suitably increased to account for reduction in total volume at the site of mixing.

(ii) Brick aggregate - Nominal size of brick aggregate shall be40 mm and its grading shall be as specified in the Table 4 when tested for sieve.

Table 4 -Brick aggregate

IS Sieve Designation(by weight)	Percentage passing
75 mm	100
37.5 mm	95-100
19.0 mm	45-100
4.75	0-5

Note -Coarse aggregate for cement concrete shall generally conform to para 4.2.1 of IS: 456 and fine aggregate shall conform to IS: 383.

4.1.2.4. Stacking - Aggregate shall be stacked on a hard, dry and level patch of ground. When stack piling, the aggregate shall not form pyramids resulting in segregation of different sized materials. It shall be stacked separately according to nominal size of coarse aggregates. Stacking shall be done in regular stacks, of height not exceeding 100 cm.

4.1.2.5. Testing - Coarse aggregate shall be tested for the following (as per IS: 2386)

(a) Determination of particle size and shape
(b) Estimation of organic impurities (as per IS: 2386-Part II)
(c) Surface moisture
(d) Determination of 10% fine value

Measurements - The aggregates shall be measured in stacks and paid for after making a deduction of 7.5% of the gross measurements of stacks in respect of aggregates of nominal size 40 mm and above. No deduction from the gross measurements of the stacks is to be made in respect of aggregates

nominal size below 40 mm.

4.1.2. Admixtures - When required, admixtures of approved quality shall be mixed with concrete, as specified. The admixtures shall conform to IS: 9103.

4.2. SPECIFICATIONS FOR CEMENT CONCRETE

4.2.0. This shall be prepared by mixing graded stone or brick aggregate of nominal size as specified with fine aggregate and cement in specified proportions with required quantity of water. The grading and quality of aggregates shall be such as to give minimum compressive strength of 140 kg/cm² and 210 kg / cm² at 7 days and 28 days respectively in case of mix 1:2:4, (One cement - two Coarse sand - four stone aggregate).

One sample consisting of 6 cubes 15x15x15 cm shall be taken for every 15 cubic meter or part thereof cement concrete 1:2:4. The cube tests shall not be carried out in case the quantity of cement concrete placed on any day is less than 15 cubic meter unless otherwise specific. For other details, refer section on R.C.C. work.

4.2.1. Proportioning - It shall be done by volume. Boxes of suitable size shall be used for measuring sand and aggregate. The internal dimensions of the boxes shall be generally 35 X 25 X40 cm deep or as otherwise approved by the engineer. The unit of measurement of cement shall be a bag of 50 kg. and this shall be taken as 0.035 cubic meter. While measuring the aggregate, shaking, ramming or heaping shall not be done. The proportioning of sand shall be on the basis of its dry volume and in case of damp sand, allowances for bulk age shall be made as given for mortar.

4.2.2. Preparation - This shall be prepared by mixing coarse aggregate, fine aggregate and cement in specified proportions with required quantity of water. Nominal size and quality of aggregate shall be as specified.

Except where brick aggregate is used in cement concrete, minimum compressive strength on works test for different concrete mixes shall be as specified for various grades prepared by volume basis, in Table 5 below. The work test shall be carried out for every 15 cum of a day's concreting unless otherwise specified.

Table 5

Concrete mix	Min compressive strength on15 cm cube in Kg / cm²	
	7 days strength	28 days strength
1:1:2	210	315

1:1½ :3		265
1:2:4	140	175

4.2.2.1. Mixing - Concrete shall be mixed in mechanical batch type concrete mixers conforming to IS: 1791 having two blades and fitted with power loader (lifting hopper type). Half bag mixers and mixers without lifting hoppers shall not be used for mixing concrete. In exceptional circumstances, such as mechanical break down of mixer, work in remote areas or power breakdown and when the quantity of concrete work is very small, hand mixing may be done with the specific prior permission of the engineer in writing subject to adding 10% extra cement. When hand mixing is permitted, it shall be carried out on a watertight platform and care shall be taken to ensure that mixing is continued until the concrete is uniform in colour and consistency. Before mixing the brick aggregate shall be well soaked with water for a minimum period of two hours and stone aggregate or gravel shall be washed with water to remove, dirt, dust and other foreign materials. For guidance, the mixing time may be 1½ to 2 minutes, for hydrophobic cement it may be taken as 2½ to 3 minutes.

4.2.2.2. Power loader - Mixer will be fitted with a power loader complying with the following requirements.

a). The hopper shall be of adequate capacity to receive and discharge the maximum nominal batch of unmixed materials without spillage under normal operating conditions on a level site.

Note - In such a case the volume of the maximum nominal batch of mixed material is 50% greater than the nominal mixed batch capacity.

b). The minimum inside width of the feeding edge of the hopper shall be as specified below in Table 6.

Table 6

Nominal size of mixer (T, NT or R), litre	Minimum inside width of hopper feeding edge in mm
140	1.0
200	1.1
280	1.2
375	1.4
500	1.5
1000	2.0

T = tilting; NT = non-tilting; R = Reverse

a) The design of the loader shall be such that it allows the loading hopper to be elevated to such a height that the center line of the chute plate of the hopper when in discharge position, is at an angle of not less than 50° to the horizontal. A mechanical device to aid discharge of the contents as quickly as possible from the hopper to the drum may also be provided. Even when a mechanical device is provided, it is recommended that the angle of center line of the chute plate of the hopper when in discharge position, should be as large as practicable, preferably not less than 40° to horizontal.

b) When the means of raising and lowering the loading hopper includes flexible wire ropes winding on to a drum or drums, the method of fastening the wire to rope to the drums shall be such as to avoid, as far as possible any tendency to cut the strands of the ropes and the fastening should preferably be positioned clear of the barrel of the drum for example, outside the drums flange. When the loading hopper is lowered to its normal loading position, there should be at least one and half drums of rope on the drum.

c) Clutch brake and hydraulic control lever shall be designed so as to prevent displacement by liberation or by accidental contact with any person.

d) The clutch and brake control arrangements shall also be so designed that the operator can control the falling speed of the loader.

e) Safety device shall be provided to secure the hopper in raised position when not in use

4.2.2.3. Mixing efficiency - The mixer shall be tested under normal working conditions in accordance with the method specified in IS - 4643 with a view to check its ability to mix the ingredients to obtain concrete having uniformity within the prescribed limits. The uniformity of mixed concrete shall be evaluated by finding the percentage variation in quantity (mass in water) of cement, fine aggregate and coarse aggregate in a freshly mixed batch of concrete.

The percentage variation between the quantities of cement, fine aggregate and coarse aggregates (as found by weighing in water) in the two halves of a batch and average of the two halves of the batch shall not be more than the following limits -

Cement	8%
Fine aggregate	6%
Coarse aggregate	5%

4.2.2.4. Machine mixing - The mixer drum shall be flushed clean with water. Measured quantity of coarse aggregate shall be placed first in the hopper. This shall be followed with measured quantity of fine aggregate and then

cement. In case fine aggregate is damp, half the required quantity of coarse aggregate shall be placed in the hopper, followed by fine aggregate and cement. Finally the balance quantity of coarse aggregate shall be fed in the hopper, & then the dry materials are slipped into the drum by raising the hopper. The dry material shall be mixed for at least four turns of the drum. While the drum is rotating, water shall be added gradually to achieve the water cement ratio as specified or as required by the engineer. After adding water, the mixing shall be continued until concrete of uniform colour, uniformly distributed material and consistency is obtained. Mixing shall be done for at least two minutes after adding water. If there is segregation after unloading from the mixer, the concrete should be remixed. The drum shall be emptied before recharging. When the mixer is closed down for the day or at any time exceeding 20 minutes, the drum shall be flushed clean with water.

4.2.2.5 Hand mixing - When hand mixing has been specifically permitted in exceptional circumstances by the engineer in writing, subject to adding 10% extra cement, it shall be carried out on a smooth, clean and water tight platform of suitable size. Measured quantity of sand shall be spread evenly on the platform and the cement shall be dumped on the sand and distributed evenly. Sand and cement shall be mixed intimately with spade until mixture is of even colour throughout. Measured quantity of coarse aggregate shall be spread on top of cement sand mixture and mixing done by shoveling and turning till the coarse aggregate gets evenly distributed in the cement sand mixture. Three quarter of the total quantity of water required shall be added in a hollow made in the middle of the mixed pile and the material is turned towards the middle of pile with spade. The whole mixture it turned slowly over and again and the remaining quantity of water is added gradually. The mixing shall be continued until concrete of uniform colour and consistency is obtained. The mixing platform shall be washed and cleaned at the end of the day.

4.2.3. Workability - The quantity of water to be used for each mix shall be such that the concrete is of adequate workability for the placing conditions of the concrete and can properly be compacted with the means specified. Generally, the quantity of water to be used for each mix of 50 Kgs cement shall not be more than 34 litres for 1:3:6 mix, 30 litres for 1:2:4 mix, 30 litres for 1:1½:3 mix and 25 litres for 1:1:2 mix. In case of vibrated concrete, the quantity of water may be suitably reduced to avoid segregation. The quantity of water shall be regulated by carrying out regular slump tests as described in Annexure 4.A.1. The slump and workability for different kind of

works shall be as per Table 7 below

Table 7

Placing conditions.	Degree of workability	Value of workability
Concreting of shallow Sections with vibration	Very low	0.75-0.80 Compacting factor.
Concreting of lightly reinforced section with vibration.	Low	Slump up to 25 mm, 10-5 Seconds, vee bee time 0.8-0.85 compacting factor.
Concreting of lightly reinforced Section without vibration or heavily reinforced sections with vibration.	Medium	25-75 mm, slump for 20 mm aggregate.
Concreting of heavily reinforced sections without vibration.	High	75-125 mm slump for 20 mm aggregate.

Note - Where considered necessary, the workability of the concrete my also be ascertained by compacting factor test and vee-bee censistometer method as specified in IS: 1199. For suggested ranges of value of workability of concrete by the above methods, reference may be made to IS: 456-2000.

4.2.4. Transportation - Concrete shall be transported from the mixer to the place of laying as rapidly as possible by methods which will prevent the segregation or loss of any of the ingredients and maintaining the required workability.

4.2.5. Placing - The concrete shall be deposited as nearly as practicable in its final position to avoid rehandling. It shall be laid gently (not thrown) and shall be thoroughly vibrated and compacted before setting commences and should not be subsequently disturbed. Method of placing shall be such as to preclude segregation. Care shall be taken to avoid displacement of reinforcement or movement of form work and damage due to rains.

4.2.6. Compaction - Concrete shall be thoroughly compacted and fully worked around embedded fixtures and into corners of the form work. Compaction shall be done by mechanical vibrator of appropriate type till a dense concrete is obtained. The mechanical vibrators shall conform to IS: 2505 specifications for concrete vibrators (immersion type). To prevent segregation, over vibration shall be avoided. The use of mechanical vibrator

may be relaxed by the engineer at his discretion for certain items and permit hand compaction. Hand compaction shall be done with the help of tamping rods. Compaction shall be completed before the initial setting starts. For the items where mechanical vibrators are not to be used, the contractor shall take permission of the engineer in writing before the start of the work. After compaction the top surface shall be finished even and smooth with wooden trowel before the concrete begins to set.

4.2.7. Construction joints - Connecting shall be carried out continuously up to construction joints. The position and arrangement of construction joints shall be as shown in the structural drawings or as directed by the engineer. Number of such joints shall be kept minimum and shall be kept as straight as possible.

4.2.7.1. When the work has to be resumed on a surface which has hardened, such surface shall be roughened. It shall then be swept clean and thoroughly wetted. For vertical joints, neat cement slurry, of workable consistency by using 2kgs of cement per sq m shall be applied on the surface before it is dry. For horizontal joints, the surface shall be covered with a layer of mortar about 10-15 mm thick composed of cement and sand in the same ratio as the cement and sand in concrete mix. This layer of cement slurry of mortar shall be freshly mixed and applied immediately before placing of the concrete

4.2.7.2. Where the concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire or bristle brushes, care being taken to avoid dislodgement of particles of coarse aggregate. The surface shall be thoroughly wetted and all free water removed. The surface shall then be coated with neat cement slurry @ 2 kgs of cement per sqm. On this surface, a layer of concrete not exceeding 150 mm in thickness shall first be placed and shall be well rammed against corners and close spots; work, thereafter, shall proceed in the normal way.

4.2.9. Curing - When the concrete begins to harden i.e. two to three hours after compaction, the exposed surfaces shall be kept damp with moist gunny bags, sand or any other material approved by the engineer 24 hours after compaction, the exposed surface shall be kept continuously in damp or wet conditions by ponding or by covering with a layer of sacking, canvass, Hessian or similar absorbent materials and kept constantly wet for at least 7 days where ordinary Portland cement is used and 10 days, where Portland pozzolana cement is used from the date of placing of concrete. For concrete work with other types of cement, curing period shall be as directed by the

engineer.

Approved curing compounds may be used in lieu of moist curing with the permission of the engineer. Such compounds shall be applied to all exposed surfaces of the concrete as soon as possible after the concrete has set

4.2.9.1 Freshly laid concrete shall be protected from rain by suitable covering.

4.2.9.2 Over the foundation concrete, the masonry work may be started after 48 hours of its compaction but the curing of exposed surfaces of cement concrete shall be continued along with the masonry work for at least 7 days. And where cement concrete is used as base concrete for flooring, the flooring may be commenced before the curing of period of base concrete is over but the curing of base concrete shall be continued along with top layer of flooring for a minimum period of 7 days.

4.2.10. Testing of concrete will be done as described in section on R.C.C

4.2.11. Form work - Form work shall be as specified in R.C.C section and shall be paid for separately unless otherwise specified.

4.2.12. Finishes - Plastering and special finishes other than those, obtained through form work shall be specified and paid for separately unless otherwise specified.

4.2.13. Measurements

4.2.13.1. Dimensions of length, breadth and thickness shall be measured correct to nearest cm. Except for the thickness of slab and partition which shall be measured to nearest 5 mm. Area shall be worked out to nearest 0.01 square meter and the cubic contents of consolidated concrete shall be worked out nearest 0.001 cubic meters. Any work done in excess over the specified dimension or as required by engineer is ignored.

4.2.13.2. Concrete work executed in the following conditions shall be measured separately

a. At or near the ground level
b. Work in liquid mud
c. Work in or under foul positions

4.2.13.3. Cast-in-situ concrete and or precast concrete work shall be measured in stages described in the item of work, such as -

a. At or near the ground level
b. Up to specified floor level
c. Between two specified floor levels
d. Up to specified height above or depth below plinth level/ defined datum level

e. Between two specified heights or depths with reference to plinth level / defined datum level

4.2.13.4. No deduction shall be made for the following -

a. Ends of dissimilar materials for example beams, girders, rafters, purlins trusses corbels and steps up to 500sq. cm in cross sections.

b. Opening up to 0.1sq meter (1000sq.cm).

c. Volume occupied by pipes, conduits, sheathing etc. not exceeding 100sq cm each in cross sectional areas.

d. Small voids such as shaded portions in Figure when these do not exceed 40sq cm each in cross section.

Note - In calculating area of opening, the thickness of any separate lintel or still shall be included in the height. Nothing extra shall be payable for forming such openings or voids.

4.2.13.5. Cast-in-situ concrete shall be classified and measured as follows -

a) Foundation, footings, bases for columns

b) Walls (any thickness) including attached pilasters, buttresses, plinth and string courses, fillets etc.

3. STONE WORK:-

Requirements of a good structural stone - Structural stones should primarily be (a) strong against crushing, (b) durable, (resistance to weather), (c) good in appearance (colour), (d) susceptible of being quarried in large sizes, and (e) fire resisting.

The strength of a stone depends upon its density and weight.

5.1.4. Stones used in building construction - The principal stones used in building construction are granites, gneiss, trap or basalt, quartzites, laterites, schists, lime stones, sand stones, pot stones and slates.

a) Granites – A. typical granite contains large proportion of feldspar than quartz, mixed with little mica, either the Muscovite or the Biotite variety.

(1) Syenite is a variety of granite, composed of orthoclase feldspar and hornblende.

(2) Diorite is another variety of granite containing plagioclase (feldspar with inclined planes or cleavage) and hornblende or some other Ferro magnesium silicate often associated with free quartz. It usually occurs as introduced in masses in the form of dykes.

(3) Mica is a source of weakness in granite. If the feldspar is of the orthoclase variety, the granite is not very strong.

(a). The best form of granite is that which contains a large production of quartz plagioclase feldspar and very little mica. If it is fine grained, it can be easily worked and polished and used for ornamental works also.

(b) Gneiss - A metamorphic rock. Gneisses are grouped according to the nature of the dark mineral present in the sample or according to the type of igneous rock to which they are most related. Normal granite is a massive rock without foliation. Normal granite is a massive rock without foliation; when it talks foliated structure subsequent to its crystallisation it is termed gneiss.

(c) Trap or Basalt - Both are igneous rocks. Trap contains feldspar and hornblende while Basalt, which contains feldspar, augite and iron. Both are fine grained. They are very compact, hard and durable stones. They are rather hard to work and obtainable in small sizes and not obtainable in large blocks.

(d) Quartzites - Derived from the metamorphosis of sandstones or conglomerates. It is very hard to work and breaks up into irregular sizes and large blocks are not available.

(e) Laterites - are clay stones with a vesicular texture, the vesicular being impregnated with iron in cellular structure. It is a soft rock suitable for light buildings. It contains moisture (quarry sap) when freshly quarried and is thus very easy to dress at that time. After exposure for a month or two, it becomes harder. It is very easy to work but care is required in selection of stones.

5.1.12. Specification for random rubble stone masonry:

5.1.12.1. Stone - The stone will be of the type specified such as granite, trap, lime stone, sand stone, quartzite, etc. and shall be obtained from the quarries, approved by the engineer. Stone shall be hard, sound, durable, and free from weathering decay and defects like cavities, cracks, flaws, sand holes, injurious veins, patches of loose or soft materials and other similar defects that may adversely affect its strength and appearance. As far as possible stone shall be of uniform colour, quality, or texture. Generally stones shall not contain crystalline silica or chart, Mica and other deleterious materials like iron oxide, organic impurities etc. Stones with round surface shall not be used.

The compressive strength of common types of stones shall be as per Table 1 and the percentage of water absorption shall generally not exceed 5% for stones other than specified in Table 1. For laterite this percentage is 12%.

Table 1

Type of stone	Maximum Water Absorption percentage by weight	Minimum Compressive strength kg/sq cm

Granite	0.5	1000
Basalt	0.5	400
Lime stone (Slab & Tiles)	0.15	200
Sand stone (Slab & Tiles)	2.5	300
Marble	0.40	500
Quartzite	0.40	800
Laterite (Block)	12	35

Note 1: Test for compressive strength shall be carried out as laid down in IS: 1121 (Part 1).

Note 2: Test for water absorption shall be carried out as laid down in IS: 1124.

5.1.12.2. Size of stones - Normally stones used should be small enough to be lifted and placed by hand. Unless otherwise indicated, the length of stones for stone masonry shall not exceed three times the height and the breadth or base shall not be greater than three-fourth the thickness of the wall, or not less than 15 cm. The height of stone may be up to 30 cm.

4. SPECIFICATIONS FOR FORMWORK (CENTRING & SHUTTERING)

4.6.2.1 - Form work shall include all temporary or permanent forms or moulds required for forming the concrete which is cast-in-situ, together with all temporary construction required for their support.

4.6.2.2 - Design & tolerance in construction - Form work shall be designed and constructed to the shapes, lines and dimensions shown on the drawings with the tolerances given below.

a)	Deviation from specified dimensions of cross section of columns and beams		+ 12 mm
b)	Deviation from dimensions of footings		+ 12 mm
	i)	Dimension in plan	+ 50 mm
	ii)	Eccentrically in plan	0.02 times the width of the footings in the direction of deviation but not more than 50 mm
	iii)	Thickness	+ 0.05 times the specified thickness.

(Note – Tolerance apply to concrete dimensions only, and not to positioning of vertical steel or dowels.)

4.6.2.3. General requirement - It shall be strong enough to withstand the dead and live loads and forces caused by ramming and vibrations of concrete and other incidental loads, imposed upon it during and after casting of concrete. It shall be

made sufficiently rigid by using adequate number of ties and braces, Screw jacks or hard board wedges where required shall be provided to make up any settlement in the form work either before or during the placing of concrete.

Forms shall be so constructed as to be removable in sections in the desired sequence, without damaging the surface of concrete or disturbing other sections. Care shall be taken to see that no piece is keyed into the concrete. See also Annexure 4-A.7

4.6.2.4. Material for form work

Propping and centering - All propping and centering should be either of steel tubes with extension pieces or built up sections of rolled steel.

Centering / Staging - Staging should be as designed with required extension pieces as approved by engineer to ensure proper slopes, as per design for slabs /beams etc. and as per levels as shown in drawings. All the staging to be either tubular steel structure with adequate bracings as approved or made of built up structural sections made from rolled structural steel sections

a). In case of structures with two or more floors, the weight of concrete, centering and shuttering of any upper floor being cast shall be suitably supported on one floor below the top most floor already cast.

b). Form work and concreting of upper floor shall not be done until concrete of lower floor has set at least for 14 days.

Shuttering - Shuttering used shall be of sufficient stiffness to avoid excessive deflection and joints shall be tightly butted to avoid leakage of slurry. If required, rubberized lining of material as approved by the engineer shall be provided in the joints.

Steel shuttering used for concreting should be sufficiently stiffened. The steel shuttering should also be properly repaired before use and properly cleaned to avoid stains, honey combing, seepage of slurry through joints etc.

Runner joints RS, MS Channel or any other suitable section of the required size shall be used as runners.

Assembly of beam head over props, Beam head is an adopter that fits snugly on the head plates of props to provide wider support under beam bottoms.

Form work shall be properly designed for self weight, weight of reinforcement, weight of fresh concrete, and in addition, the various live loads likely to be imposed during the construction process (such as workmen, materials and equipment). In case the height of centering exceeds 3.50 meters, the prop may be provided in multi-stages. Typical arrangements of form work for 'Beams, columns and walls, and forms secured by wall ties are shown in Figure 1 to 8: and typical detail of multistage shuttering is given in Fig. 9.

Camber - Suitable camber shall be provided in horizontal members of structure, especially in cantilever spans to counteract the effect of deflection. The form work shall be so assembled as to provide for camber. The camber for beams and slabs shall be 4 mm per meter (1 to 250) or as directed by the engineer, so as to offset the subsequent deflection. For cantilevers the camber at free end shall be 1/50th of the projected length or as directed by the engineer.

Walls - The forms faces have to be kept at fixed distance apart and an arrangement of wall ties with spacer tubes or bolts is considered best. A typical wall form with

the components identified is given in Fig.1, 2, & 3. The two shutters of the wall are to be kept in place by appropriate ties, braces and studs.

Removal of form work (stripping time) - In normal circumstance and where ordinary Portland cement is used, forms may generally be removed after the expiry of the following periods -

a) Walls ,columns and faces of all structural members 24 to 48 hours as many be decided by the engineer

b) Slab

i)	Spanning up to 4.50 M	7 days
ii)	Spanning over 4.50 M	14 days

c) Beams and arches

i)	Spanning up to 6 M	14 days
ii)	Spanning over 6 M & up to 9 m	21 days
iii)	Spanning over 9 M	28 days

Note 1 -For the other types of cement, the stripping time recommended for ordinary Portland cement may be suitably modified. If Portland pozzolana or low heat cement has been used for concrete, the stripping time will be 10/7 of the period stated above.

Note 2 - The number of props left under, their sizes and disposition shall be such as to be able to safely carry the full dead of the slabs, beam or arch as the case may be together with any live load likely to occur during curing of further construction.

Note 3 - For rapid hardening cement, 3/7 of above periods will be sufficient in all cases except for vertical side of slabs, beams and columns which should be retained for at least 24 hours.

Note 4 - In case cantilever slabs and beams, the centering shall remain till structures for counter acting or bearing down have been erected and have attained sufficient strength.

Note 5 - Proper precautions should be taken to allow for the decrease in the rate of hardening that occurs with all types of cement in cold weather and accordingly stripping time shall be increased.

Note 6 - Work damaged through premature or careless removal of forms shall be reconstructed.

4.6.2.5. Surface treatment

Oiling the surface - Shuttering gives much longer service life in the surfaces are coated with suitable mould oil which acts both as a parting agent and also gives surface protections. Typical mould oil is heavy mineral oil or purified cylinder oil containing not less than 5% pentachlorophenol conforming to IS 716 well mixed to a viscosity of 70-80 centipoises.

After 3-4 uses and also in case when shuttering has been stored for a long time, it should be recoated with mould oil before the next use. The design of form work shall conform to sound engineering practices and relevant IS codes.

4.6.2.6. Inspection of form work - The completed form work shall be inspected and approved by the engineer before reinforcement bars are placed in position. Proper from work should be adopted for concreting so as to avoid honey combing, blow

holes, grout loss, stains or discolouration of concrete etc. Proper and accurate alignment and profile of finished concrete surface will be ensured by proper designing and erection of form work which will be approved by engineer.

Shuttering surface before concreting should be free from any defect / deposits and fully cleaned so as to give perfectly straight smooth concrete surface. Shuttering surface should be therefore checked for any damage to its surface and exclusive roughness before use.

4.6.2.7. Erection of form work (centering and shuttering) - Following points shall be borne in mind while checking during erection.

Any member which is to remain in position after the general dismantling is done, should be clearly marked.

Material used should be checked to ensure that, wrong items / rejects are not used.

If there are any excavations nearby which may influence the safety of form works, corrective and strengthening action must be taken.

i) The bearing soil must be sound and well prepared and the sole plates shall bear well on the ground.

Sole plates shall be properly seated on their bearing pads or sleepers.

The bearing plates of steel props shall not be distorted.

The steel parts on the bearing members shall have adequate bearing areas.

d) Safety measures to prevent impact of traffic; scour due to water etc. should be taken. Adequate precautionary measures shall be taken to prevent accidental impacts etc.

e) Bracing, struts and ties shall be installed along with the progress of form work to ensure strength and stability of form work at intermediate stage. Steel sections (especially deep sections) shall be adequately restrained against tilting, over turning and form work should be restrained against horizontal loads. All the securing device and bracing shall be tightened.

f) The stacked materials shall be placed as catered for, in the design.

g) When adjustable steel props are used, they should -

i). Be undamaged and not visibly bent.

ii). Have the steel pins provided by the manufacturers for use.

iii). Be restrained laterally near each end.

iv). Have means for centralizing beams placed in the fork heads.

h) Screw adjustment of adjustable props shall not be over extended.

i) Double wedges shall be provided for adjustment of the form to the required position wherever any settlement / elastic shortening of props occur. Wedges should be used only at the bottom end of single prop. Wedges should not be too steep and one of the pair should be tightened / clamped down after adjustment to prevent their shifting.

j) No member shall be eccentric upon vertical member.

k) The number of nuts and bolts shall be adequate.

l) All provisions of the design and / or drawings shall be complied with.

m) Cantilever supports shall be adequate.

n) Props shall be directly under one another in multistage constructions as far as possible.

o) Guy ropes or stays shall be tensioned property.

p) There shall be adequate provision for the movement and operation of vibrators and other construction plant and equipment.

q) Required camber shall be provided over long spans.

r) Supports shall be adequate, and in plumb within the specified tolerances.

4.6.2.8 Measurements

4.6.2.8.1. General - The form work shall include the following;

a) Splayed edges, notching, allowance for overlaps and passing at angles, sheathing battens, strutting, bolting, nailing, wedging, easing, striking and removal.

b) All supports, struts, braces, wedges as well as mud sills, piles or other suitable arrangements to support the form work.

c) Bolts, wire ties, clamps, spreaders, nails or any other items to hold the sheathing together.

d) Working scaffolds ladders, gangways, and similar items.

e) Filling to form stop chamfered edges of splayed external angles not exceeding 20 mm wide to beams, columns and the like.

f) Where required, the temporary openings provided in the forms for pouring concrete, inserting vibrators, and cleaning holes for removing rubbish from the interior of the sheathing before concrete.

g) Dressing with oil to prevent adhesion and

h) Raking or circular cutting.

4.6.2.8.2. Classification of measurements - Where it is stipulated that the form work shall be paid for separately, measurements shall be taken of the area of shuttering in contact with the concrete surface. Dimensions of the form work shall be measured correct to a cm. The measurements shall be taken separately for the following -

a). Foundations, footings, bases of columns etc. and for mass concrete and precast shelves,

b). Walls (any thickness) including attached pilasters, buttresses, plinth and string courses etc. c). Suspended floors, roofs, landings, shelves and their supports and balconies. d). Lintels, beams, girders, Bressummers and cantilevers. e). Columns, pillars, posts and struts. f). Stairs (excluding landing) except Spiral staircase. g). Spiral staircase (including landing). h). Arches. i). Domes, vaults, shells roofs, arch ribs and folded plates. j). Chimneys and shafts. k). Well steining. l). Vertical and horizontal fins individually nor forming box, louvers and bands. m). Waffle or ribbed slabs. n). Edges of slabs and breaks in floors and walls (to be measured in running meters where below 200 mm in width or thickness). o). Cornices and mouldings. p). Small surfaces, such as cantilevers ends, brackets and end of steps, caps and boxes to pilasters and columns and like. q). Chula hoods, weather shades, Chajjas, corbels etc. including edges and r). Elevated water reservoirs.

4.6.2.8.3 Centering, and shuttering where exceeding 3.5 meter height in one floor shall be measured and paid for separately.

4.6.2.8.4 Where it is not specifically stated in the description of the item that form work shall be paid for separately, the rate of the RCC item shall be deemed to include the cost of form work.

4.6.2.8.5. No deductions from the shuttering due to the openings / obstructions shall be made if the area of such openings / obstructions does not exceed 0.1 square meters. Nothing extra shall be paid for forming such openings.

4.6.2.8.7 Rate - The rate of the form work includes the cost of labour and materials required for all the operations described above.

5. SPECIFICATIONS FOR REINFORCEMENTS IN CONCRETE

4.6.3.1. General requirements - Steel conforming to para 4.6.1.2. for reinforcement shall be clear and free from loose mill scales, dust, loose rust, coats of paints, oil or other coatings which may destroy or reduce bond. It shall be stored in such a way as to avoid distortion and to prevent deterioration and corrosion. Prior to assembly of reinforcement on no account any oily substance shall used for removing the rust.

(1). Assembly of reinforcement - Bars shall be bent correctly and accurately to the size and shape as shown in the detailed drawing or as directed by engineer. Preferably bars of full length shall be used. Necessary cutting and straightening is also included. Over lapping of bars, where necessary shall be done as directed by the engineer. The overlapping bars shall not touch each other and these shall be kept apart with concrete between them by 25 mm or 1 ¼ times the maximum size of the coarse aggregate whichever is greater. But where this is not possible, the overlapping bars shall be bound together at intervals not exceeding twice the dia. Of such bars with two strands annealed steel wire of 0.90 mm to 1.6 mm twisted tight. The overlaps / splices shall be staggered as per directions of the engineer. But in no case the over lapping shall be more than 50% of cross sectional area at one section.

(2). Bonds and hooks forming end anchorages - Reinforcement shall be bent and fixed in accordance with procedure specified in IS 2502, code of practice for bending and fixing of bars for concrete reinforcement. The details of bends and hooks are shown below for guidance.

a) U-Type hook - In case of mild steel plain bars standard U-type hook shall be provided by bending ends of rod into semicircular hooks having clear diameter of the bar

Note-In case of work in seismic zone, the size of hooks at the end of the rod shall be eight times the diameter of bar or as given in the structural drawing.

b) Bends - Bend forming anchorage to a M.S. plain bar shall be bent with an internal radius equal to two times the diameter of the bar with a minimum length beyond the bend equal to four times the diameter of the bar.

(3). Anchoring bars in tension - Deformed bars may be used without end anchorages provided, development length requirement is satisfied. Hooks should normally be provided for plain bars in tension. Development length of bars will be determined as per clause 25.2.1 of IS: 456-2000.

(4). Anchoring bars in compression - The anchorage length of straight bar in compression shall be equal to the 'Development length' of bars is compression as specified in of IS: 456-2000. The projected length of hooks, bends and straight

lengths beyond bend, if provided for a bar in compression, shall be considered for development length.

(5). Binders, stirrups, links and the like - In case of binders, stirrups, links etc. the straight portion beyond the curve at the end shall be not less than eight times the nominal size of bar.

(6). Welding of bars - Whenever facility for electric arc welding is available, welding of bars shall be done in lieu of overlap. The location and type of welding shall be got approved by the engineer. Welding shall be as per IS: 2751 for mild steel bars and for cold worked bars.

4.6.3.2 Placing in position - Fabricated reinforcement bars shall be placed in position as shown in the drawings or as directed by the engineer. The bars crossing one another shall be tied together at every intersection with two stands of annealed steel wire 0.9 to 1.6 mm thickness twisted tight to make the skeleton of the steel work rigid so that the reinforcement does not get displaced during deposition of concrete.

Track welding in crossing bars shall also be permitted in lieu of bending with steel wire if approved by engineer.

The bars shall be kept in correct position by the following methods -

a) In case of beam and slab construction precast cover blocks of cement mortar 1:2 about 4x4 cm section and of thickness equal to the specified cover shall be placed between the bars and shuttering, so as to secure and maintain the requisite cover of concrete over reinforcement.

b) In case of cantilevered and doubly reinforced beams or slabs, the vertical distance between the horizontal bars shall be maintained by introducing chairs, spacers or support bars of steel at 1.0 meter or at shorter spacing to avoid sagging.

c) In case of columns and walls, the vertical bars shall be kept in position by means of timber templates with slots accurately cut in them; or with block of cement mortar 1:2 of required size suitably tied to the reinforcement to ensure that they are in correct position during concreting.

d) In case of R.C.C. structure such arches, domes, shells, storage tanks etc. a combination of cover blocks, spaces and templates shall be used as directed by engineer.

Tolerance on placing of reinforcement - Unless otherwise specified by the engineer, reinforcement shall be placed within the following tolerances -

Tolerance in spacing

		Tolerance in spacing
a)	For effective depth 200 mm or less	± 10
b)	For effective depth More than 200 mm	± 15

The cover shall in no case be reduced by more than one third of specified cover or 5 mm which ever is less.

Bending at construction joints - Where reinforcement bars are bent aside at construction joints and afterwards bent back into their original position care should be taken to ensure that at no time the radius of the bend is less than 4 bars diameters for plain mild steel or 6 bar diameters for deformed bars. Care shall also be taken when bending back bars to ensure that the concrete around the bars in not damaged.

4.6.3.3. Measurements - Reinforcement including authorised spacer bars and laps shall be measured in length of different diameters, as actually (not more than as specified in the drawings.) used in the work nearest to a centimeter and their weight calculated on the basis of standard weight given in Table 14 below. Wastage and unauthorized overlaps shall be paid for. Annealed steel wire required for binding or tack welding shall not be measured, its cost being included in the rate reinforcement.

Wherever tack welding is used in lieu of binding, such welds shall not be measured. Chairs separators etc. shall be provided as directed by the engineer and measured separately and paid for.

Table 14 Cross-sectional area and mass of steel bar

Nominal size mm	Cross sectional area sq.mm	Mass per meter run kg
6	28.3	0.222
7	38.5	0.302
8	50.3	0.395
10	78.6	0.617
12	113.1	0.888
16	201.2	1.58
18	254.6	2.00
20	314.3	2.47
22	380.3	2.98
25	491.1	3.85
28	616.0	4.83
32	804.6	6.31
36	1018.3	7.99
40	1257.2	9.85
45	1591.1	12.50
50	1964.3	15.42

Note - These are as per clause 5.2 of IS 1786.

4.6.3.4. Rate - The rate for reinforcement shall include the cost of labour and materials required for all operations described above such as cleaning of reinforcement bars, straightening, cutting, as required of directed including tack welding on crossing of bars in lieu of binding with wires.

4.6.4 SPECIFICATIONS FOR CONCRETING

The concrete shall be done as specified. The proportion by volume of ingredients shall be as specified.

4.6.4.1 Consistency - The concrete which will flow sluggishly into the forms and around the reinforcement without any segregation of coarse aggregate from the mortar shall be used. The consistency shall depend on whether the concrete is vibrated on or hand tamped. It shall be determined by slump test as n[prescribed in chapter " concrete under para 4.2.3 workability"

Where considered necessary, the workability of the concrete may also be ascertained by compacting factor test and VEE BEE censistometer method specified in IS: 1199. For suggested ranges of values of workability of concrete by the above two methods, reference may be made to IS: 456.

4.6.4.2 Placing of concrete

Concreting shall be commenced only after engineer has inspected the centering, shuttering and reinforcement as placed and passed the same. Shuttering shall be clean and free from all shaving, saw dust, pieces of wood, or other foreign material and surfaces shall be treated as prescribed.

In case of concreting of slabs and beams, wooden plank or cat walks of chequered MS plates or bamboo chlies or any other suitable material supported directly on the centering by means of wooden blocks or lugs shall be provided to convey the concrete to the place of deposition without disturbing the reinforcement in any way. Labour shall not be allowed to walk over the reinforcement.

In case of columns and walls, it is desirable to place concrete without construction joints. The progress of concreting in the vertical direction shall be restricted to one meter per hour.

The concrete shall be deposited in its final position in a manner to preclude segregation of ingredients. In deep trenches and footings concrete shall be placed through chutes or as directed by the engineer. In case of columns and walls, the shuttering shall be so adjusted that the vertical drop of concrete in not more than 1.5 meters at a time.

During cold weather, concreting shall not be done when the temperature falls below 4.5° c. the concrete placed shall be protected against frost by suitable converting. Concrete damaged by frost shall be removed and work redone.

During hot weather precaution shall be taken to see that the temperature of wet concrete does not exceed 38°C. no concrete shall be laid within half of the closing time of the day, unless permitted by the engineer.

It is necessary that the time taken between mixing and placing of concrete shall not exceed 30 minutes so that the initial setting process is not interfered with

4.6.4.3 Compaction - Concrete shall be compacted into dense mass immediately after placing by means of mechanical vibrators designed for continuous operations. The engineer may however relax this conditions at his discretion for certain items, depending on the thickness of the members and feasibility of vibrating the same and permit hand compaction instead. Hand compaction shall be done with the help of tamping rods so that concrete is thoroughly compacted and completely worked around the reinforcement, embedded fixtures, and into corners of the from. The layers of concrete shall be so placed that the bottom layer does not finally set before the top layer is placed. The vibrators shall maintain the whole of concrete under

treatment in an adequate state of agitation, such that de-aeration and effective compaction is attained at a rate commensurate with the supply of concrete from the mixers. The vibration shall continue during the whole period occupied by placing of concrete, the vibrators being adjusted so that the centre of vibrations approximates to the centre of the mass being compacted at the time of placing.

Concrete shall be judged to be properly compacted, when the mortar fills the spaces between the coarse aggregate and begins to cream up to form an even surface. When this condition has been attained, the vibrator shall be stopped in case of vibrating tables and external vibrators. Needle vibrators shall be withdrawn slowly so as to prevent formation of loose pockets in case of internal vibrators. In case both internal and external vibrators are being used, the internal vibrator shall be first withdrawn slowly after which the external vibrators shall be stopped so that no loose pocket is left in the body of the concrete. The specific instructions of the makers of the particular type of vibrator used shall be strictly complied with. Shaking of reinforcement for the purpose of compaction should be avoided. Compaction shall be completed before the initial setting starts, i.e. within 30 minutes of addition of water to the dry mixture.

4.6.4.4 Construction joints - Concreting shall be carried out continuously up to the construction joints, the position and details of which shall be as shown in structural drawing or as indicated in Fig. 26 or as directed by engineer. Number of such joints shall be kept to minimum. The joints shall be kept at places where the shear force is the minimum. These shall be straight and shall be at right angles to the direction of main reinforcement.

In case of columns the joints shall be horizontal and 10 to 15 cm below the bottom of the beam running into the column head. The portion of the column between the stepping off level and the top of the slab shall be concreted with the beam.

When stopping the concrete on a vertical plane in slabs and beams, an approved stop-board (see Fig.26C) shall be placed with necessary slots for reinforcement bars or any other obstruction to pass the bars freely without bending. The construction joints shall be keyed by providing a triangular or trapezoidal fillet nailed on the stop-board. Inclined or feather joints shall not be permitted. Any concrete flowing through the joints of stop-board shall be removed soon after the initial set. When concrete is stopped on a horizontal plane, the surface shall be roughened and cleaned after the initial set.

When the work has to be resumed, the joint shall be thoroughly cleaned with wire brush and loose particles removed. A coat of neat cement slurry at the rate of 2.75 kg of cement per square meter shall then be applied on the roughened surface before fresh concrete is laid.

4.6.4.5 Expansion joints - Expansion joints shall be provided as shown in the structural drawings or as indicated in Fig. 10 to 25 or as directed by engineer, for the purpose of general guidance. However it is recommended that structures exceeding 45 m in length shall be divided by one or more expansion joints. The filling of these joints with bitumen filler, bitumen felt or any such material and provision of copper plate, etc. shall be paid for separately in running meter. The measurement shall be taken up to two places of decimal stating the depth and width of joint.

4.6.4.6 Curing - After the concrete has begun to harden i.e. about 1 to 2 hours after its laying, it shall be protected from quick drying by covering with moist gunny bags, sand, canvass Hessian or any other material approved by the engineer. After

24 hours of laying of concrete, the surface shall be cured of ponding with water for a minimum period of 7 days from the date of placing of concrete.

4.6.4.7 Finishing - In case of roof slabs the top surface shall be finished even and smooth with wooden trowel, before the concrete begins to set.

Immediately on removal of forms, the R.C.C work shall be examined by the engineer, before any defects are made good.

The work that has sagged or contains honey combing to an extent detrimental to structural safety or architectural concept shall be rejected as given for visual inspection test.

Surface defects of a minor nature may be accepted. On acceptance of such a work by the engineer, the same shall be rectified as follows -

1) Surface defects which require repair when forms are removed, usually consist of bulges due to movement of forms, ridges at form joints, honey combed areas, damage resulting from the stripping of forms and bolt holes, bulges and ridges are removed by careful chipping or tooling and the surface is then rubbed with a grinding stone. Honey-combed and other defective areas must be chipped out, the edges being cut as straight as possible and perpendicularly to the surface, or preferable slightly undercut to provide a key at the edge of the path.

2) Shallow patches are first treated with a coat of thin grout composed of one part of cement and one part of fine sand and then filled with mortar similar to that used in the concrete. The mortar is placed in layers not more than 10 mm thick and each layer is given a scratch finish to secure bond with the succeeding layer. The last layer is finished to match the surrounding concrete by floating, rubbing or tooling on formed surfaces by pressing the form material against the patch while the mortar is still plastic.

3) Large and deep patches require filling up with concrete held in place by forms. Such patches are reinforced and carefully dowelled to the hardened concrete.

4) Holes left by bolts are filled with mortar carefully packed into places in small amounts. The mortar is mixed as dry as possible, with just enough water so that it will be tightly compacted when forced into place.

5) Tiered holes extending right through the concrete may be filled with mortar with a pressure gun similar to the gun used for greasing motor cars.

6) Normally, patches appear darker than the surrounding concrete, possibly owing to the presence on their surface of less cement laitance. Where uniform surface colour is important, this defect shall be remedied by adding 10 to 20 percent of white Portland cement to the patching mortar, the exact quantity being determined by trial.

7) The same amount of care to cure the material in the patches should be taken as with the whole structure. Curing must be started as soon as possible, after the patch is finished to prevent early drying. Damp Hessian may be used but in some locations it may be difficult to hold it in place. A membrane curing compound in these cases will be most convenient.

c). The exposed surface of R.C.C work shall be plastered with cement mortar 1 -3 (1 cement - 3 fine sand) of thickness not exceeding 6 mm to give smooth and even surface true to line and form. Any RCC surface which remains permanently exposed to view in the completed structure shall be considered exposed surface for the purpose of this specification.

Where such exposed surface exceeding 0.5 sq.m in each location is not plastered with cement mortar 1:3 (1 cement to 3 fine sand) 6 mm thick, necessary deduction shall be made for plastering not done.

d). The surface which is to receive plaster or where it is to be joined with brick masonry wall, shall be properly roughened immediately after the shuttering is removed, taking care to remove the laitance completely without disturbing the concrete. The roughening shall be done by hacking. Before the surface is plastered, it shall be cleaned and wetted so as to give bond between concrete and plaster.

e). The surface of RCC slab on which the cement concrete of mosaic floor is to be laid shall be roughened with brushes while the concrete is green. This shall be done without disturbing the concrete.

4.6.4.8 Strength of concrete - The compressive strength on work tests for different mixes shall be as given in Table 15 below -

Table 15

Concrete mix (Nominal mix on volume basis)	Compressive strength in (kg/sq cm)	
	7 days	28 days
1:1:2	210	315
1:1 ½ : 3	175	265
1:2:4	140	210

4.6.4.9 Testing of concrete

(1). Regular mandatory tests on the consistency and workability of the fresh concrete shall be done to achieve the specified compressive strength of concrete. These will be of two types

Mandatory Lab. Test

Mandatory Field Test

(3). Results of Mandatory Field Test will prevail over Mandatory Lab. Test.

a) Work Test-Mandatory Lab. Test shall be carried out as prescribed.

b) Mandatory Field Test (Hammer Test), shall be carried out as prescribe in Annexure 4.A.2

(4). Additional test - Additional test, if required, shall be carried out as prescribed in Annexure 4.A.7

(5). Slump test - This test shall be carried out as prescribed in Annexure 4.A.1

(6). Visual inspection test - The concrete will be inspected after removal of the form work as described. The question of carrying out mandatory test or other tests described in Annexure 4-A.2 and 4-A.4 will arise only after satisfactory report of visual inspection.

The concrete is liable to be rejected, if,

(i) It is porous or honeycombed.-

(ii) Its placing has been interrupted without providing a proper construction joint;

(iii) The reinforcement has been displaced beyond tolerance specified; or construction tolerance has not been met.

However, the hardened concrete may be accepted after carrying out suitable remedial measures to the satisfaction of the engineer at the risk and cost of the contractor.

4.6.4.10 Standard of acceptance

(1). Mandatory lab test - For concrete sample and tested as prescribed in Annexure 4- A.2 the following requirement shall apply.

Out of six sample cubes, three cubes shall be tested at 7 days and remaining three cubes at 28 days, if found necessary.

(2). 7days' tests

(a). Sampling - The average of the strength of three specimens shall be accepted as the compressive strength of the concrete provided the variation In strength of individual specimen is not more than ± 15% of the average. Difference between the maximum and minimum strength should not exceed 30% of average strength of three specimen. If the difference between maximum and minimum strength exceeds 30% of the average strength, then 28 days' test shall have to be carried out.

(a). Strength - If the actual average strength of sample accepted in para 'sampling' above is equal to or higher than specified strength up to 15% then strength of the concrete shall be considered in order. In case the actual average strength of sample accepted in the above para is lower than the specified or higher by more than 15% then 28 days' test shall have to be carried out to determine the compressive strength of concrete cubes.

(3). 28 days' test

(a) The average of the strength of three specimen be accepted as the compressive strength of any individual cube shall neither be less than 70% nor higher than 130% of the specified strength.

(b) If the actual average strength of accepted sample exceeds specified strength by more than 30%, the engineer, if he so desires may further investigate the matter. However, if the strength of any individual cube exceeds more than 30% of specified strength, it will be restricted to 130% only for computation of strength.

(c) If the actual average strength of accepted sample is equal to or higher than specified strength upto30% then strength of the concrete shall be considered in order and the concrete shall be accepted at full rates.

(d) If the actual average strength of accepted sample is less than specified strength but not less than specified strength but not less than 70% of specified strength, the concrete may be accepted at reduced rate at the discretion of engineer.

(e) If the actual average strength of accepted sample is less than 70% of specified strength, the engineer shall reject the defective portion of work represented by sample and nothing shall be paid for the rejected work. Remedial measures necessary to retain the structure shall be taken at the risk and cost of contractor. If, however, the engineer so desires, he may order additional tests (see Annexure 4-A.4) to be carried out to ascertain if the structure can be retained. All the charges in connection with these additional tests shall be borne by the contractor.

(4). Acceptance criteria of mandatory field test

(A) Preparation of standard test cubes for calibration of rebound hammer at site

(a) In the beginning the standard test cubes of specified mix shall be prepared by field units before undertaking any concrete work in each project.

(b) At least 18 standard cubes necessary for formation of one specimen of specified mix, shall be cast by site staff well in advance. From these 18 cubes any 3 cubes may be selected at random to be tested for crushing strength of 7 days. The crushing strength obtained should satisfy the specified strength for the mix as per specification or agreement. If the strength is satisfactory then the remaining cubes will form the standard samples for calibration of rebound hammer. In case of failure, the site staff should totally reject the samples and remove them also and then make another set of samples by fresh mixing or alternatively, out of the remaining 15 cubes 3 cubes will be tested on 28 days. If the 28 days' tests are found satisfactory then remaining 12 cubes will form the standard sample for calibration at 28 days' strength otherwise all samples shall be rejected and whole procedure repeated to form a fresh specimen. All the results shall be recorded in a register.

(c) No concreting will be allowed unless the standard specimen cubes are obtained.

The criteria for acceptance and calibration of hammer will be 28 days' strength. the 7 days' strength is only to facilitate the work to start.

(d) No work (for the concrete cast between 8th day) shall be allowed to be paid unless 28 days' cube strength is obtained. For the concrete cast between 8th and 28th day, the decision to make the payment may be taken by the engineer on the basis of existing criteria. Concrete work will be rejected if 28 days' strength falls short as per acceptance criteria. No further work will be allowed till the acceptable standard cubes are obtained.

(e) Frequency - It will be once in each quarter or as per the direction and discretion of engineer. Whenever the acceptance criteria is changed or concrete mix or type of cement is changed or engineer feels it necessary for recorded reasons with the approval of the authority according technical sanction, fresh specimen shall be prepared.

(B) Calibration of hammer

(a) Simultaneously, same three cubes to be tested on 28 days as referred in para A (b) above shall be used to correlate the compressive strength of their concrete with rebound number as per procedure described in para 5.2 of the IS: 13311 (Part 2) "Indian standard for non-destructive testing of concrete Method of test by rebound hammer which is given below in para B (b). the average of values of the rebound number (minimum readings) obtained in respect of same three cubes passing on 28 days' work test shall form the datum reference for remaining cubes for the strength of cubes.

(b) The concrete cubes specimens are held in a compression testing machine under a fixed load, measurements of rebound hammer taken and then compressive strength determined as per IS: 516. The fixed load required is of the order of 7N / mm^2 when the impact energy of the hammer is about 2.2 NM.

If the specimens are wet cured, they should be removed from wet storage & kept in the laboratory atmosphere for about 24 hours before testing. Only the vertical faces of the cubes as cast should be tested for rebound number. At least nine readings should be taken on each of the three vertical faces accessible in the compression testing machine when using rebound hammers. The points of impact on the

specimen must not be nearer than 20 mm from each other. The same points must not be impacted more than once.

(c) The rebound number of hammer will be determined on each of the remaining (18-3-3=12) cubes. Whenever the rebound number of hammer of any individual cube varies by more than ± 25% from the datum readings referred to in para B(a) above, that cube will be excluded and will not be considered for standard specimen cubes for calibration. It must be ensured that at least 8 cubes out of 12 that is 66.6% are within the permissible range of variation of rebound number i.e. ± 25% or otherwise whole procedure shall have to be repeated and fresh specimen prepared.

These 8 cubes will form one standard sample in the beginning before commencement of work and shall be kept carefully for the visiting officers who will calibrate their hammers on these cubes.

(d) This calibration will be done by field staff with their hammer and then chart of calibration giving the details of the average readings, date & month of casting, mix of the concrete etc. shall be prepared and signed by engineer and will be duly preserved for future reference as and when required.

(C) Preservation of cubes at site - Standard sample cubes cast shall be carefully preserved at site under the safe custody of AE or his representative for making them available together with the charts, to the any other senior departmental officers, during their inspection of the work.

(D) Testing at site - (D-2) Testing will be done generally by non-destructive methods like rebound hammers etc. Each field Division / Sub Division / Unit will purchase rebound hammers and keep them in working order at work site. Testing will be done only by hammers, which are dully calibrated.

(D-3) The relative strength of actual field work will be tested with reference to strength of these standard cubes and calibration charts of a hammer for determining the rebound number on the field work. The hammer will be used as per manufacturer's guidelines at various locations chosen at random. The number of location / reading on each wall, beam or column etc. shall not be less than 12. All the readings should be within the ± 25% range of values prescribed in calibration chart normally. However, reading indicating good strength will be when it is at par with calibrated value between 100% & 125% and very good if more than 125%. Any value between 100% & 75% of calibrated value shall be considered satisfactory. Values from 75% to 50% shall be considered for fragment at rates reduced on prorata basis. The concrete indicating rebound number less than 50%of calibrated value shall be rejected and not paid for.

(E) Acceptance of field tests and strength - If the relative strength of actual field work is found satisfactory considering the calibration charts with reference to the standard cube test kept at site, the representative work will be considered satisfactory. If the work is considered below satisfactory, the same will be dealt as stated in para D-3 above.

(F) 7 days' Strength in rare cases only - Normally cube crushing strength on 28 days' test shall form the basis of acceptance. However in rare cases of time bound projects / urgent repairs 7 days' cube test strength criteria may be adopted on similar lines using 7 days' standard test cubes and calibration graphs / curves /charts for 7 days' in lieu of 28 days' and testing work done at 7 days'.

(G) Precautions

(G-1) The testing shall be done generally as per the guidelines of manufacturer of the apparatus and strictly in accordance with the procedure laid down in clause 6 of IS: 13311 (part 2) Indian Standard for Non-Destructive Testing of concrete-Method of Test by Rebound Hammer.

(G-2) The rebound hammers are influenced by number of factors like type of cement aggregate, surface conditions, moisture content, age of concrete etc. Hence care shall be taken to compare the cement, aggregate etc. and tested under the similar surface conditions having more or less same moisture content and age. However effect of age can be ignored for concrete between 3 days & 3 months old.

4.6.4.11 Measurement

4.6.4.11.1. Dimensions shall be measured nearest to a cm except for the thickness of slab which shall be measured correct to 0.5 cm.

4.6.4.11.2. The areas shall be worked out nearest to 0.01 sq. mt. The cubical contents shall be worked out to nearest 0.01 cubic meters.

4.6.4.11.3. Reinforced cement concrete whether cast-in-situ or present shall be classified and measured separately as follows.

(a) Raft, footing, bases of columns etc. and mass concrete. (b) walls (any thickness) including attached pilasters, buttresses, plinth and string course, fillets etc. (c) suspended floors, roofs, landings and balconies. (d) Shelves (e) Chajjas (f) Lintel, beams and Bressummers. (g) Columns, pillars, piers, abutments, posts and struts. (h) Stair-cases including waist or waist less slab but excluding landing except in (I) below. (j) Spiral stair-case (including landing). (k) Arches, arch ribs, domes and vaults. (l) Chimneys and shafts. (m) Well steining. (n) Vertical and horizontal fins individually or forming box, louvers and fascias. (o) Kerbs, steps and the like. (p) String course, bands, coping, bed plates, anchor blocks, plain window sills and the like. (q) Moldings as in cornices window sills etc.

Shell, dome and folded plates. (r) Extra for shuttering in circular work in plan.

4.6.4.11.4 No deduction shall be made for the following -

(a) Ends of dissimilar materials (e.g. joists, beams post girders, rafters, purlin trusses, corbels steps etc.) up to 500 sq cm in cross-section

(b) Opening up to 0.1sq.m.

Note-In calculating area of openings up to 0.1sq.m the size of opening shall include the thickness of any separate lintels or sills. No extra labour for forming such opening or voids shall be paid for.

(c) The volume occupied by reinforcement.

(d) The volume occupied by water pipes, conducts etc. not exceeding 25 sq cm each in cross sectional area. Nothing extra shall be paid for leaving and finishing such cavities and holes.

4.6.4.11.5 Measurement shall be taken before any rendering is done in concrete members. Measurement will not include rendering. The measurement of R.C.C. work between various units shall be regulated as below -

(a) Slabs shall be taken as running continuously through except when slab is monolithic with the beam. In that case it will be from the face to face of the bream.

(b) Beams shall be measured from face to face of columns and shall include haunches, if any, between columns and beam. The depth of the bottom of beam

shall be from the bottom of slab to the bottom of beam and slabs are not monolithic. In case of monolithic construction where slabs are integrally connected with beam, the depth of beam shall be from the top of the slab to the bottom of beam.

(c) The columns measurement shall be taken through.

(d) Chajjas along with its bearing on wall shall be measured in cubic meter nearest to two places of decimal. When Chajjas is combined with Lintel, slab or beam, the projecting portion shall be measured as Chajjas, built in bearing shall be measured as per item of Lintel, slab or beam in which chhajja bears.

(e) Where the band and Lintels are of the same height and the band serves as Lintel, the portion of the band to be measured as lintel shall be for clear length of opening plus twice the over all depth of band.

4.6.4.12. Tolerances - Subject to the condition that structural safety is not impaired and architectural concept does not hamper, the tolerances in dimensions of R.C.C members shall be as specified in the drawing by the designer. Whenever these are not specified, the permissible tolerance shall be decided by the engineer after consultations with the Designer, if necessary.

When tolerances in dimensions are permitted, following procedure for measurements shall apply.

(a). If the actual dimensions of R.C.C members do not exceed or decrease the design dimensions of the members plus or minus tolerance limit specified above, the design dimensions shall be taken for the purpose of measurements.

(b). If the actual dimensions exceed the design dimensions by more than the tolerance limit, the design dimensions only shall be measured for the purpose of payment.

(c). If the actual dimensions decrease more than the tolerance limit specified, the actual dimensions of the RCC members shall be taken for the purpose of measurement and payment.

(d). For acceptance of RCC members whose dimensions are not exactly as per design dimension of engineer shall be final. For the purpose of payment, however, the clarification as given in para a, b & c above shall apply

4.6.4.13 Rate

The rate includes the cost of materials and labour involved in all the operations described above except for the cost of centering and shuttering.

On the basis of mandatory lab tests, in case of actual average compressive strength being less than specified strength but upto 70% of specified strength, the rate payable shall be in the same proportion as actual average compressive strength bears to the specified compressive strength.

Example

1. Average compressive strength in 80% of specified strength. Rate payable shall be 80% of agreement rate.

2. In case average compressive strength in less than 70% of the specified strength, the work represented by the sample shall be rejected.

3. However, on the basis of mandatory field test, where they prevail, the rates of the work represented by samples showing actual compressive strength less than

specified strength shall be worked out as per para above. In addition, engineer may order for additional tests (see Annexure 4-A.4) to be carried out at the cost of contractor to ascertain if the portion of structure where in concrete represented by the samples has been used, can be retained on the basis of these test. Engineer may take further remedial measures as necessary to retain the structure at the risk and cost of the contractor.

Where throating or plaster drip or molding is not required to be provided in RCC Chajjas, deduction for not providing throating or plaster drip or molding shall be made from the item of R.C.C. In Chajjas. The measurement for deduction item shall be measured in running meters direct to a cm of the edge of chhajja.

No extra payment for richer mix which projects into any meter from another member during concreting of junctions of beams and columns etc. will be made except to the extent structurally considered necessary and when so indicated in the structural drawing. The payments for work done under items of different mixes shall be limited strictly to what is indicated in the structural drawings.

SPECIFICATIONS FOR PLAIN AND REINFORCED CONCRETE (EXTRACT OF IS 456:2000)

This standard was first published in 1953 under the title 'Code of practice for plain and reinforced concrete for general building construction' and subsequently revised in 1957. The code was further revised in 1964 and published under modified title 'Code of practice for plain and reinforced concrete', thus enlarging the scope of use of this code to structures other than general building construction also. The third revision was published in 1978, and it included limit state approach to design.
This is the fourth revision of the standard. This revision was taken up with a view to keeping abreast with the rapid development in the field of concrete technology and to bring in further modifications/improvements in the light of experience gained while using the earlier version of the standard.
This revision incorporates a number of important changes. The major thrust in the revision is on the following lines;

a) In recent years, durability of concrete structures have become the cause to all concrete technologists. This has led to the need to codify the durability requirements world over. In this revision of the code, in order to introduce in-built protection from factors affecting a structure, earlier clause on durability has been elaborated and a detailed clause covering different aspects of design of durable structure has been incorporated.

b) Sampling and acceptance criteria for concrete have been revised. With this revision acceptance criteria has been simplified in line with the provisions given in BS 5328 (Part 4): 1990 'Concrete: Part 4 Specifications for the procedures to be used in sampling, testing and assessing compliance of concrete'.

Some of the significant changes incorporated in section 2 are as follows;

(a) All the three grades of ordinary Portland cement, namely 33 grade, 43 grade and 53 grade and sulphate resisting Portland cement have been included in the list of types of cement used (in addition to other types of cement). (b) The permissible limits for solids in water have been modified keeping in view the durability requirements. (c) The clause on admixtures has been modified in view of the availability of new types of admixtures including super plasticizers. (d) In Table 2

'Grades of Concrete', grades higher than M - 40 have been included. (e) It has been recommended that minimum grade of concrete shall be not less than M 20 in reinforced concrete work (see also 6.1.3.). (f) The formula for estimation of modulus of elasticity of concrete has been revised. (g) In the absence of proper correlation between compacting factor, vee-bee time slump, workability has now been specified only in terms of slump in line with the provisions in BS 5328 (Parts 1 to 4). (h) Durability clause has been enlarged to include detailed guidance concerning the factors affecting durability. The table on 'Environmental Exposure Conditions' has been modified to include 'very severe' and 'extreme' exposure conditions. This clause also covers requirements for shape and size of member, depth of concrete cover, concrete quality, requirement against exposure to aggressive chemical and sulphate attack, minimum cement requirement and maximum water cement ratio, limits of chloride content, alkali silica reaction, and importance of compaction, finishing and curing. (i) A clause on 'Quality Assurance Measures' has been incorporated to give due emphasis to good practices of concreting. (j) Proper limits have been introduced on the accuracy of measuring equipments to ensure accurate batching of concrete. (k) The clause on 'Construction Joints' has been modified. (l) The clause on 'Inspection' has been modified to give more emphasis on quality assurance.

The significant changes incorporated in section 3 are as follows;

(a) Requirements for 'Free Resistance' have been further detailed. (b) The figure for estimation of modification factor for tension reinforcement used in calculation of basic values of span to effective depth to control the deflection of flexural member has been modified. (c) Recommendations regarding effective length of cantilever have been added. (d) Recommendations regarding deflection due to lateral loads have been added. (e) Recommendations for adjustments of support moments in restrained slabs have been included. (f) In the determination of effective length of compression members, stability index has been introduced to determine sway or no sway conditions. (g) Recommendations have been made for lap length of hooks for bars in direct tension and flexural tension. (h) Recommendations regarding strength of welds have been modified. (i) Recommendations regarding cover to reinforcement have been modified. Cover has been specified based on durability requirements for different exposure conditions. The term 'nominal cover' has been introduced. The cover has now been specified based on durability requirement as well as for fire requirements.

The significant change incorporated in section 4 is the modification of the clause on Walls. The modified clause includes design of walls against horizontal shear.

In section 5 on limit state method a new clause has been added for calculation of enhanced shear strength of sections close to supports. Some modifications have also been made in the clause on Torsion. Formula for calculation of crack width has been added (separately given in Annex F).

Working stress method has now been given in Annexure B so as to given greater

emphasis to limit state design. In this Annex, modifications regarding torsion and enhanced shear strength on the same lines as in section 5 have been made.

Whilst the common methods of design and construction have been covered in this code, special systems of design and construction of any plain or reinforced concrete structure not covered by this code may be permitted on production of satisfactory evidence regarding their adequacy and safety by analysis or test or both (see 19).

In this code it has been assumed that the design of plain and reinforced cement concrete work is entrusted to a qualified engineer and that the execution of cement concrete work is carried out under the direction of a qualified and experienced supervisor.

In this formulation of this standard, assistance has been derived from the following publications;

BS 5328: Part 1: 1991 Concrete: Part 1 Guide to specifying concrete, British Standards Institution.

BS 5328: Part 2: 1991 Concrete: Part 2 Methods for specifying concrete mixes, British standards institution.

BS 5328: Part 3: 1990 Concrete: Part 3 Specification for the procedures to be used in producing and transporting concrete, British Standards Institution.

BS 5328: Part 4: 1990 Concrete: Part 4 Specification for the procedures to be used in sampling, testing and assessing compliance of concrete, British Standards Institution.

BS 8110: Part 1: 1985 Structural use of concrete: Part 1 Code of practice for design and construction, British Standards Institution.

BS 8110: Part 2: 1985 Structural use of concrete: Part 2 Code of practice for special circumstances, British Standards Institution.

ACI 319: 1989 Building code requirements for reinforced concrete, American Concrete Institute.

AS 3600:1988 Concrete structures, Standards Association of Australia.

DIN 1045 July 1988 Structural use of concrete, design and construction, Deutsche Institute fur Normung E.V.

CEB-FIP Model code 1990, Comite Euro – International Du Belon

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS: 2:1960 'Rules for rounding off numerical values (revised)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. Scope

1.1. This standard deals with the general use of plain and reinforced concrete.

1.1.1. For the purpose of this standard, plain concrete structures are those where reinforcement, if provided is ignored for determination of strength of the structure.

1.2. Special requirements of structures, such as shells, folded plates, arches,

bridges, chimneys, blast resistant structures, hydraulic structures, liquid retaining structures and earthquake resistant structures, covered in respective standards have not been covered in this standard; these standards shall be used in conjunction with this standard.

2. **References -** The Indian Standards listed in Annexure A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annexure A.

3. **Terminology -** For the purpose of this standard, the definitions given in IS4845 and IS 6461 (Parts 1 to 12) shall generally apply.

4. Symbols - For the purpose of this standard, the following letter symbols shall have the meaning indicated against each; where other symbols are used, they are explained at the appropriate place**;**

A – Area

b – Breadth of beam, or shorter dimension of a rectangular column

bef – Effective width of slab

bf – Effective width of flange

bw – Breadth of web or rib

D – Overall depth of beam or slab or diameter of column; dimension of a rectangular column in the direction under consideration

Df – Thickness of flange

DL – Dead load

d - Effective depth of beam or slab

d' – Depth of compression reinforcement from the highly compressed face

Ec – Modulus of elasticity of concrete

EL – Earthquake load

E3 – Modulus of elasticity of steel

e – Eccentricity

fck – Characteristic cube compressive strength of concrete

fcr – Modulus of rupture of concrete (flexural tensile strength)

fct – Splitting tensile strength of concrete

fd – Design strength

fy – Characteristic strength of steel

Hw – Unsupported height of wall

Hws – Effective height of wall

Ief – Effective moment of inertia

Igr – Moment of inertia of the gross section excluding reinforcement

Ir – Moment of inertia of cracked section

K – Stiffness of member

k – Constant or co-efficient or factor

Ld – Development length
LL – Live load or imposed load
Lw – Horizontal distance between centres of lateral restraint
l – Length of a column or beam between adequate lateral restraints or the unsupported length of a column
Ief – Effective span of beam or slab or effective length of column
Iex – Effective length about x-x axis
Iey - Effective length about y-y axis
In – Clear span, face-to-face of supports
l'n - l'n for shorter of the two spans at right angles
lx – Length of shorter side of slab
ly – Length of longer side of slab
l0 – Distance between points of zero moments in a beam
l1 – Span in the direction in which moments are determined, centre to centre of supports.
l2 – Span transverse to l1, centre to centre of supports
l'2 – l2 for the shorter of the continuous spans
M – Bending moment
m – Modular ratio
n – Number of samples
P – Axial load on a compression member
qo – Calculated maximum bearing pressure of soil
r – Radius
s – Spacing of stirrups or standard deviation
T – Torsional moment
t - Wall thickness
V – Shear force
W – Total load
WL – Wind load
w - Distributed load per unit area
wd – Distributed dead load per unit area
w1 – Distributed imposed load per unit area
x – Depth of neutral axis
Z – Modulus of section
z – Lever arm
α ß – Angle or ratio
γf – Partial safety factor for load
γm – Partial safety factor for material
δm – Percentage reduction in moment
Єcc – Creep strain of concrete
δcbc - Permissible stress in concrete in bending compression
δcc – Permissible stress in concrete in direct compression

δmc – Permissible stress in metal in direct compression
δsc – Permissible stress in steel in compression
δsv – Permissible tensile stress in shear reinforcement
ζbd – Design bond stress
ζc – Shear stress in concrete
ζc,max – Maximum shear stress in concrete with shear reinforcement
ζv – Nominal shear stress
Φ – Diameter of bar

Materials, workmanship, inspection and testing

5. **Materials**

5.1. **Cement -** The cement used shall be any of the following and the type selected should be appropriate for the intended use;

(a) Ordinary Portland cement conforming to IS: 269 : 2015

(f) Portland pozzolana cement (calcined clay based) conforming to IS: 1489 (Part 1). (g) Portland pozzolana cement (Calcined clay based) conforming to IS: 1489 (Part 2). (h) Hydrophobic cement conforming to IS: 8043. (i) Low heat Portland cement conforming to IS: 12600. (j) Sulphate resisting Portland cement conforming to IS: 12330

Other combinations of Portland cement with mineral admixtures (see 5.2) of quality conforming with relevant Indian Standards laid down may also be used in the manufacture of concrete provided that there are satisfactory data on their suitability, such as performance test on concrete containing them.

5.1.1. Low heat Portland cement conforming to IS: 12600 shall be used with adequate precautions with regard to removal of formwork, etc.

5.1.2. High alumina cement conforming to IS: 6452 or super-sulphated cement conforming to IS: 6909 may be used only under special circumstances with the prior approval of the engineer. Specialist literature may be consulted for guidance regarding the use of these types of cements.

5.1.3. The attention of the engineers and users of cement is drawn to the fact that quality of various cements mentioned in 5.1 is to be determined on the basis of its conformity to the performance characteristics given in the respective Indian Standard Specification for that cement. Any trade-mark or any trade name indicating any special features not covered in the standard or any qualification or other special performance characteristics sometimes claimed/indicated on the bags or containers or in advertisements alongside the 'Statutory Quality Marking' or otherwise have no relation whatsoever with the characteristics guaranteed by the Quality Marking as relevant to that cement. Consumers are, therefore, advised to go by the characteristics as given in the corresponding Indian Standard Specification or seek specialist advise to avoid any problem in concrete making and construction.

5.6. **Reinforcement -** The reinforcement shall be any of the following **Corrosion resistant steel**;

(a) High strength deformed steel bars conforming to IS: 1786. (b) Hard-drawn steel wire fabric conforming to IS: 1566... (c) Structural steel conforming to Grade A of IS: 2062.

5.6.1. All reinforcement shall be free from loose mill scales, loose rust and coats of paints, oil, mud or any other substances, which may destroy or reduce bond. Sand blasting or other treatment is recommended to clean reinforcement.

5.6.2. Special precautions like coating of reinforcement may be required for reinforced concrete elements in exceptional cases and for rehabilitation of structures. Specialist literature may be referred to in such cases.

5.6.3. The modulus of elasticity of steel shall be taken as 200kN/mm². The characteristic yield strength of different steel shall be assumed as the minimum yield stress/0.2 percent proof stress specified in the relevant Indian Standard.

5.7. **Storage of materials -** Storage of materials shall be as described in IS 4082.

6. **Concrete**

6.1. **Grades -** The concrete shall be in grades designated as per Table 2.

6.1.1. The characteristic strength is defined as the strength of material below which not more than 5 percent of the test results are expected to fall.

6.1.2. The minimum grade of concrete for plain and reinforced concrete shall be as per Table 5.

6.1.3. Concrete of grades lower that those given in Table 5 may be used for plain concrete constructions, lean concrete, simple foundations, foundation for masonry walls and other simple or temporary reinforced concrete construction.

6.2. **Properties of concrete**

6.2.1. **Increase of strength with age -** There is normally a gain of strength beyond 28 days. The quantum of increase depends upon the grade and type of cement, curing and environmental conditions, etc. The design should be based on 28 days characteristic strength of concrete unless there is an evidence to justify a higher strength for a particular structure due to age.

Table 2 Grades of concrete (Clause 6.1, 9.2.2., 15.1.1. and 36.1.)

Group	Grade Designation	Specified Characteristic Compressive Strength of 150mm Cube at 28days in N/mm²
Ordinary Concrete	M 10	10
	M 15	15
	M 20	20
Standard Concrete	M 25	25
	M 30	30
	M 35	35
	M 40	40
	M 45	45
	M 50	50
	M 55	55
High Strength Concrete	M 60	60
	M 65	65
	M 70	70

	M 75	75
	M 80	80

Notes: 1. In the designation of concrete mix M refers to the mix and the number to the specified compressive strength of 150mm size cube at 28 days, expressed in N/mm².

2. For concrete of compressive strength greater than M 55, design parameters given in the standard may not be applicable and the values may be obtained from specialized literatures and experimental results.

6.2.1.1. For concrete of grade M 30 and above, the rate of increase of compressive strength with age shall be based on actual investigations.

6.2.1.2. Where members are subjected to lower direct load during construction, they should be checked for stresses resulting from combination of direct load and bending during construction.

6.2.2. **Tensile strength of concrete -** The flexural and splitting tensile strengths shall be obtained as described in IS 516 and IS 5816 respectively. When the designer wishes to use an estimate of the tensile strength from the compressive strength, the following formula may be used;

Flexural Strength, $f_{cr} = 0.7 \sqrt{f_{ck}}$ N/mm²

Where, f_{ck} is the characteristic cube compressive strength of concrete in N/mm².

6.2.3. **Elastic deformation -** The modulus of elasticity is primarily influenced by the elastic properties of the aggregate and to a lesser extent by the conditions of curing and age of the concrete, the mix proportions and the type of cement. The modulus of elasticity is normally related to the compressive strength of concrete.

6.2.3.1. The modulus of elasticity of concrete can be assumed as follows;

$E_c = 5000 \sqrt{f_{ck}}$

Where, E_c is the short term static modulus of elasticity in N/mm².

Actual measured values may differ by ± 20 percent from the values obtained from the expression.

6.2.4. **Shrinkage -**The total shrinkage of concrete depends upon the constituents of concrete, size of the member and environmental conditions. For a given humidity and temperature, the total shrinkage of concrete is most influenced by the total amount of water present in the concrete at the time of mixing and, to a lesser extent, by the cement content.

6.2.4.1. In the absence of test data, the approximate value of the total shrinkage strain for design may be taken as 0.0003 (for more information, see IS 1343).

6.2.5. **Creep of concrete -** Creep of concrete depends, in addition to the factors listed in 6.2.4, on the stress in the concrete, age at loading and the duration of loading. As long as the stress in concrete does not exceed one-third of its characteristic compressive strength, creep may be assumed to be proportional to the stress.

6.2.5.1. in the absence of experimental data and detailed information on the effect of the variables, the ultimate creep strain may be estimated from the following

values of creep coefficient (that is, ultimate creep strain/elastic strain at the age of loading); for long span structure, it is advisable to determine actual creep strain, likely to take place;

Age of loading	Creep coefficient
7 days	2.2
28 days	1.6
1 year	1.1

Note – The ultimate creep strain, estimated as described above does not included the elastic strain.

6.2.6. **Thermal expansion -** The coefficient of thermal expansion depends on nature of cement, the aggregate, the cement content, the relative humidity and the size of sections. The value of coefficient of thermal expansion for concrete wit different aggregates may be taken as below;

Types of aggregate	Coefficient of thermal expansion for Concrete/°C
Quartzite	1.2 to 1.3 x 10^{-5}
Sandstone	0.9 to 1.2 x 10^{-5}
Granite	0.7 to 0.95 x 10^{-5}
Basalt	0.8 to 0.95 x 10^{-5}
Limestone	0.6 to 0.9 to x 10^{-5}

7. **Workability of concrete**

7.1. The concrete mix proportions chosen should be such that the concrete is of adequate workability for the placing conditions of the concrete and can properly be compacted with the means available. Suggested ranges of workability of concrete measured in accordance with IS 1199 are given below:

Placing conditions	Degree of workability	Slump (mm)
Blinding concrete; Shallow sections; Pavement using pavers	Very low	See 7.1.1
Mass concrete; Lightly reinforced sections in slabs, Beams, walls, columns; floors; Hand placed pavements; Canal lining; Strip footings	Low	25-75
Heavily reinforced sections in slab, Beams, walls, columns; Slip form work; Pumped concrete	Medium	50-100 75-100
Trench fill; In-situ piling Tremie concrete	High Very high	100-150 See 7.1.2

Note – For most of the placing conditions, internal vibrators (needle vibrators) are suitable. The diameter of the needle shall be determined based on the density and spacing of reinforcement bars and thickness of sections. For tremie concrete, vibrators are not required to be used (see also 13.3)

7.1.1. In the 'very low' category of workability where strict control is necessary, for example pavement quality concrete, measurements of workability by determinations of compacting factor will be more appropriate than slump (see IS: 1199) and a value of compacting factor of 0.75 to 0.80 is suggested.

7.1.2. In the 'very high' category of workability, measurement of workability by determination of flow will be appropriate (see IS: 9103).

8. **Durability of concrete**

8.1. **General -** A durable concrete is one that performs satisfactorily in the working environment during its anticipated exposure conditions during service. The materials and mix proportions specified and used should be such as to maintain its integrity and, if applicable, to protect embedded metal from corrosion.

8.1.1. One of the main characteristics influencing the durability of concrete is its permeability to the ingress of water, oxygen, carbon dioxide, chloride, sulphate and other potentially deleterious substances. Impermeability is governed by the constituents and workmanship used in making the concrete. With normal-weight aggregates a suitably low permeability is achieved by having an adequate cement content, sufficiently low free water/cement ratio, by ensuring complete compaction of the concrete, and by adequate curing. The factors influencing durability include;

(a) The environment (b) The cover to embedded steel; (c) The type and quality of constituent materials; (d) The cement content and water/cement ratio of the concrete; (e) Workmanship, to obtain full compaction and efficient curing; and (f) The shape and size of the member.

The degree of exposure anticipated for the concrete during its service life together with other relevant factors relating to mix composition, workmanship, design and detailing should be considered. The concrete mix to provide adequate durability under these conditions should be chosen taking account of the accuracy of current testing regimes for control and compliance ad described in this standard.

8.2. **Requirements for durability**

8.2.1. **Shape and size of member -** The shape or design details of exposed structures should be such as to promote good drainage of water and to avoid standing pools and rundown of water. Care should also be taken to minimize any cracks that may collect or transmit water. Adequate curing is essential to avoid the harmful effects of early loss of moisture (see 13.5). Member profiles and their intersections with other members shall be designed and detailed in a way to ensure easy flow of concrete and proper compaction during concreting.

Concrete is more vulnerable to deterioration due to chemical or climatic attack when it is in thin sections, in sections under hydrostatic pressure from one side only, in partially immersed sections and at corners and edges of elements. The life of the structure can be lengthened by providing extra cover to steel, by chamfering the corners or by using circular cross-sections or by using surface coating which prevent or reduce the ingress of water, carbon dioxide or aggressive chemicals.

8.2.2. **Exposure conditions**

8.2.2.1. **General environment -** The general environment to which the concrete will be exposed during its working life is classified into five levels of severity, that is, mild, moderate, severe, very severe and extreme as described in Table 3.

Table 3 Environment exposure conditions (clauses 8.2.2.1. and 35.3.2.)

Sl.No.	Environment	Exposure conditions

i	Mild	Concrete surfaces protected against weather or aggressive conditions, except those situated in coastal area.
ii	Moderate	Concrete surfaces sheltered from server rain or freezing whilst wet Concrete exposed to condensation and rain concrete continuously under water concrete in contact or buried under non-aggressive soil/ground water concrete surfaces sheltered from saturated salt air in coastal area.
iii	Severe	Concrete surfaces exposed to severe rain, alternate wetting and drying or occasional freezing whilst wet or severe condensation. Concrete completely immersed in sea water Concrete exposed to coastal environment
iv	Very severe	Concrete surfaces exposed to sea water spray, corrosive fumes or severe freezing conditions whilst wet Concrete in contact with or buried under aggressive sub-soil/ground water
v	Extreme	Surface of members in tidal zone Members in direct contact with liquid/solid aggressive chemicals

8.2.2.2. **Abrasive -** Specialist literatures may be referred to for durability requirements of concrete **surfaces exposed to abrasive action, for example in case of machinery and metal tyres.**

8.2.2.3. **Freezing and thawing -** Where freezing and thawing actions under wet conditions exist, enhanced durability can be obtained by the use of suitable air entraining admixtures. When concrete lower than grade M 50 is used under these conditions, the mean total air content by volume of the fresh concrete at the time of delivery into the construction should be;

Nominal maximum size aggregate (mm)	Entrained air percentage
20	5 ± 1
40	4 ± 1

Since air entrainment reduces the strength, suitable adjustments may be made in the mix design for achieving required strength.

8.2.2.4. **Exposure to sulphate attack -** Table 4 gives recommendations for the type of cement, maximum free water/cement ratio and minimum cement content, which are required at different sulphate concentrations in near-neutral ground water having pH of 6 to 9.

For the very high sulphate concentrations in class 5 conditions, some form of lining such as polyethylene or polychloroprene sheet; or surface coating based on asphalt, chlorinated rubber, epoxy; or polyurethane materials should also be used to prevent access by the sulphate solution.

Table 4 Requirements for concrete exposed to sulphate attack (Clause 8.2.2.4. and 9.1.2.)

Sl.	Class	Concentration of sulfhates, expressed as SO3

No.		In soil		In ground water
		Total SO3	SO3 in 2:1 water: soil extract	
		Percent	G/1	G/1
(1)	(2)	(3)	(4)	(5)
i	1	Traces (<0.2)	Less than 1.0	Less than 0.3
ii	2	0.2 to 0.5	1.0 to 1.9	0.3 to 1.2
iii	3	0.5 to 1.0	1.9 to 3.1	1.2 to 2.5
iv	4	1.0 to 2.0	3.1 to 5.0	2.5 to 5.0
v	5	More than 2.0	More than 5.0	More than 5.0

Cont,

Sl. No.	Types of cement	Dense, fully compacted concrete, made with 20mm nominal max.size aggregate complying with IS 383	
		Minimum cement content kg/m³	Maximum face water cement ratio
	(6)	(7)	(8)
i	Ordinary Portland cement or Portland slag cement or Portland pozzolana cement	280	0.55
ii	Ordinary Portland cement or Portland slag cement or Portland pozzolana cement	330	0.50
	Supersulphated cement or sulphate resisting Portland cement	310	0.50
iii	Supersulphated cement	330	0.50
	Sulphate resisting Portland cement Portland pozzolana cement or Portland slag cement	350	0.45
iv	Supersulphated or sulphate resisting Portland cement	370	0.45
v	Sulphate resisting Portland cement or supersulphated cement with protective coatings	400	0.40

8.2.3. **Requirement of concrete cover**

8.2.3.1. The protection of the steel in concrete against corrosion depends upon an adequate thickness of good quality concrete.

8.2.3.2. The nominal cover to the reinforcement shall be provided as per 26.4.

8.2.4. **Concrete mix proportions**

8.2.4.1. **General -**The free water-cement ratio is an important factor in governing the durability of concrete and should always be the lowest value. Appropriate values for minimum cement content and the maximum free water-cement ratio are given in Table 5 for different exposure conditions. The minimum cement content and maximum water-cement ratio apply to 20mm nominal maximum size aggregate. For other sizes of aggregate they should be changed as given in Table 6.

8.2.4.2. **Maximum cement content -** Cement content not including fly ash and ground granulated blast furnace slag in excess of 450 kg/m³ should not be used unless special consideration has been given in design to the increased risk of cracking due to drying shrinkage in thin sections, or to early thermal cracking and to the increased risk of damage due to alkali silica reactions.

Notes: (1) Cement content given in this table is irrespective of grades of cement. (2) Use of supersulphated cement is generally restricted where the prevailing temperature is above 40 °C. (3) Supersulphated cement gives an acceptable life provided that the concrete is dense and prepared with a water-cement ratio of 0.4 or less, in mineral acids, down to pH 3.5. (4) The cement contents given in col 6 of this table are the minimum recommended. For SO3 contents near the supper limit of any class, cement contents above these minimum are advised. (5) For severe conditions, such as thin sections under hydrostatic pressure on one side only and sections partly immersed, considerations should be given to a further reduction of water-cement ratio. (6) Portland slag cement conforming to IS 455 with slag content more than 50 percent exhibits better sulphate resisting properties. (7) Where chloride is encountered along with Sulphates in soil or ground water, ordinary Portland cement with C3A content from 5 to 8 percent shall be desirable to be used in concrete, instead of sulphate resisting cement. Alternatively, Portland slag cement conforming to IS 455 having more than 50percent slag or a blend of ordinary Portland cement and slag may be used provided sufficient information is available on performance of such blended cements in these conditions.

8.2.5. Mix constituents

8.2.5.1. **General -** For concrete to be durable, careful selection of the mix and materials is necessary, so that deleterious constituents do not exceed the limits.

8.2.5.2. **Chlorides in concrete -** Whenever there is chloride in concrete there is an increased risk of corrosion of embedded metal. The higher the chloride content, or if subsequently exposed to warm moist conditions, the greater the risk of corrosion. All constituents may contain chlorides and concrete may be contaminated by chlorides from the external environments. To minimize the chances of deterioration of concrete from harmful chemical salts, the levels of such harmful salts in concrete coming from concrete materials, that is, cement, aggregates water and admixtures, as well as by diffusion from the environment should be limited. The total amount of chloride content (as CI) in the concrete at the time of placing shall be as given as

Table 7.

The total acid soluble chloride content should be calculated from the mix proportions and the measured chloride contents of each of the constituents. Wherever possible, the total chloride content of the concrete should be determined.

8.2.5.3. **Sulphate in concrete -** Sulphates are present in moist cement and in some aggregates; excessive amounts of water-soluble sulphate from these or other mix constituents can cause expansion and disruption of concrete. To prevent this total water-sulphate content of the concrete mix, expressed as SO3, should not exceed 4 percent by mass of the cement in the mix. The sulphate content should be calculated as the total from the various constituents of the mix. The 4 percent limit does not apply to concrete made with supersulphated cement complying with IS: 6909.

8.2.5.4. **Alkali-aggregate reaction -** Some aggregates containing particular varieties of silica may be susceptible to attack by alkalis (Na2O and K2O) originating from cement or other sources, producing an expansive reaction which can cause cracking and disruption of concrete. Damage to concrete from this reaction will normally only occur when all the following are present together;

(a) A high moisture level, within the concrete; (b) A cement with high alkali content, or another source of alkali; (c) Aggregate containing an alkali reactive constituent.

Where the service records of particular cement/aggregate combination are well established, and do not include any instances of cracking due to alkali-aggregate reaction, no further precautions should be necessary. When the materials are unfamiliar, precautions should take one or more of the following forms;

(a) Use of non-reactive aggregate from alternate sources.

Table 5 Minimum cement content, maximum water-cement ratio and minimum grade of concrete for different exposures with normal weight aggregates of 20mm nominal maximum size

(Clause 6.1.2., 8.2.4.1. and 9.1.2.)

Sl. No.	Exposure	Plain concrete			Reinforced concrete		
		Minimum cement content kg/m³	Maximum free water cement ratio	Minimum grade of concrete	Minimum cement content kg/m³	Maximum free water cement ratio	Minimum grade of concrete
i	Mild	220	0.60	---	300	0.55	M 20
ii	Moderate	240	0.60	M 15	300	0.50	M 25
iii	Severe	250	0.50	M 20	320	0.45	M 30
iv	Very severe	260	0.45	M 20	340	0.45	M 35
v	Extreme	280	0.40	M 25	360	0.40	M 40

Notes: 1. Cement content prescribed in this table is irrespective of the grades of cement and it is inclusive of additions mentioned in 5.2. The additions such as fly ash or ground granulated blast furnace slag may be taken into account in the concrete composition with respect to the cement content and water-cement ratio if the suitability is established and as long as the

maximum amounts taken into account to do not exceed the limit of pozzolona and slag specified in IS: 489 (Part 1) and IS 455 respectfully.2. Minimum grade for plain concrete under mild exposure condition is not specified.

Table 6 Adjustments to minimum cement contents for aggregates other than

20mm nominal maximum size (Clause 8.2.4.1.)

Sl.No.	Nominal maximum aggregate size mm	Adjustments to minimum cement contents in Table 5 Kg/m³
i	10	+40
ii	20	0
iii	40	-30

Table 7 Limits of chloride content of concrete (Clause 8.2.5.2.)

Sl.No.	Type or Use of Concrete	Maximum Total Acid Soluble Chloride Content Expressed as Kg/m³ of Concrete
i	Concrete containing metal and steam cured at elevated temperature and pre-stressed concrete	0.4
ii	Reinforced concrete or plain concrete containing embedded metal	0.6
iii	Concrete not containing embedded metal or any material requiring protection from chloride	3.0

(b) Use of low alkali ordinary Portland cement having total alkali content not more than 0.6 percent (as Na2O equivalent). Further advantage can be obtained by use of fly ash (Grade 1) conforming to IS 3812 or granulated blast furnace slag conforming to IS: 12089 as part replacement of ordinary Portland cement (having total alkali content as Na2O equivalent not more than 0.6 percent), provided fly ash content is at least 20percent or slag content is at least 50percent. (c) Measures to reduce the degree of saturation of the concrete during service such as use of impermeable membranes. (d) Limiting the cement content in the concrete mix and thereby limiting total alkali content in the concrete mix. For more guidance specialist literatures may be referred.

8.2.6. **Concrete in aggressive soils and water**

8.2.6.1. **General -** The destructive action of aggressive waters on concrete is progressive. The rate of deterioration decreases as the concrete is made stronger and more impermeable, and increases as the salt content of the water increases. Where structures are only partially immersed or are in contact with aggressive soils or waters on one side only, evaporation may cause serious concentrations of salts with subsequent deterioration, even where the original salt content of the soil or water is not high.

Note: Guidance regarding requirements for concrete exposed to sulphate attack is given in 8.2.2.4.

8.2.6.2. **Drainage -**At sites where alkali concentrations are high or may become very high, the ground water should be lowered by drainage so that is will not come into direct contact with the concrete.

Additional protection may be obtained by the use of chemically resistant stone facing or a layer of plaster of Paris covered with suitable fabric, such as jute thoroughly impregnated with bituminous material.

8.2.7. **Compaction, finishing and curing -**Adequate compaction without segregation should be ensured by providing suitable workability and by employing appropriate placing and compacting equipment and procedures. Full compaction is particularly important in the vicinity of construction and movement joints and of embedded water bars and reinforcement. Good finishing practices are essential for durable concrete. Overworking the surface and the addition of water/cement to aid in finishing should be avoided; the resulting laitance will have impaired strength and durability ad will be particularly vulnerable to freezing and thawing under wet conditions. It is essential to use proper and adequate curing techniques to reduce the permeability of the concrete and enhance its durability by extending the hydration of the cement, particularly in its surface zone (see 13.5).

8.2.8.2. As far as possible, preference shall be given to pre-cast members unreinforced, well-cured and hardened, without sharp corners, and having trowel smooth finished surfaces free from crazing, cracks or other defects; plastering should be avoided.

9. **Concrete mix proportioning**

9.1. **Mix proportion -** The mix proportions shall be selected to ensure the workability of the fresh concrete and when concrete is hardened, it shall have the required strength, durability and surface finish.

9.1.1. The determination of the proportion of cement aggregates and water to attain the required strengths shall be made as follows;

a) By designing the concrete mix; such concrete shall be called '**Design mix concrete**', or

b) By adopting nominal concrete mix; such concrete shall be called '**Nominal mix concrete**'.

Design mix concrete is preferred to nominal mix. If design mix concrete cannot be used for any reason on the work for grades of M20 or lower, nominal mixes may be used with the permission of engineer, which, however, is likely to involve higher cement content.

9.1.2. **Information required -**In specifying a particular grade of concrete, the following information shall be included;

(a) Type of mix, that is, design mix concrete or nominal mix concrete; (b) Grade designation; (c) Type of cement; (d) Maximum nominal size of aggregate; (e) Minimum cement content (for design mix concrete); (f) Maximum water-cement ratio; (g) Workability; (h) Mix proportion (for nominal mix concrete); (j) Exposure conditions as per Tables 4 and 5; (k) Maximum temperature of concrete at the time of placing; (m) Method of placing; and (n) Degree of supervision.

9.1.2.1. In appropriate circumstances, the following additional information may be specified;

(a) Type aggregate, (b) Maximum cement, and (c) Whether an admixture shall or shall not be used and the type of admixture and the condition of use.

9.2. **Design mix concrete -**9.2.1. As the guarantor of quality of concrete used in the construction, the constructor shall carry out the mix design and the mix so designed (not the method of design) shall be approved by the employer within the limitations of parameters and other stipulations laid down by this standard.

9.2.2. The mix shall be designed to produce the grade of concrete having the required workability and characteristic strength not less than appropriate values given in Table 2. The target mean strength of concrete mix should be equal to the characteristic strength plus 1.65 times the standard deviation.

9.2.3. Mix design done earlier not prior to one year may be considered adequate for later work provided there is no change in source and the quality, of the materials.

9.2.4. **Standard deviation -** The standard deviation for each grade of concrete shall be calculated, separately.

9.2.4.1. **Standard deviation based on test strength of sample**

a) **Number of test results of samples** - The total number of test strength of samples required to constitute an acceptable record for calculation of standard deviation shall be not les than 30. Attempts should be made to obtain the 30 samples, as early as possible, when a mix is used for the first time.

b) **In case of significant changes in concrete -**When significant changes are made in the production of concrete batches (for example changes in the materials used, mix design, equipment or technical control), the standard deviation value shall be separately calculated for such batches of concrete.

c) **Standard deviation to be brought up to date** - The calculation of standard deviation shall be brought up to date after every change of mix design.

9.2.4.2. **Assumed standard deviation -** Where sufficient test results for a particular grade of concrete are not available, the value of standard deviation given in Table 8 may be assumed for design of mix in the first instance. As soon as the results of samples are available, actual calculated standard deviation shall be used and the mix designed properly. However, when adequate past records for a similar grade exist and justify to the designer a value of standard deviation different from that shown in Table 8, it shall permissible to use that value.

Table 8 Assumed standard deviation (Clause 9.2.4.2. and Table 11)

Grade of concrete	Assumed standard deviation N/mm²
M 10	3.5
M 15	
M 20	4.0
M 25	
M 30	5.0
M 35	
M 40	

M 45	
M 50	

Note : The above values correspond to the site control having proper storage of cement; weight batching of all materials; controlled addition of water; regular checking of all materials, aggregate gradings and moisture content; and periodical checking of workability and strength. Where there is deviation from the above the values given in the above table shall be increased by 1N/mm².

9.3. **Nominal mix concrete -** Nominal mix concrete may be used for concrete of M 20 or lower. The proportions of materials for nominal mix concrete shall be in accordance with Table 9.

9.3.1. The cement content of the mix specified in Table 9 for any nominal mix shall be proportionately increased if the quantity of water in a mix has to be increased to overcome the difficulties of placement and compaction, so that the water-cement ratio as specified is not exceeded.

Grade of concrete	Total quantity of dry aggregates by mass per 50kg of cement, to be taken as the sum of the individual masses of fine and coarse aggregates, Kg, Max	Proportion of fine aggregate to coarse aggregates (by mass)	Quantity of water per 50kg of cement, max1
M 5	800	Generally 1:2 but subject to an upper limit of 1:1½ and a lower limit of 1:2½	60
M 7.5	625		45
M 10	480		34
M 15	330		32
M 20	250		30

Note: The proportion of the fine to coarse aggregates should be adjusted from upper limit progressively as the grading of fine aggregates becomes finer and the maximum size of coarse aggregate becomes larger. Graded coarse aggregate shall be used.

Example - For an average grading of fine aggregate (that is, Zone II of Table 4 of IS 383), the proportions shall be 1:1½, 1:2 and 1:2½ for maximum size of aggregates 10mm, 20mm and 40mm respectively.

10. **Quality Assurance Plan**

10.1. Each party involved in the realization of a project should establish and implement a **Quality Assurance Plan,** for its participation in the project. Supplier's and subcontractor's activities shall be covered in the plan. The individual Quality Assurance Plans shall fit into the General Quality Assurance Plan. A quality assurance plan shall define the tasks and responsibilities of all persons involved, adequate control and checking procedure, and the organization and maintaining adequate documentation of the building process and its results. Such documentation should generally include.

(a) Test reports and manufacturer's certificate for materials, concrete mix design details; (b) Pour cards for site organization and clearance for concrete placement; (c) Record of site inspection of workmanship, field tests; (d) Non-conformance reports, change orders; (e) Quality control charts; and

(f) Statistical analysis..

10.2. **Batching -** To avoid confusion and error in batching, consideration should be given to using the smallest practical number of different concrete mixes on any site or in any one plant. In batching concrete, the quality of both cement and aggregate shall be determined by mass; admixture, if solid, by mass; liquid admixture may however be measured in volume or mass; water shall be weighed or measured by volume in a calibrated tank (see also IS: 4925).

Ready-mixed concrete supplied by ready-mixed concrete plant shall be preferred. For large and medium project sites the concrete shall be sourced from ready-mixed concrete plants or from on site or off site batching and mixing plants (see IS: 4926).

10.2.1. Except where it can be shown to the satisfaction of the engineer that supply of properly graded aggregate of uniform quality can be maintained over a period of work, the grading of aggregate should be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions when required, the different sizes being stocked in separate stock-piles. The material should be stock-piled for several hours preferably a day before use. The grading of coarse and fine aggregate should be checked as frequently as possible, the frequency for a given job being determined by the engineer to ensure that the specified grading is maintained.

10.2.2. The accuracy of the measuring equipments shall be within ± 2 percent of the quantity of cement being measured and within ± 3 percent of the quantity of aggregate, admixtures and water being measured.

10.2.3. Proportion/Type and grading of aggregates shall be made by trial in such a way so as to obtain densest possible concrete. All ingredients of the concrete should be used by mass only.

10.2.4. Volume batching may be allowed only where weigh batching is not practical and provided accurate bulk densities of materials to be actually used in concrete have earlier been established. Allowance for bulking shall be made in accordance with IS: 2386 (Part 3). The mass volume relationship should be checked as frequently as necessary, the frequency for the given job being determined by engineer to ensure that the specified grading is maintained.

10.2.5. **It is important to maintain the water-cement ratio constant at its correct value -**To this end, determination of moisture contents in both fine and coarse aggregates shall be made as frequently as possible, the frequency for a given job being determined by the engineer according to weather conditions. The amount of the added water shall be adjusted to compensate for any observed variations in the moisture contents. For the determination of moisture content in the aggregates, IS: 2386 (Part 3) may be referred to. To allow for the variation in mass of aggregate due to variation in their moisture content, suitable adjustments in the masses of aggregates shall also be made. In the absence of exact data, only in the case of nominal mixes, the amount of surface water may be estimated from the values given in Table 10.

Table 10 Surface water carried by aggregate (Clause 10.2.5.)

Sl.No.	Aggregate	Approximate quantity of surface water	
		Percent by mass	$1/m^3$
i	Very wet sand	7.5	120
ii	Moderately wet sand	5.0	80
iii	Moist sand	2.5	40
iv	Moist gravel or crushed rock	1.25-2.5	20-40
	(Coarser the aggregate, less the water it will carry).		

10.2.6. No substitutions in materials used on the work or alterations in the established proportions, except as permitted in 10.2.4 and 10.2.5 shall be made without additional tests to show that the quality and strength of concrete are satisfactory.

10.3. **Mixing -** Concrete shall be mixed in a mechanical mixer. The mixer should comply with IS 1791 and IS 12119. The mixers shall be fitted with water measuring (metering) devices. The mixing shall be continued until there is a uniform distribution of the materials and the mass is uniform in colour and consistency. If there is segregation after unloading from the mixer, the concrete should be remixed.

10.3.1 For guidance, the mixing time shall be at least 2mm. For other types of more efficient mixers, manufacturer recommendations shall be followed; for hydrophobic cement it may be decided by the engineer.

10.3.2 Workability should be checked at frequent intervals (see IS 1199).

10.3.3. Dosages of Retarders, Plasticisers and Super-plasticizers shall be restricted to 0.5, 1.0 and 2.0 percent respectively by weight of cementitious materials and unless a higher value is agreed upon between the manufacturer and the constructor based on performance test.

12. **Assembly of reinforcement**

12.1. Reinforcement shall be bent and fixed in accordance with procedure specified in IS 2502. The high strength deformed steel bars should not be re-bent or straightened without the approval of engineer.

Bar bending schedules shall be prepared for all reinforcement work.

12.2. All reinforcement shall be placed and maintained in the position shown in the drawings by providing proper cover blocks, spacers, supporting bars, etc.

12.2.1. Crossing bars should not be tack-welded for assembly of reinforcement unless permitted by engineer.

12.3. **Placing of reinforcement -**Rough handling, shock loading (prior to embedment) and the dropping of reinforcement from a height should be avoided. Reinforcement should be secured against displacement outside the specified limits.

12.3.1. **Tolerances on placing of reinforcement**

Unless otherwise specified by engineer, the reinforcement shall be placed within the following tolerances;

a) For effective depth 200mm or less - ± 10mm

b) For effective depth more than 200mm - ± 15mm

12.3.2. **Tolerance for cover - Unless** specified otherwise, actual concrete cover should not deviate from the required nominal cover by +10/0mm.

Nominal cover as given in 26.4.1 should be specified to all steel reinforcement including links. Spacers between the links (or the bars where no links exist) and

the formwork should be of the same nominal size as the nominal cover. Spacers, chairs and other supports detailed on drawings, together with such other supports as may be necessary, should be used to maintain the specified nominal cover to the steel reinforcement. Spacers or chairs should be placed at a maximum spacing of 1m and closer spacing may sometimes be necessary. Spacers, cover blocks should be of concrete of same strength or PVC.

12.4. **Welded joints or mechanical connections -** Welded joints or mechanical connections in reinforcement may be used but in all cases of important connections, tests shall be made to prove that the joints are of the full strength of bars connected. Welding of reinforcement shall be done in accordance with the recommendations of IS: 2751 and IS: 9417.

12.5. Where reinforcement bars upto 12mm for high strength deformed steel bars and up to 16mm for mild steel bars are bent aside at construction joints and afterwards bent back into their original positions, care should be taken to ensure that at no time is the radius of the bend less than 4 bar diameters for plain mild steel or 6 bar diameters for deformed bars. Care shall also be taken when bending back bars, to ensure that the concrete around the bar is not damaged beyond the band.

12.6. Reinforcement should be placed and tied in such a way that concrete placement be possible without segregation of the mix. Reinforcement placing should allow compaction by immersion vibrator. Within the concrete mass, different types of metal in contact should be avoided to ensure that bimetal corrosion does not take place.

13. **Transporting, placing, compaction and curing**

13.1. **Transporting and handling** - After mixing, concrete shall be transported to the formwork as rapidly as possible by methods which will prevent the segregation or loss of any of the ingredients or ingress of foreign matter or water and maintaining the required workability.

13.1.1. During hot or cold weather, concrete shall be transported in deep containers. Other suitable methods to reduce he loss of water by evaporation in hot weather and heat loss in cold weather may also be adopted.

13.2. **Placing -** The concrete shall be deposited nearly as practicable in its final position to avoid re-handling. The concrete shall be placed and compacted before initial setting of concrete commences and should not be subsequently disturbed. Methods of placing should be such as to preclude segregation. Care should be taken to avoid displacement of reinforcement or movement of formwork. As a general guidance, the maximum permissible free fall of concrete may be taken as 1.5m.

13.3. **Compaction -** Concrete should be thoroughly compacted and fully worked around the reinforcement, around embedded fixtures and into corners of the formwork.

13.3.1. Concrete shall be compacted using mechanical vibrators complying with IS: 2505, IS: 2506, IS: 2514 and IS: 4656. Over vibration and under vibration of concrete are harmful and should be avoided. Vibration of very wet mixes should also be avoided. Whenever vibration has to be applied externally, the design of formwork and the disposition of vibrators should receive special consideration to ensure efficient compaction and to avoid surface blemishes.

13.4. **Construction joints and cold joints -** Joints are a common source of weakness and, therefore, it is desirable to avoid them. If this is not possible, their number shall be minimized. Concreting shall be carried out continuously up to construction joints, the position and arrangement of which shall be indicated by the designer. Construction joints should comply with IS: 11817.

Construction joints shall be placed at accessible locations to permit cleaning out of laitance, cement slurry and unsound concrete, in order to create rough/uneven surface. It is recommended to clean out laitance and cement slurry by using wire brush on the surface of joint immediately after initial setting of concrete and to clean out the same immediately thereafter. The prepared surface should be in a clean saturated surface dry condition when fresh concrete is placed, against it. In the case of construction joints at locations where the previous pour has been cast against shuttering the recommended method of obtaining a rough surface for the previously poured concrete is to expose the aggregate with a high pressure water jet or any other appropriate means. Fresh concrete should be thoroughly vibrated near construction joints so that mortar from the new concrete flows between large aggregates and develop proper bond with old concrete. Where high shear resistance is required at the construction joints, shear keys may be provided. Sprayed curing membranes and release agents should be thoroughly removed from joint surfaces.

13.5. **Curing -** Curing is the process of preventing the loss of moisture from the concrete whilst maintaining a satisfactory temperature regime. The prevention of moisture loss from the concrete is particularly important if the water cement ratio is low, if the cement has a high rate of strength development, if the concrete contains granulated blast furnace slag or pulverised fuel ash. The curing regime should also prevent the development of high temperature gradients within the concrete.

The rate of strength development at early ages of concrete made with supersulphated cement is significantly reduced at lower temperatures. Supersulphated cement concrete is seriously affected by inadequate curing and the surface has to be kept moist for at least seven days.

13.5.1. **Moist curing -** Exposed surfaces of concrete shall be kept continuously in a damp or wet condition by pounding or by covering with a layer of sacking, canvas, hessian or similar materials and kept constantly wet for at least seven days from the date of placing concrete in case of ordinary Portland cement and at least 10 days where mineral admixtures or blended cements are used. The period of curing shall not be less than 10 days for concrete exposed to dry and hot weather conditions. In the case of concrete where mineral admixtures or blended cements are used, it is recommended that above minimum periods may be extended to 14 days.

13.5.2. **Membrane curing -** Approved curing compounds may be used in lieu of moist curing with the permission of the engineer. Such compounds shall be applied to all exposed surfaces of the concrete as soon as possible after the concrete has set. Impermeable membranes such as polyethylene sheeting covering closely the concrete surface may also be used to provide effective barrier against evaporation.

13.5.3. For the concrete containing Portland pozzolana cement, Portland slag cement or mineral admixture, period of curing may be increased.

13.6. **Supervision**

It is exceedingly difficult and costly to alter concrete once placed. Hence, constant and strict supervision of all the items of the construction is necessary during the progress of the work, including the proportioning and mixing of the concrete. Supervision is also of extreme importance to check the reinforcement and its placing before being covered.

13.6.1. Before any important operation, such as concreting or stripping of the formwork is started, adequate notice shall be given to the construction supervisor.

14. **Concreting under special conditions**

14.1. **Work in extreme weather conditions**

During hot or cold weather, the concreting should bed done as per the procedure set out in IS: 7861 (Part 1) or IS: 7861 (Part 2).

14.2. **Under-water concreting**

14.2.1. When it is necessary to deposit concrete under water, the methods, equipment, materials and proportions of the mix to be used shall be submitted to and approved by the engineer before the work is started.

14.2.2. Under-Water concrete should have a slump recommended in 7.1. The water-cement ratio shall not exceed 0.6 and may need to be smaller, depending on the grade of concrete or the type of chemical attack. For aggregates of 40mm maximum particle size, the cement content shall be at least 350 kg/m^3 of concrete.

14.2.3. Coffer-dams or forms shall be sufficiently tight to ensure still water if practicable, and in any case to reduce the flow of water to less than 3 m/min through the space into which concrete is to be deposited. Coffer-dams or forms in still water shall be sufficiently tight to prevent loss of mortar through the walls. De-watering by pumping shall not be done while concrete is being placed or until 24 hours thereafter.

14.2.4. Concrete cast under should not fall freely through the water. Otherwise it may be leached and become segregated. Concrete shall be deposited, continuously until it is brought to the required height. While depositing, the top surface shall be kept as nearly level as possible and the formation of seams avoided. The methods to be used for depositing concrete under water shall be one of the following;

a) **Tremie** – The concrete is placed through vertical pipes the lower end of which is always inserted sufficiently deep into the concrete, which has been placed previously but has not set. The concrete emerging from the pipe pushes the material that has already been placed to the side and upwards and thus does not come into direct contact with water.

When concrete is to be deposited under water by means of tremie, the top section of the tremie shall be a hopper large enough to hold one entire batch of the mix or the entire contents the transporting bucket, if any. The tremie pipe shall be not less than 200 mm in diameter and shall be large enough to withstand the external pressure of the water in which it is suspended, even if a partial vacuum develops inside the pipe. Preferably, flanged steel pipe of adequate strength for the job should be used. A separate lifting device shall be provided for each tremie pipe with its hopper at the upper end. Unless the lower end of the pipe is equipped with an approved automatic check valve, the upper end of the pope shall be plugged with a wadding of the gunny sacking or other approved material before delivering the concrete to the tremie pipe through the hopper, so that when the concrete is forced down from the hopper to the pipe, it will force the plug (and along with it any water in the pipe) down the pipe and out of the bottom end, thus establishing a continuous stream of concrete. It will be necessary to raise slowly the tremie in order to cause a uniform flow of the concrete, but the tremie shall not be emptied so that water enters the pipe. At all times after the placing of concrete is started and until all the concrete is placed, the lower end of the tremie pipe shall be below the top surface of the plastic concrete. This will cause the concrete to build up from below instead of flowing out over the surface, and thus avoid formation of laitance layers. If the charge in the tremie is lost while depositing, the tremie shall be raised above the concrete surface, and unless sealed by a check valve, it shall be re-plugged at the top end, as at the beginning, before refilling for depositing concrete.

b) **Direct placement with pumps** – As in the case of the tremie method, the vertical end piece of the pipe line is always inserted sufficiently deep into the previously cast concrete and should not move to the side during pumping.

c) **Drop bottom bucket** – The top of the bucket shall be covered with a canvas flap. The bottom doors shall open freely downward and outward when tripped. The

bucket shall be filled completely and lowered slowly to avoid backwash. The bottom doors shall not be opened until the bucket rests on the surface upon which the concrete is to be deposited and when discharged, shall be withdrawn slowly until well above the concrete.

d) **Bags** – Bags of at least 0.028 m^3 capacity of jute or other coarse cloth shall be filled about two-thirds full of concrete, the spare end turned under so that bag is square ended and securely tied. They shall be placed carefully in header and stretcher courses so that whole mass is interlocked. Bags used for this purpose shall be free from deleterious materials.

e) **Grouting** – A series of round cages made from 50mm mesh of 6mm steel and extending over the full height to be concreted shall be prepared and laid vertically over the area to be concreted so that the distance between centres of the cages and also to the faces of the concrete shall not exceed one metre. Stone aggregate of not less than 50mm nor more than 200mm size shall be deposited outside the steel cages over the full area and height to be concreted with due care to prevent displacement of the cages.

A stable 1:2 cement-sand grout with a water-cement ration of not less than 0.6 and not more than 0.8 shall be prepared in a mechanical mixer and sent down under pressure (above 0.2N/mm^2) through 38 to 50 mm diameter pipes terminating into steel cages, about 50mm above the bottom of the concrete. As the grouting proceeds, the pipe shall be raised gradually up to a height of not more than 6000mm above its starting level after which it may be withdrawn and placed into the next cage for further grouting by the same procedure. After grouting the whole area for a height of about 600mm, the operation shall be repeated, if necessary, for the next layer of 600mm and so on.

The amount of grout to be sent down shall be sufficient to fill all the voids which may be either ascertained or assumed as 55percent of the volume to be concreted.

14.2.5. To minimize the formulation of laitance, great care shall be exercised not to disturb the concrete as far as possible while it is being deposited.

15. **Sampling and strength of designed concrete mix**

15.1. **General -** Samples from fresh concrete shall be taken as per IS 1199 and cubes shall be made, cured and tested at 28 days in accordance with IS 516.

15.1.1. In order to get a relatively quicker idea of the quality of concrete, optional tests on beams for modulus of rupture at 72 ± 2 h or at 7 days, or compressive strength tests at 7 days may be carried out in addition to 28 days compressive strength test. For this purpose the values should be arrived at based on actual testing. In all cases, the 28 days compressive strength specified in Table 2 shall alone be the criterion for acceptance or rejection of the concrete.

5.2. **Frequency of sampling**

15.2.1. **Sampling procedure -** A random sampling procedure shall be adopted to ensure that each concrete batch shall have a reasonable chance of being tested that is, the sampling should be spread over the entire period of concreting and cover all mixing units.

15.2.2. **Frequency -** The minimum frequency of sampling of concrete of each grade shall be in accordance with the following;

Quantity of concrete in the work, m^3	Number of samples
1 – 5	1
6 – 15	2
16 – 30	3
31 – 50	4
51 and above	4 plus one additional sample for each

	additional 50m³ or part thereof

Note : At least one sample shall be taken from each shift. Where concrete is produced at continuous production units, such as ready-mixed concrete plant, frequency of sampling may be agreed upon mutually by suppliers and purchasers.

15.3. **Test specimen -** Three test specimens shall be made for each sample for testing at 28 days. Additional samples may be required for various purposes such as to determine the strength of concrete at 7 days or at the time of striking the formwork, or to determine the duration of curing, or to check the testing error. Additional samples may also be required for testing samples cured by accelerated methods as described in IS 9103. The specimen shall be tested as described in IS 516.

15.4. **Test results of sample -** The test results of the sample shall be the average of the strength of three specimens. The individual variation should not be more than ± 15 percent of the average. If more, the test results of the sample are invalid.

16. **Acceptance criteria**

16.1. **Compressive strength -** The concrete shall be deemed to comply with the strength requirements when both the following condition are met;

(a) The mean strength determined from any group of four consecutive test results compiles with the appropriate limits in col 2 of Table 11. (b) Any individual test result complies with the appropriate limits in col 3 of Table 11.

16.2. **Flexural strength -** When both the following conditions are met, the concrete complies with the specified flexural strength.

(a) The mean strength determined from any group of four consecutive test results exceeds the specified characteristic strength by at least 0.3 N/mm². (b) The strength determined from any test result is not less than the specified characteristic strength less 0.3 N/mm².

16.3. **Quantity of concrete represented by strength test results -** The quantity of concrete represented by a group of four consecutive test results shall include the batches from which the first and last samples were taken together with all intervening batches. For the individual test result requirements given in col 2 of Table 11 or in item (b) of 16.2, only the particular batch from which the sample was taken shall be at risk. Where the mean rate of sampling is not specified the maximum quantity of concrete that four consecutive test results represent shall be limited to 60m³.

16.4 If the concrete is deemed not to comply pursuant to 16.3, the structural adequacy of the parts affected shall be investigated (see 17) and any consequential action as needed shall be taken.

16.5 Concrete of each grade shall be assessed separately.

16.6 Concrete is liable to the rejected if it is porous or honey-combed, its placing has been interrupted without providing a proper construction joint, the reinforcement has been displaced beyond the tolerances specified, or construction tolerances have not been met. However, the hardened concrete may be accepted after carrying out suitable remedial measures to the satisfaction of the engineer.

17. **Inspection and testing of structures**

17.1. **Inspection -** To ensure that the construction complies with the design an inspection procedure should be set up covering materials, record workmanship and construction.

17.1.1. Test should be made on reinforcement and the constituent materials of concrete in accordance with the relevant standards. Where applicable, use should be made of suitable quality assurance schemes.

ADDITIONAL TESTS FOR CONCRETE

C-0 In case the concrete fails when tested as per the method prescribed in Annexure 4-A.5, one or more of the following check tests may be carried out at the discretion of engineer to satisfy the strength of the concrete laid. All testing expenditure shall be borne by the contractor. The number of additional tests to be carried out shall be determined by the engineer. He shall be the final authority for interpreting the results of additional tests and shall decide upon the acceptance or otherwise. His decision in this regard shall be final and binding. For the purpose of payment, the Hammering test results only shall be the criteria. Some of the tests are outlined below -

C-1 Cutting cores - This method involves drilling and testing cores from the concrete for determination of compressive strength. In suitable circumstances the compressive strength of the concrete in the structure may be assessed by drilling cores from the concrete and testing. The procedure used shall comply with the requirements of IS: 1199 and IS: 516.

The points from which cores shall be taken shall be representative of the whole concrete and at least three cores shall be obtained and tested. If the average of the strength of all cores cut from the structure is less than the specified strength, the concrete represented by the cores shall be liable to rejection and shall be rejected if a static load test (C-4) either cannot be carried out or is not permitted by the engineer.

C-2 Ultrasonic test - If an ultrasonic apparatus is regularly used by trained personnel in accordance with IS: 13311 (part I) and continuously maintained individual charts are kept showing a large number of readings and the relation between number f readings and the relation between the reading and strength of cubes made from the same batch of concrete, such charts may used to obtain approximate indications of the strength of concrete in the structures. In cases of suspected lack of compaction or low cubes strength the results obtained from the ultrasonic test results on adjacent acceptable sections of the structures may be used for the purpose of assessing the strength of concrete in the suspected portion.

C-3 Load Tests on Individual Precast Units - The load tests described in this clause are intended as check on the quality of the units and should not be used as substitute for normal design procedures. Where members require special testing, such special testing procedures shall be in accordance with the specification. Test loads shall be applied and removed incrementally.

C-3.1. Non-destructive tests - The unit shall be supported at its designed points of support and loaded for five minutes with a load equal to the sum of the characteristic dead load plus one and a quarter time the characteristic imposed load. The deflection is then recorded. The maximum deflection after application of the load shall be in accordance with the requirements defined by the engineer. The recovery is measured five minutes after the removal of the load and the load then reimposed. The percentage recovery after the second loading shall be not less than that after the first loading nor less than 90% of the deflection recorded during the second loading.

At no time during the tests, shall be unit show any sign of weakness of faulty construction as defined by the engineer in the light of reasonable interpretation of relevant data.

C-3.2. Destructive tests - The units is loaded while supported at its design point of support an must not fail at its design load for collapse, within 15 minutes of time

when the test load becomes operative. A Defection exceeding 1/40 of the test span is regarded as failure of the unit.

C-3.3. Special tests - For very large units or units not readily amenable to the above test e.g. columns, the precast parts of composite beams and members designed foe continuity or fixity, and the testing arrangement shall be agreed upon before such units are cast.

C-4. Load tests of structures or parts of structures - The tests described in this clause are intended as check where there is a doubt regarding structural strength. Test loads are to be applied and removed incrementally.

C-4.1. Age at tests - The test is to be carried as soon as possible after the expiry of 28 days from the time of placing of the concrete. When the test is for a reason other than the quality of concrete in the structure being in doubt, the test may be carried out earlier, provided that the concrete has already reached is specified characteristic strength.

C-4.2. Test load - The tests loads to be applied for the limit states of deflection and local damage are the appropriate design loads i.e. the characteristic dead and superimposed loads. When the limit state of collapse is being considered the test load shall be equal to the sum of characteristic dead load plus one and a quarter times the characteristic imposed load and shall be maintained for a period of 24 hours. In any of the test temporary supports of sufficient strength to take the whole load shall be placed in position underneath but not in contact with the member being tested. Sufficient precautions must be taken to safeguard persons in the vicinity of the structure.

C-4.3. Measurements during tests - Measurements of deflection and crack width shall be taken immediately after application of the load and, in the case of 24h loaded period, after removal of the load and after 24h recovery period. Sufficient measurements shall be taken to enable side effects to be taken into account. Temperature and weather conditions shall be recorded during the tests.

C-4.0. Assessment of results - In assessing the strength of a structure or a part of the structure following a load test, the possible effects of variation in temperature and humidity during the period of the test shall be considered.

The following requirements shall be met -

The maximum width of any crack measured immediately on application of the test load for local damage, is to be not more than 2/3 of the value of the appropriate limit state requirement.

For members spanning between two supports the deflection measured immediately on application of the test load for deflection is to be not more than 1/500 of the effective span. Limits shall be agreed upon before testing cantilevered portions of structures.

If maximum deflection in mm shown during 24 h under load is less than $40\ L^2$ / DD where L is effective span in m and D is overall depth of construction in mm, it is not necessary for the recovery to be measured and the requirements (d) does not apply, and

If within 24 hours of the removal of test load for collapse as calculated in clause (a) a reinforced concrete structure does not show a recovery of at least 75 per cent of the maximum deflection shown during the 24 h under load, the loading should be repeated. The structure should be considered to have failed to pass the test if the

recovery after second loading is not at least 75 per cent of the maximum deflection shown during the second loading.

Annexure 4-A.5

FORMWORK AND SCAFFOLDING

1. Concrete is the most widely used construction material today because of its durability, mouldability and other characteristic. Concrete in its plastic stage has no form and therefore, needs to be molded to the required shape. Formwork includes the mould in contact with the wet concrete and all the necessary supports, hardware and bracing. The hardware supports and bracings are generally referred to as centering or false work. Scaffolding is the structure made to provide access to the point of working.

2. In the early days, formwork was generally rigged up by carpenter with available timber and nails as best as possible, using rule of thumb approach. Along with the growth in the development of concrete construction, formwork techniques have also developed side by side. With the technological advancement and introduction of new materials such as plywood, steel, aluminium, polypropylene, fibre reinforced plastics etc more rational approach is being made in the design of formwork.

3. Formwork - The basic objectives of the formwork designer should be to achieve the following:

4. Safety: to build substantially so that formwork is capable of supporting all dead and live loads, without collapse or danger to workmen and to the concrete structure.

5. Quality: To design and build forms accurately so that the desired size, shape and finish of the concrete is attained.

6. Economy: To build efficiently saving time and money for the contractor and owner.

7. Safety must find the first place in the design, construction, erection and stripping of formwork and centering systems.

8. Design consideration - To achieve the above basic objectives of formwork design the following should be considered.

a) Correct assessment of loads that come over forms with due consideration to pressures that arise from wet concrete.

b) Selection of proper forming material considering its strength, durability and cost.

c) Selection of proper supporting systems, either of wood, steel or aluminium. Proprietary supporting systems that are standardised and proved by tests should be adopted with advantage.

d) Provision for proper ties/anchors for the forms and bracing for support.

e) Provision of proper and safe working/access platforms for labour and equipment.

f) Proper scheduling, stripping and refixing of shores.

It is important to realize that centering design requires the same skill and attention to details as the design of permanent structure of like type.

9. Loads on forms - The loads on vertical forms are to be assessed from consideration of:

a. Density of concrete, b. Slump of concrete, c. Rate of pour, d. Method of discharge, e. Concrete temperature, f. Vibration, g. Height of discharge, h. Dimensions of section cast, i. Reinforcement details, j. Stiffness of forms

10. Form material and type - The choice of the form material mainly depends on the availability and cost of the material. Form materials include timber, plywood, hardboard, plastic fiber board, corrugated boxes, steel, aluminium, plaster of Paris etc., Thin metal sheets, neoprene craft paper, hardboard, fibre board and gypsum are generally used as forms liners attached to inside face to improve or alter the surface texture of concrete. Timber, plywood and steel are the main materials used in our country.

11. Timber - Traditional material for formwork has been timber due to its easy availability, relatively low cost and ease for shaping. The disadvantages of timber are warping, twisting, deterioration under stress of heat and contact with wet concrete. It is common practice to support formwork for slab in buildings with timber ballies cut to approximate sizes with wedges used underneath them for final adjustments. These make weak points and are seldom prevented from displacement. Timber ballies are generally not straight and do not transmit load axially.

12. Plywood - The advantages of plywood are large panels for economical construction and removal, choice of thickness, physical properties, good finish and economy from repeated uses.

13. Steel - Steel has been an important material for fabrication of standard as well as special purpose forms, accessories and hardware. Steel is also extensively used for making horizontal and vertical shores. Because of the known characteristics of steel, design calculations for the system can be precisely made. Steel formwork system also facilitates to maintain accurate alignment, level and dimension with excellent surface finish.

Readymade forms are modular panel systems and accessories that can be adopted to build formwork for various sizes and shapes. Tailor made or special purpose made forms is fabricated to order and include tunnel forms, bridge girder shutters, dam shutters etc.

14. Climbing formwork - Most commonly used formwork system is the Climbing Forms. This system basically consists of form panels assembled with or without whalers and supported by vertical strong back members (generally called soldiers) of various designs. The Climbing Form System for large and deep concrete pours may incorporate special features such as, working platforms, adjustable push-pull struts for aligning the formwork and also roller mechanism for shifting the form assembly to allow tying reinforcement and fixing other inserts, in case of thin walls. Various types of anchorage's are used to fix or support the Climbing Form Assembly to the previous concrete lift complete floor height in case of shear walls in buildings, deep pours in piers, abutments of bridges and duct walls are typical examples where such systems are used and generally handled by cranes. For smaller structures and shallow pours, lighter soldiers are used and the Form assembly is usually dismantled in small sections and refixed from pour to pour manually, with external access scaffolding.

15. Slip forms - Slip form construction also known, as sliding forms of construction is similar to extrusion process. The rate of movement of forms is regulated so that

when forms leave the concrete it is strong enough to retain its shape while supporting its own weight. Vertical slip form is used for bins, soils, bridge piers etc. where as horizontal slip form is used for canal lining, tunnel inverts etc. Recent developments in slip form techniques enable construction of tapered structures like chimneys, cooling towers etc where simultaneously with moving of forms, vertically, mechanical/hydraulic jacks also adjust the forms circumferentially to the required sizes as the slide progresses.

16. Suspended forms - This is a climbing system of formwork used for construction of chimneys, silos etc. the forms for outside of the structure is suspended from a concreting platform which in turn is suspended from a central scaffold tower by means of chain pulley block. The formwork system incorporates a radial shift mechanism for adjusting the outer form to the required diameter. The inside forms are usually the climbing types.

17. Travelling or moving forms - Travelling or moving forms are usually made of steel and are generally resorted for construction of long stretches of similar section such as tunnel linings, sewers, galleries, culverts etc. Substantial saving in time and labour is possible by using travelling forms. Travelling forms are tailors made form fabricated/assembled to shape and supported by framework or gantry structure which is fitted with wheels for movement either manually or by electric or hydraulic motors. Hinges or other stripping devices are provided in the shutter itself for collapsing the formwork by means of jacks or turnbuckles. In telescopic type the form is so designed that with one mobile gantry several units of formwork can be handled by telescoping one section of formwork through the other.

18. Aluminum forms - Certain aluminium alloys are used for making forms, which are similar to steel forms. They are lightweight and reduce handling costs.

19. Concrete hardware's - Formwork systems generally incorporate a variety of hardware's such as ties and anchors for resisting lateral pressure exerted by green concrete. Form ties are tensile units consisting of an internal tension member and an external holding device. The ties can be continuous single unit or internal disconnecting type. Form anchors are devices embedded in previously poured concrete and are used for securing formwork for the subsequent lifts.

20. Formwork supports or centering - Various types of formwork supports have been developed in steel. They have been specially designed to cut labour cost in erection and stripping and to make them versatile by incorporating an adjustability feature in most cases. Generally formwork supports are either single leg type or multilegged type such as a frame or a tripod or a trestle. The single leg type is called a prop or a shore and is generally tubular and telescopic type. It incorporates adjusting features through a collar or nut to provide infinite adjustment in height. The props are usually used for supporting formwork upto heights of about 5 M. Beyond this height, they may be used in tiers in which case they are properly tied and braced to form a rigid structure. Bracings can be provided by means of tubes and clamps.

Among the multilegged support systems the common ones are of prefabricated tubular frames in a variety of shapes and modular sizes which can be assembled one over other to get the required heights and also spaced at suitable intervals depending on the loads to be carried. The forms are usually braced together by means of ledgers and cross braces to form a rigid structure. For finer adjustments in height, there are special accessories like screw jack either at top or bottom or both.

Like vertical formwork supports or shores there are also many types of horizontal formwork supports available. These are usually latticed or boxed beams which also telescope one into the other and cater for a range of spans. These horizontal supports rest either on beam forms or other shores at ends. The need for intermediate supports is eliminated and free access and working space is obtained during construction.

An important development in the formwork system particularly for flat slab and multistoried construction is the drop head system. Drop head is fitted on top of the prop or supports which continue to support the slab while the remaining form for the decking could be struck for reuse, there by affecting a great economy in the formwork costs. With this system only an extra set of shores would be required to get faster cycle of slab construction.

Various scaffolding systems may also be adopted and used to act as centering especially when the heights of supports involved is large such as in the case of high industrial buildings, motorway decks, high shell or barrel roof hangers etc.

21. Scaffolding - Practically in all stages of construction, scaffolds are required to provide temporary platforms at various levels to carry out all these works which can not be conveniently and easily carried out either from ground level or any other floor of the building or with the use of a ladder.

22. Timber scaffold - Timber has been used for building scaffold from time immemorial and continues to be used even today. The most common type of scaffolding used in India even today is bally or bamboo scaffold. Barring a few cases where bally or bamboo scaffolding is neatly erected, properly braced and well tied to the building, invariably such scaffolds are in crooked and awkward shapes presenting a dreadful sight particularly on tall building where a stronger and safer scaffolding is called for. The draft revision of IS 3696 suggests limiting bamboo and timber scaffold up to maximum of 18 M. height.

23. Metal scaffold - By and large metal scaffolds are made of steel tubes. Many countries have formulated standard specifications and codes of practice for metal scaffolding. IS: 2750 for steel scaffolding and IS: 4014 parts 1 and 2 for steel tubular scaffolding are relevant Indian Standards.

Metal scaffolds are broadly two types viz. Tubes and fitting type and prefabricated unit frame type.

Tubes and fittings type consists of plain tubes, which are, used for making uprights, transoms, ledger and putlog. Various type of clamps viz. Right angle or double coupler, swivel coupler, putlog coupler, joint pins etc are available for connecting tubes.

Many designs of prefabricated unit type of scaffold have been developed by proprietary concerns and are now being extensively used in most of the construction sites through out the world. Units have been designed incorporating the following basic features.

i) Prefabrication of adjustable components with few or no loose parts.

ii) Simple and fool-proof devices as far as practical to ensure maximum safety.

iii) Speed and ease in erection and dismantling at site by unskilled workers.

iv) Known characteristics of each component enabling complete calculation of loading to ensure use of minimum materials.

v) High degree of versatility and durability enables hundreds of uses for a wide range of applications.

Some of the prefabricated types of scaffoldings available are as follows:

24. Unit frame or three pieces frame - This consists of two verticals and one horizontal member with specially designed end fittings and when three are assembled together it forms a H frame. The end fittings on the horizontal also incorporate a fixing device for the longitudinal ledger. The unit frames can be erected one above the other and are spaced at suitable intervals depending on the duty of the scaffolding. The manufacturers provide complete data on loading capacities. The advantage of this type of three piece frame is that the units can be spaced at any required intervals and also the platforms can be had at any required levels and hence scaffold of this type may be truly called as all purpose type.

25. Welded frame type - These scaffold frames are made as welded units consisting of two uprights and one or more cross members to form a rectangular or H frame. Such frames can be erected one over the other to the required height. Lengthwise such frames are connected either by scissors type cross braces or ledgers. In this system the length of the ledger of cross braces decides the longitudinal spacing of the frame. Accessories such as base plate, adjustable stirrup head etc are also supplied to complete the system. The frames are made of tubes in different grades viz. Light duty or heavy duty as required.

26. Wedge lock or collar grip type - Wedge lock type scaffold consists of verticals, ledgers, transoms and diagonals. The uprights have housing welded on them at regular intervals. The transoms, ledgers and diagonals have specially designed wedge lock assemblies fitted at ends, which engage in the housing on the uprights. This type of scaffolding can be erected very fast and does not require any special tool except a small hammer to drive the wedges in. Necessary accessories are also supplied to complete the system. This is extensively used for building scaffold towers inside chimneys, silos etc and also in ship building.

29. Scaffold boards - Scaffold boards for platform are generally in timber, particularly in pinewood because of its lightweight and strength. Apart from timber boards, Steel planks are also available. They are generally made with thin M.S.Sheet with pressed or cold-formed flanges and provided with anti-skid surface treatment. It may be noted that steel planks would not be suitable for platform in extreme tropical climate and also where oil/grease or such other slippery materials are likely to fall on platforms.

30. Safety requirements - Codes of practice specify the construction details of scaffolding and also give guidelines for bracketing and tying of scaffolds for stability. Single pole scaffolds shall be braced longitudinally and the double pole scaffold shall be braced both longitudinally and transversally, so that the scaffolds from a rigid and stable structure. The scaffold shall be effectively tied to a building or adjacent structure to prevent movement of the scaffold either towards or away from the building or structure. In extreme wind conditions, it may be necessary to provide additional ties, guys or other suitable supports as decided by the engineer.

31. Scaffolding systems.

1. Metallic scaffolding is mainly of steel although aluminum is also finding increasing use as a raw material. Steel scaffolding generally includes the following.

2. Tubes & fittings. This is the commonest type of metallic scaffold first used in 1908 by a British company. This system is versatile but cumbersome and time-

consuming to use since it involves a lot of joints and several loose components, which necessitate safety precautions during erection. It is recommended only for limited applications such as access scaffold for not a very tall building and for old structures/connections.

3. Welded frame-Type-Fabricated - Steel frames and cross braces systems frames are placed at regular intervals one over the other and inter-connected by cross braces for rigidity and stability. This is sturdier and safer, easy to erect and dismantle, and is suited for most staging and scaffolding jobs. But the system has some limitations in use due to the fixed size of components. It is ideal for access scaffold, heavy staging of industrial buildings, bridges, flyovers, aqueducts, etc.

4. All-purpose units / Wedge-lock type scaffolds: These scaffolds are fairly versatile but require more time to erect and dismantle compared to the welded frame type of scaffold. They are suited for access scaffolding and slab staging of industrial structures. All-purpose units consist of two vertical and one horizontal unit which are interconnected by ordinary 40 mm. NB M.S. tubes called ledgers.

5. CUPLOK systems - This is among the most versatile modular scaffolding arrangements in the world. Its unique node point connection makes it a fast assembly scaffolding. The absence of loose parts and a unique cup action allows four horizontal units to be fixed or released in a single operation by means of only a hammer. Careful selection of raw materials for various components such as higher grade YST-240 tube, malleable cast iron top cups, deep drawn steel of bottom cups and drop-forged ledger blades makes it a sturdy and yet light scaffolding system. It is ideally suited for all access scaffolds and slab staging for any type of construction. The prime feature of CUPLOK is that since its vertical member has cup joints at every 500 mm. One has to just change the location of the horizontal units (thereby reducing or increasing l/r ratio) for different loading conditions without changing the size or thickness of the vertical tubes. Modular scaffolding systems have been effectively used for boiler maintenance, chimneystacks, access, flyovers, silos as well as offshore structures/ship building and repairs. These systems prove economical as they cut down erection time significantly.

6. Slab shuttering & support systems - From the days of timber shuttering & wooden props, slabs shuttering and centering have come a long way. The various slab shuttering systems are:

a) Conventional span–prop arrangements: Adjustability of the components makes the system versatile for normal slab shuttering.

b) Shuttering for heavier slab/deck slab - Specially designed shutters are made for jobs such as slab of industrial building, flyovers, bridges, etc.

c). Metriform unit – Decking arrangements: These consist of modular Metriform beams and panels while supporting the slab on drop-heads fitted over steel props or scaffolds. Slab shuttering can be removed in three days instead of the regular seven days thereby considerably increasing the rotation of shuttering materials. It is thus ideal for today's time-bound projects.

d) Shuttering for waffles troughs - Made out of moulded plastic materials to give architectural finish.

e) Flying form - This includes the crane-handled formwork of a complete floor slab of a building for speedy completion. All the slabs of the building should be identical in this case.

f) Support staging - Slab/beam staging is normally effected through adjustable steel props or any type of system scaffold depending on the height and load of the structure to be taken on support staging.

7. Wall / column shuttering - The construction of RCC walls/columns requires sturdy shuttering to take care of concrete pour pressures. The systems generally available are:

a) Conventional channel/heavy duty soldier - This consists of steel panels connected side by side with soldiers. Heavy duty soldiers are used for one-sided shuttering such as for RCC piers, retaining walls, etc. these are ideal for lift walls, shear walls, RCC piers, columns etc.

b) Heavy duty/ strong back arrangement - This is meant for a pour height of up to 5 m. using J-4 or Slimlite back-up soldiers. Shuttering can be of steel/ply with soldiers provided as back-ups, behind the shutters. It is ideal for fast concreting, with the help of pumps and can be crane-handled.

8. Special shuttering - Construction of special structures also requires suitable formwork. Some of the applications are:

a) Slip form of chimneys/silos: Hydraulically lifted complete shuttering by means of heavy duty jacks enables concreting of a tall chimney in hardly any time as more often the slipping (or concreting) is continuous once it starts.

b) Dam shuttering: Special heavy duty hinged soldiers along with heavy shutters are used to match the profile of a dam.

c) Canal lining: Mobile shutters are specially designed to move along the canal, for the concrete lining.

d) Bridge shuttering: Shutters for girders are specially designed to take care of concreting loads.

9. Conclusion - It is obvious that modern shuttering and scaffolding systems, which are continuously evolving, are among the most important aspects of construction and maintenance. Unfortunately, so far neither the industry nor the engineering institutions have really gone into the relevance and details of this equipment are which should be utilized for effecting proper and economical designs for particular applications. With the advent of professional scaffolding organisations and realisation of the need on the part of the industry for safer, faster and economical construction, one hopes for the development of this long-neglected but important area in the near future is going to be a reality.

Annexure-4-A.7

CONCRETE WORK --- LIST OF BUREAU OF INDIAN STANDARDS

Sl No	IS No.	Subject
1	306-1983	Tin bronze ingots and castings (3rd revision) Reaffirmed 1993.
2	383-1970	Coarse and fine aggregate from Natural source for concrete (2nd revision) Reaffirmed 1990.
3	456-2000	Code of practice for plain and reinforced concrete (3rd revision)

		(Amendments 2) Reaffirmed 1991.
4	516-1959	Method of sampling and analysis of concrete. Reaffirmed 1991.
6	1200 (Part II) 1974	Method of measurement of building and civil engineering work Part 2 (concrete works). (3rd revision) (Amendments 2) Reaffirmed 1991.
7	1322-1993	Bitumen felt for water proofing and damp proofing (4th revision) (previously 13220-1982)
8	1791-1985	Batch type concrete mixers. (2nd revision) Reaffirmed 1990.
9	2386-1963	Method of test for aggregate for concrete work. Part 1 particle size and shape (Amendments 2) Reaffirmed 1990
		Part 2 Estimation of deleterious materials and organic impurities (Amendments 1) Reaffirmed 1990.
		Part 3 Specific gravity, density, voids, absorption and builking – Reaffirmed 1990.l
		Part 4 Mechanical properties (Amendments 3) Reaffirmed 1990.
10	2505-1980	General requirements for concrete vibrators immersion type. Reaffirmed 1993.
11	2505-1985	General requirements for screed board concrete vibrators. (1st revision) Reaffirmed 1990.
12	2645-1975	Integral cement water proofing components (1st revision) (Amendments 1) Reaffirmed 1992.
13	2686-1977	Cinder as fine aggregate for use in lime concrete (1st revision) (Amendments 1) Reaffirmed 1992.
14	3068-1986	Broken butnt (clay) coarse aggregate for use in lime concrete. (2nd revision) Reaffirmed 1991.
15	3812-1981	Flyash for use as pozzolana and admixtures (1st revision) Reaffirmed 1992.
16	4643-1984	Section wrenches for fire bridge use (1st revision) Reaffirmed 1992.
17	4656-1968	Form vibrators for concrete. Reaffirmed 1991.
18	7861 (Part 1) 1981	Code of practice for extreme weather concreting (Part 1) recommended practice for hot weather concreting (Amendments 1) Reaffirmed 1990.
19	7861 (Part 2) 1975	Code of practice for cold weather concreting (Part 2) Recommended practice for cold weather concreting (Amendments 1) Reaffirmed 1992.
20	9103-1979	Admixture for concrete Reaffirmed 1990.

6. STEEL, IRON AND ALLUMINIUM WORKS

7.1 Materials

7.1.1. Steel - All finished steel shall be well and cleanly rolled to the dimensions and weight specified by Bureau of Indian Standards subject to permissible tolerances as per IS: 1852. A List of BI Standards applicable to this section is Annexure 7-A.1. The finished materials shall be reasonably free from cracks, surface flaws laminations, rough and imperfect edges and all other harmful defects.

7.1.2. Steel sections, shall be free from excessive rust, scaling and pitting and shall be well protected. The decision of the engineer regarding rejecting any steel section on account of any of the above defects shall be final and binding.

7.1.3. Structural steel work shall conform to the following requirements. The following varieties of steel should be used for structural purposes

7.1.4. S.T. 42S - The standard quality steel designated as ST–42S, conforming to IS: 226 shall be used for all types of structure (riveted or bolted) including those subject to dynamic loading and where fatigue, wide fluctuation of stresses are involved, as for example crane gantry girders, road and rail bridges etc. It is also suitable for welded structures provided that the thickness of materials does not exceed 20 mm.

7.1.5. S.T. 42W - The fusion welding quality steel designated as S.T. 42W, conforming to IS: 2062 shall be used for structures subject to dynamic loading (Wind load is not to be considered as dynamic load for this purpose) where welding is employed for fabrication and where fatigue, wide fluctuation of, stresses reversal of stress and great restraint are involved as for example, crane gantry girders and road and rail bridges.

7.1.6. S.T. 420 - The ordinary quality steel designated as S. T. 420 conforming IS: 1977 shall be used for structures not subjected to dynamic loading other than wind loads where welding is not employed or / and structures not situated in earth quake zones or / and design has not been based on plastic theory.

7.1.7. S.T. 320 - The ordinary quality steel designated as S. T. 420 conforming to IS: 1977 shall be used for doors, window frames, window bars, grills, steel gates, hand railing, builders hardware, fencing post, tie bars etc.

7.1.8. Casting shall be cast from cast iron of grade FG 150 conforming to IS: 210-1978, Specification for grey iron castings. The castings shall be sound, clean and free from porosity, blow holes, hard spots, cold shuts (i.e. irregularities due to casting at too low a temperature), distortion and other harmful defects. They shall be well dressed and fettled, accurately moulded in accordance with the pattern/drawing and shall be of uniform thickness except where the design necessitates variation. Abrupt changes in the section of adjoining members shall be avoided as far as possible. Unless otherwise indicated edges of castings shall be rounded and internal angles finished with an angle fillet. No welding or repairs shall be carried out, unless otherwise indicated.

7.1.9. Rivets - Rivets shall be made from rivet bars of mild steel as per IS: 1148-1982. High tensile rivet bars shall conform to IS: 1149-1982.

7.1.10. Bolts - These are of two type's namely turned and fitted bolts and black bolts. Turned & fitted bolts are turned to exact diameter in automatic lathe. For these bolts, whether reamed or drilled bolts, the same unit stresses are allowed as for rivets. In case of black bolts which are not finished to exact sizes, a lower working stress other than for turned bolts is adopted. They shall conform to IS: 1367 Technical supply conditions for threaded steel fasteners.

7.1.11. Electrodes - The electrodes required for metal arc welding shall be covered electrodes and shall conform to IS: 814-1991.

7.2. Workmanship – General

7.2.1. Structural steel work riveted, bolted or welded shall be carried out described in IS: 800-1984, Code of practice for use of structural steel in general building construction.

7.2.2. Straightening and bending - All material shall be straight and if necessary, before being worked shall be straightened and flattened by pressure, unless required to be of curvilinear form and shall be free from twists. Straightening of steel by hammer blows is not permitted. All bending and cutting shall be carried out in cold condition, unless otherwise directed, in such manner as not to impair the strength of the metal.

7.2.3. Cutting and machining - Member shall be cut mechanically by saw or shear or by oxyacetylene flame. All sharp rough or broken edges and all edges of joints which are subjected to tensile or oscillating stresses shall be grounded. No electric metal arc cutting shall be allowed. All edges cut by oxyacetylene pores shall be cleaned of impurities and slag prior to assembly, cutting tolerance shall be as follows (a) For member connected at ends ± 1 mm. (b) Elsewhere ± 3 mm.

When compression members depend on contact surfaces for stress transmission, then ends of columns and bases together with gussets, angles and channels (after riveting / welding together) shall be accurately measured so that the parts connected butt over the entire surfaces of contact. Columns at bases or at caps or at butt joints need to be machined.

7.2.4. Holes - All holes shall be accurately marked and drilled. Holes through more than one thickness shall preferably be drilled together after the members are assembled and tightly clamped or bolted together. In such cases, if required, these parts shall be separated after drilling and burrs removed. For thickness of materials less than 16 mm the holes may be punched 3 mm less in diameter than the required size and may be reamed to the full diameter after assembly. Finished holes for rivets and black bolts shall be more than 1.5 mm (2.0 mm for rivets and bolts of diameter more than 25 mm) in diameter larger than the diameter of rivets and bolts passing through them. All matching holes for rivets shall be so prepared that a gauge 0.8 mm diameter less than the hole can pass freely through the members assembled for riveting. Holes other than those required for close tolerance may be punched full size through material not less than 12 mm thick.

All holes shall have their axis perpendicular to the surface bored through Holes through two or more members shall be truly concentric. No rivet or bolt hole shall be nearer the edge of the member than a distance equal to its own diameter. Holes shall not be formed by gas cutting process.

7.2.5. Assembly

7.2.5.1. Laying out - Steel structure shall be laid out on a level platform to full scale and to full size or in parts as shown on working drawings or as directed by engineer. Wooden templates 12 mm to 19 mm thick or metal sheet templates shall be made to correspond to each member and part; rivet holes shall be marked accurately on them and drilled. The templates shall be laid on the steel members and holes for riveting and bolting marked on them. The ends of the steel members shall also be marked for cutting. The base of steel columns and the positions of anchor bolts shall be carefully set out. The component parts shall be assembled in

such a manner that they are neither twisted nor otherwise damaged and shall be so prepared that the specified cambers, if any, are provided. All box sections shall be sealed so as to prevent the access of moisture to the inside of the members.

Assembly shall be done by using assembly fixtures, jigs and stands which facilitate high quality assembly with proper safety. Misalignment and distortion of parts after assembly shall not be allowed; only thoroughly straightened parts free from burrs, grease, rust, etc. shall be allowed for assembly.

Temporary connection of parts during assembly shall be done in the following way:

For welded structures joining shall be done by means of tack weld, fastening devices and fixtures.

For riveted and bolted structures joining shall be done by adequate number of bolts. If tack welding is permitted, in such cases the same shall be removed after the work is over.

For riveted structures in which holes are to be drilled after assembly, joining shall be done by appropriate fixtures.

Tack welding shall be done on the side and along the line of the weld. Tack weld dimension all be minimum, welding being carried out with similar electrodes as the final welding and the tacks shall completely fuse with the final weld metal. In case splicing is necessary, the individual members shall be spliced first before assembly and before final welding with other members.

For riveted structures, members shall be well tightened by assembly bolts in every third hole maximum distance between bolts shall not exceed 500 mm. To prevent stiffening drift pins shall be used 30 per cent of the assembly bolts. After tightening, the gap between members to be jointed shall be checked by 0.2 mm thick feeler gauge which should not go inside by more than 2 mm, looseness of bolts shall be checked by tapping with a test hammer.

7.2.6. Riveting

Riveting shall be done by pneumatic riveting or hydraulic riveting equipment, riveting of diameter less than 10 mm may be fitted cold. In cold riveting the rivets are driven with the aid of powerful pneumatic or electrical clamps and the holes filled with sufficient tightness. However where such facilities are not available, hand riveting may be permitted by the engineer.

Members to be riveted shall be properly pinned, or bolted and rigidly held together while riveting. Rivets shall be heated uniformly throughout the length without burning or excess scaling and shall be of sufficient length to provide ahead of standard dimension. They shall, when driven, completely fill the holes and if countersunk, the countersinking shall be fully filled by the rivet. Any proudness of countersunk head shall be dressed off flush. All loose, burnt and badly formed or otherwise defective rivets shall be cut out and replaced before the structure is loaded. The heads of rivets shall be central to shanks and shall grip the assembled members firmly. In cutting out rivets care shall be taken so as not to injure the assembled members. Caulking or recupping shall not be permitted.

7.2.7. Bolting

Bolt heads and nuts shall be of such length as to project one clear thread beyond the nuts when fixed in position, and these shall fit in the holes without any shake. The nuts shall fit in the threaded ends of bolts properly.

Round washers shall be placed under the heads and nuts of permanent bolts. Maximum two washers for one nut and one for each bolt head shall be used. Both threads shall be outside the limits of joining members and unthreaded portion of bolt shall not be outside the washer.

Where there is risk of the nuts being removed or becoming loose due to vibration or reversal of stresses, these shall be secured from slackening by the use of lock-nuts or spring washers, as directed by the engineer. Bolts, nuts and washers shall be thoroughly cleaned and dipped in double boiled linseed oil before use. Quality of lightening of bolts shall be inspected by tapping them with a hammer. The bolt shall not be shaken or shifted. The bolts shall be tightened starting from centre of the joint towards the edge.

7.2.8. Welding

Welding shall be done by metal arc process unless otherwise permitted by the engineer, in writing, in accordance with IS: 816-1969 Code of Practice for use of metal arc welding of general construction in mild steel, and IS: 9595-1980. Recommendation of Metal Arc Welding, regarding workmanship welding method, welding procedure with suitable electrodes and wire flux, combinations, quality of welds, correction of weld faults etc.

7.2.9. Preparation of members for welding

Assembly of structural members shall be made with proper jigs and fixtures to ensure correct positioning of members (angles, axis, nodes etc.).

Sharp edges, rust of cut edges, notches, irregularities and fissures due to faulty cutting shall be chipped or ground or filed over the length of the affected area, deep enough to remove faults completely. Edge preparation for welding shall be carefully and accurately made so as to facilitate a good joint. Generally no special edge preparation shall be required for members under 8 mm thick.

Edge preparation (beveling) denotes cutting of the same so as to result in V, X, K or U seam shapes as per IS: 9595-1980.

The members to be assembled shall be clean and dry on the welding edges. Under no circumstances shall wet, greasy rust of dirt covered parts be assembled. Joints shall be kept free from any foreign matter, likely to get into the gaps between members to be welded.

Before assembly, the edges to be welded as well as adjacent areas extending for at least 20 mm shall be cleaned (Until metallic polish is achieved). When assembling members proper care shall be taken of welding shrinkage and distortions, as the drawing dimensions cover finished dimensions of the structure. The elements shall be got checked and approved by the engineer before assembly wherever it is specified. The permissible tolerances for assembly of members preparatory to welding shall be as per IS: 9595. After assembly has been checked, temporary tack welding in position shall be done by electric welding; keeping in view finished dimensions of the structure. Preheating of members to be joined to be carried put as per standards wherever necessary.

7.2.10. Butt welds

The form of joint, angle between fusion faces, gap between parts and the welding procedure shall be such that the welded joint shall comply with the design requirements. The ends of butt joints in plate shall be welded so as to provide full throat thickness. In the gas welded condition, the weld face shall be proud of the

surface of the parent metal. Where a flush surface is required, the excess metal shall be dressed off. Where no dressing is to be carried out, the permissible weld profile shall be as specified in the relevant IS.

For butt weld, where these are to be welded for both sides, certain welding procedures allow this to be done without back going, but where complete penetration cannot be achieved, the back of the first run shall be gouged out to clean sound metal before welding is started on the gouged outside.

7.2.11. Fillet Welds

A fillet weld as deposited shall be not less than the specified dimensions indicated as throat thickness and/or leg thickness taking into account penetration processor partial penetration. For concave fillet welds the actual throat thickness shall be not less than 0.7 times the specified leg length. For convex fillet welds, the actual throat thickness shall be not less than 0.9 times the specified leg length.

7.2.12. Preparation of joint faces

If preparation or cutting of material is necessary, this shall be done by shearing, chipping, grinding, machining, thermal cutting or thermal gouging. When shearing is used the effect of work hardening shall be taken care of to ensure that there is no cracking of the edges. Removal of 1 mm to 2 mm from a cut face normally eliminates the layer of hardness.

7.2.13. Fusion faces

Fusion faces and adjacent surfaces shall be free from cracks, notches or other irregularities which might be the cause of defects or would interfere with the deposition of the weld. They shall also be free from heavy scale, moisture, oil, paint and any other substance which might affect the quality of weld or impede the progress of welding.

7.2.14. Assembly for welding

Jigs and manipulators should be used, where practicable, so that the welding can be carried out in the most suitable position. Jigs shall maintain the alignment with the minimum restraint so as to reduce the possibility of lock in stresses.

7.2.15. Alignment of butt joint

The root edges or root faces of butt joints shall not be out of alignment by more than 25 per cent of the thickness of the thinner material for material up to 12 mm thick or by more than 3 mm for thicker material. For certain applications closer tolerances may be necessary for proper alignment.

7.2.16. Fit up of parts jointed by fillet welds

The edges and surfaces to be jointed by fillet welds shall be in as close contact as possible since any gap increases the risk of cracking but in no case should the gap exceed 3 mm.

7.2.17. Tack welds (Fig.1)

Tack welds shall be not less than the throat thickness or leg lengths of the root run to be used in the joint. The length of the tack weld shall not be less than four times the thickness of the thicker part or 50 mm whichever is similar. If smaller tack welds are desired, these shall be so indicated.

Where the tack weld is incorporated in a welded joint, the shape of the tack shall be suitable for incorporation in the finished weld and it shall be free from cracks and other deposition faults.

7.2.18. Protection from weather

Surface to be welded shall be dry. When rain or snow is falling or during periods of high wind, necessary precautions shall be taken for outdoor welding arc. Warming shall be carried out at all ambient temperatures below 10 degree C.

7.2.19. Inter–run cleaning

Each run of weld bead and each layer of weld shall be thoroughly cleaned of slag, spatters, etc. before depositing subsequent bead or weld with particular reference to thorough cleaning of toes of the welds. Visible defects such as cracks, cavities and other deposition faults, if any, shall be removed to sound metal before depositing subsequent run or layer of weld.

7.2.20. Welding procedure

Welding shall be carried out only by fully trained and experienced welders as tested and approved by the engineer. Qualification tests for welders as well as tests for approval of electrodes will be carried out as per IS: 823-1964. The nature of test for performance qualification for welders shall commensurate with the quality of welding required on this work as judged by the engineer. The steel structures shall be automatically, semi automatically or manually welded. Welding shall be only after the checks have been carried out. Welding procedures and Tests for welders shall be conducted as per IS: 9595 and approved by the engineer. The welder shall mark with his identification mark on each element welded by him. When welding is carried out in open air steps shall be taken to protect the places of welding against wind or rain. The electrodes wire and parts being weld on shall be dry. Before beginning the welding operation each joint shall be checked to assure that the parts to be welded are clean and root gaps provided as per IS: 9595. For continuing the welding of seams discontinued due to some reasons the end of the discontinued seam shall be melted in order to obtain a good continuity. Before resuming the welding operation the groove as well as the adjacent parts shall be well cleaned for a length of approximately 50 mm. For single butt welds (in V, ½ V or U) and double butt welds (in K, double U, etc.) the re-welding of the root butt is mandatory but only after the metal deposition on the root has been cleaned by back gouging or chipping. The welding seams shall be left to cool slowly. The contractor shall not be allowed to cool the welds quickly by any method. For multilayer welding before welding the following layer, the formerly welded layer shall be cleaned metal bright by light chipping and wire brushing. Backing strips shall not be allowed. The order and method of welding shall be so that (a) no unacceptable deformation appears in the welded parts. (b) due margin is provided to compensate for contraction due to welding in order to avoid any high permanent stresses. The defects in welds must be rectified according to IS: 9595-1980 and as per instruction of engineer.

7.2.21. Approval and testing of welders

The contractor shall satisfy the engineer that the welder is suitable for the work upon which they will be employed.

7.2.22. Weld inspection

The weld seems shall satisfy the following

Shall correspond to design shapes and dimensions.(b)Shall not have any defects such as cracks, incomplete penetration and fusion under cuts, rough surfaces, burns, blow holes and porosity etc. beyond permissible. During the welding operation and approval of finished elements inspections and tests shall be made as shown in Table 1 below

Table 1 Extent of inspection and testing

Sl .No	Inspection of test	Coverage	Procedure	Evaluation and remedy of defects
1	Inspection of weld seam Appearance	All welds	Naked eye or lens	All faulty welds shall be rectified.
2	Checking of sizes	Atleast one for each weld seam	Ordinary measuring instruments (Rule template)	Should faulty weld be found, all welds shall be checked and all defects shall be rectified.
	Mechanical test for welding procedure, performance & electrodes.		As per IS: 9595	As per IS: 9595

The mechanical characteristics of the welded joints shall be as in IS: 9595.

7.2.23. Quality of welds and corrections

Welded joints shall be from defects that would impair the service performance of the construction. All welds shall be free from incomplete penetration, incomplete fusion, slag inclusion, burns, un-welded crators, undercuts and cracks in the weld metal or in the heat affected zone, porosity etc. Unacceptable undercutting shall be made good by grinding. In case of shrinkage cracks, cracks in parent plate and crator, defective portions shall be removed down to sound metal and re-welded. Whenever corrections necessitate the deposition of additional weld metal, electrode of a size not exceeding 4 mm may be used. Rectification of welds by caulking shall not be permitted.

7.2.24. Cleaning - All welds shall be cleaned of slag and other deposits after completion; till the work is inspected and approved, painting shall not be done.

7.2.25. Plaining of ends

Plaining of ends of members like Column ends shall be done by grinding where so specified.

Plaining of but welded member shall be done after these have been assembled and the edges be removed with grinding machine or file.

The following tolerances shall be permitted on members that have been plained

The length of member having both ends plained max ± 2 mm with respect to design.

Level difference between plained surface = 0.3 mm.

Deviation between plained surface and member axis = max 1 /5000.

7.2.26. Safety and health

The contractor shall ensure that the safety requirements and health provisions laid down in IS: 818-1968 Code of Practice for safety and health requirements in electric and gas welding and cutting operations are complied with during welding operations. The contractors shall also provide equipment for eye and face protection during welding as laid down in IS: 1179-1967. Fire precautions shall be taken in accordance with IS: 3016-1982 Code of Practice for fire precautions in welding and cutting operations.

7.2.27. Erection

Erection works shall be performed in accordance with the general construction schedule. A scheme shall be worked before the commencement of the erection which shall also contain rules for safety precautions as detailed in IS: 7205-1973. (Safety Code for erection of structural steel work).

Anchor bolts for fastening of steel structures shall be set in designed position and grouted along with foundations. Alternatively anchor bolts should be provided in the concrete foundations with bolt boxes and anchor channels for the purpose of flexibility and grouted after final alignment and leveling of column. The gaps between the bearing surface of foundation and bottom of the structures to be erected shall be filled properly by cement grouting. Grouting shall be done after the verification and proper positioning of the structures but before encasing the structures with concrete if specified. Damaged structural members shall be examined and rectified or replaced as directed. The erected parts of the structure shall be stable during all the stages of errection; and structural elements to be erected shall be stable and strong to bear erection loads. Working on the already erected structures is permitted only after they are finally fixed. Erection of structures of each tier high structures shall be executed only after the relevant fastening of lower tier by the permanent or temporary fastening devices as per schedule of execution of work and certified for safety. The joint and mating surface including the mating planes, strips and filler or spacers shall be cleaned of dust, rust and water.

Erected structural members shall be firmly fastened by bolts and drifts, permanent or provisional tacking, crossing bars and so on before the erection crane book is removed. The trusses shall be lifted only at nodes. The trusses above 12 m span shall not be slinged at the apex, as it will develop compression stresses in the bottom tie member. It shall be lifted by slinging at two mid points of

rafters, which shall be temporarily braced by a wooden member of suitable section. After the trusses are placed in position, purlins and wind bracings shall be fixed as soon as possible. The end of truss which faces the prevailing winds shall be fixed with holding down bolts and the other end kept free to move. In case of small truss of span say up to 12 m the free end of the truss shall be laid on steel plate as per design and the holes for holding down bolts shall be made in the form of oblong slot so as to permit the free movement of the truss end. For large spans, the free end of the truss shall be provided with suitable rocker and roller bearing where indicated.

7.2.28. Erection joints

While erecting, holes to be riveted shall be fitted with temporary bolts and drifts of diameters equal to those of the holes. It is necessary to initial drifts for accurate matching of holes. Number of bolts and drifts shall not be less than 40 per cent of

total number of holes. Forces applied to drifts shall be same as approved for rivets. Number of drifts shall be 10 per cent of number of holes.

The number, size and length of tack welds in erection joints bearing erection forces shall be as indicated. For the erection joints which do not bear the erection forces the length of tack welds shall be minimum 10 per cent of the designed weld length of the joints.

Welding, riveting and final fastening or permanent bolts shall be done only after the inspection of the structural elements for their positions. Head bolts and nuts shall perfectly be in touch with the surfaces of structures and washers.

7.2.29. Tolerance allowed in erection

Building without crane - The maximum Tolerance for line and level of steel structure shall be +/ 3.00 mm on any part of the structure. The structure shall not be out of plumb more than 5.00 mm each 10 metre section in height and not more than 7.00 mm per 30 metre section. These tolerances shall apply to all parts of structure unless otherwise specified.

Tolerance allowed in erection of steel structure containing cranes shall be as per following Table.

Table

Component	Description		Tolerance allowed
Main columns And roof posts	a i	Shifting of columns axis at foundation level with respect to building line: In longitudinal direction	± 5.00 mm
	ii	In lateral direction	± 5.00 mm
	b	Deviation of both major column axis from vertical between foundation and other member connection levels:	
	i	For a column upto and including 10 m height	± 5.00 mm from true vertical.
	ii	For a column greater than 10 m but less than 40 m height	± 5.00 mm from True vertical for any 10 M length measured between connection levels but not more than ± 8.00 mm for 30 m length.
	c	For adjacent pairs of columns across the width of the building prior to placing of truss.	± 5.00 on true span
	d	For any individual column deviation of any bearing or resting level from levels shown on drawings.	± 5.00 mm

	e	For adjacent pairs of columns either across the width of buildings or longitudinally level difference allowed between bearing or seating level supposed to be at the same level.	5.00 mm
Trusses	a	Deviation at centre of span or upper chord member from vertical plane running through centre of bottom chord.	1/500 of the span or 10 mm whichever is less.
	b	Lateral displacement of top chord at centre of span from vertical plane running through centre of supports.	1/250 of depth of truss or 20 mm whichever is less.

7.3. Steel reinforcement

Steel reinforcement for concrete - Steel reinforcement shall be Corrosion resistant stee, deformed bars, steel wire fabrics and of grade / types as indicated.

Mild Steel Bars shall be of grade I or grade II indicated and conforming to IS: 432 (Part I)-1982 and (part II) (Annexure 7-A.7 & 7-A.8) Specification for mild steel and medium tensile steel bars. Alternatively mild steel shall be of grade Fe 410S conforming to IS: 226-1975 of or grade Fe 4100 conforming to IS: 1977-(1975) as indicated. The limitations, on the use of mild steel bars or of grade Fe 4100 as given under structural steel shall apply. Deformed Bars shall conform to IS: 1786-1979 Specifications for High strength deformed bars and wires for concrete reinforcement- enclosed as Annexure 7-A.9. Fabric reinforcement shall conform to IS: 1566-(1982) Specification for hard drawn steel wire fabrics for concrete reinforcement.

7.3.5. Tolerance on size of reinforcement bars

The tolerance on diameter of the mild steel bars shall be ± 0.5 mm for bars up to and including 25 mm with a total margin of 1mm and ± 0.75 mm for bars above 25 mm dia with total margin of 1.5 mm. The tolerance on the diameter in the case of coiled round bars shall be ± 0.5 mm up to and including 12 mm diameter with a total margin of 1 mm. Measurement shall be taken at point sufficiently away from the ends ensuring exclusion of heavy ends.

7.3.6. Tolerance on weight

The tolerance on weight of plain and deformed round shall be ± 4 per cent with a total margin of 8 per cent for bars up to and including 8 mm diameter and ± 2.5 percent for bars over 8 mm diameter with a total margin of 5 percent.

Tolerance on weight of fabric reinforcement shall be ± 6 per cent.

7.3.7. Freedom from defects

All finished bars shall be well and cleanly rolled to the dimensions and weights specified; these shall be sound and free from cracks, surface flaws, laminations and rough, jagged and imperfect edges and other defects and shall be finished in a workman like manner.

Steel reinforcement shall be stored as to prevent distortion and corrosion. Any reinforcement that has deteriorated or corroded or is considered defective by the engineer shall not be used in the work. Bars of different classification, sizes and

lengths shall be stored separately to facilitate use in such sizes and lengths as to minimise wastage in cutting from the standard lengths.

7.3.8. Bends and hooks forming end anchorages

Ends of plain round mild steel bars shall be bent to radius of not less than 2 diameters and the straight portion beyond the curve shall not be less than 4 diameters unless otherwise indicated. In the case of deformed bars, bends shall be made to radius of 4 times the diameter of the bar and straight portion beyond the curve shall not be less than 4 diameters, unless otherwise indicated. Ends of deformed bars are not bent to form hooks. In the case of binders, stirrups, links, etc., the straight portion beyond end of the curve at the end shall be not less than 8 times the nominal size of the bar.

Bars specified to be formed to radii exceeding those given in Table X of IS 2502-1963 Code of practice for bending and fixing of bars for concreting, need not be bent but the required curvature may be obtained during the placing.

7.3.9. Bending of bars

Bars shall be bent to shape cold except that bars larger than 25 mm in size may be bent hot at cherry red heat (not exceeding 850 degree C). Hot bar shall not be cooled by quenching. A bar which shows any sign of cracks at a bend shall be rejected.

7.3.10. Splicing

Where bars required are longer than those carried in stock, splices shall be provided as far as possible, away from the section of maximum stress and be staggered. The use of short length bars shall not be permitted. IS: 456-1978 Code of practice for plain and reinforced concrete recommends

that splices in flexural members should not be at sections where the bending moment is more than 50 per cent of the moment of resistance ; and not more than half the bars shall be spliced at a section.

7.3.11. Lap splices

Lap splices shall not be used for bars larger than 36 mm dia, larger diameter bars may be welded, in cases where welding is not practicable, lapping of bars larger than 36 mm dia may be permitted in which case additional spirals shall be provided around the lapped bars. Lap length shall be not less than 30 diameters for flexural tension and direct tension and not less than 24 diameters for compression. When bars of two different diameters are to be spliced the lap length shall be calculated on the basis of diameter of the smaller bar. End bearing splices shall be used only for the bars in compression. The ends of the bars shall be square out and concentric bearing ensured by suitable devices. When larger diameters have to be welded to avoid congestion rather than lapped for splicing, the method of welding shall be as directed. The location of staggered welds at heights or position shall be convenient for welding.

7.3.12. Spiral reinforcement

Spirals shall be provided with one and a half extra turns at both top and bottom. Where necessary to splice the spiral it shall be done by a lap of one and a half turns or by shop welding.

7.3.13. Placing and fixing of bars

Reinforcements shall be placed in position as per detailed design drawing and shall be secured at that position. In case of delay occurring between fixing of reinforcement and concreting, the position of the reinforcement shall be checked prior to concreting. Bars crossing each other shall be secured by binding wire (annealed) of size not less than 0.9 mm, and conforming to IS: 280-1977. Specification for mild steel wire, in such a manner that they will not slip over each other at the time of fixing and concreting. Every compression bar shall be tied at least in two perpendicular directions.

7.3.14. Cover blocks

Cover blocks generally of cement mortar shall be used to ensure the required cover for the reinforcement. The mortar or concrete used for the cover blocks or rings shall be not leaner than the mortar or concrete in which they would be embedded.

7.3.15. Spacers

Where multiple rows of reinforcement are provided distances between successive rows shall be properly maintained while concreting by providing suitable spacer bars.

7.3.16. Placing reinforcements

All mill scale, loose or scaly rust, oil and grease or any coating that will destroy or reduce bond shall be thoroughly cleaned off the steel reinforcement with a stiff wire brush or other approved means before it is placed in forms. Steel reinforcement when placed in the forms shall be properly braced, supported, or otherwise held firmly in position so that placing and ramming / vibrating of concrete does not displace it. It shall be ensured that all the reinforcement can be properly placed. Congestion of steel shall be avoided at points where members intersect.

7.3.17. Tolerance in placing of reinforcement

Unless otherwise indicated, reinforcement shall be placed within following tolerance.

(a) For effective depth 200 mm or less ± 10 mm (b) For effective depth more than 200 mm or ± 15 mm

The cover shall in no case be reduced by more than 1/3 of specified cover or 5 mm whichever is less.

7.3.18. Steel wire fabric reinforcement

Hard drawn steel fabric shall conform to IS 1566-1982 – Specification for hard drawn steel wire fabric for concrete reinforcement, MESH size, weight, size of wire for square and oblong welded shall be indicated. The fabric shall be formed by spacing the main and the cross wire, which shall be fixed at the point of intersection by electric welding.

Since fabric is supplied in long rolls it is rarely necessary to have a joint of the main wires. In structural slab laps in regions, of maximum stress shall be avoided. When splicing of welded wire fabric is to be carried out, lap splices of wires shall be made so that overlap measured between the extreme cross wires shall be not less than the spacing of cross wires plus 10 cm. For edge laps a lap of 5 cm shall be provided.

7.3.19. Welding of reinforcement

Welding of bars where indicated or agreed to by the engineer, in writing, in lieu of lapping shall be done in accordance with IS: 2751-1979, Code of practice for welding of concrete construction. Welding in general shall be done as described for structural steel work.

Bars up to and including 20 mm dia shall be lap welded and those larger than 20 mm dia shall be butt welded. In case of lap welds, the length of lap shall be five times the dia or 100 mm whichever is greater. The throat thickness shall not be less than 3 mm for bars up to 16 mm dia and 5 mm for bars over 16 mm dia and up to 20 mm dia.

7.3.20. Butt welding

Where it is not possible to rotate bars for welding in flat positions the axis of the bars shall be horizontal and the respective axis of welds shall be vertical. The edge preparation for inclined bars shall be such that welding is done only on sides. All the bars to be butt welded shall be aligned and set up in position with their axis in one straight line. This may be done in a jig or by means of a clamp or by using guides. Rotation of the bars shall be avoided, until they are adequately welded.

7.3.21. Lap welding

Edge preparation is not necessary for lap welds.

7.3.22. Finish

The profile of the welds shall be uniform, slightly convex and free from overlap at the toes of the welds. The weld face shall be uniform in appearance throughout its length. The welded joint shall be free from undercut. The joints in the weld run shall be as smooth as practicable and shall show no pronounced hump or crater in the weld surface. The surface of the weld shall be free from porosity, cavities and trapped slag.

7.4. SPECIFICATIONS FOR STEEL WORK IN SINGLE SECTION FIXED INDEPENDENTLY WITH CONNECTING PLATE

7.4.1. The steel work in single sections of R. S. joists, flats, Tees Angles fixed independently with or without connecting plate, is described in these clauses.

7.4.2. Fabrication

The steel sections as specified shall be straightened and cut square to correct lengths and measured with a steel tape. The cut ends exposed to view shall be finished smooth. No two pieces shall be welded or otherwise jointed to make up the required length of a member.

All straightening and shaping to form, shall be done by pressure. Bending or cutting shall be carried out in such a manner as not to impair the strength of the metal.

7.4.3. Painting

All surfaces which are to be painted, oiled or otherwise treated shall be dry and thoroughly cleaned to remove all loose scale and loose rust. Surfaces not in contact but inaccessible after shop assembly, shall receive the full specified protective treatment before assembly. This does not apply to the interior of sealed hollow sections. Part to be encased in concrete shall not be painted or oiled. A priming coat of approved steel primer i.e. red oxide zinc chrome primer conforming to IS:

2074 shall be applied before any member of steel structure are placed in position or taken out of workshop.

7.4.4. Erection

Steel work shall be hoisted and placed in position carefully without any damage to itself and other building work and injury to workmen. Where necessary mechanical appliances such as lifting tackle winch etc shall be used. The suitability and capacity of all plant and equipment used for erection shall be to the satisfaction of the engineer.

7.4.5. Measurements

The work as fixed in place shall be measured in running metres correct to a millimeter and weights calculated on the basis of standard tables correct to the nearest kilogram.

Unless otherwise specified, weight of cleats, brackets, packing pieces, bolts, nuts, washers, distance pieces, separators, diaphragm, gussets (taking overall square dimensions) fish plates, etc., shall be added to the weight of respective items. In riveted work, allowance is to be made for weight of rivet

heads. Unless otherwise specified an addition of 2.5% of the weight of structure shall be made for shop and site rivet heads in riveted steel structures.

No deduction shall be made for rivet / or bolt holes (excluding holes for anchor or holding down bolts).

Deduction in case of rivet or bolt hole shall however be made if its area exceeds 0.02 sqm.

The weight of steel sheets, plates and strips shall be taken from relevant Indian Standards based on 7.85 kg/m2 for every millimetre sheet thickness. For rolled sections, steel rods and steel strips, weight given in relevant Indian Standards shall be used.

7.4.6. Rate

Rate includes the cost of labour and materials required for all the operations described above.

7.17. SPECIFICATIONS FOR M. S. BARS AND M. S. GRILLS IN WOODEN OR STEEL FRAMES

7.17.1. M. S. round or square bars, with or without M. S. flats M. S. grills of different patterns with flats with M. S. or without M. S. bars, round or square, fixed in wooden or steel windows or clerestory windows etc. are described in this clause.

7.17.2. Fabrication

When M. S. bars round or square are to be fixed in wooden or steel frame these are cut in to required length to form the required pattern then fixed as per drawing. In case of wooden frames the length will be for fixing in the hole 5 cm deep in one frame and right through and flush with outer side of the frame. When M. S. round or square bars are to be fixed to steel frames or in combination with M. S. flats these are to be cut to proper size welded to steel frames or MS flats to form the required pattern. In case of M. S. flats they should have counter sunk holes to facilitate fixing them to wooden frames with wood screws. Welding to be done in an approved workshop and not at site.

When the grill is to be fabricated mainly with M. S. flats with or without M. S. round or square bars, the flats of required size are cut and bent to form the required pattern and length and design as per drawing or as directed by the engineer. The cut and bent flats and bars are then welded by fillet welding all around the width of the flats or circumference of bars which are joined, forming at right angle corners of flat proper mitered joint angle shall be provided with welding for full width. Welding to be done in approved workshop and not at site.

7.17.3. Fixing

When MS round or square bars are to be fixed to wooden frames the bars shall be passed in to the wooden frame, from the end having a through hole and fixed flush with that end while at the other end it will be 5 cm deep in the hole drilled in the frame. In case of steel frames, the bars will be welded to the steel frame by fillet weld all along the circumference of the bars in an approved workshop and not at site. In case of grill of bars welded to M. S. Flat forming the required pattern, the outer frame of M. S. flats shall be fixed to the wooden frame with wood screws in the counter sunk holes drilled in M. S. flats ensuring that screws are driven with some screw driver (not hammered) till the screws are embedded fully inside flush with the M. S. flats. In case of fixing to steel frames, M. S. flats of required pattern with or without M. S. round or square bars, the method of fixing will be similar to what is described above. Any kind of welding at site shall be permitted only under written order of the engineer.

7.17.4. Measurements - The different types of M. S. grills as described will be measured separately and paid for. The length of bars and flats used in grills will be measured correct to a cm and then weights calculated in kg by using standard tables.

7.17.5. Rate - The rate shall include the cost of materials and labour required for all the operations described above. Grill of different types as mentioned shall be paid for separately.

List of Bureau of Indian Standards (IS) **

Sl. No	IS No.	Subject
1	63-1978	Whiting for paints and putty (2nd revision) (Amendment 2) (Reaffirmed 1994)
2	198-1978	Varnish gold size (1st revision) (Amendment 1) (Reaffirmed 1991)
3	226-1975	Structural steel (standard quality) (5th revision) superseded by IS 2062:1992.
4	277-2003	Specification for galvanized steel sheets (plain and corrugated) (5th revision) (Amendments 2)
5	800-1984	Code of practice for use of structural steel in general in steel construction (2nd revision) (Amendments 2) (Reaffirmed 1991)
6	806-1968	Code of practice for use of steel tubes in general building construction (1st revision) (Amendment 1) (Reaffirmed 1991)
7	812-1978	Glossary of terms relating to welding and cutting of metals (Reaffirmed 1991)

8	813-1986	Scheme of symbols for welding (revised) (Reaffirmed 1991)
9	814-2004	Covered electrodes for manual metal arc welding of carbon and carbon manganese steel (5th revision)
10	815-1974	Classification and coding of covered electrodes for metal arc welding of structural steels (2nd revision) (Supercedes by IS 8141:1991).
11	816-1969	Code of practice for use of metal arc welding for general construction in mild steel (1st revision) (Amendments 2) (Reaffirmed 1992)
12	817-1966	Code of practice for training and testing of metal arc welders (revised) (Reaffirmed 1991) Part I-1992, Part-II-1996
13	818-1968	Code of practice for safety and healthy requirements in electric and gas welding and cutting operations (1st revision) (Reaffirmed 1991)
14	822-1970	Code of procedure for inspection of welds (Reaffirmed 1991)
15	823-1964	Code of procedure for manual for metal arc welding in mild steel (withdrawn)
16	1038-1983	Steel doors, windows and ventilators (3rd revision) (Amendment 1) (Reaffirmed 1991)
17	1081-1960	Code of practice for fixing and glazing of metal (steel and aluminium) doors, windows and ventilators (Amendment 1) (Reaffirmed 1991)
18	1148-1982	Hot rolled steel rivet bars (upto 40 mm diameters) for structural purposes (3rd revision) (Reaffirmed 1992)
19	1161-1979	Steel tubes for structural purposes (3rd revision) (Amendments 2) (Reaffirmed 1998)
20	1182-1983	Recommended practice for radiographic examination of fusion welded butt joints in steel plates (2nd revision) (Reaffirmed 1991)
21	1200-1993 (Part 8)	Method of measurements of building and civil engineering works Part 8 steel work and iron works (4th revision) Part I,II & III 2002
22	1363-1992	Hexagonal head bolts, screws and nuts of product grade C 2002
	Part-1	(Hexagon head bolt) (size range M5 to M64) (3rd revision) 2002
	Part-2	(Hexagon head screws) (size M5 to M64) (3rd revision) 2002
	Part-3	(Hexagon nuts) (size range M5 to M64) (3rd revision) 2002
23	1367-1980	(Part 1-19) Technical supply conditions for threaded steel fasteners (Part 1 to 19)
24	1599-1985	Method for bond test for steel products other than sheet, strip, wire and tube (2nd revision) (superseding IS 1692 : 1974, IS 3260 : 1960, 815, 4598 : 1968) (Reaffirmed 1991)
25	1608-2005	Method of tensile testing for steel products (1st revision) (Amendments 1) (Reaffirmed 1991)

26	1821-1987	Dimensions for clearance holes for bolts and screws (3rd revision) (Reaffirmed 1992)
27	1852-1985	Rolling and cutting tolerances for hot rolled steel products (4th revision) (Amendment 1) (Reaffirmed 1991)
28	1894-1972	Method for tensile testing of steel tubes (1st Revision) (Reaffirmed 1991)
29	1977-1975	Structural steel (ordinary quality) (2nd revision) (Amendments 4) (Reaffirmed 1996)
30	2062-1992	Steel for general structural purposes (4th revision) (Supersedes IS 226:1975) (Amendment 1) 1999
31	2074-1992	Ready mixed paint, air drying red oxide-zinc chrome, priming (2nd revision)
32	4351-1976	Specification for steel door frames (1st revision) (Amendment 1) (Reaffirmed 2003) 2003
33	4454-1981 (Part 1)	Steel wires for cold formed springs. Patented and cold drawn steel wires unalloyed (2nd revision) (Reaffirmed 1992) Part I -2001, Part II -2001, Part II – 1975 & Part IV 2001
34	4736-1986	Hot-dip zinc coatings on mild steel tubes (1st revision) (Amendment 1) (Reaffirmed 1992)
35	6248-1979	Metal rolling shutters and rolling grills (1st revision) (Reaffirmed 1991)
36	7452-1990	Specifications for hot rolled steel sections for doors, windows and ventilators (2nd revision).

ANNEX A (Clause 2.1)

List of referred Indian standards

IS No.	Title
SP 46-1988	Engineering , drawing practice for schools and colleges
IS: 812-1957	Glossary of terms relating to welding and cutting of metals
IS: 813-1986	Scheme of symbols for welding (first revision)
IS: 814(Part 1)-1974	Specification for covered electrodes for metal arc welding of structural steels : Part 1 For welding products other than sheets (fourth revision)
IS: 815-1974	Classification and coding of covered electrodes for metal arc welding of structural steels (second revision)
IS: 818-1968	Code of practice for safety and health requirements in

	electric and gas welding and cutting operations (first revision)
IS: 1179-1967	Specification for equipment for eye and face protection during welding (first revision)
IS: 1786-1985	Specification for high strength deformed steel bars and wires for concrete reinforcements (third revision)
IS: 1851-1975	Specification for single operator type arc welding transformers (second revision)
IS: 2635-1975	Specification for DC electric welding generators (second revision)
IS: 2641-1964	Specification for electric welding accessories
IS: 2751-1979	Code of practice for welding of mild steel plain and deformed bars for reinforced concrete construction (first revision)
IS: 3016-1982	Code of practice for fire precautions in welding and cutting operations
IS: 9595-1980	Recommendations for metal arc welding of carbon and carbon manganese steels
IS: 9857-1981	Specification for welding cables

ANNEX B (Clause 6. 1)

Selection of equipment and accessories for welding cold-worked bars used for reinforced concrete construction

B-1. General

B-1.1. The methods of welding covered in this annex are:

(a) Flash butt welding, and (b) Shielded metal arc welding with covered electrodes.

B.2. Flash butt welding equipment

B - 2.1. The efficiency of the flash butt welding equipment, manifested by its conjunctive efficiency for cold-worked steels should be about 8 kVA/cm2 of the cross sectional area of the bar in order that sufficient cold weld maybe accomplished.

B - 2.2. The jaws for clamping the bars should preferably be long and pin shaped in order to assume a rectilinear central feeding of the bar ends. The joint should preferably be of copper to assume a smooth and uniform flow of current from the jaws into the bar.

B – 3. Shielded metal arc welding equipment

B - 3.1. In its simplest form, the equipment required for shielded metal arc welding of cold-worked steel bars for concrete reinforcing consists of:

(a) Welding power source;(b) Accessories, such as, electrode holders, earth clamp, welding cable, connectors, chipping hammer and wire brush;(c) Protective equipment for the operator, such as, hand screen or helmet, gloves, apron, etc; and(d) Suitable electrode storage and drying equipment, where necessary.

B - 3.1.1. Welding power source - The current for welding may be alternating or direct. There is little to choose between them for work involving mild steel welding. Electricity from the mains is usually at too high a voltage for arc welding. Various types of equipment arc used for reducing this voltage and delivering a welding current of right characteristics.

B - 3.1.1.1. Alternating current transformer oil-cooled or air-cooled type has the advantage of being low in initial cost and requiring very little maintenance. Various types of controls for varying the current to suit conditions in common use. Some of these are:

(a) Static choke with tapings, (b) a choke the value of which may be varied by means of the movement of the core, (c) a choke with a saturable core, and (d) a variable flux linkage transformer.

Being essentially a single-phase load, welding transformers when connected to 3-phase supply mains may cause slightly unbalanced load conditions. Condensers of adequate rating may also be connected across the input lines for improving the power factor.

B - 3.1.1.2. Rotary machines, such as, motor generators suitable for use on alternating-current mains give a direct current output of the required characteristics. They have the advantage that they impose a balanced load on 3-phase bar supply mains. They are, however, initially more expensive and require more maintenance than transformers.

B - 3.1.2. Where the mains supply is direct current, a motor generator designed for direct current bar main use has to be selected.

B - 3.1.3. Rectifier welding sets which arc relatively high in initial cost, require very little maintenance because of elimination of most moving parts. They also impose a balanced load on 3-phase supply, mains.

B - 3.1.4. For work at sites where mains power supply is not available, a petrol or diesel engine driven welding generator may be selected. Such machines are often mounted on trailers for easy portability.

B - 3.1.5. Other points to be considered when selecting the equipment are:

(a) that the machine is designed to work satisfactorily in the climatic conditions that will be met with during service;(b) that it is well made and conforms to relevant Indian Standards, wherever these exist; and(c) that the current capacity is adequate for welding with the sizes of electrodes expected to be used.

B-3.1.5.1. IS: 1851-1975 covers transformer welding equipment and IS: 2635-1975 covers motor generator equipment for manual metal arc welding.

B-3.1.5.2. Electrode holders shall conform to the requirements laid down in IS: 2641-1964 and shall be of suitable rating for welding with electrodes in sizes expected to be used.

B-3.1.5.3. Welding cables shall conform to the requirements laid down in IS: 9857-1981, if cables with copper conductors are used. Cables are with aluminium conductors shall be of a quality proved for performance. Two lengths of cables are required, one from the welding set to the electrode holder and the other from the work piece to the welding set.

B - 3.1.5.4. All cable terminal connections, such as, sockets-earth clamp, shall also conform to the requirements specified in IS: 2641-1964.

B - 3.1.5.5. A well made chipping hammer with a hardened and tough cutting edge and a narrow type wire brush which may reach the root of the weld would also be required for deslagging and cleaning the weld.

B-3.1.6. Protective equipment - A non-conducting hand screen or helmet fitted with protective filter lens will be required to protect the face and eyes of the operator from the ultra-violet and infra-red rays emitted by the arc. The filter lens has the double function of securing good vision of the arc and giving effective protection by cutting off the harmful rays. The eye and face protection equipment should conform to the appropriate stipulations laid down in IS: 1179-1967.

B-3.1.6.1. Aprons and leather gloves should be of a standard that has been proved adequate for welder's use. Shoulder guards, leggings and other such protective garments may be necessary when the operator has to do positional welding in conditions where freedom of movement is restricted.

B - 3.1.7. Storage - The conditions of the electrodes used have an important bearing on the ultimate quality of the weld produced. Particularly, when moist ambient conditions are envisaged, for instance, at site work, the storage of electrodes has to be given much attention. Heated storage cabinets or drying ovens arc a must when low hydrogen type electrodes are being used for site work. Other types of electrodes also are preferably stored before use in such cabinets when ambient conditions are unfavorable.

ANNEX C (Clause 10.4.2)

GAS PRESSURE WELDING

C-1. Gas pressure welding process

The gas pressure welding process may be used for butt welding of reinforcing bars.

C- 1.1. Preparation for welding

C- 1.1.1. The ends of bars and the extreme untwisted ends of new bars shall be cut by shearing or

machining to make the face approximately normal to the axis of the bar. Care should be taken to ensure that the bar ends do not twist while shearing.

C- 1.1.2. Rust, oil, paint, cement paste and any other coating over the bar-ends shall be removed and the surfaces to be, welded shall be finished as flat as possible.

C-1.2. Procedure.

C-1.2.1. Bars are clamped securely in the clamping unit with no misalignment keeping the gap between the bar ends less than 3 mm.

C-1.2.2. To begin with, the bar ends arc heated by a reducing flame to avoid any oxide formation. The flame shall be directed at the joint and the burner shall be rotated to ensure uniform heating of the bar ends. On sufficient heating, the gap between the bar ends shall be

closed by the application of axial pressure (preliminary or first stage pressurization).

C-1.2.3. After preliminary pressurization and complete closing of the gap, the bar ends shall be heated by a neutral flame. The heating shall be done for an appropriate period ensuring that the bar ends do not melt.

C-1.2.4. On sufficient heating of the bar ends, appropriate axial pressure (final or second stage pressurization) is applied so that the bulge at the weld interface is about 1.4 times the bar diameter. Heating shall be stopped at this stage. However, pressure application shall be maintained for some time even after the flame is put off.

C-1.2.5. The bars shall be unclamped after the glow of the heated area vanishes.

C-1.2.6. In case the flame dies out during heating the affected area shall be cut off and the welding procedure begun afresh,

C.2. Gas pressure-welding equipment

C-2.1. The equipment for gas pressure welding comprises or:

(a) Oxygen and acetylene gas cylinders with regulating values, etc; (b) Multi-nozzle burner;(c) Clamping unit; and (d) Pressurize.

C-2.1.1. The burner consists of a blow pipe with four or more nozzles. The nozzles shall be so arranged to ensure uniform heating of the bar surface. The burner shall provide stable flame during heating and the heating capacity shall be appropriate to the size of the bar.

C-2.1.2. The clamping unit shall grip the bars well, be easy to handle, capable of being used in horizontal or vertical position of welding, and have such mechanism that no misalignment develops at the welded portion.

C-2.1.3. Pressurize shall be either hydraulic or mechanical and may be either manually operated or electrically driven. The pressurize shall be capable of maintaining uniform axial pressure.

List of Indian standard specifications and codes of practice relevant to the inspection of welding

a) Materials	
1) Rolled steel	
IS: 2062-1999	Structural steel (standard quality)
IS: 808-1964	Rolled steel beam, channel and angle sections (revised)
IS: 961-1962	Structural steel (high tensile)(revised)
IS: 1079-1968	Hot rolled carbon steel sheet and strip (second revision)
IS: 1173-1967	Hot rolled and slit steel, tee bars (first revision)
IS:1252-1958	Rolled steel sections bulb angles
IS:1730-1961	Dimensions for steel plate, sheet and strip for structural and general engineering purposes
IS:1731-1961	Dimensions for steel flats and for structural and general engineering purposes
IS:1732-1961	Dimension for round and square steel bars for structural and general engineering purposes
IS:1762-1961	Code for designation of steel
IS: 1852-1967	Rolling and cutting tolerances for hot-rolled steel products

IS:1863-1961	Dimensions for rolled steel bulb plates
IS:1977-1969	Structural steel (ordinary quality)
IS: 2002-1962	Steel plates for boilers
IS: 2049-1963	Colour code for the identification of wrought steels for general engineering purposes
IS: 2062-1969	Structural steel (fusion welding quality) (first revision)
IS: 3039-1965	Structural steel (shipbuilding quality)
IS: 3503-1966	Steel for mariner boilers, pressure vessels and welded machinery structures
IS: 3747-1966	Steel for flanging and pressing
2. Steel castings	
IS: 2856-1964	Carbon steel castings suitable for high temperature service (fusion welding quality)
3. Other metals	
IS: 737-1965	Wrought aluminium and aluminium alloys, sheet and strip (for general engineering purposes)revised)
IS: 1550-1967	Copper sheet and strip for the manufacture of utensils and for the general purposes (first revision)
4. Tubes	
IS: 1161-1968	Steel tubes for structural purposes (second revision)
IS: 1239 (Part I)1968	Mild steel tubes, tubular and other wrought steel fittings Part 1 mild steel tubes (second revision)
IS: 1914-1961	Carbon steel boiler tubes and super heater tubes
IS: 3589-1966	Electrically welded steel pipes for waster, gas and sewage (200 to 2000 mm nominal diameters)
IS: 3601-1966	Steel tubes for mechanical and general engineering purposes
IS: 4310-1967	Weldable steel pipe fittings for marine purposes
IS: 4922-1968	Seamless, steel tubes (suitable for welding) for aircraft purposes
b) Electrodes and consumables	
1. Welding Rods and Electrodes	
IS: 814-1970	Covered electrodes for metal arc welding of structural steel (third revision)
IS: 815-1966	Classification and coding of covered electrodes for metal arc welding of mild steel and low alloy high tensile steel (revised)
IS: 1278-1967	Filler rods and wires for gas welding (first revision)
IS:1395-1964	Molybdenum and chromium molybdenum low alloy steel electrodes for metal arc welding (revised)

IS: 2680-1964	Filler rods and wires for inert gas tungsten arc welding
IS: 2879-1967	Mild steel for metal arc welding electrode core wire (first revision)
IS: 4972-1968	Resistance spot-welding electrodes
IS: 5206-1969	Corrosion-resisting chromium and chromium nickle steel covered electrodes for manual metal arc welding
IS: 5511-1969	Covered electrodes for manual metal arc welding of cast iron
2. Automatic arc welding wire and flux	
IS: 3613-1966	Acceptance tests for wire flux combination for submerged arc welding
3. Gas welding	
IS: 5760-1969	Compressed argon
c) Welding equipment and accessories	
1. Arc welding	
IS: 1851-1966	Single operator type arc welding transformers (first revision)
IS: 2635-1966	dc electric welding generators (revised)
IS:2641-1964	Electrical welding accessories
IS:4559-1968	Single operator rectifier type dc arc welder
2. Resistance welding	
IS: 4804(part I)-1968	Resistance welding equipment: Part I Single-phase transformers
IS: 4804 (Part II)-1968	Resistance welding equipment: Part II Single –phase rocker arm spot welding machines
IS: 4804 (Part III) –1969	Resistance welding equipment Part III Single-phase spot and projection welding machines
d) Terminology and symbols	
1. Terminology	
IS: 812-1957	Glossary of terms relating to welding and cutting of metals
IS: 813-1961	Scheme of symbols for welding (amended)
e) Training and testing of welders	
IS: 817-1966	Code of practice for training and testing of metal arc welders (revised)
IS: 1181-1967	Qualifying test for metal arc welders (engaged in welding structures other than pipes) (first revision)
f) Codes of procedure	
IS: 819-1957	Code of pratice for resistance spot welding for light assemblies in mild steel
IS: 823-1964	Code of procedure for manual metal arc welding of mild steel

IS: 2811-1964	Recommendations for manual tungsten inert-gas arc welding of stainless steel
IS:4944-1968	Code of procedure for welding at low ambient temperatures
g) Mechanical testing	
1. Tensile testing	
IS: 1521-1960	Method for tensile testing of steel wire
IS:1608-1960	Method for tensile testing of steel products other than sheet, strip, wire and tube
IS:1663 (Part I)-1960	Method for tensile testing of steel sheet and strip: Part I Steel sheet and strip of thickness 0.5 mm to 3 mm
IS:1663(Part II)-1962	Method for tensile testing of steel sheet and strip: Part II steel sheet and strip of thickness above 3 mm
IS: 1894-1962	Method for tensile testing of steel tubes
2. Impact test	
IS: 1499-1959	Method for charpy impact test (U-notch) for steel
IS:1598-1960	Method for izod impact test for steel
3. Bend test	
IS: 1403-1959	Method for reverse bend test for steel sheet and strip less than 3 mm thick
IS:1599-1960	Method for bend test for steel products other than sheet, strip , wire and tube
IS: 2329-1963	Method for bend test on steel tubes
4. Hardness test	
IS: 1500-1959	Method for Brinell hardness test for steel
IS: 1501-1959	Method for Vickers hardness test for steel
IS: 1586-1960	Methods for Rockwell hardness test (B and C scales) for steel
IS: 5072-1969	Method for Rockwell superficial hardness test (N and T scale) for steel
h) Non-destructive testing	
1. Radiography	
IS: 1182-1967	Recommended practice for radiographic examination of fusion welded butt joints to steel plates (first revision)
IS:2478-1963	Glossary of terms relating to industrial radiology
IS: 2595-1963	Code of practice for radiographic testing
IS: 2598-1966	Safety code for industrial radiographic practice
IS:3657-1966	Radiographic image quality indicators
2. Ultrasonics	

IS: 2417-1963	Glossary of terms relating to ultrasonic testing
IS: 3664-1966	Code of practice for ultrasonic testing by pulse echo method (direct contact)
IS: 4225-1967	Recommended practice for ultrasonic testing of steel plates
IS: 4260-1967	Recommended practice for ultrasonic testing of welds in ferritic steel
3. Magnetic particle flaw detection	
IS: 3415-1966	Glossary of terms used in magnetic particle flaw detection
IS:3703-1966	Code of practice for magnetic particle flaw detection
IS: 3658-1966	Code of practice for liquid penetrant flaw detection
4. Testing of welds	
IS: 3600-1966	Code of procedure for testing of fusion welded joints and weld metal in steel
j) Applications: use and design	
1. Structural steel work	
IS: 800-1962	Code of practice for use of structural steel in general building construction (revised)
IS: 803-1962	Code of practice for design, fabrication and erection of vertical mild steel cylindrical welded oil storage tanks
IS: 805-1968	Code of practice for use of steel in gravity water tanks
IS: 1024-1968	Code of practice for use of welding in bridges and structures subject to dynamic loading
IS: 2751-1966	Code of practice for welding of mild steel bars used for reinforced concrete construction

Annexure 7-A.13

7. SPECIFICATION FOR FINISHING WORKS

15.5. SPECIFICATIONS FOR CEMENT PLASTERING

15.5.0. The cement plaster shall be 12 mm, 15 mm or 20 mm thick as specified in the item.

15.5.1. Scaffolding and preparation of surface shall be as specified in 15.1

15.5.2 **Mortar -** The mortar of the specified mix using the type of sand described in the item shall be used. It shall be as specified. For external work and under coat work, the fine aggregate shall conform to grading IV. For finishing cost work the fine aggregate conforming to grading zone V shall be used.

15.5.3. **Application -** The specifications as in 15.1.4 shall apply except in the following respects -

a) Beating with thin bamboo strips shall not be done on the cement plaster, and

b) No lime putty solution shall be applied on the face when finishing. Further the plastering and finishing shall be completed within half an hour of adding water to the dry mortar.

15.5.4. **Thickness -** Where the thickness required as per description of the item is 20 mm the average thickness of the plaster shall not be less than 20 mm whether the wall treated is of brick or stone. In the case of brick work, the minimum thickness over any portion of the surface shall be not less than 15 mm while in case of stone work the minimum thickness over the bushings shall be not less than 12 mm.

15.5.5. **Curing -** Curing shall be started as soon as the plaster has hardened sufficiently not to be damaged when watered.

The plaster shall be kept wet for a period of at least 7 days. During this period, it shall be suitably protected from all damages at the contractor's expense by such means as the engineer may approve. The dates on which the plastering is done shall be legibly marked on the various sections plastered so that curing for the specified period thereafter can be watched.

Specifications for Finish, Precautions, Measurements and Rate shall be as described in 15.1

15.6. SPECIFICATIONS FOR CEMENT PLASTER WITH A FLOATING COAT OF NEAT CEMENT

15.6.0. The cement plaster shall be 12, 15 or 20 mm thick, finished with a floating coat of neat cement, as described in the item.

15.6.1. Specifications for this item of work shall be same as described except for the additional floating coat which shall be carried out as below.

When the plaster has been brought to a true surface with the wooden straight edge (clause 13.5.3 It shall be uniformly treated over its entire area with a paste of neat cement and rubbed smooth, so that the whole surface is

covered with neat cement coating. The quantity of cement applied for floating coat shall be 1 kg per sqm. Smooth finishing shall be completed with trowel immediately and in no case later than half an hour of adding water to the plaster mix. The rest of the specifications as described in 15.5.3 shall apply.

15.27. SPECIFICATIONS FOR WHITE WASHING WITH WHITING

15.27.1. Preparation of Mix - Whiting (ground white chalk) shall be dissolved in sufficient quantity of warm water and thoroughly stirred to form thin slurry which shall then be screened through a clean coarse cloth. Two kg of gum and 0.4 kg of copper sulphate dissolved separately in hot water shall be added for every cum of the slurry which shall then be diluted with water to the consistency of milk so as to make a wash ready for use.

15.27.2. Other specifications described shall apply in this case also.

15.33. SPECIFICATIONS FOR PAINTING

15.33.1. Materials - Paints, oils, varnishes etc. of approved brand and manufacture shall be used. Only ready mixed paint (Exterior grade) as received from the manufacturer without any admixture shall be used.

If for any reason, thinning is necessary in case of ready mixed paint the brand of thinner recommended by the manufacturer or as instructed by the Engineer shall be used.

Approved paints, oil or varnishes shall be brought to the site of work by the contractor in their original containers in sealed condition. The material shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnight's work. The materials shall be kept in the joint custody of the contractor and the engineer. The empties shall not be removed from the site of work, till the relevant item of work has been completed and permission obtained from the engineer.

15.33.2. Commencing Work - Painting shall not be started until the engineer has inspected the items of work to be painted, satisfied himself about their proper quality and given his approval to commence the painting work. Painting of external surface should not be done in adverse weather condition like hail storm and dust storm.

Painting, except the priming coat, shall generally be taken in hand after practically finishing all other building work.

The rooms should be thoroughly swept out and the entire building cleaned up, at least one day in advance of the paint work being started.

15.33.3. Preparation of Surface - The surface shall be thoroughly cleaned and dusted off. All rust, dirt, scales, smoke splashes, mortar droppings and grease shall the thoroughly removed before painting is started. The prepared surface shall have received the approval of the engineer after inspection, before painting is commenced.

15.33.4. Application

15.33.4.1. Before pouring into smaller containers for use, the paint shall be stirred thoroughly in its containers, when applying also, the paint shall be

continuously stirred in the smaller containers so that its consistency is kept uniform.

15.33.4.2. The painting shall be laid on evenly and smoothly by means of crossing and laying off, the latter in the direction of the grains of wood. The crossing and laying off consists of covering the area over the paint, brushing the surface hard for the first time over and then brushing alternately in opposite direction, two or three times and then finally brushing lightly in a direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and lying off will constitute one coat.

15.33.4.3. Where so stipulated, the painting shall be done by spraying. Spray machine used be (a) high pressure (small air aperture) type, or (b) a low pressure (large air gap) type, depending on the nature and location of work to be carried out. Skilled and experienced workmen shall be employed to the requisite consistency by adding a suitable thinner.

15.33.4.4. Spraying should be done only when dry condition prevails. Each coat shall be allowed to dry out thoroughly and rubbed smooth before the next-coat is applied. This should be facilitated by thorough ventilation. Each one except the last coat, shall be lightly rubbed down with sand paper or fine pumice stone and cleaned off dust before the next coat is laid.

15.33.4.5. No left over paint shall be put back into the stock tins. When not in use, the containers shall be kept properly closed.

15.33.4.6. No hair marks from the brush or clogging of paint puddles in the corners of panels, angles of moldings etc. shall be left on the work.

15.33.4.7. In painting doors and windows, the putty round the glass panes must also be painted but care must be taken to see that no paint stains etc. are left on the glass. Tops of shutters and surfaces in similar hidden locations shall not be left out in painting. However, bottom edge of the shutters where the painting is not practically possible, need not be done nor any deduction on this account will be done but two coats of primer of approved make shall be done on the bottom edge before fixing the shutters.

15.33.4.8. On painting steel work, special care shall be taken while painting over bolts, nuts, rivets overlaps etc.

14.33.4.9. The additional specifications for primer and other coats of paints shall be as according to the detailed specifications under the respective headings.

15.33.5. Brushes and containers - After work, the brushes shall be completely cleaned of paint and linseed oil by rinsing with turpentine. A brush in which paint has dried up is ruined and shall on no account be used for painting work. The containers when not in use shall be kept closed and free from air so that paint does not thicken and also shall be kept safe from dust. When the paint has been used, the containers shall be washed with turpentine and wiped dry with soft clean cloth, so that they are clean, and can be used again.

15.33.6. Measurements

15.33.6.1. The length and breadth shall be measured correct to a cm. The area shall be calculated in sqm (correct to two places of decimal), except otherwise stated.

15.33.6.2. Small articles not exceeding 10 sq. decimeter (0.1 sqm) of painted surfaces where not in conjunction with similar painted work shall be enumerated.

15.33.6.3. Painting up to 10 cm in width or in girth and not in conjunction with similar painted work shall be given in running meters and shall include cutting to line where so required.

Note: Components of trusses, compound girders, stanchions, lattices and similar work shall, however, be given in sq. meters irrespective of the size or girth of members. Priming coat of painting shall be included in the work of fabrication.

15.33.6.4. In measuring painting, varnishing, oiling etc. of joinery and steel work etc. The coefficients as indicated in following tables shall be used to obtain the area payable. The coefficients shall be applied to the areas measured flat and not girthed.

Table 1 Equivalent plain areas of uneven surface

Sl. No.	Description of work	How measured	Multiplying coefficients
1	2	3	4
I.	Wood work doors, windows etc**.**		
1	Panelled or framed and braced doors, windows etc.	Measured flat (not girthed including)	1.30 (for each side)
2	Ledged and battened or ledged, battened and braced doors, windows etc.	Frame, edges chocks, cleats, etc. shall be deemed to be included in the item.	
3	Flush doors etc.	- do -	1.20 (for each side)
4	Part panelled and part glazed or gauzed doors, windows etc. (Excluding painting of wire gauze portion)	- do -	1.00 (for each side)
5	Fully glazed or gauged doors, windows etc. (Excluding painting of wire gauze portion)	- do -	0.80 (for each side)
6	Fully venetianed or louvered doors,	- do -	1.80 (for each windows

			etc. side)
7	Trellis work one way or two way	Measured flat overall, no deduction shall be made for open spaces, suppor ting members shall not be measured separately	2 (for pain-ting all over)
8	Carved or enriched work	Measured flat	2 (for each side)
9	Weather boarding	Measured flat (not girthed supporting frame work shall not be measured separately)	1.20 (for each side)
10	Wood shingle roofing	Measured flat (not girthed)	1.10 (for each side)
11	Boarding with cover fillets and	Measured flat (not girthed)	1.05 (for each match boarding side)
12	Tile and slate battening	Measured flat overall no deductions shall be made for open spaces	0.80 (for painting all over)
II.	Steel Work Doors, Windows, etc**.**		
13	Plain sheeted steel doors or windows	Measured flat (not girthed including frame edges etc.)	1.10 (for each side)
14	Fully glazed or gauzed steel doors and windows (excluding painting of wire gauze portion)	- do -	0.50 (for each side)
	Partly panelled and partly glazed doors and windows (excluding painting of wire gauze portion)	- do -	0.80 (for each side)
16	Corrugated sheeted steel doors or windows	- do -	1.25 (for each side)
17	Collapsible gates	Measured flat	1.50 (for painting all

			over)
18	Rolling shutters of interlocked laths	Measured flat (size of opening) all over ; jamb guides, bottom rails and locking arrangement etc. shall be included in the item (top cover shall be measured separately)	1.10 (for each side)
III.	**General**		
19	Expanded metal, hard drawn steel Wire fabric of approved quality, grill works and gratings in guard Bars, balustrades, railing partitions and MS bars in windows frames	Measured flat overall, no deduction shall be made for open spaces; supporting members shall not be measured separately.	1 (for paint all over)
	Open palisade fencing and gates inclu ding standards, braces, rails stays etc. in timber or steel.	- do - (see note No. 12)	1 (for paint all over)
	Corrugated iron sheeting in roofs, side cladding etc.	- do – Measured flat (not girthed)	1.14 (for each side)
	AC semi-corrugated sheeting in roofs, side cladding etc.	- do -	1.20 (for each side)
	AC semi-corrugated sheeting in roofs, side cladding etc. or Nainital pattern using plain sheets	- do -	1.10 (for each side)
	Wire gauze shutters including painting of wire gauze.	- do-	1.00 (for each side)

Explanatory notes for Table 1:

1) Measurements for doors windows etc., shall be taken flat (and not girthed) over all including frames, where provided. Where frames are not provided, the shutter measurements shall be taken.

2) Where doors, windows, etc., are of composite types other than those included in Table 1 the different portion shall be measured separately with their appropriate coefficients, the centre line of the common rail being taken as the dividing line between the two portions.

3) The coefficients for door and windows shall apply irrespective of the size of frames and shutter members.

4) In case steel frames are used the area of doors, windows shutters shall be measured flat excluding frames.

5) When the two faces of a door, window etc. are to be treated with different specified finishes, measurable under separate items, the edges of frames and shutters shall be treated with the one or the other type of finish as ordered by the Engineer and measurement of this will be deemed to be included in the measurement of the face treated with that finish.

6) In the case where shutters are fixed on both faces of the frames, the measurement for the door frame and shutter on one face shall be taken in the manner already described, while the additional shutter on the other face will be measured for the shutter only excluding the frame.

7) Where shutters are provided with clearance at top or / and bottom each exceeding 15 cm height, such openings shall be deducted from the overall measurements and relevant coefficient shall be applied to obtain the area payable.

8) Collapsible gates shall be measured for width from outside to outside of gate in its expanded position and for height from bottom to top of channel verticals. No separate measurements shall be taken for the top and bottom guide rails rollers, fittings etc.

9) Coefficients for sliding doors shall be the same as for normal types of doors in the table. Measurements shall be taken outside to outside of shutters, and no separate measurements shall be taken for the painting guide rails, rollers, fittings, etc.

10) Measurements of painting as above shall be deemed to include painting all iron fittings in the same or different shade for which no extra will be paid.

11) The measurements of guard bars, expanded metal, hard drawn steel wire fabric of approved quality, grill work and gratings, when fixed in frame work, painting of which is once measured else where shall be taken exclusive of the frames. In other cases the measurements shall be taken inclusive of the frames.

12) For painting open palisade fencing and gates etc., the height shall be measured from the bottom of the lowest rail, if the palisades do not go below it, (or from the lower end of the palisades, if they project below the lowest rail), up to the top of rails or palisades whichever are higher, but not up to the top of standards when the latter are higher than the top rails or the palisades.

15.33.6.5. Width of moulded work of all other kinds, as in hand rails, cornices, architraves shall be measured by girth.

15.33.6.6. For trusses, compound girders, stanchions, lattice girders, and similar work, actual areas shall be measured in sq. meters and no extra shall be paid for painting on bolt heads, nuts, washers etc. even when they are picked out in a different tint to the adjacent work.

15.33.6.7. Painting of rain water, soil, waste, vent and water pipes etc. shall be measured in running metres of the particular diameter of the pipe concerned. Painting of specials such as bends, heads, branches, junctions, shoes, etc. shall be included in the length and no separate measurements shall be taken for those or for painting brackets, clamps etc.

15.33.6.8. Measurements of wall surfaces and wood and other work not referred to already shall be recorded as per actual.

15.33.6.9. Flag staffs, steel chimneys, aerial masts, spires and other each objects requiring special scaffolding shall be measured separately.

15.33.7. **Precautions -** All furnitures fixtures, glazing, floors, etc. shall be protected by covering and stains, smears, splashings, if any shall be removed and any damages done shall be made good by the contractor at his cost.

15.33.8. **Rate -** Rates shall include cost of all labour and materials involved in all the operations described above and in the particular specifications given under the several items.

8.17.1 Dismantling

The term "dismantling" implies carefully taking up or down and removing the building materials without damaging them. The articles dismantled shall be lowered to the ground and not thrown. Dismantling work shall cover complete removal of the existing structure or part of a work including all relevant items as indicated or as directed, clearing the site, sorting out useful materials and stacking them as described, and disposing of the unserviceable materials

8.17.2 **Serviceable materials**

Any material which is in the opinion of the engineer could be refused or otherwise useful will be considered as serviceable

8.17.3 Unserviceable materials –

Any material declared by the engineer are not serviceable shall be considered as unserviceable.

A register shall be opened at the work site to show day-to-day account of the turn out of salvaged materials. The register shall also indicate whether dismantled materials are properly stacked or wasted.

The contractor shall be reasonable for the safe custody of serviceable materials until handed over to the engineer's representative or incorporated in the work and a written receipt for the same obtained.

8. PROVIDING & CONSTRUCTION LATERITE MASONRY MANHOLES:

Providing and constructing laterite size stone masonry in CM 1:6 using available Laterite Stone including cost and conveyance of materials (except Laterite), curing etc complete as per specification I.S. 3620/1979 having compressive strength not less than 3.5 N/mm2 for saturated dry samples - For Basement in CM 1:6.

Providing and constructing laterite size stone masonry including cost and conveyance of all materials curing etc complete as per specification I.S. 3620/1979 having compressive strength not less than 3.5 N/mm2 for saturated dry samples - For Super structure in CM 1:6

9. WOODWORK

GENERAL SPECIFICATIONS FOR TIMBER USED IN BUILDINGS

Timbers generally used in buildings are either of solid timber or panel products like plywood, particle board, etc. The major use is in door and window frames and their shutters, furniture and the like. It is also used in structures specially in hilly regions where timber is abundantly available and other common building materials like brick are not easy to come by.

India has around two hundred species of commercial timber grown in different parts of the country. For quite sometime timber was transported over long distances for some specific services even when species suitable for the purpose would be secured from nearby sources. The reason apparently appears to be the misconception that in timber there are primary species (teak) and secondary species. No such classification exists and it is a misnomer. All species can used, only each species has different end use. Some species are even stronger in cumulative properties than teak. IS 3991963 classifies commercial timber and their distribution in India along with different end uses. Therefore it is necessary to check locally available timber for building purposes before specifying the species for woodwork.

Moisture content is an important requirement for use of timber in woodwork. Moisture content affects its workability, size, etc. the moisture content of timber changes from season to season depending on atmospheric humidity. The application of a finish (paint or varnish) reduces the change in moisture content with changes in humidity in the atmosphere. IS 2871993 governs the recommendations for maximum permissible moisture content for timber used for different purposes.

For actual end use seasoning and treatment of timber are necessary. Seasoning will help in the control of moisture and it should be done as per IS 11411993; and preservation as per IS 4011982.

Classification of timber

Zonal distribution

IS 3991963 details the zonal distribution of common commercial and timber of India, classified according to their various end uses and gives information on availability and on some of the other properties of these timbers. The uses, include

a) Constructional purpose, including building construction, piles, bridges, poles, railways sleepers, etc; and

b) Furniture and cabinet making.

India is divided into five zones for convenience in tabulating the information on timber. The zones are

Zone 1 - Jammu & Kashmir, Punjab, Himachal Pradesh, Haryana and Rajasthan.

Zone 2 - Assam, Manipur, Tripura, West Bengal, Bihar, Orrisa, Mizoram, Arunachal Pradesh, Nagaland, Sikkim, Haryana, Bhutan, Andamans.

Zone 3 - Madhya Pradesh, Vidharba areas of Maharastra and north east part of Andhra Pradesh (Godavari Delata area).

Zone 4 - Maharastra (except Vidharbha area), Gujarat, and north west part of Karnataka.

Zone 5 - Tamil Nadu, Pondichery, Andhra Pradesh (except Godhavari Delta area), Kerala and Karnataka (except north west part).

Information on timber

Tables in IS 399 1963 give information on the following aspects of timbers available in these zones.

a) **Availability** - Availability of commercial timber is categorized under three classes as given below

X - Most common, 1400 cu.m and more per year

Y - Common, 350 – 1400 cu.m per year

Z - Less common. Below 350 cu.m per year.

b) Mass per cubic metre– The average mass per cubic metre at 12 percent moisture content for all timbers.

c) Durability - The figures of durability are based on grave yard tests carried out on 60 cm X 5 cm X 5 cm specimens and are categorized as below

High – Timber having, an average life of 120 months and over

Moderate – Timber having an average life between 60 to 120 months.

Low – Timber having an average life less than 120 months.

d) Treatability – Treatability, reflecting the resistance offered by the heartwood to the penetration of preservation fluid under pressure of 10.5 kg/cm^2 is classified as below

a – Heartwood easily treatable

b – Heartwood treatable, but complete penetration of preservative not always obtained

c – Heartwood only partially treatable

d – Heartwood refractory to treatment

e – Heartwood very refractory to treatment, penetration being practically nil from side or end

e) Compressive strength coefficient – The compressive strength coefficient is arrived at by grouping the various important mechanical properties of timber that may come into play for any particular use and giving due weightage to the relative important of these properties.

The handbook SP 33 (S & T) 1986 covers the engineering aspects of use timber.

Timber species be identified by using IS 49701973 [keys for identification of commercial timbers] around 50 cards are available for identifying species.

Timber may be graded on the basis of defects as per IS 65341971 which gives guidelines of grading and inspection of timber.

Since publication of IS 3991963 further work has been done in identifying species of timber suitable for doors and window shutters and frames; and for furniture and cabinets. These are covered in IS 12896 1990 for shutters and frames and IS 136221993 for furniture and cabinets. These additional species have been brought in for these end uses.

10. Specifications for asbestos cement corrugated sheet roofing

Asbestos cement corrugated sheets

The sheets shall be of the approved quality and shall conform to IS:459. The sheets shall be free from cracks, chipped edges or corners and other damages.

8.5.2 Slope - The roof shall not be pitched at flatter slope than 1 vertical to 5 horizontal. The normal pitch adopted shall usually be 1 vertical to 3 horizontal.

8.5.3 Laying

8.5.3.1 The sheets shall be laid on the purlins and other roof members as indicated in the working drawings or as instructed by the engineer.

8.5.3.2 The maximum spacing of purlins under the sheets shall be 1.40 metres in the case of 6 mm thick sheets and these shall be in no case be exceeded. Ridge purlins shall be fixed at 75 mm to 115 mm from the apex of the roof.

8.5.3.3 The top bearing surfaces of all purlins and of other roof members shall be in one plane so that the sheets when being fixed shall not require to be forced down to rest on the purlins. The finished roof shall present a uniform slope and the line of corrugations shall be straight and true. The sheets shall be laid with the smooth side upwards.

8.5.3.4 The sheets shall be laid with a side lap of half a corrugation and an end lap of 15 cm minimum in the case of roofs with a pitch flatter than 1 vertical to 2.5 horizontal (approx. 22 degree) or in the case of very exposed situations, the minimum permissible end lap shall be 20 cms. Side laps should be laid on the side facing away from the prevailing monsoon winds.

8.5.3.5 The free overhang of the sheets at the eaves shall not exceed 30 cm. Corrugated sheets shall be laid from left to right starting at the eaves. The first sheet shall be laid uncut but the remaining sheets in the bottom row shall have the top left hand corners cut or mitred. The sheets in the second and other intermediate rows except the first and the last sheets, shall have both the top left hand corner and bottom right hand corner cut. The last or top row sheets shall all have the bottom right hand corner cut with the exception of the last sheet which shall be laid uncut. If for any reason such as on consideration of the direction of prevailing winds, laying is to be started from the bottom right hand corner, then the whole procedure should be reversed.

8.5.3.6 The 'Mitre' described above is necessary to provide a snug fit where four sheets meet at a lap. It is cut from a point 15 cm (or whatever the length of the end lap may be) up the vertical side of the sheet to a point 5 cm long along the horizontal edge. This cutting may be done with an ordinary wood saw at site.

8.5.4 Fixing

8.5.4.1 Sheets shall be secured to the purlins and other roof members by means of 8 mm diameter galvanised iron J or L hook bolts and nuts. While, J hooks are used for fixing to angle iron purlins, L hooks are used for fixing to R. S. joists, timber or precast concrete purlins.

8.5.4.2 The grip of the J or L hook bolt on the side of the purlin shall not be less than 25 mm. Each galvanised iron J or L hook bolt shall have a bitumen washer and a

galvanised iron washer placed over the sheet before the nut is screwed down from above. On each purlin there shall be one hook bolt on the crown adjacent to the side lap on either side. Bitumen washer shall be of approved manufacture. Galvanising of G. I. J or L hooks and washers shall be as provided.

8.5.4.2 The G. I. flat washer shall be of 25 mm in diameter. 1.6 mm thick and the bitumen washer shall be 35 mm in diameter and 1.5 mm thick. The length of J bolt or crank bolt shall be as specified in table 2 below.

9 Table 2

S. No	Situation	No. of Bolts & Washers	Length of Bolts
1	At horizontal (end) laps of sheets. At eaves when filter pieces are used. At ridges when sheets and ridge pieces are secured by the same bolt.	Twice the No. of sheets on one horizontal course.	Depth of purlin plus 90 mm.
2	At eaves when filler pieces are not used. At ridge when corrugated sheets and ridge pieces are secured by the same bolt.	Twice the No. of sheets in the horizontal course.	Depth of purlin plus 75 mm.
3	At intermediate purlins where horizontal laps do not occur	Twice the No. of sheets in the horizontal course.	Depth of purlin plus 75 mm.

8.5.4.3 Each nut shall be screwed lightly at first. After a dozen or more sheets are laid, the nuts shall be tightened to ensure a leak proof joint.

8.5.4.4 Holes for hook bolts etc. shall be drilled and not punched always through the crown of the corrugation and not in valleys, in locations to suit the purlins while the sheets are on the roof in their correct position. The diameter of holes shall be 2 mm more than the diameter of the fixing bolts. No. hole shall be nearer than 40 mm to any edge of a sheet or any accessory.

8.5.4.5 Roof ladders or planks shall always be used when laying and fixing the sheets, to avoid damage to the sheets, and to provide security to the workmen.

8.5.5 Wind ties - Wind ties may be provided where the situation justify their provision. These shall be of 40 x 6 mm flat iron section or of other size as specified. These shall be fixed at the eave ends of the sheets. The fixing shall be done with the same hook bolts which secure the sheets to the purlins. Wind ties shall be paid for separately unless described as included in the items of the roof work.

8.5.6 Finish - The completed roof shall present a neat and uniform appearance and be leak proof.

8.5.7 Measurements

8.5.7.1 Length and breadth shall be measured correct to a cm and its area shall be calculated in square metres correct to two places of decimal.

8.5.7.2 The superficial area of roof coverings shall be measured on the flat without allowance for laps and corrugations. Portions of roof covering overlapping of the

ridge or hips etc. shall be included in the measurements of the roof.

8.5.7.3 Roof with curved sheets shall be measured and paid for separately. Measurements shall be taken on the flat and not girthed. The breadth of the roof shall be measured along the rest of the curved sheets.

8.5.7.4 No deductions in measurements shall be made for opening up to 0.4 sqm and nothing extra shall be allowed for forming such opening. For any opening exceeding 0.4 sqm in area, deduction in measurements for the full opening shall be made and in such cases the labour involved in making these openings shall be paid for separately. Cutting across corrugation shall be measured on the flat and not girthed.

8.5.8 Rate - The rate shall include the cost of all the materials and labour involved in all the operations described above except otherwise stated. This includes the cost of roof sheets, galvanised iron J or L hook, bolts and nuts, bituminous and galvanised iron washers.

11. RELEVANT BIS CODE FOR TECHNICAL SPECIFICATION

S. No.	IS Code	Description
A. EARTHWORK IN EXCAVATION AND BACKFILLING		
1	IS: 783	Code of Practice for laying of concrete pipes.
2	IS: 1200 (Part 1)	Method of measurement of building and civil engineering works - Earth Work.
3	IS: 1489	Specification for Portland Pozzolana Cement
4	IS:2720 (All Parts)	Methods of test for soils.
5	IS:2809	Glossary of terms and symbols relating to soil engineering.
6	IS:3764	Safety code for excavation work.
7	IS:4081	Safety code for blasting and related drilling operations.
8	IS:4988 (All Parts)	Glossary of terms and classifications of earth moving machinery.
B. PLAIN, REINFORCED AND PRESTRESSED CONCRETE		
1	IS: 269	Specification for 33 Grade Ordinary Portland Cement.
2	IS: 303	Specification for Plywood for General Purpose.
3	IS: 383	Specification for Coarse and Fine Aggregates from Natural Source for Concrete.
4	IS: 432 (All Parts)	Specifications for Mild Steel and Medium-tensile Steel Bars and Hard-drawn Steel Wire for Concrete Reinforcement.

5	IS: 432 (Part - I)	Mild Steel and Medium-tensile Bars.
6	IS: 432 (Part - II)	Hard-drawn Steel Wire.
7	IS: 455	Specification for Portland Slag Cement.
8	IS: 456	Code of Practice for Plain and Reinforced Concrete.
9	IS: 460	Specification for Test Sieves.
10	IS: 515	Specification for Natural and Manufactured Aggregates for use in Mass Concrete.
11	IS: 516	Methods of Tests for Strength of Concrete.
12	IS: 650	Standard Sand for Testing of Cement.
13	IS:1199	Sampling and Analysis of Concrete.
14	IS:1200	Method of Measurement of Building Works.
15	IS:1489	Specification for Portland Pozzolana Cement.
16	IS:1542	Sand for Plaster.
17	IS:1566	Specification for Hard-drawn Steel Wire Fabric for Concrete Reinforcement.
18	IS:1785	Specification for Plain Hard-drawn Steel Wire for Prestressed Concrete (Part - I) - Cold Drawn Stress Relieved Wire.
19	IS:1786	Specification for High Strength Deformed Steel Bars and Wires for Concrete Reinforcement.
20	IS:1791	Batch Type Concrete Mixers.
21	IS:2386	Methods of Test for Aggregates for Concrete (8 Parts).
22	IS:2502	Code of Practice for Bending and Fixing of Bars for Concrete Reinforcement.
23	IS:2505	General Requirements for Concrete Vibrators.
24	IS:2506	General Requirements for Screed Board Concrete Vibrators.
25	IS:2722	Specification for Portable Swing Weigh Batcher (single and double bucket type).
26	IS:2911	Code of Practice for Design and Construction of Pile Foundation.
27	IS:3366	Pan Vibrators.
28	IS:3558	Code of Practice for the use of Immersion Vibrators for Consolidating Concrete.
29	IS:3370	Code of Practice for Concrete Structures for the (All Parts) Storage of Liquids.
30	IS:4656	Form Vibrators for Concrete.
31	IS:5525	Recommendation for Detailing of Reinforcement in Reinforced Concrete Works.

32	IS:5640	Method of Test for Determining Aggregate Impact Value of Soft, Coarse Aggregate.
33	IS:5816	Method of Test for Splitting Tensile Strength of Concrete Cylinder.
34	IS:6006	Specification for Uncoated Stress Relieved Strand for Prestressed Concrete.
35	IS:6461	Cement Concrete : Glossary of Terms.
36	IS:8041	Specifications for Rapid Hardening Portland Cement.
37	IS:8043	Specifications for Hydrophobic Cement.
38	IS:8112	Specification for 43 Grade Ordinary Portland Cement.
C. STEEL REINFORCEMENT		
1	IS:1785	Cold Drawn Stress relieved wire (Part I).
2	IS:1786	Specification for Cold Twisted Steel Bars for Concrete Reinforcement.
3	IS:2751	Code of Practice for Welding of M.S.Bars.
4	IS:5525	Recommendation for detailing of Reinforcement in Reinforced Concrete Works.
5	IS:6006	Uncoated Stress Relieved Strand for Prestressed Concrete.
6	IS:14268	Specifications for uncoated stress Relieved Low Relaxation Seven Ply Strand for Prestressed Concrete.
7	IS:800	General Construction in Steel
8	IS:816	Metal-arc welding for general construction in mild steel
9	IS:817	Training & Testing of metal-arc welders
10	IS:226	Structural Steel Sections
11	IS:2062	Weldable Structural Steel
12	IS:814	Welding Electrodes
13	IS:919	Recommendations for limits and fits for Structural Engineering.
14	IS:1477	Code of Practice for painting of ferrous metals in buildings.
15	IS:1977	Structural Steel (Ordinary quality)
16	IS:7205	Safety Code for erection of structural steel work
17	IS:7215	Tolerances for fabrication of steel structures
18	IS:8500	Weldable structural steel (medium and high strength qualities).
D. WATERPROOFING		
1	IS:6494	Code of Practice for waterproofing of Underground Water Reservoirs.
2	IS:2645	Indian Standard Specifications for integral cement waterproofing compounds.

E. PLASTERING AND POINTING		
1	IS: 269	Specification for 33 Grade Ordinary Portland Cement.
2	IS: 712	Specification for Building Limes.
3	IS:1542	Specification for Sand for Plaster.
4	IS:1630	Specification for Mason's Tools for plaster work and pointing work.
5	IS:1661	Code of Practice for application of cement lime plaster finishes.
6	IS:2402	Code of Practice for external rendered finishes.
7	IS:8041	Specification for Rapid Hardening Portland Cement.
8	IS:8112	Specification for 43 Grade Ordinary Portland Cement.
9	IS:12600	Specification for Low Heat Portland Cement.
F. PAINTING		
1	IS: 63	Whiting for Paints.
2	IS:110	Reading mixed paint, brushing, gray filler for Enamels, for use over primers.
3	IS:426	Specification for paste filler for color coats.
4	IS:428	Specification for Distemper, Oil Emulsion, color as required.
5	IS:710	Specification for Marine Plywood.
6	IS:1477 (Part I)	Code of Practice for painting of ferrous metals in buildings - Pretreatment.
7	IS:1477 (Part II)	Code of Practice for painting of ferrous metals in buildings - Painting.
8	IS:2338 (Part I)	Code of Practice for finishing of wood and wood based materials - Operations and Workmanship for finishing.
9	IS:2338 (Part II)	Code of Practice for finishing of wood and wood based materials - Schedules.
10	IS:2395 (Part I)	Code of Practice for painting concrete masonry and plaster surfaces - Operation and workmanship.
11	IS:2395 (Part II)	Code of Practice for painting concrete masonry and plaster surfaces - Schedules.
12	IS:2524 (Part I)	Code of Practice for painting of non-ferrous metals in buildings - Pre-treatment.
13	IS:2524 (Part II)	Code of Practice for painting of non-ferrous metals in buildings - Painting.
14	IS:3140	Code of Practice for painting asbestos cement building products.
15	IS:5410	Specification for cement paints, colour as required.
G. STEEL, ALUMINIUM AND IRON WORK		
1	IS:1956	Glossary of terms relating to iron and steel.

2	IS:814 (Part I)	Specifications for covered electrodes for metal arc welding of structural steel - For welding products other than sheets.
3	IS:814 (Part II)	Specifications for covered electrodes for metal arc welding of structural steel - For welding sheets.
4	IS:815	Classification and Coding of covered electrodes for metal arc welding of structural steel.
5	IS:818	Code of Practice for safety and health requirements in electric and gas. welding and cutting operations.
6	IS:1182	Recommended Practice for Radiographic examination of fusion welded butt joint in steel plates.
7	IS:1148	Specification for Rivet Bars for structural purposes.
8	IS:816	Code of Practice for use of metal arc for general construction in mild steel.
9	IS:3600	Method of testing fusion welded joints and weld metal in steel.
10	IS:6227	Code of Practice for use of metal arc welding in tubular structure.
11	IS:6248	Specifications for metal rolling shutter and rolling grill.
12	IS:1081	Code of Practice for fixing and glazing of metal (steel and aluminium) Doors, Windows and Ventilators.
13	IS:1361	Specifications for steel windows for Industrial Buildings.
14	IS:1200 (part VIII)	Method of Measurement of steel work and iron work
15	IS:1038	Specifications for steel doors, windows and ventilators.
16	IS:226	Specifications for structural steel (Standard Quality).
17	IS:823	Code of Procedure for manual metal arc welding of metal steel.
18	IS:102	Ready mixed paint, brushing, red lead non-sitting, priming.
19	IS:1363	For black hexagonal bolts, nuts and lock-nuts (dia 6 to 39 mm) & black hexagonal screws (dia 6 to 24 mm)
20	IS:813	Scheme of symbols for welding.
21	IS:817	Code of Practice for training and testing of metal arc welders. (Revised)
22	IS:800	Code of Practice for use of structural steel in general building construction.

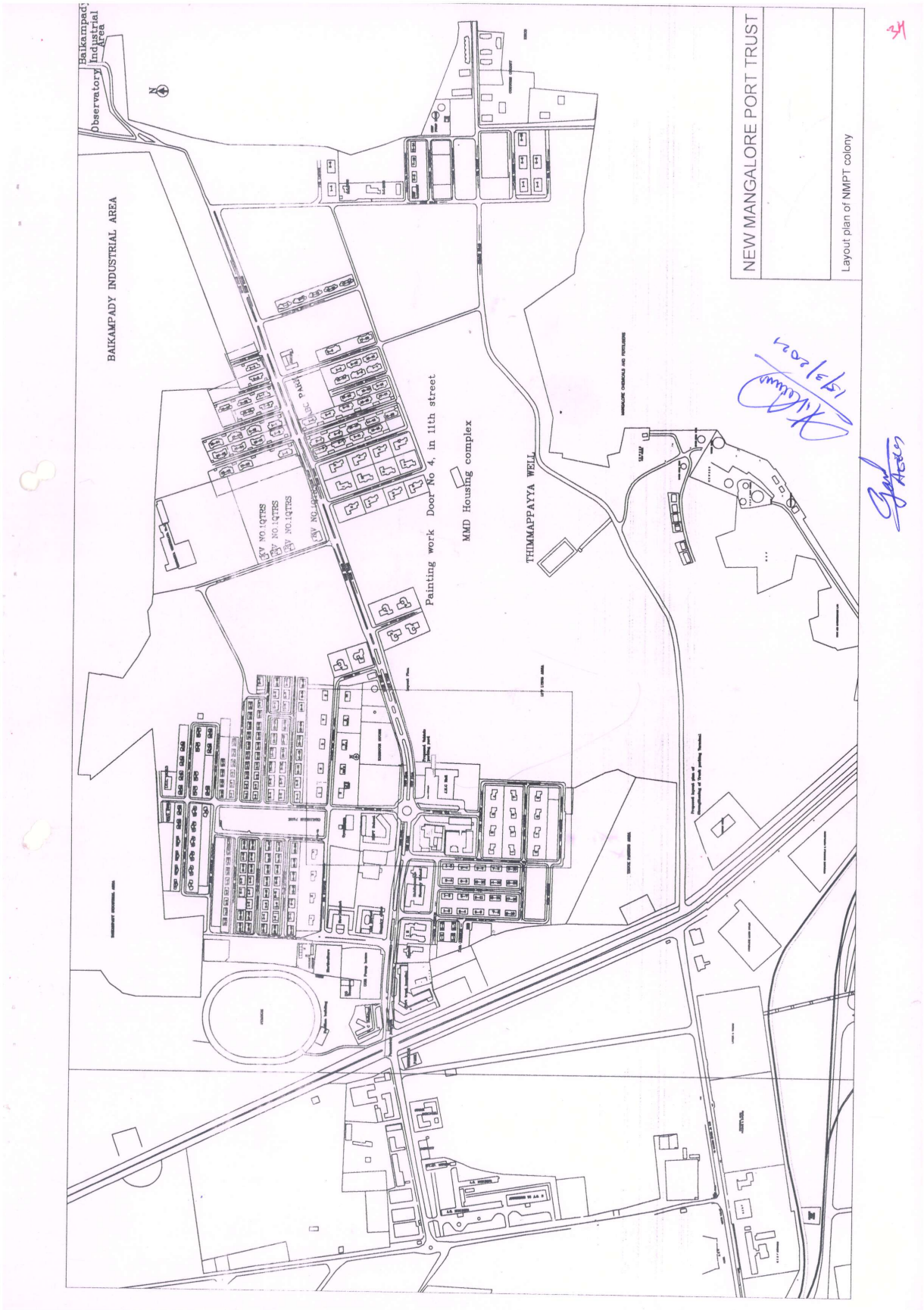
SECTION V

DRAWINGS

Brief Description of drawing

The Works are shown in the following drawings that are issued as a part of the Tender Documents:

Sl. No	Drawing No.	Description
1	No. 5/361/MTC-I/01-LP	LOCATION PLAN


NEW MANGALORE PORT TRUST
Layout plan of NMPT colony
BAIKAMPADY INDUSTRIAL AREA
Baikampady Industrial Area
Observatory
N
Painting work Door No 4, in 11th street
MMD Housing complex
THIMMAPPAYYA WELL
SQ.NO.1QTRS
SQ.NO.1QTRS
SQ.NO.1QTRS

NEW MANGALORE PORT AUTHORITY
Panambur, Mangalore

"ANNUAL MAINTENANCE OF RESIDENTIAL & NON-RESIDENTIAL BUILDINGS ON THE EAST OF NH-66 IN NMPA FOR THE YEAR 2024-25"

TENDER DOCUMENT

Volume - III

BILL OF QUANTITIES

Table of Contents

VOLUME III

SECTION VI

(i) PREAMBLE TO BILL OF QUANTITIES

1. General Instructions

1.1 General

1.1.1 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, 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.

1.1.2 Notwithstanding that the work has been sectionalized 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 practicable to do so.

1.1.3 The detailed descriptions of work and materials given in the Specifications are not necessarily being repeated in the Bill of Quantities.

1.1.4 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.

1.1.5 The Tenderer will be held to have familiarised himself with all local conditions, in so far as they affect the work, means of access and the locality of existing services, in order to execute the Works measured and described hereinafter. No claims for want of knowledge in this respect will be reimbursed.

1.2 Rates and Prices to be Inclusive

1.2.1 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 there from and are to cover the cost of provision of plant, labour, supervision, materials, test charges, freight, transportation, erection, installation, performance of work, care of works, insurance, maintenance, overheads and profits and every incidental and contingent cost and charges whatsoever including taxes if any excluding GST including 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 general condition of contract) and all the Contractor's obligations under the Contract and all matters and things necessary for the proper completion and maintenance of the Works.

1.2.2 The rates and prices set down against the items are to be the full inclusive value of the finished work shown on the Drawing and/or described in the Specification or which can reasonably be inferred the reform and to cover the cost of every description of Temporary Works executed or used in connection therewith (except those items in respect of which specific provision has been separately made in these Bills of Quantities) and all the Contractor's obligations under the Contract including testing, giving samples and all matters and things necessary for the proper execution, completion and maintenance of the Works.

1.2.3 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 entered in the Bill of Quantities. The rates and 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 interpretation

will be done according to General Conditions of Contract.

1.2.4 The quantities given in the Bill are approximate and are given to provide a common basis for tendering. They are not to be taken as a guarantee that the quantities scheduled will be carried out or required or that they will not be exceeded. The Employer / Engineer reserves the right to delete any item and / or increase / reduce quantities indicated in the Bills of Quantities at any time. Payment will be made according to the actual quantities of work ordered and carried out in the contract. However, the rates quoted shall be valid for any extent of variation in quantity of each individual item provided that the total contract value does not get altered by more than indicated in conditions of contract. No claim whatsoever for extra payment due to variation of quantities within the above said limit would be entertained.

1.2.5 The drawings for tender purposes are indicative only of the work to be carried out. However, the Tenderer must allow within his price for the items of work included in the Tender Documents for the details which will appear on subsequent drawings developed for construction purposes. Rate and price shall include any additional design/ detailing to be carried out by contractor.

1.2.6 The rates and prices shall include (except where separate items are given) for the provision and operation of the following items, for compliance with the Conditions of Contract, Special Conditions, the specifications and Tender drawings:

i) Supervision and labour for the Works;
ii) All materials, installation/erection, handling and transportation;
iii) All Contractor's Equipment;
iv) All testing, commissioning, insurance, maintenance, security, welfare facilities, overheads and profit and every incidental and contingent costs and charges whatsoever including;
v) All temporary fencing, watching, lighting, sanitary accommodation, general security arrangements,

welfare facilities and first aid provision;

vi) Provision and maintenance of Contractor's site offices, cabins, huts, maintenance and storage areas;

vii) Taxes if on the transfer of property in goods in the execution of works, other than GST, Customs Duty for materials to be permanently incorporated into the Works);

viii) All necessary temporary services including fresh water, compressed air lines, electrical cabling and switchgear, telephone, walkie-talkie and facsimile facilities;

ix) The maintenance of all Contractor's services;

x) All insurances for the Works;

xi) Allowance for complying with all environmental aspects as specified;

xii) Detail design of components of temporary works, wherever necessary as directed by Engineer.

1.4 Method of Measurement

1.4.1 Measurement of Work shall be in accordance with IS 1200 and shall be net off the dimensions of the works shown on the drawings except as mentioned below:

1.4.2 Units of Measurement: The units of measurement used in this Bill of Quantities are in metric units as follows:

i) Linear: Linear metre, centimeterormillimeter abbreviated to 'Rm', 'cm' or 'mm' respectively.

ii) Superficial: Square metre or Square centimeter abbreviated to 'Sq.M' or 'sq.cm' respectively.

iii) Volumetric: Cubic metre abbreviated to 'cu.m'. Litre abbreviated to 'L'

iv) Weight: Tonne = 1000 Kilograms, abbreviated to 'T', / 'MT' Kilogram abbreviated to 'kg'

v) Numbers: Numbers abbreviated to Nos. or No.

vi) Lump sum: Lump sum abbreviated to 'L.S.'

1.5 Currency

1.5.1 All monetary reference herein and the Bill of Quantities shall be priced in Indian Rupee Currency.

2. Civil Works

2.2 Precast Concrete

2.2.1 Shuttering for precast concrete shall not be measured and paid for separately.

2.2.2 Effort for placement of precast concrete at the final locations shall not be measured unless a specific item is provided in the Bill of Quantities.

2.2.3 The precast concrete units shall be measured as shown on the detailed drawings.

2.3 In-situ Concrete

2.3.1 Shuttering for In-situ concrete shall not be measured and paid for separately.

2.3.2 No deduction will be made for chamfers smaller than 50 sq.cm. sectional area, reinforcement bolts and other embedded parts 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.

2.3.3 The rates for reinforced concrete shall include for all batching, mixing, transporting, hoisting or lowering to any height / depth, placing in position and compaction in work of any sectional area or thickness including shuttering, forming necessary construction joints, shear keys and stop ends, and for curing and protecting etc. all as specified.

2.3.4 The rates shall include for preparing construction joints, shear keys and surfaces against which next stage concrete is to be cast and building in fittings including pipes and bolts except where specifically billed separately. No separate payment will be made for making openings/pockets/pits of any size and shape. Where surfaces are to receive finishes the rates shall include for leaving the surface rough or for hacking and roughening the surface to form a key.

2.3.5 Unless otherwise noted, rates shall include for inserting pipes

and other inserts in position accurately, concreting while they are in position and also for protecting the same as the work proceeds.

2.3.6 Unless otherwise noted, the rates for concrete items shall include for finishing the top surface to levels and slopes and surface finish as specified. Rates for concrete shall include for finishing the slab to specified slope towards drains, etc.

2.4 Reinforcement

2.4.1 Steel reinforcement will be measured by weight 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'.

2.4.2 The rates shall include for cutting, weldinglaps, and waste, straightening short and long lengths, bending, fixing, rolling margin and the provision of spacer bars or support, chairs, binding wire, saddles, forks and all dense concrete spacer blocks, etc., including preparing bending schedules from the Drawings.

2.4.3 The rates shall include for all necessary descaling, wire brushing and cleaning to remove all rust and mill scale, dirt, grease and other deleterious matter before fixing and whilst still exposed during construction.

2.5 Structural and Miscellaneous Steel work

2.5.1 Rates for structural steel work and iron work shall include supply, fabrication, delivery and erection/embedment in concrete at Site and all charges for welding, cutting, bending, bolting, site connections, fixing to foundations.

2.5.2 The rates for Structural Steelwork shall include:

i) Supply, fabrication, delivery and erection
ii) Rolling margin, cutting and waste, weld metal, bolts, fixings and fittings
iii) Hoisting, drilling, bolting or welding and fixing in the manner specified or indicated in the drawing
iv) Fabrication drawings

v) Welding trials and tests
vi) Erection trials
vii) Protective treatment (painting, hot dip galvanizing etc), including making good any damage if provided in the BOQ item.

2.5.3 Metalwork items are described in the Bills of Quantities and the Tenderer is to include for all the fittings, etc., described. All items shall include the necessary fabrication, joints, angles, intersections and ends, all bolts or fixing lugs, all hoisting and scaffolding required and casting in fixings or later cutting out or forming pockets for same, grouting, supporting and making good.

2.5.4 Rates are to include for all necessary scaffolding, working over water and at any height staging and hoisting and tarpaulin or other protective covers and the cleaning and removal of paint stains and spots, etc.

3.4.1 The Contractor's unit rates and prices shall include all equipment, apparatus, material indicated in the Drawings, and/or Specifications in connection with the item in question and also associated labour as well as all additional equipment, apparatus, material, consumables usually necessary to complete the system even though not specifically shown, described or otherwise referred to and also associated labour.

3.4.2 The rate for providing and fixing above items shall include all fittings, fixtures, base and sole plates, anchor bolts, including epoxy grouting, etc. all complete as specified, including the necessary additional supervision to ensure accurate alignment

3. Abbreviations

4.1.1 The following abbreviations are used in the Specifications and Bill of Quantities:

IS :	Indian Standard
BS :	British Standard
Qty. :	Quantity
mm :	Millimeters
cm :	Centimeters
M / m / MTR :	Meters
LM :	linear metre
LS :	lump sum

Rs. :	Rupees
P. :	Paise
Nos. :	Numbers
do :	Ditto
MS :	mild steel
T :	Tones
Kg :	Kilogram
EO :	Extra over (previous sum unless specified otherwise)
sq.m. /m^2 /SQMT:	square metre
sq.cm. :	square centimeters
mm^2 :	Square Millimetre
Cu.m/CUM. :	cubic meters
YST :	yield stress
dia :	Diameter
wt. :	Weight
Drg.No.:	drawing number
max. :	Maximum
min :	Minimum
approx :	Approximately
n.e.:	not exceeding
incl:	Including
circ:	Circular
set :	set / sets
c/c	centre to centre
@ :	at the rate of

ii) BILL OF QUANTITIES

NAME OF WORK : ANNUAL MAINTENANCE OF RESIDENTIAL & NON-RESIDENTIAL BUILDINGS ON THE EAST OF NH-66 IN NMPA FOR THE YEAR 2024-25					
Item No.	**DESCRIPTION OF ITEM**	**QTY**	**UNIT**	**RATE IN figures**	**AMOUNT (Rs. Ps.)**
1	Removing and resetting Mangalore tiles and replacing broken ones wherever necessary (excluding cost of new tiles).	3000.00	Sqm	27.78	83340.00
2	Providing Jungle wood such as Nerale, Neem wrought and putup for purlins, common rafters and similar work including cost of materials, labour, usage charges complete as per specifications.	10.00	Cum	44929.00	449290.00
3	Supplying and fixing new Mangalore tiles on existing reepers	6000.00	No.	47.60	285600.00
4	Providing Mangalore Ridge tiles set in C.M. 1:2 and pointed with C.M. 1:2	300.00	No.	103.75	31125.00
5	Removing & resetting the dislocated ridge tiles in cement, lime, sand,in the proportion of 1:1:3 mix, disposing the debries with 300mm lead incluidng cost & conveyance of all material, labour charges etc. complete as per specification for - Ground Floor Buildings	2000.00	No.	61.00	122000.00
6	Providing and fabricating 50mm dia medium class G.I. pipe including, cutting, welding flange with bolt holes & ends sealed with M.S Plate applying 2 coats of Anti corrosive Steel paint over a coat of primer conveyance of all materials, transportation to work site, cost of Labour, all Tools & Plants, Bolts & Nuts for fixing, charges etc complete.	100.00	RM	343.84	34384.00
7	Providing & fixing 24 guage G.I. corrugated or plain sheet over the roof scantling using J or L bolt with washer incluidng cost	120.00	Sqm	810.83	97299.60

	& conveyance of all material, labour charges etc. complete as per specification - MSB				
8	Providing and laying to required line and slope roofing with corrugated asbestos cement sheet 6mm. thick fixed with galvanised iron J or L hooks, bolts and nuts 8mm. dia C.I plain and bitumen washers over the existing purlins, rafters and trusses including cost of materials, labour,complete as per specifications	50.00	Sqm	332.00	16600.00
9	Replacement of corroded G.I. sheet from valley gutter, removing lime mortor band and providing 18 guage G.I. sheet of approved quality and make fixing to the valley gutter fixing in existing condition including cost and conveyance of all materials, labour charges, etc. complete as per specification.	30.00	RM	1056.45	31693.50
10	Supplying & fixing chimney pipe of approved quality and make including cost & conveyance all material, labour charges and T &P charges and all other incidental charges etc. complete as per specification. complete.	5.00	NO	308.51	1542.55
11	Earth work excavation by manual means for drains,canals, waste weir, draft, approach channels, key trenches, foundation of bridges and such simillar works in all kinds of soils , as per drawing and technical specifications, including setting out, shoring, strutting, barricading, caution lights, removal of stumps and other deleterious matter, excavated surface leveled and sides neatly dressed disposing off the excavated stuff or sorting & stacking the selected stuff for reuse in a radius of 50 m and lift upto 1.5	25.00	Cum	242.00	6050.00

	m including cost of labour, tools & other appurtenaces required to complete the work.				
12	Providing and laying in Cement Concrete for all Basement & surface level works, return walls, retaining walls, sunken floors etc. The granite/trap/ basalt crushed graded coarse aggregates and fine aggregates as per relevant IS Codes machine mixed with super plasticisers, laid in layers, well compacted using needle vibrators, providing weep holes wherever necessary, including all lead & lifts, cost of all materials of quality, labour, Usage charges of machinery, curing and all other appurtenances required to complete the work as per technical specifications. M20 Design Mix Using 20 mm nominal size graded crushed coarse aggregates	15.00	Cum	6323.00	94845.00
13	Providing and laying in position Cement Concrete for all Foundation works. The granite/trap/basalt crushed graded coarse aggregates and fine aggregates as per relevant IS Codes machine mixed with super plasticizers laid in finished layers, well compacted using needle vibrators, including all lead & lifts, cost of all materials, quality confirming to the requirements of relevant IS codes, labour, Usage charges of machinery, curing and all the other appurtenances required to complete the work as per technical specifications. M20 Design Mix Using 20 mm nominal size graded crushed coarse aggregates	10.00	Cum	6287.00	62870.00
14	Providing and constructing laterite size stone masonry in CM 1:6 using available Laterite	30.00	Cum	3627.00	108810.00

	Stone including cost and conveyance of materials (except Laterite), curing etc complete as per specification I.S. 3620/1979 having compressive strength not less than 3.5 N/mm2 for saturated dry samples - For Basement in CM 1:6.				
15	Providing and constructing laterite size stone masonry including cost and conveyance of all materials curing etc complete as per specification I.S. 3620/1979 having compressive strength not less than 3.5 N/mm2 for saturated dry samples - For Super structure in CM 1:6	25.00	Cum	6755.00	168875.00
16	Providing Size Stone masonry with hard stone in foundation & plinth with Cement mortar 1:6 (1 cement : 6 coarse sand)	3.00	Cum	6389.00	19167.00
17	Providing Brick work with common burnt clay modular bricks of class designation 3.5 in foundation and plinth in Cement mortar 1:6 (1 cement: 6 coarse sand) including cost of all materials, labour, scaffolding and usage charges of machinery & other incidental charges complete as per the direction of engineer incharge of work.	10.00	Cum	8661.00	86610.00
18	Providing Flush/ Ruled pointing: Pointing on stone work with cement mortar 1:3 (1 cement : 3 fine sand) after raking joints to depth nicely lining, including cost of materials, labour, curing as per specifications and as per directions of Engineer-in-charge.	300.00	Sqm	255.00	76500.00
19	Providing 12 mm cement plaster with cement mortar 1:4 (1 cement: 4 fine sand) to brick masonry including rounding off corners wherever required smooth rendering, providing	300.00	Sqm	255.00	76500.00

	and removing scaffolding, including cost of materials, labour, curing complete as per specifications and as per directions of Engineer-in-charge.				
20	Extra for providing and mixing waterproofing compound in cement plaster work at one kg per bag or in the proportion recommended by the manufacturers, for cement mortar 1:3, 12mm thick cost of materials complete as per specifications.	200.00	Sqm	5.79	1158.00
21	Providing Cement Plaster floor finish with C.M 1:3, 20mm thick, with red/black oxide including preparation of the surface, laying, Finishing to achieve smooth, glossy surface of uniform colour, true to level & gradient, thread lining, curing, cost & conveyance of all materials, labour, T & P and all other incidental charges etc. complete including cost of Cement.	300.00	Sqm	254.01	76203.00
22	Providing 20 mm cement plaster of mix :1:4 (1 cement: 4 fine sand) to brick/stone masonary including rounding off corners wherever required smooth rendering, providing and removing scaffolding, including cost of materials, labour, curing complete as per specifications and as per directions of Engineer-in-charge.	500.00	Sqm	354.00	177000.00
23	Providing 20 mm cement plaster with cement mortar 1:3 (1 cement: 3 coarse sand) finished with a floating coat of neat cement to brick/stone masonry including rounding off corners wherever required smooth rendering, providing and removing scaffolding, including cost of materials, labour, curing	1000.00	Sqm	429.00	429000.00

	complete as per specifications and as per directions of Engineer-in-charge.				
24	Dismantling old plaster or skirting raking out joints and cleaning the surface for plaster including disposal of rubbish to the dumping ground to the appropriate disposal area as per direction of Engineer-in-charge.	100.00	Sqm	37.00	3700.00
25	Dismantling dressed stone work ashlar face stone work, marble work or precast concrete work manually/ by mechanical means including stacking of serviceable and disposal of unserviceable material to the appropriate disposal area as per direction of Engineer-in-charge.	5.00	Cum	1001.00	5005.00
26	Providing skirting, dadooing, rises of steps with colour glazed tiles 6mm thick on 10mm thick cement plaster 1:3 and jointed with white cement slurry over existing rough plaster surface using glazed tiles of approved make and size including cost of materials, labour, complete as per specifications.	50.00	Sqm	1449.00	72450.00
27	Providing flooring with 25mm to 40mm thick polished Cadapa slabs using cement mortar 1:6, 25mm thick over existing cement concrete bed or top of roof laid to line and level and jointed with cement slurry mixed with pigment to match the shade of the slab, , including cost of materials, labour, curing, polishing complete as per specifications.	10.00	Sqm	1493.34	14933.40
28	Providing and fixing white vitreous china pedestal type water closet (European type W.C. pan) with seat and lid, 10 litre low level white P.V.C. flushing cistern, including flush pipe, with manually controlled device (handle lever), conforming to IS : 7231, with all	25.00	EA	4838.00	120950.00

	fittings and fixtures complete, including cutting and making good the walls and floors wherever required :W.C. pan with ISI marked white solid plastic seat and lid				
29	Providing and fixing water closet squatting pan (Indian type W.C. pan)with 100 mm sand cast Iron P or S trap, 10 litre low level white P.V.C. flushing cistern, including flush pipe, with manually controlled device (handle lever) conforming to IS : 7231, with all fittings and fixtures complete, including cutting and making good the walls and floors wherever required: White Vitreous china Orissa pattern W.C. pan of size 580x440 mm with integral type foot rests	15.00	EA	4884.00	73260.00
30	Providing and fixing CI Nahani trap of approved make conforming to ISI specifications and construction of Cistern in CC 1:2:4 as per directions (Rate is inclusive of cost of materials and fixtures and conveyance of materials to work spot)- 10 cms x 7.5 cms.	10.00	EA	289.41	2894.10
31	Supplying & fixing CPB grating with frame of approved quality and make including cost & conveyance all material, labour charges and T &P charges and all other incidental charges etc. complete as per specification. complete.	100.00	No.	120.39	12039.00
32	Providing & fixing 2.5Kg/cm2 110mm PVC drainage pipes including cost of all materials, labour, curing and other incidental charges etc complete.	100.00	RM	256.34	25634.00
33	Providing & fixing 110mm SWR Y/T with inspection door including cost of all materials, labour, curing and other incidental charges etc complete.	10.00	No.	255.83	2558.30
34	Providing & fixing 110mm SWR elbow/tee including cost of all	50.00	No.	173.08	8654.00

	materials, labour, curing and other incidental charges etc complete.				
35	Supply of 50mm PVC pipes of approved make and quality to the required alignment in the wall and below the ground including cement patch finish work with 1:3 mix curing etc. including cost & conveyance , labour T&P etc. complete.	50.00	RM	72.29	3614.50
36	Supply of 50mm SWR bend with inspection door of approved make and quality including cement patch finish work with 1:3 mix curing etc. including cost & conveyance , labour T&P etc. complete.	15.00	No.	93.14	1397.10
37	Supply of 50mm SWR bend of approved make and quality including cement patch finish work with 1:3 mix curing etc. including cost & conveyance , labour T&P etc. complete.	30.00	No.	75.25	2257.50
38	Supply of 50mm SWR Y/T of approved make and quality including cement patch finish work with 1:3 mix curing etc. including cost & conveyance , labour T&P etc. complete.	10.00	No.	105.35	1053.50
39	Carefully dismantling door/window frame, hinge, fastenings and stacking all the materials & disposing the debries within a lead of 50mts including cost and conveyance of all materials, labour charges, etc. complete as per specification.	30.00	No.	119.23	3576.90
40	Carefully dismantling ventilator fastenings and stacking all the materials & disposing the debries within a lead of 50mts including cost and conveyance of all materials, labour charges, etc. complete as per specification.	10.00	No.	81.30	813.00
41	Carefully dismantling door shutter, hinge, fastenings and stacking all the materials & disposing the debries within a	70.00	No.	67.75	4742.50

	lead of 50mts including cost and conveyance of all materials, labour charges, etc. complete as per specification				
42	Carfully dismantling window shutter, hinge, fastenings and stacking all the materials & disposing the debries within a lead of 50mts including cost and conveyance of all materials, labour charges, etc. complete as per specification.	100.00	No.	45.19	4519.00
43	Providing and fixing RCC door frames factory manufactured, with C.C. 1:1 1/2 :3 reinforced with 3 Nos. of 6 mm dia. Main bars and 6 mm dia. Stirrups welded at 30 cm C/C, vibrating, curing including cost of steel and fabrication charges having 3 Nos. of hinges with 20mm x 3mm M.S. flat welded with required iron rods and flats with drilling and fixing 4 No.of flat screw nuts each in concrete for fixing hinges and making necessary provision in concrete for fixing aldrops, tower bolts etc., including cost of one coat of oil based enamel primer, 4 No.of hold fasts, 3 Nos. ISS Iron oxidised hinges necessary metal screws etc., complete. 60mm x 100 mm size-Door frames.	10.00	M	1031.45	10314.50
44	Providing Mathi/Nandi wood frames of doors, windows, clerestory windows, ventilators and other frames, wrought, framed or assembled including making plaster groves (excluding cost of cement concrete and side clamps), but including cost of materials, labour, usage charges complete as per specifications.	2.00	Cum	124202.00	248404.00
45	Providing and fixing in position fully panelled Honne wood shutters for doors with stiles and rails of 40mm. thick with bottom and lock rails 180mm wide top rail and stiles 100mm	120.00	Sqm	7444.00	893280.00

	wide as per drawing and panels of 25mm thick including cost of materials, labour, usage charges complete as per specifications. (excluding cost of fixtures)				
46	Providing and fixing in position fully glazed for windows shutters with Teak wood stiles and rails of 25mm. thick, 75mm wide in single shutters with 4mm thick plain glass fixed with wooden beading including cost of materials, labour charges, usage charges complete as per specifications. (excluding cost of fixtures)	50.00	Sqm	4831.00	241550.00
47	Providing and fixing in position Honne wood fully panelled shutters for windows with stiles and rails of 25mm. thick, 75mm wide in two halves with panels of 20mm thick including cost of materials, labour charges, usage charges complete as per specifications. (excluding cost of fixtures)	15.00	Sqm	6263.00	93945.00
48	Rewedging, cramping joinery of any description with new wedges in glue or white lead and repinning including rehanging or refixing of shutters, hinges or pivots, exceeding one m2 but not exceeidng two m2 per leaf, removing or dismantling excluding cost of wood but including cost of labour, complete as per specifications.	10.00	LEAF	886.75	8867.50
49	Providing & fixing hinges 100mm including cost and conveyanceof all material, fixing charges, tools & plants and all other incidental charges etc. complete.	120.00	No.	45.13	5415.60
50	Providing & fixing hinges 75mm including cost and conveyance of all material, fixing charges, tools & plants and all other incidental charges etc.	350.00	No.	28.67	10034.50

	complete.				
51	Providing & fixing stoppers including cost and conveyance of all material, fixing charges, tools & plants and all other incidental charges etc. complete.	10.00	No.	33.12	331.20
52	Providing & fixing aldrop and locking arrangements including cost and conveyance of all material, fixing charges, tools & plants and all other incidental charges etc. complete.	70.00	No.	865.34	60573.80
53	Providing & fixing aluminium tower bolt of 100mm including cost and conveyance of all material, fixing charges, tools & plants and all other incidental charges etc. complete.	20.00	No.	63.22	1264.40
54	Providing & fixing tower bolt 200mm including cost and conveyance of all material, fixing charges, tools & plants and all other incidental charges etc. complete.	210.00	No.	111.47	23408.70
55	Providing & fixing tower bolt 300mm including cost and conveyance of all material, fixing charges, tools & plants and all other incidental charges etc. complete.	15.00	No.	142.85	2142.75
56	Providing & fixing hook & eye including cost and conveyance of all material, fixing charges, tools & plants and all other incidental charges etc. complete.	350.00	No.	31.40	10990.00
57	Providing & fixing aluminium handles including cost and conveyance of all material, fixing charges, tools & plants and all other incidental charges etc. Complete.	150.00	No.	107.15	16072.50
58	Providing and fixing weld mesh 75 mm X 25 mm 6G X 10G	20.00	Sqm	1727.18	34543.60
59	Easing of shutter of door	800.00	No.	100.72	80576.00
60	Easing of shutters of windows	1400.00	No.	97.24	136136.00
61	Providing and fixing aluminium die cast body tubular type universal hydraulic door closer (having	10.00	No.	1114.00	11140.00

	brand logo with ISI, IS :3564, embossed on the body, door weight upto 35 kg and door width upto 700 mm), with necessary accessories and screws etc. complete.				
62	Providing and fixing aluminium work for doors, windows, ventilators and partitions with extruded built up standard tubular sections/ appropriate sections and other sections of approved make conforming to IS: 733 and IS:1285, fixing with dash fasteners of required dia and size, including necessary filling up the gaps at junctions, i.e. at top, bottom and sides with required EPDM rubber/ neoprene gasket etc. Aluminium sections shall be smooth, rust free, straight, mitred and jointed mechanically wherever required including cleat angle,Aluminium snap beading for glazing / paneling, C.P. brass/ stainless steel screws, all complete as per architectural drawings and the directions of Engineer-in-charge. (Glazing, paneling and dash fasteners to be paid for separately) :For Fixed Portion: Powder coated aluminium (minimum thickness of powder coating 50 micron) including cost of materials, labour, usage charges of machinery complete as per specifications.	150.00	kgs	489.00	73350.00
63	Providing and fixing M.S. grills of required pattern in frames of win- dows etc. with M.S. flats, square or round bars etc. including priming coat with approved steel primer all complete. Fixed to openings / wooden frames with rawl plugs screws etc.	500.00	KG	183.00	91500.00
64	Supply and fixing of door	70.00	Sqm	2315.25	162067.50

	shutters made of rigid PVC extruded hollow section (Nandi or equivalent) of 20mmx200mm with the wall thickness of 1.0mm+/-0.1mm equally divided into 4nos with tongue an groove locking arrangements. The shutter frame is made of 30mm x 79mm with the wall thickness of 1.5mm+/-0.15mm section metric cut and joined at 4 corners with 125mmx225mm plastic brackets. The shutter shall be horizontally reinforced with 2nos of 8mm PVC rods. Teak wood battons shall be reinforced inside the door shutter during the fabrication of the door shutter at those points wherever the hardware is fixed on to the door shutter.				
65	Applying one coat of water thinnable cement primer of approved brand and manufacture on wall surface :Water thinnable cement primer to give an even shade after thoroughly brooming the surface to remove all dirt, dust, mortar drops and foreign matter including preparing the surface even and sand paper smooth, cost of materials, labour complete as per specifications and as per directions of Engineer-in-charge.	500.00	Sqm	53.00	26500.00
66	Finishing walls with water proofing cement paint of required shade:Old work (one coat applied @ 2.20 kg/10 m²) over priming coat of primer applied @ 0.80 litrs/10 m² complete including cost of Priming coat including preparing the surface after thoroughly cleaning the surface to remove all dirt, dust and foreign matter, cost of materials, labour complete as	300.00	Sqm	87.00	26100.00

	per specifications and as per directions of Engineer-in-charge.				
67	Distempering with 1st quality acrylic distemper, having VOC (Volatile Organic Compound) content less than 50 grams/ litre, of approved brand and manufacture, including applying additional coats wherever required, to achieve even shade and colour. One coat as per specifications and as per directions of Engineer in charge.	1000.00	Sqm	43.00	43000.00
68	Painting with synthetic enamel paint of approved brand and manufacture of required colour to give an even shade :One coats on old work as per specifications and as per directions of Engineer in charge.	200.00	Sqm	76.00	15200.00
69	Applying priming coats with primer of approved brand and manufacture, having low VOC (Volatile Organic Compound) content. With ready mixed pink or grey primer on wood work (hard and soft wood) having VOC content less than 50 grams/ litre as per specifications and as per directions of Engineer in charge.	300.00	Sqm	56.00	16800.00
70	Removing white or colour wash by scrapping and sand papering and preparing the surface smooth including necessary repairs to scratches etc. complete as per specifications and as per directions of Engineer in charge.	300.00	Sqm	13.00	3900.00
71	Painting with synthetic enamel paint of approved brand and manufacture of required colour to give an even shade :Two coats on new work over an under coat of suitable shade with ordinary paint of	350.00	Sqm	167.00	58450.00

	approved brand and manufacture after thoroughly brooming the surface to remove all dirt, dust, mortar drops and foreign matter including preparing the surface even and sand paper smooth, cost of materials, labour complete as per specifications and as per directions of Engineer-in-charge.				
72	Wall painting with plastic emulsion paint of approved brand and manufacture to give an even shade: One coats on old work as per specifications and as per directions of Engineer in charge.	600.00	Sqm	82.00	49200.00
73	Servicing the collapisible gate and folding type shutters with minor repairs and rectification works including cost of all fixtures cost & conveyance of all material, fixing charges, tools & plants and all other incidental charges etc. complete.	5.00	No.	1197.48	5987.40
74	Servicing the rolling shutters including removing and refixing the all fixtures greasing reconditioning to prOpnr functioning and rectification works including cost of all fixtures cost & conveyance of all material, fixing charges, tools & plants and all other incidental charges etc. complete	20.00	No.	1138.86	22777.20
75	Providing & fixing new laths of rolling shutters with replacing the damaged laths including painting with two coats of anticorrosive steel paint of approved colour including cost of all fixtures cost & conveyance of all material, fixing charges, tools & plants and all other incidental charges etc. complete	100.00	RM	173.02	17302.00
76	Providing & fixing new bottom plate of rolling shutters with replacing the damaged bottom plates including painting with two coats of anticorrosive steel	15.00	RM	382.04	5730.60

	paint of approved colour including cost of all fixtures cost & conveyance of all material, fixing charges, tools & plants and all other incidental charges etc. complete				
77	Providing & fixing new guide of rolling shutters with replacing the damaged guide including painting with two coats of anticorrosive steel paint of approved colour including cost of all fixtures cost & conveyance of all material, fixing charges, tools & plants and all other incidental charges etc. complete	10.00	RM	309.95	3099.50
78	Providing & fixing new spring of rolling shutters with replacing the damaged guide including painting with two coats of anticorrosive steel paint of approved colour including cost of all fixtures cost & conveyance of all material, fixing charges, tools & plants and all other incidental charges etc. complete	10.00	No.	1507.56	15075.60
79	Providing and fixing top covers made out of 20 guage M.S. sheet over pull and push rolling shutters bent to shape including cost of red lead primer coat of painting , materials, labour, HOM of machinery complete as per specifications.	10.00	M	557.98	5579.80
80	Resetting the non operative aluminium door shutter with replacing the hinge/pivot arrangements and making the shutter to easy Opnration including cost & conveyance of all material, labour charges and all other incidental charges etc. complete	25.00	No.	513.09	12827.25
81	Removal of debries from the work site for 2 KM including cost of tranportation & conveyance charges and all other incidental charges etc. complete as per specification	10.00	LOAD	549.51	5495.10
82	Supply of unskilled labour for	450.00	No.	748.65	336892.50

	mescellaneous works like, Cleaning of A.C sheet roofing, Cleaning and clearing canopy & roof slabs of multistoried buildings to avoid water leakage. And also for removing weeds and plants from multistoried buildings and other emergency unforeseen works .				
83	Supply of skilled labour for carpentry work using plywood & lamiantes, Masonry work for crack filling, bitumen sheet fixing, water proofing works etc, fabricators for fabrication works and other emergency unforeseen skilled works .	120.00	No.	991.30	118956.00
84	Providing and fixing 4mm thick glass panes to steel windows including T.W. beading of 10 mm thick and 2 coats of approved paints.	25.00	Sqm	1038.39	25959.75
85	Earth work excavation for pipelines/cables by Manual means upto 600 mm trench width, as per drawing and technical specifications, including setting out, shoring, strutting, barricading, caution lights, removal of stumps and other deleterious matter, including dressing of excavated surfaces, disposing off or leveling the excavated earth or sorting & stacking the selected earth for reuse in a radius of 50 m. Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering and lift upto 1.5 m including cost of labour, tools, usage& other appurtenances required to complete the work.	30.00	M	484.00	14520.00
86	Providing & fixing steel fan hooks, chipping the concrete	60.00	Each	528.79	31727.40

	and removing the old hook ,if already fixed, applying a coat of zinc primer on the exposed reinforcemnt bar, filling the openeig with cement concrete, after fixing the hook, including cost and conveyance of all materials, fixing charges, tools & plants and all other incidental charges etc. complete.				
87	Demolishing brick work manually/ by mechanical means including stacking of serviceable material and disposal of unserviceable material to the appropriate disposal area as per direction of Engineer-in-charge.	10.00	Cum	482.00	4820.00
88	Painting lines, dashes, arrows etc on roads in two coats on old work with ready mixed road marking paint conforming to IS: 164 on bituminous surface, including cleaning the surface of all dirt, dust and other foreign matter, demarcation at site and traffic control	200.00	m2	122.38	24476.00
89	Providing & fixing hinges 125mm (Heavy Duty) including cost and conveyanceof all material, fixing charges, tools & plants and all other incidental charges etc. complete	300.00	No.	56.42	16926.00
90	Providing & fixing 453 X 357 mm rectangular shape mirror with plastic moulded frame of approved make and shade with 6mm thick hard board backing including cost of materials, labour, complete as per specification.	30.00	unit	1315.06	39451.80
91	Supplying, fitting and placing TMT FE 550 / 550D Steel Reinforcement including cost of all materials, machinery, labour, cleaning, straightening, cutting, bending, hooking, laping/welding joints, tying with binding wire / soft	0.60	Tonne	79011.00	47406.60

	annealed steel wire and other ancilary operations complete as per drawing and technical specification				
92	Providing and removing centering, shuttering, strutting, propping etc., and removal of form work for foundation, suspended floors, landings, balconies and likes, cover slabs etc. thickness upto 200 mm including cost of all mateials, labour complete as per specifications. 0 to 5 mts	50.00	Sqm	472.31	23615.50
93	Providing & fixing comode covers of size 17" x 15" including cost and conveyance of all material, fixing charges, tools & plants and all other incidental charges etc. complete.	30.00	No.	978.64	29359.20
94	Providing & fixing Godrej/Europa or equivalent main door lock, including cost and conveyance of all material, fixing charges, tools & plants and all other incidental charges etc. complete.	10.00	No.	2143.68	21436.80
95	Demolishing cement concrete manually/ by mechanical means including disposal of material to the appropriate disposal area as per direction of Engineer-in-charge.	10.00	Cum	1663.00	16630.00
96	Providing and laying Ceramic glazed floor tiles of size 300x300 mm (thick ness to be specified by the manufacturer), of 1st quality conforming to IS : 15622, of approved make, in all colours, shades, except White, Ivory, Grey, Fume Red Brown, laid on 20 mm thick bed of cement mortar 1:4 (1 Cement : 4 Coarse sand), jointing with grey cement slurry @ 3.3 kg/ m2 including pointing the joints with white cement and matching pigments etc., complete	50.00	Sqm	889.00	44450.00
97	Providing and laying vitrified	50.00	Sqm	1145.00	57250.00

	floor tiles with thickness 9-10 mm in different sizes with water absorption less than 0.08% and conforming to IS: 15622, of approved make, in all colours and shades, laid on 20mm thick cement mortar 1:4 (1 cement : 4 coarse sand), jointing with grey cement slurry @ 3.3 kg/ m2 including grouting the joints with white cement and matching pigments etc., complete. Size of Tile 600x600 mm				
98	Providing and applying white cement based putty of average thickness 1 mm, of approved brand and manufacturer, over the plastered wall surface to prepare the surface even and smooth complete as per specifications and as per directions of Engineer in charge.	100.00	Sqm	100.00	10000.00
99	Providing and applying water proofing to concrete surfaces using high quality ploymer-modified bituminous compound reinforced with non wovn ployster fabric, weighing with 1.5mm thick. It shall be provided after priming the surface usig shali Bond bituminous adhesive at 0.5 ltr/m2.(The rate exculde cost of all labours charges,cleaning, application.)	300.00	Sqm	301.43	90429.00
100	Providing and applying damp proof/ water proofing to roof slab, terraces, landsccape are, podium etc.Applying damp proof fiber reinforced elastomeric liquid water proofing membrane on the surface. The surface shall be cleaned free from dust and other particle before usage.the application shall be done either by roller application / brush application/spray. This will be applied in three coats with a	400.00	Sqm	24.22	9688.00

	duration of 4 to 6 hours on horizontal surface.(The rate exculde cost of all labours charges, cleaning, application.)				
101	Rectification of existing old aluminium sliding windows /aluminium partition by replacing the U rubber glass beaing, replacement of necessary nylon wheels, aluminium sections, handles,clips and locking arrangement etc. complete including cost of all materials, labours, tools & plants and other incidental charges etc. complete	20.00	Sqm	1962.57	39251.40
102	Supplying and fixing GI sheet to the wooden door shutters which are exposed to water of 0.5mm thick including cost of all materials, Transportation, cutting an fixing charges, labours,tools & plants and other incidental chrges etc. complete.	20.00	Sqm	344.98	6899.60
103	Epoxy bonding of new concrete to old concrete including cost of all materials, labours,HOM complete as per specifications.	50.00	Sqm	1690.50	84525.00
104	Cutting out cracks of roof terrace to V - section cleaning out and filling solidly with a hot mixure of bitumen and clean dry sand 1:1 by weight including cost of materials, labour, complete as per specifications.	50.00	M	31.00	1550.00
105	Providing and fixing 19mm thick plywood sheet(commercial)including cost of all materials adhesive, fixing charges etc.complete	40.00	Sqm	1288.43	51537.20
106	Providing and fixing 12mm thick plywood sheet (commercial) including cost of all materials adhesive, fixing charges etc.complete	40.00	Sqm	920.31	36812.40
107	Providing 1mm thick laminate sheet including conveying th materials to work spot,	40.00	Sqm	752.46	30098.40

	including cost of all materials adhesive, fixing charges etc.complete				
108	Providing and fixing 12 mm thick prelaminated particle board flat pressed three layer or graded wood particle board conforming to IS: 12823 Grade l Type ll, in panelling fixed in aluminum doors, windows shutters and partition frames with C.P. brass / stainless steel screws etc. complete as per architectural drawings and directions of engineer-in-charge: Pre laminateparticle board with decorative lamination on one side and balancing lamination on other side including cost of materials, labour, usage charges of machinery complete as per specifications.	20.00	Sqm	897.00	17940.00
109	Providing and fixing glazing in aluminium door, window, ventilator shutters and partitions etc. with EPDM rubber / neoprene gasket etc. complete as per the architectural drawings and the directions of engineer-in-charge . (Cost of aluminium snap beading shall be paid in basic item):With float glass panes of 5 mm thickness (weight not less than 12.50 kg/m²) including cost of materials, labour, usage charges of machinery complete as per specifications.	30.00	Sqm	1171.00	35130.00
110	Providing and fixing Steel work in built up tubular (round, square or rectangular hollow tubes etc.) trusses etc., including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer, including welding and bolted with special shaped washers etc. complete. Hot finished welded type tubes including cost of materials,	500.00	kgs	136.00	68000.00

	labour, usage charges of machinery complete as per specifications and as per directions of the Engineer-in-Charge.				
111	PROVIDING TRAPEZOIDAL PROFILED SHEET Providing and installing of pre painted Galvolume iron Trapezoidal profiled sheet of approved make 1060 mm width (1000 mm cover width), 28-30 mm crest height with crest distance of 200 mm c/c with 2 ribs at the centre for stiffening. The total coated thickness (TCT) of the sheet will be 0.47 mm +/- 0.02 mm tolerance Zinc-Alu Alloy coating AZ150 gsm as per ASTM 1397/A755-550 mpa steel grade, 5-7 microns epoxy primer on both side of the sheet and polyester top coat 20-22 microns using self drilling/self tapping screws of 25 mm length, to be fixed over the existing purlins, rafters, channels and trusses.	100.00	Sqm	758.52	75852.00
112	Providing and laying heavy duty cobble stones 60mm thick interlock pavers, using cement and course sand for manufacture of blocks of approved size, shape and colour with a minimum compressive strength of 281 kg per m2 over 50mm thick, 6mm down size metal chips (average thickness) and compacting with plate vibrator having 3 tons compaction force thereby forcing part of sand underneath to come up in between joints, final compaction of paver surface joints into its final level , including cost of materials, labour and Usage charges of machinery complete as per specifications.	150.00	Sqm	1064.70	159705.00
113	Providing and fixing pre-cast	50.00	No.	1708.39	85419.50

	M20 Grade RCC poles of height 2.1m and size 0.15m x 0.15m, with 3 no of through holes equidistant at 0.4m distance so as to tie the chain link fencing on to the poles, with 4 nos of 12mm dia Main Bars & 10 nos of 8mm dia stirrups, including cost of labour, transport, T&P, etc all complete				
114	Providing and fixing chain link fencing of mechanically woven double twisted hexagonal type zink + pvc coated Maccaferri or equivalent Netting rolls of mesh wire dia: 2.7/3.7mm, mesh type 10x12, with 5 rows of Maccaferri or equivalent Lacing wires, fixing firmly to the existing RCC fencing pole with 8mm dia & 250mm long GI bolts and GI flats 12mm x 4mm x 100mm including cost & conveyance of all materials, labour, tools & plants and all other incidental charges etc, complete.	200.00	Sqm	512.95	102590.00
115	Providing & fixing 10 mm thick plaster of Paris (gypsum anhydrous) ceiling up to a height of 5 m above floor level, over first class kail wood strips 25x6 mm with 10 mm gap in between and reinforced with rabbit wire mesh fixed to wooden frame. Flat surfaces	100.00	Sqm	1274.00	127400.00
116	Providing and fixing new 9mm PVC laminated false ceiling suspended with the frame work and accessories completed from the roof slab, beams etc. by means of aluminum angles, J bolts, Tee runners and edge trim etc. , cuting the openings for fixing light fittings, including cost of materails, labours, lead and lift finishing etc. complete as per specification.	100.00	Sqm	1430.89	143089.00
117	Providing stitching & fixing curtains of selected fabric with	50.00	Sqm	686.07	34303.50

	ring, belt, frills, welcrow etc. to the doors, windows and parition walls as directed by the Engineer –in-charge.				
118	Providing powder coated aluminium curtain rods and brass brackets of selected colours and design to the doors, windows and partion walls for fixing the curtains as directed by the Engineer –in-charge.	50.00	RM	73.71	3685.30
119	Providing and constructing load bearing wall with Solid Concrete blocks of size 400x100x200mm having block density more than 1800kg/m3 and minimum compressive strength of 4.00 N/mm2 conforming to IS 2185 (Part - I) - 2005 and constructed with CM 1:4 as per IS 2572:2005 including cost of all materials, labour, scaffolding and curing, usage charges of machinery etc complete as per specifications.	50.00	Sqm	1104.00	55200.00
120	Providing & fixing window blinds with approved quality fabric for the zebra blinds, selected colour, pattern and design including all the necesaary fittings as directed by the Engineer –in-charge.	30.00	Sqm	2313.27	69398.10
121	Providing and fixing UPVC Gutter pipe of 200mm width fitted with UPVC support saddles fitted to the edge Galvalume roofing sheet with proper slope towards the downtake pipe to facilitate easy flow of rain water including cost of all materials, labour, transportation, T&P, etc. all complete.	50.00	M	848.93	42446.50
122	Providing and fixing on wall face unplasticised Rigid PVC rain water pipes conforming to IS : 13592 Type A, including jointing with seal ring conforming to IS : 5382, leaving 10 mm gap for thermal expansion, (i) Single socketed	50.00	M	197.00	9850.00

	pipes 75 mm diameter				
123	Removing and taking away the damaged old nets and Providing and fixing new mosquito nets to all the windows with wel crow fixed to the cotton strip inturn fix to the window frames including cost of labour, transport, T& P etc., all complete	60.00	Sqm	694.88	41692.80
124	Removing & Resetting existing Heavy Duty Cobble/Interlocking stones/Pavers of thickness 60/75/80/100mm using Cement and 40mm thick sand bed (average thickness) and compactingwith plate vibrator to achieve final desired compaction & setting of paver to its final level , including cost of materials, labour and usage charges of machinery complete as per specifications. (The cost of new paver/stones required shall be added separately)	100.00	Sqm	484.00	48400.00
125	French spirit polishing :One coats on old work to give an even surface including preparing the surface after thorougly cleaning oil, grease, dirt and foreign matter, sand papering smooth , cost of materials, labour complete as per specifications and as per directions of Engineer-in-charge	30.00	Sqm	149.00	4470.00
126	Providing and fixing to the required line and slope roofing with semi-corrugated fibre roofing sheets white colour day light sheet, fixed with self tapping screws with washers, over the existing purlins, rafters and trusses including cost of materials, labour, complete as per specification.	50.00	Sqm	544.95	27247.50
127	Providing & fixing Sink Waste Coupling/PVC Coupling with Bucket including cost and conveyance of all material, fixing charges, tools & plants	30.00	No.	290.00	8700.00

	and all other incidental charges etc. complete.				
128	Providing and laying linoleum plain flooring or coloured 3.2mm thick sheet / tiles laid with an approved adhesive on sub floor stretching, cutting and fixing complete , including cost of materials, labour, complete as per specifications.	50.00	Sqm	904.00	45200.00
Credit for taking away dismantled Material					
129	Credit for taking away Dismantled Door frame	-30.00	Sqm	148.76	-4462.80
130	Credit for taking away Dismantled Window frame	-30.00	Sqm	184.65	-5539.50
131	Credit for taking away Dismantled Door shutter	-50.00	Sqm	336.71	-16835.50
132	Credit for taking away Dismantled window shutter	-50.00	Sqm	269.88	-13494.00
133	Credit for taking away Dismantled Rolling Shutter laths	-20.00	RM	18.72	-374.40
134	Credit for taking away Dismantled Rolling Shutter side guide	-10.00	RM	33.55	-335.50
135	Credit for taking away Dismantled Rolling Shutter spring	-10.00	No.	143.59	-1435.90
136	Credit for taking away Dismantled Rolling Shutter top cover	-25.00	Sqm	60.45	-1511.25
137	Credit for taking away Dismantled Rolling Shutter bottom plate	-10.00	RM	41.36	-413.60
Total Rs.					**78,25,431.95**
Excess / Less (In percentage in two decimals)					
Quoted amount in Figures Rs.					

(Quoted amount - Rupees .....

Note:
1) GST as applicable will be paid separately in the Tax invoice.
2) Contractor shall file the applicable returns with Tax department in time and submit the same as documentary evidence.

SIGNATURE OF THE BIDDER

(iii) FORM OF TENDER

NAME OF CONTRACT.....

To
The Chairman
New Mangalore Port Authority
Panambur
Mangalore - 575 010

Gentlemen,

1. We have examined the Conditions of Contract, Specification, Drawings, Bill of Quantities, and Addenda Nos---------- for the execution of the above-named Works, and we the undersigned, offer to execute and complete such Works and remedy any defects therein in conformity with the Conditions of Contract, Specifications, Drawings and Bill of Quantities and Addenda
2. We acknowledge that the Appendix forms part of our Tender.
3. We undertake, if our Tender is accepted, to commence the Works as soon as is reasonably possible after the receipt of the Engineer's notice to commence, and to complete the whole of the Works comprised in the Contract within the time stated in the Appendix to Tender.
4. We agree to abide by this Tender for the period of 120 days from the last date fixed for receiving the same and it shall remain binding upon us and may be accepted at any time before the expiration of that period.
5. Unless and until a formal Agreement is prepared and executed, this Tender together with your written acceptance thereof shall constitute a binding Contract between us.

6. We understand that you are not bound to accept the lowest or any tender you may receive.

Dated this_____ day of _____ 201____

Signature _____ in the Capacity of _____ duly

authorised to sign Tenders for and on behalf of ____ _____ ___ __ _____ _____ _____ _____

(IN BLOCK LETTERS)

Address:_____
_____
_____
_____

Witnesses

1. Signature : _____
Name : _____
Address : _____
_____
_____
_____

2. Signature : _____
Name : _____
Address : _____
_____
_____
_____

SECTION VII

SCHEDULE – A

ROYALTY

SCHEDULE II

(See sub rule (1) of Rule 36)

SI. No.	Name of the Mineral	Present Rate of Royalty	Royalty to be revised	
			Export	Domestic
1	Ornamental and Decorative Building Stones as defined under clause(m) of Rule 2 A)Dyke Rock (i)Black granites: (a)Chamarajanagar District:	15% of Sale Value or of Average Selling Price on advalorembasisor Rs.4,500 per m3 which is higher.	Rs.1,200 per MT	Rs.600 per MT
	(b)All other Districts other than(a)above	15% of Sale Value or of Average Selling Price on advalorem basis orRs.1,500 per m3 which is higher.	Rs.1700 per MT	Rs.400 per MT
	(ii)Other varieties of dyke other than black granites(Entire State)	15% of Sale Value or of Average Selling Price on advulorembasis or Rs.1,500per m3 which is higher.	Rs.500 per MT	Rs.375 per MT
	(B)(l)Pink and Red Granites (Ilkal Pink Variety) (i) Hungunda and BadamiTaluk of Bagalkot District, Kustagi of Koppal District.	15%of Sale Value or of Average Selling Price on advalorembasis or Rs.1,200	Rs.1,000 per MT	Rs.400perMT
	(ii) Pink and Red Granites, Gneissess and their structural verities (other than Ilkal Pink Variety)	15% of Sale Value or Average Selling Price on advalorem basis or Rs.1,800 Variety) per m3	Rs.600 per MT	Rs.350 per MT

		which is higher		
	C)Grey and White Granites and their varieties: (i) Very fine grained Grey granite (SiragreyVariety) Price on Chintanmi, SiddlaghattaofChikkaballapuraDistrictHoskote of Bangalore District.	15% of SaleValue or of Average Selling Price on advalorembasisor Rs.1,350 per m3 which is higher.	Rs.500 per MT	Rs.350 per MT
	(ii) Greyandwhitegranites and textural varieties having shades of grey, balckand white colours (other than (i) above Entire State.	15% of SaleValue or of Average Selling Price on advalorembasisor Rs.1,050 per m3 which is higher.	Rs.375 per MT	Rs.250 per MT
	(iii) Grey granite of DevanahalliTaluk of Bangalore Rural District and Chikkaballapurtaluk of Chikkaballapur District	15% of SaleValue or of Average Selling Price on advalorembasisor Rs.600 per m3 which is higher.	Rs.300 per MT	Rs.200 per MT
2	Felsite and its varieties suitable for use as Ornamental Stone-Entire State	15% of SaleValue or of Average Selling Price on advalorembasisor Rs.1800 per m3 which is higher.	Rs.900 per MT	
3	Quartzite and sand stone and their varieties suitable for use as Ornamental Stone-Entire State	15% of Sale Value or of Average Selling Price on advalorembasisor Rs.1800 per m3 which is higher.	Rs.900 per MT	
4	Marable and Crystalline Limestone as ornamental Stone-Entire State	15% of Sale Value or of Average Selling Price on advalorembasisor Rs.1800 per m3 which is higher.	Rs.1000 per MT	
5	Bentonite-Entire State	Rs.400 per MT	Rs.500 per MT	

6	Fuller Earth-Entire State	Rs.125 per MT	Rs.125 per MT
7	Buff colour (waste) the permits notexceed20% of permit issued For Fullers Earth	Rs.60 per MT	Rs.70 per MT
8	Limestone under the title "Shahabad Stone"	Rs.70 per 10 Sqmeters or Rs.70 per MT	Rs.50 per 10 Sqmeters or Rs.50 per MT
9	Limestone(non-cement) when used for building stone-Entire State	Rs.25 per MT	Rs.60 per MT
10	Ordinary Building Stone(Entire State as defined under clause(g) of Rule2(1)	Rs.60 per MT	Rs.70 per MT
11	Limeshell-Entire State	100 per MT	120 per MT
12	Lime Kankar(non cement) Entire State	50 per MT	80 per MT
13	Agate, Chalcedony, Flint-Entire State	240 per MT	300 per MT
14	Ordinary Sand-Entire State	60 Per MT	80 Per MT
15	Steatite and sand stone used formakinghousehold utensils / articles-Entire State.	40 Per MT	80 Per MT
16	(i)Murram (All types of soils)-Entire State	20 per MT	40 per MT
	(ii)Clay used for manufacturing tile sand bricks	40 per MT	60 per MT
17	Waste rocks generated in ornamental stone quarry-which is suitable for ornamental purpose Entire State (See explanation under Rule36)	300 per MT or 850 CUM	300perMT
18	Irregular shaped waste rock generated in Ornamental stone quarry,	60 per MT	40 per MT

	which is not suitable for ornamental purpose (used for making aggregates and m-sand) Entire State.		
19	Waste rocks generated in Shahabad stone quarry-Entire State (See explanation under Rule-36)	60 per MT	40 per MT
20	Finished Kerb stones/cubes not exceeding 30 cms each face-Entire State.	110per MT	150 per MT
21	Barytes (i) A Grade (Grey colour (ii) B Grade (Greycolour) (iii) C, D Grade &Waste	6.5% of average selling price or of sale value whichever is higher on ad-valorem basis	400 per MT 300 per MT 200 per MT
22	Calcite	15% of average selling price or of sale value whichever is higher on ad-valorem basis	80 per MT
23	China clay and Kaolin (including Ball clay, White shell, Fireclay and white clay) i)Crude/Raw ii)Processed	8% of average selling price or of sale value whichever is higheronad-valorem basis. 12% of average selling price or of sale value whichever is higher on ad-valorem basis	80 Per MT 600 per MT
24	Corundum	12% of average sellingpriceor of sale value whichever is higher on ad-valorem basis	15% of Sale Value or of Average Selling Price on ad valorem basis which is higher.
25	Dolomite	Rs.75 per MT	100 per MT

26	Dunite and Pyroxenite	Rs. 30 per MT	60 per MT
27	Felsite (Other than for ornamental purpose)	12% of average selling price or of sale value whichever is higher on ad-valorem basis	120 per MT
28	Gypsum	20% of average selling price or of sale value whichever is higher on ad-valorem basis	150 per MT
29	Jasper	12% of average selling price or of sale value whichever is higher on ad-valorem basis	150 per MT
30	Quartz, feldspar	15% of average selling price or of sale value whichever is higher on ad-valorem basis	100 per MT
31	Mica i. Crude ii. Waste	4% of average selling price or of sale value whichever is higher on ad-valorem basis	1500 per MT 500 per MT
32	Quartzite & Fuchsite Quartzite not suitable for use as Ornamental /Gemstones	12% of average selling price or of sale value whichever is higher on ad-valorem basis	100 per MT
33	Laterite i) /dispatched for use in cement or chemical industries or Abrasive or Refractory purpose (below threshold	Rs.60 per MT	160 per MT

	value as specified by IBM from time to time) ii) For use as building stone (below threshold value as specified by IBM)		60 per MT
34	Ochre	Rs.24 per MT	60 per MT
35	Pyrophyllite	20% of average selling price or of sale value whichever is higher on ad-valorem basis	200 per MT
36	Shale	Rs.60 per MT	150 per MT
37	Slate	Rs.45 per MT	150 per MT
38	Silica Sand	10% of average selling price or of sale value whichever is higher on ad-valorem basis	100 per MT
39	Steatite or Soapstone (Other than for house hold articles)	18%of average selling price or of sale value whichever is higher on ad-valorem basis	200perMT
	Talc	--	200perMT
40	All other minerals (which is not specified in schedule-II) Entire State	30% of sale value on ad-valorem basis	30% of Sale Value or of Average Selling Price on ad-valorem basis which is higher.

As per order of Deputy Director mines and Geological department dated 11-11-2021. The prevailing rates as per the updated order of the Geological Department during the course of the project will be applicable.

Note: Except where otherwise stated, the contractor shall pay to the authority all tonnage and other royalties, rent and other payments or compensation if any, for getting stone, sand, gravel, clay or other materials by him and his subordinates and his subcontractors and required for the works, at the rates and such conditions as notified by the State Government. The contractor should submit the Mineral Dispatch Permit (MDP) in original for the quantity executed by the contractor for the requisite

quantity of material incorporated in works for which MDP is issued by the authorized supplier. If contractor fails to submit the MDP in original the amount will be deducted at 5 times the royalty charges from the contractor's bills as per prevailing orders issued by the Authority.

SECTION VII

SCHEDULE – B

MINIMUM RATES OF WAGES

ABSTRACT OF MINIMUM RATES OF WAGES FROM RELEVANT NOTIFICATIONS

MINIMUM RATES OF WAGES APPLICABLE IN THE BEAT OF ALC(C), MANGALORE WITH EFFECT FROM ***01.10.2024***

Minimum Wages applicable "Construction or maintenance of roads, runways or in building operations including laying down underground electric, wireless, radio, television, telephone and overseas communication cables and similar other underground cabling work, electric lines, water supply lines and sewerage pipelines"-

Category			
	Area: A	Area: B	Area: C
Unskilled	783.00	655.00	526.00
Semiskilled/ Unskilled Supervisory	868.00	739.00	614.00
Skilled/Clerical	954.00	868.00	739.00
Highly Skilled	1035.00	954.00	868.00

(Kindly Note: Area A: Bangalore (UA), Area B: Mangalore (UA), Mysore (UA), Belgaum (UA), Hubli-Dharwad, Area C: All other places in Karnataka not specified above as per Ministry of Labour and Employment F.No. 1 /27(3)/2023-LS-II dated 25.09.2024.)

"Employment of Sweeping and Cleaning excluding activities prohibited under the Employment of Manual Scavengers and Construction of Dry latrines (Prohibition) Act, 1933".

Area	**Rates of wages Rs.**
'A'	783.00
'B'	655.00
'C'	526.00

"Employment of Watch and Ward"-Rates of wages for employees employed in watch and ward – Govt. of India, Ministry of Labour

	Without arms	**With arms**
Area	**Rates of wages Rs.**	**Rates of wages Rs.**
'A'	954.00	1035.00
'B'	868.00	954.00
'C'	739.00	868.00

For further details log on to Ministry of Employment