NEW MANGALORE PORT AUTHORITY

CIVIL ENGINEERING DEPARTMENT

Ref. No. 3/6/2022-23/EE(MW)/PQC TP **Date: 23.09.2022**

CORRIGENDUM - EXTENSION OF BID DUE DATE

TO THE POTENTIAL BIDDERS

Sub: Providing Pavement Quality Concrete to the existing truck parking terminal near K. K. gate adjacent to toilet block and construction of canteen, dormitory, shops, clinic building and toilet block in truck parking terminal.– Extension of bid submission due date - Reg.

Ref: NIT No. CIVIL/CE(C)/EE(C)/44/2022-23 & e-Procure Tender. Id. 2022_NMPT_708838_1, dtd. 05.09.2022.

*****

With reference to the above, it is to inform that the last date for submission of bids for the subject tender is postponed from 26.09.2022 to 06.10.2022 upto 15:00 hrs. and the date of opening of the bids shall be on 07.10.2022 after 15:30 hrs.

23/09/2022

Executive Engineer (Civil)

TENDER DOCUMENT

NEW MANGALORE PORT AUTHORITY

CIVIL ENGINEERING DEPARTMENT

NIT No. CIVIL/CE(C)/EE(C)/44/2022-23

E-Tender Event No 2022_NMPT_708838_1

Tender for

"PROVIDING PAVEMENT QUALITY CONCRETE TO THE EXISTING TRUCK PARKING TERMINAL NEAR K. K. GATE ADJACENT TO TOILET BLOCK AND CONSTRUCTION OF CANTEEN, DORMITORY, SHOPS, CLINIC BUILDING AND TOILET BLOCK IN TRUCK PARKING TERMINAL."

THROUGH E-TENDERING MODE

Tender Amount	:	Rs. 7,05,96,050/-
E.M.D.	:	Rs. 16,66,100/-
Tender Fee	:	Rs. 1,680/-(Including GST @ 12%)

TENDER DOCUMENT

NEW MANGALORE PORT AUTHORITY

CIVIL ENGINEERING DEPARTMENT

Tender for

"PROVIDING PAVEMENT QUALITY CONCRETE TO THE EXISTING TRUCK PARKING TERMINAL NEAR K. K. GATE ADJACENT TO TOILET BLOCK AND CONSTRUCTION OF CANTEEN, DORMITORY, SHOPS, CLINIC BUILDING AND TOILET BLOCK IN TRUCK PARKING TERMINAL."

Volume - 1

Table of Contents

NEW MANGALORE PORT AUTHORITY

PANAMBUR, MANGALORE -575010

NIT No: CIVIL/CE(C)/EE(C)/44/2022-23Date: 05-09-2022

TENDER ID: 2022_NMPT_708838_1

i) NOTICE INVITING TENDER

(Through E-Procurement only)

E-Tenders are invited by New Mangalore Port AUTHORITY,Panambur, Mangalore-575010through 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 "Providing Pavement Quality Concrete to the existing truck parking terminal near K. K. gate adjacent to toilet block and construction of canteen, dormitory, shops, clinic building and toilet block in truck parking terminal."

Minimum Eligibility Criteria:

a) The tenderers must have experience of having successfully 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. 282.40lakhs each

or

At least Two similar completed works costing not less than the amount equal to Rs. 353.00lakhs each

or

At least One similar completed works costing not less than the amount equal to Rs. 564.80lakhs

Note1:***Similar work(s) means**

1. **Providing Cement Concrete pavement for roads / yards with allied works**

   or

2. **Construction of Commercial Buildings / Residential buildings / Godowns / complex building with allied works.**

Note2: Documentary evidence for successful completion of the work shall be furnished along with work order and work completion certificate

b) Average Financial turnover of the tenderer over the last three financial years 2018-19, 2019-20 and 2020-21shall be at least Rs.211.80lakhs.

The financial capacity of bidders would be evaluated considering the works

in hand at NMPA. The port would award the work not exceeding the remaining financial capacity of the bidder. 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.
Pertinent information is given in the following table:

i)	Estimated Amount put to Tender	Rs7,05,96,050/-
ii)	Earnest Money Deposit (EMD)	Rs. 16,66,100/- (Rupees Sixteen Lakh SixtySix Thousand One Hundred Only.) The EMD shall be in the form of Insurance Surety Bonds, Account Payee Demand draft, Fixed Deposit Receipt, Bankers Cheque, Bank Guarantee as per Annexure 9 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 Microand 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. 1680/- (Rupees One Thousand Six Hundred Eighty 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 Udyam Registration Certificate or any other body specified by Ministry of MSME, will be considered.
iv)	Document download start date and time	05-09-2022 at 15.00 HRS
v)	Seek clarification start date and time	12-09-2022at 10.00 HRS
vi)	Seek clarification end date and time	13-09-2022at 15.00 HRS
vii)	Bid submission start date and time	19-09-2022 at 10.00 HRS
vii)	Bid submission closing date and time	26-09-2022 at 15.00 HRS
ix)	Date & time of opening of Cover -I : Technical Part - II : Financial	 27-09-2022at 15.30 HRS Shall be communicated separately.
x)	Completion period	12 (Twelve) Months excluding monsoon
xi)	Validity of Tender	120 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. 1680/-(Rupees One Thousand Six Hundred Eighty 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 and 0824-2407149

Email id:yogindra.s@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)/44/2022-23

E-Tender event No. NMPT/2022_NMPT_708838_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 for having registered with similar category should be submitted along with Technical Bid.
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 bidder/tenderer/contractor shall file the applicable returns with Tax departments in time and submit the same as documentary proof.
23. The bidder/tenderer/contractor shall file the applicable returns with Tax departments in time and submit the same as documentary proof.
24. 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 (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).
4. The tenderer shall attach Scanned copy of Pre-contract, Integrity Pact agreement executed as per Appendix II The Original copy to be submitted by post or by hand so as to reach the Executive Engineer (Civil) immediately after closing date for submission of online tender
5. Scanned copy of valid Pan card,PF,ESI and GST Registration certificate.
6. List of Ongoing works in hand at NMPA should be indicated in the prescribed form
7. Scanned copy of Form of Tender as per Section VI(iii) of volume -III
8. Technical bid document – Cover I (Volume I to Volume III) along with amendments and clarifications.

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 in respective column in the Bill of Quantities through CPP e-portalBidders 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 Digitally 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 "Providing Pavement Quality Concrete to the existing truck parking terminal near K. K. gate adjacent to toilet block and construction of canteen, dormitory, shops, clinic building and toilet block in truck parking terminal."

2. Applicants:

Contractors who wish to bid for the tender for the contract work should apply for 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 12)
	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 at least three days before start date of submission of bid. It is to be noted that queries asked after closing date of pre bid meeting 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 after closing date of online pre-bid meeting without identifying the source.

A provision is made in the CPP e-portal for online pre-bid meeting during the date mentioned in the NIT. The bidders can ask queries if any during the period of pre-bid meeting 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 after closing date of online pre-bid meeting.

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 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. 282.40 lakhs each

or

At least Two similar completed works costing not less than the amount

equal to Rs. 353.00 lakhs each

or

At least One similar completed works costing not less than the amount equal to Rs. 564.80 lakhs

Note1:*Similar work(s) means

1. **Providing Cement Concrete pavement for roads / yards with allied works**

   Or

2. **Construction of Commercial Buildings / Residential buildings / Godowns / Complex buildings with allied works".**

Note2: Documentary evidence for successful completion of the work shall be furnished along with work order and work completion certificate

b) Average Financial turnover of the tenderer over the last three financial years 2018-19, 2019-20and 2020-21shall be at least Rs.211.80lakhs.

c) The financial capacity of bidders would be evaluated considering the works in hand at NMPA. The port would award the work not exceeding the remaining financial capacity of the bidder. The financial capacity to be 3.33times 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.

Illustration:- Average turnover for 3 years is the Financial capacity or construction will be3.00cr(3x3.33) i.e10.0crores.

The turnover means sales/ contractreceipts 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 year 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 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 and attachments submitted in proof of the qualification requirements; and/or

ii) record of poor performance such as abandoning the works, not properly completing the contract, inordinate delays in completion, litigation history, or financial failures etc.,

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 in the rate in respective column 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 one hundred twenty days (120 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 Chequeor Bank Guarantee as per Annexure 9 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 Bank Guarantee or RTGS/NEFT deposit details towards Earnest Money Deposit of Rs. 1666100/- (Rupees Sixteen Lakh SixtySix Thousand One Hundred Only) as stipulated in the tender. The tender without EMD shall be treated invalid. The benefit of Exemption of EMD to all Microandsmall 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.

ii. In the event of Bidder withdrawing his Bid before the expiry of tender validity period of 120 days from the last date for online bid submission, the tender shall be cancelled and EMD shall be forfeited.

iii. 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.

iv. 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 and Submission of statutory documents. 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. 1666100/- (Rupees Sixteen Lakh SixtySix Thousand One Hundred Only) by RTGS/NEFT to NMPA Bank Account, failing which the Techno commercial Bid shall not be considered).
   iii) Transaction details of payment towards the COST OF TENDER Fee: Rs. 1680/-(Rupees One Thousand Six Hundred Eighty 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 in the rate in respective column 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,.(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 aftertheclosing date for submission of online e-tender).
   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 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.

i) NEFT Payment details towards cost of tender.

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

k) The tenderer shall attach Scanned copy of Pre-contract, Integrity Pact agreement executed as per Appendix II. The Original copy to be submitted by post or by hand so as to reach the Executive Engineer (Civil) immediately after closing date for submission of online tender.

l) 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 Microand 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, within the time specified by the Employer, the clarification sought for by the Employer for proper evaluation of the Bid

26. Examination of Bids and Determination of Responsiveness:

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

a) meets the eligibility criteria as defined in Clause 12.
b) 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;
c) is accompanied by the requisite Bid security and;
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 28 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 20 copies of the Agreement and submit to the employer within 7 days following the date of signing of 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) for an amount equivalent to 3% of the 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 NMPTandcashable 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 "Providing Pavement Quality Concrete to the existing truck parking terminal near K. K. gate adjacent to toilet block and construction of canteen, dormitory, shops, clinic building and toilet block in truck parking terminal."

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 plant and equipment – (Annexure - 7)
vii. Declaration – (Annexure – 8)
viii. Bid Security / EMD Paid by RTGS/NEFT vide UTR No.....dtd. ..... of (name and address of the branch).
ix. Banker's Details – Annexure 10 & 11
x. Tender fee paid by NEFT vide vide UTR No.....dtd. ..... of (name and address of the branch).
xi. Pre-Integrity pact agreement executed as per Appendix II
xii. Copy of valid ESI, PF &GST Registration certificate.

Signature
(Authorised Signatory)

Annexure – 2

ON STAMP PAPER of Rs 100/-

"PROVIDING PAVEMENT QUALITY CONCRETE TO THE EXISTING TRUCK PARKING TERMINAL NEAR K. K. GATE ADJACENT TO TOILET BLOCK AND CONSTRUCTION OF CANTEEN, DORMITORY, SHOPS, CLINIC BUILDING AND TOILET BLOCK IN TRUCK PARKING TERMINAL."

--

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

"PROVIDING PAVEMENT QUALITY CONCRETE TO THE EXISTING TRUCK PARKING TERMINAL NEAR K. K. GATE ADJACENT TO TOILET BLOCK AND CONSTRUCTION OF CANTEEN, DORMITORY, SHOPS, CLINIC BUILDING AND TOILET BLOCK IN TRUCK PARKING TERMINAL."

--

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

"PROVIDING PAVEMENT QUALITY CONCRETE TO THE EXISTING TRUCK PARKING TERMINAL NEAR K. K. GATE ADJACENT TO TOILET BLOCK AND CONSTRUCTION OF CANTEEN, DORMITORY, SHOPS, CLINIC BUILDING AND TOILET BLOCK IN TRUCK PARKING TERMINAL."

Tenderer 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:

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

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.

Signature

(Authorised Signatory)

Annexure – 5

NEW MANGALORE PORT AUTHORITY
"PROVIDING PAVEMENT QUALITY CONCRETE TO THE EXISTING TRUCK PARKING TERMINAL NEAR K. K. GATE ADJACENT TO TOILET BLOCK AND CONSTRUCTION OF CANTEEN, DORMITORY, SHOPS, CLINIC BUILDING AND TOILET BLOCK IN TRUCK PARKING TERMINAL."
FINANCIAL CAPABLITY

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

Net Worth	Turnover			
Year 1	Year 1	Year 2	Year 3	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 2020-21. 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)

Annexure – 6

NEW MANGALORE PORT AUTHORITY

""PROVIDING PAVEMENT QUALITY CONCRETE TO THE EXISTING TRUCK PARKING TERMINAL NEAR K. K. GATE ADJACENT TO TOILET BLOCK AND CONSTRUCTION OF CANTEEN, DORMITORY, SHOPS, CLINIC BUILDING AND TOILET BLOCK IN TRUCK PARKING TERMINAL.

LIST OF ONGOING WORKS IN HAND AT NMPA

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

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

"PROVIDING PAVEMENT QUALITY CONCRETE TO THE EXISTING TRUCK PARKING TERMINAL NEAR K. K. GATE ADJACENT TO TOILET BLOCK AND CONSTRUCTION OF CANTEEN, DORMITORY, SHOPS, CLINIC BUILDING AND TOILET BLOCK IN TRUCK PARKING TERMINAL."

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

"PROVIDING PAVEMENT QUALITY CONCRETE TO THE EXISTING TRUCK PARKING TERMINAL NEAR K. K. GATE ADJACENT TO TOILET BLOCK AND CONSTRUCTION OF CANTEEN, DORMITORY, SHOPS, CLINIC BUILDING AND TOILET BLOCK IN TRUCK PARKING TERMINAL."

--

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

"PROVIDING PAVEMENT QUALITY CONCRETE TO THE EXISTING TRUCK PARKING TERMINAL NEAR K. K. GATE ADJACENT TO TOILET BLOCK AND CONSTRUCTION OF CANTEEN, DORMITORY, SHOPS, CLINIC BUILDING AND TOILET BLOCK IN TRUCK PARKING TERMINAL."

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. If 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 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)

WHEREAS, _____ [Name of Bidder] (hereinafter called “the Bidder”) has submitted his bid dated_____ [date] for the Providing Pavement Quality Concrete to the existing truck parking terminal near K. K. gate adjacent to toilet block and construction of canteen, dormitory, shops, clinic building and toilet block in truck parking terminal.(hereinafter called “the Bid”).

KNOW ALL PEOPLE by these presents that We _____ [name of bank] of _____ (name of country) having our registered office at _____ (hereinafter called “the Bank”) are bound unto _____ [name of Employer] (hereinafter called “the Employer”) in the sum of _____ 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 _____ 20 _____

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 ..... (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 ..... 20 .....

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. Date should be inserted by the Employer before the Bidding documents are issued.

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 :

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 20 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).

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	x	Qcc	x	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 including GST. Retention money shall be refunded after completion of defect liability periodalong 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 8% of the Contract amount including GST of which 3% 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 security shall be released after completion of defect liability period.

53. Removal of Craft or Plant which has sunk

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. If 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.

The bidder shall execute Integrity Pact Agreement with NMPA as per the Integrity Pact Agreement Appendix II. The following Independent External Monitor (IEM) is nominated.

Shri Prem Chand Pankaj, Ex CMD, NEEPCO,
M 402, Pioneer Park, Sector 61, Golf Course,
Extn., Road, Gurgaon
Mob No. 9717433886
E-mail ID : prempankaj@gmail.com

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.

75. 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.

76. 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 theprevailingratenotified 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.

77. 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. lf 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.

78. 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.

79. 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)

80. 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.

81. 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.

82. 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.

83. 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.

84. 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.

85. Drawings & Designs

(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.

86. Monsoon Period

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

87. 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.

88. 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:

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

89. 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.

90. 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.

91. 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.

92. Submission of statutory documents

The successful bidder, with in 7days 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 (CII) Civil Engineering Department, NMPA, Panambur, Mangalore- 575010	
5	The name and identification number of the Contract is	
	Name of Contract :- “Providing Pavement Quality Concrete to the existing truck parking terminal near K. K. gate adjacent to toilet block and construction of canteen, dormitory, shops, clinic building and toilet block in truck parking terminal.” Tender no: CIVIL/DyCE(C)/EE(C)/44/2022-23	(1)
6	The works consist of Providing Pavement Quality Concrete to the existing truck parking terminal near K. K. gate adjacent to toilet block and construction of canteen, dormitory, shops, clinic building and toilet block in truck parking terminal..	(1)

<table>
<tr><td>Sl. No.</td><td>Description</td><td>Reference Cl. No.</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>7</td><td>The start date shall be
15 days from the date of Issue of Letter of Acceptance</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 excluding 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>
</table>

Sl. No.	Description	Reference Cl. No.
12	The Contractor shall submit a Program for the Works within 14 days of delivery of the letter of Acceptance.	(27)
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**.** 3/6/2022-23	
15	The Defects Liability Period is 1 (One) year.	(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).	(25)
26	Price Adjustment (deleted)	(47) (80)
27	The proportion of payments retained (retention money) shall be 10% of total tax invoice value from each running bill subject to a	(48)

Sl. No.	Description	Reference Cl. No.
	maximum of 5% of the 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.	[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 3% of 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

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.

Annexure B

BANK GUARANTEE FOR ADVANCE PAYMENT

To: _____ [name of Employer]

_____ [address of Employer]

_____ [name of Contract]

Gentlemen:

In accordance with the provisions of the Conditions of Contract, Sub-clause 51.1 ("Advance Payment") of the above mentioned Contract, _____[name and address of Contractor] (hereinafter called "the Contractor") shall deposit with_____[name of Employer] a bank guarantee to guarantee his proper and faithful performance under the said Clause of the Contract in an amount of

1

_____[amount of guarantee] _____[in words].

We, the_____ [bank or financial institution], as instructed by the Contractor, agree unconditionally and irrevocably to guarantee as primary obligator and not as Surety merely, the payment to_____[name of Employer] on his first demand without whatsoever right of objection on our part and without his first claim to the Contractor, in the amount not exceeding _____[amount of guarantee]1 _____[in words].

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

The guarantee shall remain valid and in full effect from the date of the advance payment under the Contract until_____[name of Employer] receives full repayment of the same amount from the Contractor.

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 ……..

Yours truly,

Signature and seal:_____

Name of Bank/Financial Institution:_____

Address:_____

Date:_____ 1. An amount shall be inserted by the bank or financial institution representing the amount of the Advance Payment, and denominated in Indian Rupees.

APPENDIX – I

TO GENERAL CONDITIONS OF CONTRACT

DISPUTES REVIEW BOARD AGREEMENT

THIS AGREEMENT, made and entered into this ..... Day of …….. 20..... Between ……..……..…….. ("the Employer") and..... ..... ("the Contractor"),and the Disputes Review Board ("the Board") consisting of One / three Board Members, (1) ……. (2) ……. (3) …….

[Note: Delete whatever is not applicable]

WITNESSETH, that
WHEREAS, the Employer and the Contractor have contracted for the ……. ……. ……. (Project name) ……. (the "Contract") and
WHEREAS, the contract provides for the establishment and operation of the Board
NOW THEREFORE, the parties hereto agree as follows:

The parties agree to the establishment and operation of the Board in accordance with this Board Agreement.

Except for providing the services required hereunder, the Board Members should not give any advice to either party or to the Engineer or his nominee concerning conduct of the Works.

The Board Members:
(a) shall have no financial interest in any party to the contract or the Engineer or his nominee, or a financial interest in the contract, except for payment for services on the Board.

(b) shall have had no previous employment by, or financial ties to, any party to the contract, or the Engineer or his nominee, except for fee based consulting

services on other projects, all of which must be disclosed prior to appointment to the Board.

(c) shall have disclosed in writing to the parties prior to signature of this Agreement any and all recent or close professional or personal or personal relationships with any director, officer, or employee of any party to the contract, or the Engineer or his nominee, and any and all prior involvement in the project to which the contract relates;

(d) shall not, while a Board Member, be employed whether as a consultant or otherwise by either party to the contract, or the Engineer or his nominee, except as a Board Member.

(e) shall not, while a Board Member, engage in discussion or make any agreement with any party to the contract, or with the Engineer or his nominee, regarding employment whether as a consultant or otherwise either after the contract is completed or after services as a Board Member is completed;

(f) shall be and remain impartial and independent of the parties and shall disclose in writing to the Employer, the Contractor, the Engineer or his nominee, and one another any fact or circumstances which might be such to cause either the Employer or the Contractor to question the continued existence of the impartiality and independence required of Board Members.

Except for its participation in the Board's activities as provided in the contract and in this Agreement none of the Employer, the Contractor, the Engineer or his nominee, and one another any fact or circumstances which might be such to cause either the Employer or the Contractor to question the continued existence of the impartiality and independence required of Board Members.

The Contractor shall :

a) furnish to each Board Members one copy of all documents which the Board may request including contract documents, progress reports, variation orders, and other documents, pertinent to the performance of the Contract.

b) in co-operation with the Employer, co-ordinate the Site visits of the Board, including conference facilities, and secretarial and copying services.

The Board shall serve throughout the operation of the contract. It shall begin operation following execution of this Agreement, and shall terminate its activities after

issuance of the taking over Certificate and the Board's issuance of its Recommendations on all disputes referred to it.

Board Member shall not assign or subcontract any of their work under this Agreement.

The Board Members are independent and not employees or agents of either the Employer or the Contractor.

The Board Members are absolved of any personal or professional liability arising from the activities and the Recommendations of the Board.

Fees and expenses of the Board Member[s] shall be agreed to and shared equally by the Employer and the Contractor. If the Board requires special services, such as accounting, data research, and the like, both parties must agree and the costs shall be shared by them as mutually agreed.

Board Site visits :

a) The Board shall visit the Site and meet with representatives of the Employer and the Contractor and the Engineer or his nominee at regular intervals, at times of critical construction events, and at the written request of either party. The timing of Site failing agreement shall be fixed by the Board.

b) Site meetings shall consist of an informal discussion of the status of the construction of the works followed by an inspection of the works, both attended by personnel from the Employer, the Contractor and the Engineer or his nominee.

c) If requested by either party or the Board, the Employer will prepare minutes of the meetings and circulate them for comments of the parties and the Engineer or his nominee.

11. Procedure for disputes referred to the Board:

a) If either party objects to any action or inaction of the other party or the Engineer or his nominee, the objecting party may file a written Notice of Dispute to the other party with a copy to the Engineer or his nominee stating that it is given pursuant to Clause 65 and stating clearly and in detail the basis of the dispute.

b) The party receiving the Notice of Dispute will consider it and respond in writing within 7 days after receipt.

c) This response shall be final and conclusive on the subject, unless a written appeal to the response is filed with the responding party within 7 days of receiving the response. Both parties are encouraged to pursue the matter further to attempt to settle the dispute. When it appears that the dispute cannot be resolved without the assistance of the Board either party may refer the dispute to the Board by written Request for Recommendation to the Board, the other party and the Engineer or his nominee stating that it is made pursuant to Clause 65.

d) The Request for recommendation shall state clearly and in full detail the specific issues of the dispute to be considered by the Board.

e) When a dispute is referred to the Board, and the Board is satisfied that the dispute requires the Board's assistance, the Board shall decide when to conduct a hearing on the dispute. The Board may request that written documentation and arguments from both parties be submitted to each Board Member before the hearing begins. The parties shall submit insofar as possible agreed statements of the relevant facts.

f) During the hearing, the Contractor, the Employer, and the Engineer or his nominee shall each have ample opportunity to be heard and to offer evidence. The Board's Recommendations for resolution of the dispute will be given in writing, to the Employer, the Contractor and the Engineer or his nominee as soon as possible, and in any event not more than 28 days after the Board's final hearing on the dispute.

12. Conduct of Hearings:

a) Normally hearing will be conducted at the Site, but any location that would be more convenient and still provide all required facilities and access to necessary documentation may be utilised by the Board. Private Sessions of the Board may be held at any location convenient to the Board.

b) The Employer, the Engineer or his nominee and the Contractor shall have representatives at all hearings.

c) During the hearings, no Board Member shall express any opinion concerning the merit of any facet of the case.

After the hearings are concluded, the Board shall meet privately to formulate its Recommendations. All Board deliberations shall be conducted in private, with all individual views kept strictly confidential. The Board's Recommendations, together with an explanation of its reasoning shall be submitted in writing to both parties and to the Engineer or his nominee. The Recommendations shall be based on the pertinent contract provisions, applicable laws and regulations, and the facts and circumstances involved in the dispute.

The Board shall make every effort to reach a unanimous Recommendation. If this

proves impossible, the majority shall decide, and the dissenting member any prepare a written minority report for submission to both parties.

[Note: Delete if it is one member Board]

13. If during the contract period, the Employer and the Contractor are of the opinion that the Dispute Review Board is not performing its functions properly; the Employer and the Contractor may together disband the Disputes Review Board. In such an event, the disputes shall be referred to Arbitration straightaway.

The Employer and the Contractor shall jointly sign a notice specifying that the Board shall stand disbanded with effect from the date specified in the notice. The notice shall be posted by a registered letter with AD or delivery of the letter, even if he refuses to do so.

APPENDIX – II

TO SPECIAL CONDITIONS OF CONTRACT

PRE CONTRACT INTEGRITY PACT AGREEMENT

General

This pre-bid pre-contract Agreement (hereinafter called the Integrity Pact) is made on_____ day of the month of _____ 20__, between, on one hand, the Board of Trustees of New Mangalore Port Authority acting through _____, Chief Engineer (Civil), (Name & Designation of the Officer) New Mangalore Port Authority (hereinafter called the 'BUYER/EMPLOYER', which expression shall mean and include, unless the context otherwise requires, his successors in office and assigns) of the First Part and M/s _____ represented by Shri _____, Chief Executive Officer (hereinafter called the 'BIDDER' which expression shall mean and include, unless the context otherwise requires, his successors and permitted assigns) of the Second Part.

WHEREAS the 'BUYER/EMPLOYER' has invited bids forProviding Pavement Quality Concrete to the existing truck parking terminal near K. K. gate adjacent to toilet block and construction of canteen, dormitory, shops, clinic building and toilet block in truck parking terminal.and the BIDDER is submitting his bid for the same and

WHEREAS the BIDDER is a Private company / Public company / Government undertaking / registered partnership firm, constituted in accordance with the relevant law in the matter and the 'BUYER/EMPLOYER' is New Mangalore Port Authority.

NOW, THEREFORE,

To avoid all forms of corruption by following a system that is fair, transparent and free from any influence/prejudiced dealings prior to, during and subsequent to the currency of the contract to be entered into with a view to:-

Enabling the 'BUYER/EMPLOYER' to obtain the desired said stores/equipment/services/works at a competitive price in conformity with the defined specifications by avoiding the high cost and the distortionary impact of corruption on public procurement, and

Enabling BIDDERS to abstain from bribing or indulging in any corrupt practice in order to secure the contract by providing assurance to them that their competitors will also abstain from bribing and other corrupt practices and the 'BUYER/EMPLOYER' will commit to prevent corruption, in any form, by its officials by following transparent procedures.

The parties hereto hereby agree to enter into this Integrity Pact and agree as follows:

Commitments of the 'BUYER/ EMPLOYER'

1.1 The 'BUYER/EMPLOYER' undertakes that no official of the 'BUYER/EMPLOYER', connected directly or indirectly with the contract, will demand, take a promise for or accept, directly or through intermediaries, any bribe, consideration, gift, reward, favour or any material or immaterial benefit or any other advantage from the BIDDER, either for themselves or for any person, organisation or third party related to the contract in exchange for an advantage in the bidding process, bid evaluation, contracting or implementation process related to the contract.

1.2 The 'BUYER/EMPLOYER' will, during the pre-contract stage, treat all BIDDERS alike and will provide to all BIDDERS the same information and will not provide any such information to any particular BIDDER which could afford an advantage to that particular BIDDER in comparison to other BIDDERS.

1.3 All the officials of the 'BUYER/EMPLOYER' will report to the appropriate Government office any attempted or completed breaches of the above commitments as well as any substantial suspicion of such a breach.

2. In case any such preceding misconduct on the part of such official(s) is reported by the BIDDER to the 'BUYER/ EMPLOYER' with full and verifiable facts and the same is prima facie found to be correct by the 'BUYER/EMPLOYER' necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings may be initiated by the 'BUYER/ EMPLOYER' and such a person shall be debarred from further dealings related-to the contract process. In such a case while an enquiry is being conducted by the 'BUYER/ EMPLOYER' the proceedings under the contract would not be stalled.

Commitments of BIDDERS

3. The BIDDER commits itself to take all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of its bid or during any pre-contract or post-contract stage in order to secure the contract or in furtherance to secure it and in particular commit itself to the following.:-

3.1. The BIDDER will not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the 'BUYER/EMPLOYER' connected directly or indirectly with the bidding process, or to any person, organisation or third party related to the contract in exchange for any advantage in the bidding, evaluation, contracting and implementation of the contract.

3.2. The BIDDER further undertakes that it has not given, offered or promised to give, directly or indirectly any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the 'BUYER/EMPLOYER' or

otherwise in procuring the Contract or forbearing to do or having done any act in relation to the obtaining or execution of the contract or any other contract with the Government for showing or forbearing to show favour or disfavour to any person in relation to the contract or any other contract with the Government.

3.3. BIDDERS shall disclose the name and address of agents and representatives and Indian BIDDERS shall disclose their foreign principals or associates.

3.4. BIDDERS shall disclose the payments to be made by them to agents/brokers or any other intermediary, in connection with this bid/contract.

3.5. The BIDDER further confirms and declares to the 'BUYER/EMPLOYER' that the BIDDER has not engaged any individual or firm or company whether Indian or foreign to intercede, facilitate or in any way to recommend to the 'BUYER/EMPLOYER' or any of its functionaries, whether officially or unofficially to the award of the contract to the BIDDER, nor has any amount been paid, promised or intended to be paid to any such individual, firm or company in respect of any such intercession, facilitation or recommendation.

3.6. The BIDDER, either while presenting the bid or during pre-contract negotiations or before signing the contract, shall disclose any payments he has made, is committed to or intends to make to officials of the 'BUYER/ EMPLOYER' or their family members, agents, brokers or any other intermediaries in connection with the contract and the details of services agreed upon for such payments.

3.7. The BIDDER will not collude with other parties interested in the contract to impair the transparency, fairness and progress of the bidding process, bid evaluation, contracting and implementation of the contract.

3.8. The BIDDER will not accept any advantage in exchange for any corrupt practice, unfair means and illegal activities.

3.9. The BIDDER shall not use improperly, for purposes of competition or personal gain, or pass on to others, any information provided by the 'BUYER/ EMPLOYER' as part of the business relationship, regarding plans, technical proposals and business details, including information contained in any electronic data carrier. The BIDDER also undertakes to exercise due and adequate care lest any such information is divulged.

3.10. The BIDDER commits to refrain from giving any complaint directly or through any other manner without supporting it with full and verifiable facts.

3.11. The BIDDER shall not instigate or cause to instigate any third person to commit any of the actions mentioned above.

3.12. If the BIDDER or any employee of the BIDDER or any person acting on behalf of the BIDDER, either directly or indirectly, is a relative of any of the

officers of the 'BUYER/EMPLOYER' or alternatively, if any relative of an officer of the 'BUYER/EMPLOYER' has financial interest/stake in the BIDDER's firm, the same shall be disclosed by the BIDDER at the time of filing of tender.

The term 'relative' for this purpose would be as defined in Section 6 of the Companies Act 1956.

3.13. The BIDDER shall not lend to or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly, with any employee of the 'BUYER/EMPLOYER'.

3.14. The bidder signing IP shall not approach courts while representing the matters to IEMs and he / she / they will wait their decision in the matter.

4. Previous Transgression

4.1 The BIDDER declares that no previous transgression occurred in the last three years immediately before signing of this Integrity Pact, with any other company in any country in respect of any corrupt practices envisaged hereunder or with any Public Sector Enterprise in India or any Government Department in India that could justify bidder's exclusion from the tender process.

4.2 The BIDDER agrees that if it makes incorrect statement on this subject, BIDDER can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

5. Earnest Money (Security Deposit)

5.1 While submitting commercial bid, the BIDDER shall deposit an amount 1666100/- (Rupees Sixteen Lakh SixtySix Thousand One Hundred Only) as Earnest Money/Security Deposit, with the 'BUYER/ EMPLOYER' through any of the following instruments:

i) Paid by RTGS in favour of FA&CAO, NMPA

The EMD is exempted on submission of Bid Security Declaration in the prescribed format as per Annexure 13 of this tender document.

The benefit of Exemption of EMD to all Microand 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

5.2 The Earnest Money/Security Deposit shall be valid upto a period of 148days or the complete conclusion of the contractual obligations to the complete satisfaction of both the BIDDER and the ‘BUYER/EMPLOYER', including

warranty period, whichever is later.

5.3 In case of the successful BIDDER, a clause would also be incorporated in the Article pertaining to Performance Security in the Project Contract that the provisions of Sanctions for Violation shall be applicable for forfeiture of Performance Security in case of a decision by the 'BUYER/EMPLOYER' to forfeit the same without assigning any reason for imposing sanction for violation of this Pact.

5.4 No interest shall be payable by the 'BUYER/EMPLOYER' to the BIDDER on Earnest Money/Security Deposit for the period of its currency.

6. Sanctions for Violations

6.1 Any breach of the aforesaid provisions by the BIDDER or any one employed by it or acting on its behalf (whether with or without the knowledge of the BIDDER) shall entitle the 'BUYER/EMPLOYER' to take all or any one of the following actions, wherever required:-

i) To immediately call off the pre contract negotiations without assigning any reason or giving any compensation to the BIDDER. However, the proceedings with the other BIDDER(s) would continue.

ii) The Earnest Money Deposit (in pre-contract stage) and/or Security Deposit/Performance Bond (after the contract is signed) shall stand forfeited either fully or partially, as decided by the 'BUYER/EMPLOYER' and the 'BUYER/ EMPLOYER' shall not be required to assign any reason therefore.

iii) To immediately cancel the contract, if already signed, without giving any compensation to the BIDDER.

iv) To recover all sums already paid by the 'BUYER/EMPLOYER', and in case of an Indian BIDDER with interest thereon at 2% higher than the prevailing Prime Lending Rate of State Bank of India, while in case of a BIDDER from a country other than India with interest thereon at 2% higher than the LIBOR. If any outstanding payment is due to the BIDDER from the 'BUYER/EMPLOYER' in connection with any other contract, such outstanding payment could also be utilized to recover the aforesaid sum and interest.

v) To encash the advance bank guarantee and performance bond/warranty bond, if furnished by the BIDDER, in order to recover the payments, already made by the 'BUYER/EMPLOYER', alongwith interest.

vi) To cancel all or any other Contracts with the BIDDER. The BIDDER shall, be liable to pay compensation for any loss or damage to the 'BUYER/EMPLOYER' resulting from such cancellation/rescission and

the 'BUYER/EMPLOYER' shall be entitled to deduct the amount so payable from the money(s) due to the BIDDER.

vii) To debar the BIDDER from participating in future bidding processes for a minimum period of five years, which may be further extended at the discretion of the 'BUYER/EMPLOYER'.

viii) To recover all sums paid in violation of this Pact by BIDDER(s) to any middleman or agent or broker with a view to securing the contract.

ix) In cases where irrevocable Letters of Credit have been received in respect of any contract signed by the 'BUYER/EMPLOYER' with the BIDDER, the same shall not be opened.

x) Forfeiture of Performance Guarantee in case of a decision by the 'BUYER/ EMPLOYER' to forfeit the same without assigning any reason for imposing sanction for violation of this Pact.

6.2 The 'BUYER/EMPLOYER' will be entitled to take all or any of the actions mentioned at para 6.1(i) to (x) of this Pact also on the Commission by the BIDDER or any one employed by it or acting on its behalf (whether with or without the knowledge of the BIDDER), of an offence as defined in Chapter IX of the Indian Penal code, 1860 or Prevention of Corruption Act, 1988 or any other statute enacted for prevention of corruption.

6.3 The decision of the 'BUYER/EMPLOYER' to the effect that a breach of the provisions of this Pact has been committed by the BIDDER shall be final and conclusive on the BIDDER. However, the BIDDER can approach the Independent Monitor(s) appointed for the purposes of this Pact.

7. Fall Clause

7.1 The BIDDER undertakes that it has not performed/is not performing similar project at a price lower than that offered in the present bid in respect of any other Ministry/Department of the Government of India or PSU and if it is found at any stage that similar project was performed by the BIDDER in any other Ministry/Department of the Government of India or a PSU at a lower price, then that very price, with due allowance for elapsed time, will be applicable to the present case and the difference in the cost would be refunded by the BIDDER to the 'BUYER/EMPLOYER', if the contract has already been concluded.

8. Independent Monitors

8.1 The 'BUYER/EMPLOYER' has appointed the following Independent Monitor (hereinafter referred to as Monitor) for this Pact in consultation with the Central Vigilance Commission Name and Address of the Monitor: Shri Prem Chand Pankaj, Ex CMD, NEEPCO,
M 402, Pioneer Park, Sector 61, Golf Course,
Extn., Road, Gurgaon

Mob No. 9717433886
E-mail ID : prempankaj@gmail.com

8.2 The task of the Monitor shall be to review independently and objectively, whether and to what extent the parties comply with the obligations under this Pact.

8.3 The Monitor shall not be subject to instructions by the representatives of the parties and perform his functions neutrally and independently.

8.4 Both the parties accept that the Monitor has the right to access all the documents relating to the project/bidding, including minutes of meetings.

8.5 As soon as the Monitor notices, or has reason to believe, a violation of this Pact, he will so inform the Authority designated by the 'BUYER/EMPLOYER'.

8.6 The BIDDER(s) accepts that the Monitor has the right to access without restriction to all Project documentation of the 'BUYER/EMPLOYER', including that provided by the BIDDER. The BIDDER will also grant the Monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his project documentation. The same is applicable to Subcontractors. The Monitor shall be under contractual obligation to treat the information and documents of the BIDDER/Subcontractor(s) with confidentiality.

8.7 The 'BUYER/EMPLOYER', will provide to the Monitor sufficient information about all meetings among the parties related to the Project provided such meetings could have an impact on the contractual relations between the parties. The parties will offer to the Monitor the option to participate in such meetings.

8.8 The Monitor will submit a written report to the designated Authority of 'BUYER/EMPLOYER' within 8 to 10 weeks from the date of reference or intimation to him by the BUYER / EMPLOYER / BIDDER and, should the occasion arise, submit proposals for correcting problematic situations.

9. Facilitation of Investigation

In case of any allegation of violation of any provisions of this pact or payment of commission, the 'BUYER/EMPLOYER' or its agencies shall be entitled to examine all the documents including the Books of Accounts of the BIDDER and the BIDDER shall provide necessary information and documents in English and shall extend all possible help for the purpose of such examination.

10. Law and Place of Jurisdiction

This Pact is subject to Indian Law.' The place of performance and jurisdiction is the seat of the 'BUYER/EMPLOYER'.

11. Other Legal Actions

The actions stipulated in this Integrity Pact are without prejudice to any other legal action that may follow in accordance with the provisions of the extant law in force

relating to any civil or criminal proceedings.

12. Validity

12.1 The validity of this Integrity Pact shall be from date of its signing and extend upto 5 years or the complete execution of the contract to the satisfaction of both the 'BUYER/EMPLOYER' and the BIDDER, including warranty period, whichever is later. In case BIDDER is unsuccessful, this Integrity Pact shall expire after six months from the date of the signing of the contract.

12.2 Should one or several provisions of this Pact turn out to be invalid, the remainder of this Pact shall remain valid. In this case, the parties will strive to come to an agreement to their original intentions.

12.3 If the BIDDER is a partnership or a consortium, this agreement must be signed by all partners or consortium members.

13. The parties hereby sign this Integrity Pact at _____ on _____

BUYER/EMPLOYER	BIDDER
Name of the Officer and Designation	CHIEF EXECUTIVE OFFICER
Witness	Witness
1. _____	1._____
2. _____	2._____,

* Provisions of these clauses would need to be amended/ deleted in line with the policy of the BUYER/ EMPLOYER in regard to involvement of Indian agents of

NEW MANGALORE PORT AUTHORITY

Panambur, Mangalore

"PROVIDING PAVEMENT QUALITY CONCRETE TO THE EXISTING TRUCK PARKING TERMINAL NEAR K. K. GATE ADJACENT TO TOILET BLOCK AND CONSTRUCTION OF CANTEEN, DORMITORY, SHOPS, CLINIC BUILDING AND TOILET BLOCK IN TRUCK PARKING TERMINAL."

TENDER DOCUMENT

Volume - II

NEW MANGALORE PORT AUTHORITY

CIVIL ENGINEERING DEPARTMENT

Tender no: CIVIL/DyCE(C)/EE(C)/44/2022-23

Tender for

"PROVIDING PAVEMENT QUALITY CONCRETE TO THE EXISTING TRUCK PARKING TERMINAL NEAR K. K. GATE ADJACENT TO TOILET BLOCK AND CONSTRUCTION OF CANTEEN, DORMITORY, SHOPS, CLINIC BUILDING AND TOILET BLOCK IN TRUCK PARKING TERMINAL."

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)

Table of Contents

SECTION IV - TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATIONS

A. GENERAL

The following Technical Specifications shall be read in conjunction with General Conditions of Contract, Conditions of Particular Applications, Schedules, Annexures and Drawings.

The normal business will be continued throughout the progress of the work and the Contractor must conduct his operations so as not to obstruct shipping, Port traffic and operations. The work shall be done strictly in accordance with specification laid down latest MORT & H Specifications, latest IS codes in practice, in addition to the specifications given of the tender, approved plan and the instructions issued by the Engineer-in-Charge from time to time.

The Contractor shall obey orders and directions given by the Engineers or his authorized representative in the course of the discharge of his duties. The work shall be carried out in accordance with the best standards of workmanship and to entire satisfaction of Engineer-in-Charge.

1.1.2 Site Information

A) Location of Work

The Port of New Mangalore is located on Latitude 12°55'2" N and Longitude 74°46'17.6" E on the West Coast of India, midway between Cochin and Mormugao.

1.1.3 Site Conditions

A). Climate

The climate at Mangalore is tropical with high humidity and a maximum shade temperature of 36ºC. The average annual rainfall is 3330 mm, the rainfall is 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.

B). Wind

The Winds 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.

Brief Description and Scope of Work

The Works are also shown in the drawings that are issued as a part of the Tender Documents:

B. MATERIALS

1.2.1 Quality of material

All materials used in the work shall be of the best quality of their respective kinds as specified herein, obtained from sources and suppliers approved by the Engineer-in-charge and shall comply strictly with the tests prescribed hereinafter, or where tests are not laid down in the specification, with the requirements of the latest issues of the relevant Indian Standard codes. Any material not fully specified herein and for which there is no relevant Indian Standard, shall be the best of their kind and to the approval of the Engineer-in-charge.

All manufactured articles unless otherwise allowed by the Engineer in charge shall bear ISI mark and shall be obtained from Manufacturers directly or from recognized dealers of manufacturers.

All material used in the work shall be subjected to inspection and test. Samples of all materials proposed to be employed in the permanent works shall be submitted to the Engineer-in-charge for approval, before they are brought to site. Material may be rejected if found not suitable or in accordance with the specifications not withstanding the results of tests at the manufacturer's works or elsewhere or test certificates or any approval given earlier.

Materials used in the works shall be stored on stacks, supports, in bins, under cover, etc., as per IS 4082 as appropriate to prevent deterioration or damage from any cause whatsoever to the entire satisfaction of the Engineer-in-charge and as stated in the succeeding clauses.

1.2.2 Procurement of Cement

The contractor shall procure all the cement of approved quality required for the work from the open market.

1.2.3 Tests after delivery to site

At the discretion of the Engineer-in-charge cement shall, after delivery to site, be subjected to all the tests and analysis required by the relevant Indian standards. Samples shall be collected as directed by the Engineer-in-charge and tests carried out at an approved laboratory / site laboratory. The cement from which the samples have been extracted shall not be in used in any works before completion of the testing and analysis and until it has been accepted as satisfactory by the Engineer-in-charges. However the use of cement will be allowed after satisfactory results of 3 days and 7 days. In addition to the above tests and analysis, the Engineer-in-charge may order further tests on the cement after it has been stored at the site prior to use, in order to determine if the cement has deteriorated during storage. No cement shall be allowed to be used until it has been accepted as satisfactory by the Engineer-in-charge.

The costs of all the tests on cement are deemed to be included in the rates and prices and shall not be paid extra.

1.2.4 Sampling and Testing

All materials used in the work shall be subjected to inspection and test. Samples of all materials proposed to be employed in the permanent works shall be submitted to the Engineer-in-charge for approval, before they are brought to site. All the materials shall be in accordance with the specification. Where materials are specified to comply with I.S., the contractor shall furnish manufacture's certificate that the materials satisfy the requirement of IS specifications.

Material may be rejected if found not suitable or in accordance with the specifications not withstanding the results of tests at the manufacturer's works or elsewhere or test certificates or any approval given earlier.

Expenditure towards samples and tests whether at the manufacturer's premises at source, at site or at any testing laboratory or institution as directed by the Engineer-in-charge shall be deemed included in the rates quoted in the Bill of Quantities and no extra payment whatsoever shall be made on this account. All the material testing equipments have to be calibrated and calibration reports for all the equipments are to be produced.

Even though it is obligatory duty of the contractor to have an up to date laboratory at site and testing equipments are required to carry out the necessary tests in presence of Engineer's representative they shall arrange to test any of the materials / concrete cubes etc or in outside laboratories of Engineer's choice. All cost i.e. cost of testing, cost of material, packaging, transportation etc. to be borne by the contractor. In case, the Contractor proposed to use ready mix concrete, the facilities for testing of materials and laboratory tests of ready mix concrete, shall be available at mixing plant.

The following are the tests to be carried out for various materials used for construction at frequencies as stated below:

Table

Sl. No.	Material	Tests	Control criteria	Frequency
1	Granular Sub Base	(a) Gradation	As per MOST- T- 401 and as per Tech. Spec.	1 test per 200m3
		(b) Atterberg limits	IS 2720 - Part 5	1 test per 200m3
		(c) Density test	IS 2720 - Part 8	1 test per 3000m3
		(d)Density of Compacted layer	IS 2720 - Part 28	1 test per 500m2
		(e) Moisture Content	IS 2720- Part 2	1 test per 250m3
		(f) CBR	IS 2720 – Part 16	As required
		(g) 10 % Fines value	BS 812 – Part 111	1 test /each source
		(h)Deleterious Constituents	IS 2720 – Part 27	As required
		(i) water Absorption of the aggregates	IS 2386 – Part 3	1 test for each source.
2	Wet Mix macadam			
		(a) Gradation (Combined and individual)	As per MOST- T- 400-11 and as per Tech. Spec.	1 test per 100m3
		(b) Atterberg limits	IS 2720 - Part 5	1 test per 250m3
		(c) Density test	IS 2720 - Part 8	As required
		(d) Density of Compacted layer	IS 2720 - Part 28	1 test per 500m2
		(e) Moisture Content prior to compaction	IS 2720 - Part 2	1 test per 500m2
		(f) CBR	IS 2720 – Part 16	As required
		(g) water Absorption of the aggregates	IS 2386 – Part 3	1 test for each source.
		(h) Aggregate Impact	IS 2386 – Part 4	1 test per 200m3

		value		
		(i) Los Angeles Abrasion value	IS 2386 – Part 4	1 test per 200m3
		(j) Soundness Test-	IS 2386 – Part 5	1 test per source
3	Cement	Chemical Tests	IS: 8112 /IS :12269	For each lot of cement received.
		(a) Lime saturation factor		
		(b) Ratio of Alumina and iron oxide.		
		(c) In soluble residue		
		(d) Magnesia % by mass		
		(e) loss of Ignition.		
		Physical Tests:		
		(a) Specific surface area		
		(b) Soundness		
		(c)Setting Time		
		(d) Compressive strength in N / mm2		
4	Concrete:			
	Cement	Consistency	IS 4031 – Part 4	1 Test per each consignment.
		Initial setting time	IS 4031- Part 5	
		Final setting Time		
		Soundness	IS 4031- Part 3	
		Finess		
		Compressive strength in N / mm2	IS 4031 – Part 6	
	Gradation	Coarse aggregate	IS 383- 1970	As per design and one test per 50m3,
		Fine aggregate	IS 2386 – Part 1	
		Water absorption	IS 2386 – Part 3	As required.
		Soundness test	IS 2386 – Part 5	1 test per source
		Aggregate Impact value / Los Angeles Abrasion value	IS 2386 – Part 4	1 test per 50m3
		Flakiness	IS 2386 – Part I	1 test per 50m3
		Bulkage and silt content	IS 2386 – Part 2 & 3	1 test per source
	M- 30 Grade Concrete			
	Workability and Slump		IS 1199	As per design requirement and 1 test per each transit mixer / dumper
	Strength of Concrete	As per design requirement	IS 516	1 to 5 M3 = 6 cubes 6 to 15 M3 = 9 cubes 16 to30M3=12 cubes 31 to50 M3 =15cubes

				> 50 m3 = 15 + 3 cubes for every 50 M3
	Dry Lean Concrete (M 10) for 7 days			
	Strength of Concrete	Compressive strength in N / mm2	As per MOST – Chapter No. 601 –IS 516	6 cubes per150m3
		F. D. D. Test		1 test per 1000m2
	Pavement Quality Concrete (M 40)			
	Strength of Concrete	Compressive strength in N / mm2	As per MOST – Chapter No. 602 – IS 516	6 cubes per150m3
		Flexural strength in Kg / cm2	As per MOST – Chapter No. 602	6 beams per150m3
		Texture depth by sand patch method	As per MOST – Chapter No. 602 & IRC 15 - 2002	1 test per 50 Rmt
		Surface evenness with 3.50 mt straight edge	IRC 15- 2002	As per requirement
		Core Strength on harden concrete	IS 516	As per requirement
		Thickness measurement by core		As per requirement
	Dowel bars	Alignment parallel to surface of base course	IS:432 , IS 1139 , 1786 and As per MOST	1 Test per each consignment.
	Tie bars	Mid-height positioning.	IS:432 , IS 1139 , 1786 and As per MOST	1 Test per each consignment
	Sealant	Hot applied sealant / cold applied sealant	AASHTO - M – 282/ BS5212.	1 Test per each consignment
	Separation Membrane	125 micron thick		
	Admixtures			As per Mix design
5.	Water	Chemical Test	IS: 456	Once for every change of source and as required.
6.	Reinforcement bars	Mechanical Test and Chemical Test (TMT bars)	IS: 432 & IS: 1786	For each Consignment of different dia of reinforcement bars received.
7	NP3- Hume pipes	3Edge bearing test and Ultimate Strength Test	IS 458- 2003	For each Consignment
8	Pave Blocks	Compressive Strength	IS 15685 -2006	As stated in IS Code

In case Contractor proposes to use Ready Mix Concrete, the above frequency should be

followed at mixing plant.

1.2.5 Storage

The Contractor shall make adequate arrangements to deliver and store sufficient quantity of all the materials required for the work at his own cost.
Tools, Equipment And Appliances
All tools equipment and appliances for the proper execution of all works and operation like batching, mixing, placing, finishing and curing of the concrete and other items shall be on the project in good working condition and all have been inspected by the Engineer in charge before the works are permitted to start. Throughout the construction of the project, the Contractor shall maintain adequate equipment in first class working condition to ensure proper execution of the work.

Specification for controlled concrete
All concrete shall comply with the requirements of I.S. 456. Wherever a reference is made to any Indian standard code of practice it shall mean the latest version of the relevant standard in use.

Concrete work shall be supervised by a competent concrete technologist approved by the Engineer in charge, whose duty will be to supervise all stages of designing the mix, preparation and placing of concrete. All cubes shall be made and site tests carried out under his direct supervision in the presence of Engineer in charge his recognized representatives. In order to exercise the required degree of constant control over the concrete materials and their preparations, the contractor shall set up and maintain at his own expense a testing laboratory at site. He shall provide all apparatus required for sensitive testing of concrete and concrete materials as stated in Clause 8.2 If the Contractor proposes to use ready mix concrete, the control shall be exercised at mixing plant.
Before the commencement of construction work, the Contractor shall supply to the Engineer in charge for his approval drawings showing the general detailed arrangement for concreting plant.

All materials which have been damaged, contaminated or have deteriorated or do not comply in any way with the requirements of this specifications shall be rejected and shall be removed from the site at the contractors expense.
Materials viz. Cement, fine aggregates, coarse aggregates, water etc. shall be tested, if directed, in an approved testing laboratory and test reports in original, shall be forwarded to Engineer in charge and all costs of tests shall be borne by the Contractor.
The concrete mix shall be designed by any of the recognized and accepted methods. The proportions chosen should be such that the concrete is of adequate workability for the conditions prevailing on the work in quality and can be properly compacted.

Except where it can be shown to the satisfaction of the Engineer in charge that supply of properly graded aggregate of uniform quality can be maintained over the 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 for various mix design, the different sizes being stocked in separate stock piles, the materials should be stock piled 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 in charge to ensure that the suppliers are maintaining the uniform grading with that of the samples used in the preliminary tests.
In proportioning concrete, the quantity of both cement and aggregate should be determined by weight. Water should be either measured by volume in calibrated tanks or weighed. All measuring equipment shall be maintained in a clean serviceable condition and their accuracy periodically checked.

Cement

Cement to be used on the work shall comply with the requirements of Indian Standard Specification Code No.8112 of 43 grade Ordinary Portland Cement. In case of use of 53 grade cement is allowed, the contractor will have to take adequate measures to reduce heat of hydration like curing etc . However the 53 grade cement shall confirm to IS-12269.

Large stock of cement shall not be kept at the work but only sufficient quantities to ensure continuity of work. The age of cement at the time of delivery to the site shall not be more than two months and the cement shall be used in the work within three months thereafter. The contractor shall provide and maintain a proper and efficient storage shed and shall be raised at least 30 cm above the ground in order to protect the bags from dampness. No cement damaged by exposures or otherwise will be allowed to be used on the works, but shall be removed at once from the site. Cement shall be used in accordance with “First come First out ” rule i.e. take out the oldest cement first.

The contractor shall note the following points:

a) Cement carrying ISI mark on every bag will only be purchased and will be permitted for use on works.

b) The contractor shall buy cement from the dealer approved by the manufacturer. Manufacturers test certificate covering the particular batch from which supply has been made by the dealer shall also be submitted.

c) The contractor shall construct and maintain in a good condition a cement godown of adequate capacity at the site of the work for proper storage of cement, the purchase of cement shall be so scheduled as to allow reasonable time for sampling and testing.

d) Compressive tests and testing other properties of cement shall be carried out as and when required as per IS :516-1959.

e) The Contractor shall inform the Engineer-in-charge of receipt of each delivery and shall forward to him the manufacturer’s certificate together with the invoice stating the quantity delivered the name and address of the manufacturer.

f) The contractor shall maintain records for Material received and consumed for Steel reinforcement, Cement, Aggregates, NP3 Pipe, Paver Blocks M40 and M25 grade and Sealant and submit the copy fortnightly to the Engineer-in-charge.

Admixtures

Admixtures shall be allowed to improve workability only if there is proved evidence that neither the strength nor the other requisite qualities of concrete and / or steel, accessories, grout are impaired by their use. The use of admixtures containing calcium chloride, fluorides, nitrates and sulphates is prohibited. The Engineers decision on all matters relating to the use of admixtures shall be final.

Admixtures shall be stored in a suitable weatherproof shed/ building. Any material which has deteriorated or which has been contaminated or damaged whether during transit or at site shall be immediately removed from the site and replaced at contractors own expense.

Fine Aggregate

It shall conform to the requirements of IS: 383 and relevant portion of IS: 515. It shall be chemically inert, strong, hard, durable, of limited porosity, free from adherent coatings, clay lumps, coal and coal residues, and shall not contain any organic matter of other admixtures that may cause corrosion of reinforcement or impair the strength of durability of the concrete. The maximum quantity of the deleterious materials shall not exceed the limits specified in the relevant Indian standard specifications.

Fine aggregates to be used in concrete shall be sieved through 4.75 mm size sieve.

The natural sand shall have grading conforming to one of the four grading limits given in the following table :

Table

IS Sieve designation	Percentage Passing			
	Grading Zone I	Grading Zone II	Grading Zone III	Grading Zone IV
10 mm	100	100	100	100
4.75 mm	90-100	90-100	90-100	95-100
2.36 mm	60-95	75-100	85-100	95-100
1.18 mm	30-70	55-90	75-100	90-100
600 micron	15-34	35-59	60-79	80-100
300 micron	5-20	8-30	12-40	15-50
150 micron	0-10	0-10	0-10	0-15

(when grading falls outside the limits of any particular grading zone of sieves, other than 600 micron sieve, by a total amount not exceeding 5% , it shall be regarded as falling within the grading zone).

Coarse Aggregate

Shall conform with the requirements of IS:383 and relevant portions of IS:515. It shall consist of hard, dense, durable, uncoated crushed rock, use of gravel shall be allowed only if specified in the schedule of quantities. Aggregates shall be free from soft, friable, thin or flaky pieces. It shall be free from injurious amounts of alkali and organic matter other than deleterious materials. The maximum quantity of deleterious materials shall not exceed the limits specified in the relevant Indian standard specifications.
Coarse aggregates shall be obtained in single sizes conforming to the grading given in the following table in respect of each nominal size. Single sized aggregates shall be blended in suitable proportions to obtain a desired grading of coarse aggregates. At the discretion of the Engineer in charge use of graded aggregates shall be allowed provided the grading conforms to the limits specified in the following table under Column B.

Table

IS Sieve designation	A % Passing for single sized aggregate of nominal size						B % passing of graded aggregate of nominal size			
	63 mm	40 mm	20 mm	16 mm	12.5 mm	10 mm	40 mm	20 mm	16 mm	12.5 mm
80 mm	100	--	--	--	--	--	100	--	--	--
63 mm	85-100	100	--	--	--	--	--	--	--	--
40 mm	0-30	85-100	100	--	--	--	95-100	100	--	--
20 mm	0-5	0-20	85-100	100	--	--	30-70	95-100	100	100
16 mm	--	--	--	85-100	100	--	--	--	90-100	--
12.5 mm	--	--	--	--	85-100	100	--	--	--	90-100
10 mm	0-5	0-5	0-20	0-30	0-45	85-100	10-35	25-55	30-70	40-85

4.75 mm	--	--	0-5	0-5	0-10	0-20	0-5	0-10	0-10	0-10
2.36 mm	--	--	--	--	--	0-5	--	--	--	--

In selecting coarse as well as fine aggregates, the contractor shall, satisfy himself that the source is suitable and adequate for regular supply and a watch shall be maintained that the particle shape and grading remain reasonable uniform through out the progress of work. If directed by Engineer in charge the aggregates shall be washed at contractor's expense.

For both fine and coarse aggregates, preliminary tests shall be carried out for physical characteristics, limits of deleterious substances, soundness, etc. prior to commencement of work and also when the source of supply is changed.

Water
Water used for both mixing and curing shall be free from injurious amounts of deleterious materials. Potable water is generally considered satisfactory for mixing and curing concrete.

Reinforcement
The Contractor shall procure the required quantity of steel from the reputed manufacturers confirming to IS: 1786 and mill certificates shall be furnished for the approval of reinforcing steel. The contractor shall make necessary arrangements for transporting, storing, maintaining & protecting the materials required for the work.

Tests shall be carried out as per the instructions of the Engineer-in-charge. Reinforcing bars shall be stored on site on timber or concrete supports suitably spaced and of sufficient height to keep steel clear of the ground. Reinforcing steel shall be stored separately section wise. All rejected steel shall be immediately removed from the site at the Contractors own expense.

All reinforcement shall be TMT bars and shall conform with the requirements of relevant IS specifications for deformed steel. All reinforcement when placed in position shall be clean and free from loose mild scales, dust, loose rust and coats of paints, oil or other coatings which may destroy or reduce bond.

Welded joints may be allowed only when tests shall be made to prove that the joints are of the full strength of the bars connected. Welding of reinforcement shall be done in accordance with the recommendations of relevant Indian standards for welding of mild steel bars used in reinforced cement concrete.

1.2.14 Concrete Mix Design:
Concrete mix for various specified design strength shall be worked out by the contractor by any of the recognized method of mix design. There shall be one or two or more mix designs for same grade of concrete for different workability as required for different structural members.

The selected mix proportion shall ensure that workability of the fresh concrete is suitable for conditions of handling and placing, so that after compaction it surrounds all reinforcement, ducts etc. and completely fills the formwork. When the concrete is hardened its quality shall be such as to comply with the strength, durability and other requirements, taking into account the conditions to which it will be exposed.

The preliminary mix design shall assume only fair control, unless the contractor can prove from his past experience that he is capable of achieving a high degree of control. Before arriving at average strength values the contractor shall give due regard to the criteria of acceptance for preliminary test as stipulated in IS: 456 consecutive cubes shall constitute a

test and the average strength of 3 consecutive cubes tested shall not be less than the stipulated strength for preliminary tests. The design mix and control shall be accepted if only one out of three cubes may give a value less than the specified strength. The contractor shall prepare well in advance all calculations, tabulations, graphs, pertaining to concrete mix design and preliminary test results and submit the copies of Engineer in charge for their instructions. Only that mix which is approved in writing by the Engineer in charge shall be allowed on the works. However it shall be clearly understood that such approval shall not absolve the contractor of his responsibility for compliance of works tests results.

1.2.15 Classes of Concrete

Table

Class	Maximum size of Aggregate mm	Minimum Crushing Strength Kg / sq.cm				Minimum Mixing Time in Minutes	Minimum Cement in concrete (Kg/Cum)	W/C
		Preliminary Test		Work Test				
		7 days	28 days	7 days	28 days			
M10 (1 :3:6)	20	100	135	70	100	2	220	0.55
DLC	25	140	---	100	---	2	150	0.65
M20	20	165	235	140	200	2	320	0.45
M40 (PQC)	20	350	500	280	400	2	400	0.40
Note: No claim for excess cement used shall be entertained. If this minimum cement content is not sufficient to produce in the field the concrete of the strength specified in the BOQ, it shall be increased as necessary without additional compensation under the contract.								

Note:- Please refer BOQ of Vol III, for minimum cement in concrete(Kg/Cum)

1.2.16 Mixing , placing of concrete and Measurement of materials

The following specifications shall apply for RM C Plant / Batching Plant. The batching plant should be well equipped with digitally controlled computerized operation to get the print out of materials incorporated the particular of batch mix. The contractor has to certify the batch mix daily with authorized signatory and calibration of the batching plant shall be done periodically.

IS 4925 - Specification for concrete batching and mixing plant.
IS 5892 - Specification for concrete transit mixer and agitator.

Concrete shall be conveyed and placed by mechanical operated equipments after approval of the entire procedure by the Engineer. The slump shall be held to the minimum necessary for conveying concrete by this method. The concrete mix shall be specially designed to suit spreading.

The charges for shuttering, vibrating, spreading and part load of concrete, non accessibility of site etc. will not be entertained and paid for. These rates are deemed to be included in the item rate for concrete indicated against respective items of work.

Every transit mixer will carry delivery ticket, which will have minimum following details:-

Date.
Ticket No.
Location of Work

Grade of concrete.
Specified workability
Cement content and grade of cement
Time of loading
Quality of concrete.

When the truck arrives at site, the drum should always be speeded to about 10 to 15 rev/min for at least 3 minutes, to make sure that the concrete is thoroughly mixed and uniform, before discharge.

Cement
In proportioning concrete, the quantity of both cement and aggregates shall be determined by weight. Where the weight of cement is determined by accepting the maker's weight per bag, a number of bags as directed by the Engineer in charge shall be weighed separately to check the net weight. Where cement is weighed on the site and not in bags it shall be weighed separately from the aggregates.

Aggregate
Aggregate shall be batted by weight in a mechanical weigh batcher or batching plant unless otherwise specifically permitted by the Engineer in charge to volumetric batching where volumetric proportion are allowed with the consent of the engineer in charge, the conversion from weight to that of volume shall be on the basis of dry bulk densities of the aggregates.

Water
Water shall be measured either by volume in calibrated tanks or weighed. Water shall not be measured using ordinary buckets. Measurement of water to control and maintain water cement ratio is utmost importance and adequate attention shall be given by the contractor to the satisfaction of the Engineer in charge.
All measuring equipment shall be of approved type and maintained in serviceable condition and their accuracy is to be periodically checked.

1.2.17 Specifications For Ready Mixed Concrete

a) All specification for cement concrete shall also be applicable to Ready Mix concrete.

b) The tenderer shall submit along with the tender, a copy of letter of consent from the RMC plant owner to the effect that he would agree to do the RMC work for the said contract, If the tenderer do not possess their own RMC plant.

c) Ready mix concrete prepared and transported will be as per IS 4926 of 1976 or the latest IS code. Design mix of specific grade of Concrete supplied by the RMC manufacturer shall be submitted by the contractor.

d) No dry mix shall be brought to the site and water added there after.

e) The following specifications shall apply for RMC.

IS 4925	-	Specification for concrete batching and mixing plant.
IS 5892	-	Specification for concrete transit mixer and agitator.
IS 7242	-	Specification for concrete spreader.

Concrete shall be conveyed and placed by mechanical operated equipments after approval of the entire procedure by the Engineer. The slump shall be held to the minimum necessary for conveying concrete by this method. The concrete mix shall be specially designed to suit pumping. Care shall be taken to avoid stoppages in work once pumping has started. The spreading shall be done by mobile boom and not by any manual method. The measurement for RMC will be made as per the dimensions of the element cast at site in cubic meter not as per the delivery challan of the RMC manufacturer.

The charges for shuttering, vibrating, spreading, pumping detention time with spreading mobile placer booms, part load of concrete, non accessibility of site etc. will not be entertained and paid for. These rates are deemed to be included in the item rate for concrete indicated against respective items of work.

f) Every transit mixer will carry delivery ticket, which will have minimum following details:-

1) Name of manufacturer and Depot
2) Serial no. of ticket.
3) Date.
4) Ticket No.
5) Name of contractor to whom the RMC is being supplied
6) Location of contract
7) Grade of concrete.
8) Specified workability
9) Cement content and grade of cement
10) Time of loading
11) Quality of concrete.
12) Time of Discharge

When the truck arrives at site, the drum should always be speeded to about 10 to 15 rev/min for at least 3 minutes, to make sure that the concrete is thoroughly mixed and uniform, before discharge.

1.2.18 Testing of Ready Mixed Concrete

The sampling and testing requirements for ready mixed concrete are no different from those for site mixed concrete. The contractor has to make sure the load is of the right workability, before discharge.

After ensuring that the concrete has been uniformly mixed, a sample is taken from the first 0.5 cum. of concrete discharge, and a slump (or compacting factor) test on the sample is done. If the result complies with the specified requirements, then the load shall be accepted. If the results fall outside the limits, a further sample shall be taken from the second 0.5 Cum. of the discharge, and if this is satisfactory, load shall be accepted, if not the concrete is regarded, as outside the specification range. The specified slump is, while carrying out above tests; it may vary by +- 10 mm, as per IS- 4926:1976.

Testing materials shall be as per requirement of IS: 4926 and the admixture used shall confirm to IS: 9103-1979.
All taxes/ duties etc. including excise, WCST etc. will be borne by the contractors and not by the NMPA. No extra payment will be made for use of admixtures.
The defect liability period of one year will be that of the main tenderer.
The shuttering for the RMC work shall be capable to resisting the pumping pressure of concrete. The cost of shuttering is deemed to be included in the rate for respective item rate.

****

TECHNICAL SPECIFICATION

C. WORKMANSHIP

1. GENERAL

The construction of concrete road pavement will be carried out as per the specification detailed below. The road construction work shall be strictly as per IRC: 15-2002 Standard Specifications and Code of Practice for Construction of Concrete Roads and as per Specification Road and Bridge works of Ministry of Shipping, Road, Transport & Highways.

1.3.2 Dismantling Flexible and C.C Pavements

A). Scope :
The work shall consists of removing flexible pavements and Dismantling of Cement Concrete Pavement etc. in road structures. Which are in place but inter fear with a new construction or are not suitable to remain in place and of salvaging and disposing of the resulting materials and back filling the resulting footpath.

Existing dismantling materials shall be removed up to the limits specified in specifications are as directed by the Engineer.

Dismantling and removal operations shall be carried out with such equipment and such a manner as leave undisturbed , adjacent pavement, structures and any other work to be left in place.

All operations necessary for removal of any existing structure in which might endanger new construction shall be completed prior to the start of the new work.

B). Disposal of materials
All materials obtained by dismantling shall be the property of Port. Unless otherwise specified, material having any salvage value shall be placed in neat stacks of like materials with in a right of way / Foot path / Berm as directed by the Engineer with all lifts and up to a lead of 6 K. M or as directed by the Engineer.

All materials obtained from dismantling operations which, in the opinion of Engineer, can not be used or auctioned shall be disposed of as directed by Engineer with all lifts and up to a lead of 6 K. M.

C). Measurement of payment:
Dismantling of flexible and cement concrete pavement measured in Cu. Mt.

D). Rates:
The contract unit rates for the various items of dismantling shall be paid in full for carrying out the required operations including full compensation for all labour, materials, tools, equipments, safe guards and incidentals necessary to complete the work. These will also include excavation and back filling where necessary to the required compaction and for handling, salvaging, disposing of the dismantled materials with in all lifts and up to a lead of 6 K. M or as directed by the Engineer.

1.3.3 Earthwork Excavation For Road way
A).General:
Earthwork excavation for leveling the ground, with requirements of lines, grades and cross sections shown in the drawings or as indicated by the Engineer. Which shall include the hauling and stacking of or hauling to the site of preparation of sub grade to the foot path and

as also the disposal of unsuitable cut materials in specified manner, trimming and finishing of the road to specified dimension or as directed by the Engineer. All stumps and roots of trees and plants, organic materials etc. shall be removed before leveling the filling area. Only such methods, tools and equipment as approved by the Engineer shall be adopted / used in the work. If so desired by the Engineer, the Contractor shall demonstrate the efficacy of the type of equipment to be used before commencement of the work. The marsh, shoulders, for widening of pavement or providing treated shoulder, surface/ sub surface drains, slides, dewatering shall be part of the excavation including plying of traffic, preservation of property, Preparation of cut formation with finishing operation.

The rate shall include all labour charges, Tools & Plants and all other incidental charges etc. complete.

B) . Measurement of payment:

Loosening and removal of unsuitable material and replacing with suitable material and compacting with required density including all lifts and lead of 6 K.M. in Cu. Mt.

C). Rates:

The contract unit rates for the items of roadway and drain excavation shall be payment in full for carrying out the required operations including for the individual items including full compensation for setting out, transporting of excavated materials and the depositing the same on the sides of the foot path or berms, trimming bottoms and slope of the excavation, dewatering, keeping the work free of water or stacking as directed with in all lifts all labour, materials, tools, equipments, safe guards , leveling of the dumping yard and incidentals necessary to complete the work to specification.. These will also include excavation and back filling where necessary to the required compaction and for handling, salvaging, disposing of the dismantled materials with in all lifts and up to a lead of 6 K. M or as directed by the Engineer.

2. SPECIFICATIONS FOR WET MIX MACADAM SUB-BASE / BASE

400.6.1. Scope - This work shall consist of laying and compacting clean, crushed, graded aggregate and granular material, premixed with water, to a dense mass on a prepared subgrade/sub-base/base or existing pavement as the case may be in accordance with the requirements of these specifications. The material shall be laid in one or more layers as necessary to lines, grades and cross-sections shown on the approved drawings or as directed by the engineer.

The thickness of a single compacted Wet Mix Macadam layer shall not be less than 75 mm. When vibrating or other approved types of compacting equipment are used, the compacted depth of a single layer of the sub-base course may be increased to 200 mm upon approval of the engineer.

400.6.2. Materials 400.6.2.1. Aggregates

400.6.2.1.1. Physical requirements - Coarse aggregates shall be crushed stone. If crushed gravel/shingle is used, not less than 90 per cent by weight of the gravel/shingle pieces retained on 4.75 mm sieve shall have at least two fractured faces. The aggregates shall conform to the physical requirements set forth in Table 10 below.

Table 10, Physical requirements of coarse aggregates for wet mix macadam for sub-base/base courses

	Test	Test Method	Requirements
1	*Los Angels Abrasion value or *Aggregate Impact Value	IS:2386(Part-4)	40 percent (Max.)

		IS:2386(Part-4) or IS:5640**	30 percent (Maxi.)
2	Combined Flakiness Elongation indices (Total)	IS: 2386(Part-1)	30 per cent (Max.) **

*Aggregate may satisfy requirements of either of the two tests.

** To determine this combined proportion, the flaky stone from a representative sample should first be separated out. Flakiness index is weight of flaky stone metal divided by weight of stone sample. Only the elongated particles be separated out from the remaining (non-flaky) stone metal. Elongation index is weight of elongated particles divided by total non-flaky particles. The value of flakiness index and elongation index so found are added up.

If the water absorption value of the coarse aggregate is greater than 2 per cent, the soundness test shall be carried out on the material delivered to site as per IS: 2386 (Part 5).

400.6.2.1.2. Grading requirements- The aggregates shall conform to the grading given in Table11.

Table11, Grading requirements of aggregates for wet mix macadam

IS sieve designation	Per cent by weight passing the IS sieve
53.00 mm	100
45.00 mm	95-100
26.50 mm	-
22.40 mm	60-60
11.20 mm	40-60
4.75 mm	25-40
2.36 mm	15-30
600.00 micron	8-22
75.00 micron	0-8

Materials finer than 425 micron shall have Plasticity Index (PI) not exceeding 6.

The final gradation approved within these limits shall be well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa.

400.6.3. Construction operations

400.6.3.1. Preparation of base - Clause 400.4.3.1 shall apply.

400.6.3.1.2. Provision of lateral confinement of aggregates - While constructing wet mix macadam, arrangement shall be made for the lateral confinement of wet mix. This shall be done by laying materials in adjoining shoulders along with that of wet mix macadam layer and following the sequence of operations described in clause 400.7.4.1.

400.6.3.2. Preparation of mix - Wet Mix Macadam shall be prepared in an approved mixing plant of suitable capacity having provision for controlled addition of water and forced / positive mixing arrangement like pugmill or pan type mixer of concrete batching plant. For small quantity of wet mix work, the engineer may permit the mixing to be done in concrete mixers. Optimum moisture for mixing shall be determined in accordance with IS: 2720 (Part 8) after replacing the aggregate fraction retained on 22.4 mm sieve with material of 4.75 mm to 22.4 mm size. While adding water, due allowance should be made for evaporation losses.

However, at the time of compaction, water in the wet mix should not vary from the optimum value by more than agreed limits. The mixed material should be uniformly wet and no segregation should be permitted.

600.6.3.3. Spreading of mix - Immediately after mixing, the aggregates shall be spread uniformly and evenly upon the prepared subgrade/sub-base in required quantities. In no case should these be dumped in heaps directly on the area where these are to be laid nor shall their hauling over a partly completed stretch be permitted.

The mix may be spread either by a paver finisher or motor grader. For portions where mechanical means cannot be used, manual means as approved by the engineer shall be used. The motor grader shall be capable of spreading the material uniformly all over the surface. Its blade shall have hydraulic control suitable for initial adjustments and maintaining the same so as to achieve the specified slope and grade.

The paver finisher shall be self-propelled, having the following features:

(i) Loading hoppers and suitable distribution mechanism; (ii) The screed shall have tamping and vibrating arrangement for initial compaction to the layer as it is spread without rutting or otherwise marring the surface profile.; (iii) The paver shall be equipped with necessary control mechanism so as to ensure that the finished surface is free from surface blemishes.

The surface of the aggregate shall be checked with templates and all high or low spots remedied by removing or adding aggregate as may be required. The layer may be tested by depth blocks during construction. No segregation of larger and fine particles should be allowed. The aggregates as spread should be of uniform gradation with no pockets of fine materials.

400.6.3.4. Compaction - After the mix has been laid to the required thickness, grade and crossfall / camber the same shall be uniformly compacted, to the full depth with suitable roller. If the thickness of single compacted layer does not exceed 100 mm, a smooth wheel roller of 80 to 100 KN weight may be used. For a compacted single layer upto 200 mm, the compaction shall be done with the help of vibratory roller of minimum static weight of 80 to 100 KN or equivalent capacity roller. The speed of the roller shall not exceed 5 km/h.

In portions having unidirectional cross fall / superelevation, rolling shall commence from the lower edge and progress gradually towards the upper edge. Thereafter, roller should progress parallel to the centre line of the road, uniformly over-lapping each preceding track by at least one third width until the entire surface has been rolled. Alternate trips of the roller shall be terminated in stops at least 1 m away from any preceding stop.

In portions in camber, rolling should begin at the edge with the roller running forward and backward until the edges have been firmly compacted. The roller shall then progress gradually towards the centre parallel to the centre line of the road uniformly overlapping each of the preceding track by at least one-third width until the entire surface has been rolled.

Any displacement occurring as a result of reversing of the direction of a roller or from any other cause

shall be corrected at once as specified and/or removal and made good.

Along forms, kerbs, walls or other places not accessible to the roller, the mixture

shall be thoroughly compacted with mechanical tampers or a plate compactor. Skin patching of an area without scarifying the surface to permit proper bonding of the added material shall not be permitted.

Rolling should not be done when the subgrade is soft or yielding or when it causes a wave-like motion in the sub-base/base course or subgrade. If irregularities develop during rolling which exceed 12 mm when tested with a 3 metre straight edge, the surface should be loosened and premixed material added or removal as required before rolling again so as to achieve a uniform surface conforming to the desired grade and crossfall. In no case should the use of unmixed material be permitted to make up the depressions.

Rolling shall be continued till the density achieved is at least 98 per cent of the maximum dry density for the material as determined by the method outlined in IS: 2720 (Part 8)

After completion, the surface of any finished layer shall be well-closed, free from movement under compaction equipment or any compaction planes, ridges, cracks and loose material. All loose, segregated or otherwise defective areas shall be made good to the full thickness of the layer and recompacted.

600.6.3.5. Setting and drying - After final compaction of wet mix macadam course, the road shall be allowed to dry for 24 hours.

600.6.4. Opening to traffic - Preferably no vehicular traffic of any kind should be allowed on the finished wet mix macadam surface till it has dried and the wearing course laid.

400.6.5. Surface finish and quality control of work

400.6.5.1. Surface evenness - The surface finish of construction shall conform to the requirements of clause 900.2.

400.6.5.2. Quality control - Control on the quality of materials and works shall be exercised by the engineer in accordance with section 900.

400.6.6. Rectification of surface irregularity - Where the surface irregularity of the wet mix macadam course exceeds the permissible tolerances or where the course is otherwise defective due to subgrade soil getting mixed with the aggregates, the full thickness of the layer shall be scarified over the affected area, reshaped with added premixed material or removed and replaced with fresh premixed material as applicable and recompacted in accordance with clause 400.6.3. The area treated in the aforesaid manner shall not be less than 5 m long and 2 m wide. In no case shall depressions be filled up with unmixed and upgraded material or fines.

400.6.7. Arrangement for traffic - During the period of construction, arrangement of traffic shall be done as per clause 100.12.

400.6.8. Measurements for Payment - Wet mix macadam shall be measured as finished work in position in cubic metres.

400.6.9. Rates - The contract unit rate for wet mix macadam shall be payment in full for carrying out the required operations including full compensation for all components listed in clause 400.1.8.

3. DRY LEAN CEMENT CONCRETE SUB–BASE

600.1. Scope

600.1.1. The work shall consist of construction of dry lean concrete sub base for cement concrete pavement in accordance with the requirements of these specifications and in conformity with the lines, grades and cross-sections shown on the drawings or as directed

by the engineer. The work shall include furnishing of all plant and equipment, materials and labour and performing all operations, in connection with the work, as approved by the engineer. A number of IRC publications are extracted and enclosed as Annexures to aid the field engineers.

600.1.2. The design parameters of dry lean concrete sub-base, viz., width, thickness, grade of concrete, details of joints, if any, etc. shall be as stipulated in the contract drawings.

600.1.2. Materials

600.1.2.1. Source of materials - The contractor shall indicate to the engineer the source of all materials with relevant test data to be used in the lean concrete work sufficiently in advance and the approval of the engineer for the same shall be obtained at least 45 days before the scheduled commencement of the work. If the contractor later proposes to obtain the materials from a different source, he shall notify the engineer for his approval at least 45 days before such materials are to be used.

600.1.2.2. Cement - Any of the following types of cement may be used with prior approval of the engineer

(1) Ordinary Portland cement IS: 269 (2) Portland Slag Cement IS: 455 (3) Portland Pozzolana Cement IS: 1489. Copy of IS publications enclosed as Annexure 600-A.1, 600-A.2 & 600-A.3. If the sub grade is found to consist of soluble sulphates in a concentration not more than 0.5 per cent, cement used shall be sulphates resistant and shall conform to IS 6909, copy enclosed as Annexure 600-A.4. Cement to be used may preferably be obtained in bulk form. It shall be stored in accordance with stipulations contained in clause 100.14 and shall be subjected to acceptance test prior to its immediate use.

600.1.2.3. **Aggregates**

600.1.2.3.1. Aggregates for lean concrete shall be natural material complying with IS: 383. Copy enclosed, as Annexure 600-A.5. The aggregates shall not be alkali reactive. The limits of deleterious materials shall not exceed the requirements set out in IS: 383. In case the engineer considers that the aggregates are not free from dirt, the same may be washed and drained for at least 72 hours before batching, as directed by the engineer.

600.1.2.3.2. **Coarse aggregate -** Coarse aggregate shall consist of clean, hard, strong, dense, non-porous and durable pieces of crushed stone or crushed gravel and shall be devoid of pieces of disintegrated stone, soft, flaky, elongated, very angular or splintery pieces. The maximum size of the coarse segregate shall be 25 mm. The coarse aggregate shall comply with clause 600.2.2.4.2.

600.1.2.3.3. **Fine aggregate -** The fine aggregate shall consist of clean, natural sand or crushed stone sand or a combination of the two and shall conform to IS 383. Fine aggregate shall be free from soft particles, clay, shale, loam, cemented particles, mica, organic and other foreign matter. The fine aggregate shall comply with clause 600.2.2.4.3.

600.1.2.3.4. The coarse and fine aggregates may be obtained in either of the following manner:

(1) In separate nominal sizes of coarse and fine aggregates and mixed together intimately before use.

(2) Separately a 25 mm nominal single size, 12.5 mm nominal size graded aggregates and fine aggregate of crushed stone dust or sand or a combination of these two. The material after blending shall conform to the grading as indicated in Table 1.

Table 1 Aggregate gradation for dry lean concrete

Sieve designation	Percentage passing the sieve by weight
26.50 mm	100
19.00 mm	80-100
9.50 mm	55-75
4.75 mm	35-60

600.00 micron	10-35
75.00 micron	0-8

600.1.2.4. **Water -** Water used for mixing and curing of concrete shall be clean and free from injurious amounts of oil, salts, acid, vegetable matter or other substances harmful to the finished concrete. It shall meet the requirements stipulated in IS: 456. Copy enclosed as Annexure 600-A.6.

600.1.2.5. **Storage of materials -** All materials shall be stored in accordance with the provisions of clause 1014 of these specifications and other relevant IS specifications. All efforts must be made to store the materials in proper places so as to prevent their deterioration or contamination by foreign matter and to ensure their satisfactory quality and fitness for use in the work. The storage place must also permit easy inspection, removal and storage of materials. All such materials even though stored in approved godowns must be subjected to acceptance test immediately prior to their use. The requirement of storage yard specified in clause 600.2.2.9. shall also be applicable.

600.1.3. **Proportioning of materials for the mix**

600.1.3.1. The mix shall be proportioned with a maximum aggregate cement ratio of 15:1. The water content shall be adjusted to the optimum as per clause 600.1.3.2. for facilitating compaction by rolling. The strength and density requirements of concrete shall be determined in accordance with clause 600.1.6 by making trial mixes.

600.1.3.2. **Moisture content -** The right amount of water for the lean concrete in the main work shall be decided so as to ensure full compaction under rolling and shall be assessed at the time of rolling the trial strength. Too much water will cause the lean concrete to be heaving up before the wheels and picked up on the wheels of the roller and too little will lead to inadequate compaction, a low in-situ and an open-textured surface. The optimum water content shall be determined and demonstrated by rolling during trial length construction and the optimum moisture content and degree of compaction shall be got approved from the engineer. While laying in the main work, the lean concrete shall have a moisture content between the optimum and optimum + 2 per cent, keeping in view the effectiveness of compaction achieved and to compensate for evaporation losses.

600.1.3.3. **Cement content -** The minimum cement content in the lean concrete shall not be less than 150 kg/cu. m. of concrete. If this minimum cement content is not sufficient to produce concrete of the specified strength, it shall be increased as necessary without additional cost compensation to the contractor.

600.1.3.4. **Concrete strength -** The average compressive strength of each consecutive group of 5 cubes made in accordance with clause 900.3.5.1.1 shall not be less than 10 MP a at 7 days. In addition, the minimum compressive strength of any individual cube shall not be less than 7.5 Mpa at 7 days. The design mix complying with the above clauses shall be go approved from the engineer and demonstrated in the trial length construction.

600.1.4. **Sub grade -** The sub-grade shall conform to the grades and cross sections shown on the drawings and shall be uniformly compacted to the design strength in accordance with these specifications and Specification stipulated in the contract. The lean concrete sub base shall not be laid on a sub-grade softened by rain after its final preparation ; surface trenches and soft spots, if any, must be properly back-filled and compacted to avoid any weak or soft spot. As far as possible, the construction traffic shall be avoided on the prepared sub-grade. A day before placing of the sub-base, the sub grade surface shall be given a fine spray of water and rolled with one or two passes of a smooth wheeled roller after a lapse of 2-3 hours in order to stabilise loose surface. If engineer feels it necessary, another fine spray of water may be applied just before placing sub-base.

600.1.5. **Construction**

600.1.5.1. **General -** The pace and programme of the lean concrete sub-base construction shall be matching suitably with the programme of construction of the cement concrete pavement only after 7 days after sub-base construction.

600.1.5.2. **Batching and mixing -** The batching plant shall be capable of proportioning the materials

by weight, each type of material being weighed separately in accordance with clause 600.2.9.3.2 The cement from the bulk stock shall be weighed separately from the aggregates. The capacity of batching and mixing plant shall be at least 25 per cent higher than the proposed capacity for the laying arrangements. The batching and mixing shall be carried out preferably in a forced action central batching and mixing plant having necessary automatic controls to ensure accurate proportioning and mixing. Other types of mixers shall be permitted subject to demonstration of their satisfactory performance during the trial length. The type and capacity of the plant shall be got approved by the engineer before commencement of the trial length. The weighing balances shall be calibrated by weighing the aggregates, cement, water and admixtures physically either by weighing with large weighing machine or in a weigh bridge. The accuracy of weighing scales of the batching plant shall be within ± 2 per cent in the case of aggregates and ± per cent in the case of cement and water.

The design features of batching plant should be such that the shifting operations of the plant will not take very long time when they are to be shifted from place to place with the progress of the work.

600.1.5.3. Transporting **-** Plant mix lean concrete shall be discharged immediately from the mixer, transported directly to the point where it is to be laid and protected from the weather by covering the tippers / dumpers with tarpaulin during transit. The concrete shall be transported by tipping trucks, sufficient in number to ensure a continuous supply of material to feed the laying equipment to work at a uniform speed and in an uninterrupted manner. The lead of the batching plant to paving as specified in clause 600.1.5.2. will be adhered to.

600.1.5.4. **Placing -** Lean concrete shall be laid / placed by a paver with electronic sensor. The equipment shall be capable of laying the material in one layer in an even manner without segregation, so that after compaction the total thickness is as specified. The paving machine shall have high amplitude tamping bars to give good initial compaction to the sub-base.

The laying of the two-lane road sub base may be done either in full width or lane by lane. Preferably the lean concrete shall be placed and compacted across the full width of the road, by constructing it in one go or in two lanes running forward simultaneously. Transverse and longitudinal construction joints shall be staggered by 500-1000 mm and 200 – 400 mm respectively from the corresponding joints in the overlaying concrete slabs.

600.1.5.5**. Compaction -** The compaction shall be carried out immediately after the material is laid and levelled. In order to ensure thorough compaction which is essential, rolling shall d dPÀbe continued on the full width till there is no further visible movement under the roller and the surface is closed. The minimum dry density obtained shall be 97 per cent of that achieved during the trial length construction vide clause 600.1.7. The densities achieved at the edges i.e. 0.5 m from the edge shall not be less than 95 per cent of that achieved during the trial construction vide clause 600.1.7. The spreading, comprising and finishing of the lean concrete shall be carried out as rapidly as possible and the operation shall be so arranged as to ensure that the time between the mixing of the first batch of concrete in any transverse section of the layer and the final finishing of the same shall not exceed 90 minutes when the concrete temperature is above 25 degree celsius. This period may be reviewed by the engineer in the light of the results of the trial run but in no case shall it exceed 2 hours. Work shall not proceed when the temperature of the concrete exceeds 30 degree celsius. If necessary, chilled water or addition of ice may be resorted to for bringing down the temperature. It is desirable to stop concreting when the ambient temperature is above 35 degree celsius. After compaction has been completed, roller shall not stand on the compacted surface for the duration of the curing period except during commencement of next day's work near the location where the work was terminated the previous day.

Double drum smooth-wheeled vibratory rollers of minimum 80 to 100 kN static weight are considered to be suitable for rolling dry lean concrete. In case of any other roller is proposed, the same shall be got approved from the engineer, after demonstrating its performance. The number of passes required

to obtain maximum compaction depends on the thickness of the lean concrete, the compatibility of the mix, and the weight and type of the roller etc. And the same as well as the total requirement of rollers for the job shall be determined during trial run by measuring the in-situ density and the scale of the work to be undertaken. In addition to the number of passes required for compaction there shall be a preliminary pass without vibration to bed the lean concrete down and again a final pass without vibration to remove roller marks and to smoothen the surface.

Special care and attention shall be exercised during compaction near joints, kerbs, channels, side forms and around gullies and manholes. In case adequate compaction is not achieved by the roller at these points, use of plate vibrator shall be made, if so directed by the engineer.

The final lean concrete surface on completion of compaction and immediately before overlaying shall be well closed, free from movement under roller and free from ridges, low spots, cracks, loose material, pot holes, ruts or other defects. The final surface shall be inspected immediately on completion of all loose, segregated or defective areas shall be corrected by using fresh lean concrete material laid and compacted as per Specification. For repairing honeycombed surface, concrete with aggregates of size 10 mm and below shall be spread and compacted. It is necessary to check the level of the rolled surface for compliance. Any level/thickness deficiency should be corrected after applying

Concrete with aggregates of size 10 mm and below after roughening the surface. Similarly the surface regularity also should be checked with 3 m straight edge. The deficiency should be made up with concrete with aggregates of size 10 mm and below.

Segregation of concrete in the dumpers shall be controlled by premixing each fraction of the aggregates before loading in the bin of the batching plant, by moving the dumper back and forth while discharging the mix on it and other means. Even paving operation shall be such that the mix does not aggregate.

600.1.5.6. **Joints -** Construction and longitudinal joints shall be provided as per the drawing.

At longitudinal or transverse construction joints, unless vertical forms are used, the edge of compacted material shall be cut back to a vertical face where the correct thickness of the properly compacted material has been obtained.

600.1.5.7. Curing - As soon as the lean concrete surface is compacted, curing shall commence. One of the following two methods shall be adopted

(a) The initial curing shall be done by spraying with liquid curing compound. The curing compound shall be white pigmented or transparent type with water retention index of 90 per cent when tested in accordance with BS 7542. Curing compound shall be sprayed immediately after rolling is complete. As soon as the curing compound has lost its tackiness, the surface shall be covered with wet hessian for three days. (b) Curing shall be done by covering the surface by gunny bags/hessian, which shall be kept continuously moist for 7 days by sprinkling water.

600.1.6. Trial mixes - The contractor shall make trial of dry lean concrete with moisture contents like 5.0, 5.5, 6.0, 6.5 and 7.0 per cent using cement content specified aggregate grading but without violating the requirement of aggregate-cement ratio specified in clause 600.1.3.1. Optimum moisture and density shall be established by preparing cubes with varying moisture contents. Compaction of the mix shall be done in three layers with vibratory hammer fitted with a square or rectangular foot as described in clause 903.5.1.1. After establishing the optimum moisture, a set of six cubes shall be cast at that moisture for the determination of compressive strength on the 3rd and the seventh day. Trial mixes shall be repeated if the strength is not satisfactory either by increasing cement content or using higher grade of cement. After the mix design is approved, the contractor shall construct a trial section in accordance with clause 600.1.7.

If during the construction of the trial length, the optimum moisture cement determined as above is found to be unsatisfactory, the contractor may make suitable changes in the moisture content to

achieve a satisfactory mix. The cube specimens prepared with the changed moisture content should satisfy the strength requirement. Before production of the mix, natural moisture content of the aggregate should be determined on a day-to-day basis so that the moisture content could be adjusted. The mix finally designed should neither stick to the rollers nor become too dry resulting in ravelling of surface.

600.1.7. Trial length

The trial length shall be constructed at least 14 days in advance of the proposed date of commencement of work. At least 30 days prior to the construction of the trial length, the contractor shall submit for the engineer's approval a "Method Statement" giving detailed description of the proposed materials, plant, equipment, mix proportion, and procedure for batching, mixing, laying, compaction and other construction procedures. The engineer shall also approve the location and length of trial construction which shall be a minimum of 60 m length and for full width of the pavement. The trial length shall contain the construction of at least one transverse construction joint involving hardened concrete and freshly laid sub-base. The construction of trial length will be repeated till the contractor proves his ability to satisfactorily construct the sub base. In order to determine and demonstrate the optimum moisture content which results in the maximum dry density of the mix compacted by the rolling equipment and the minimum cement content that is necessary, to achieve the strength stipulated in the drawing, trial mixes shall be prepared as per clause 600.1.6.

After the construction of the trial length, the in-situ density of the freshly laid material shall be determined by sand replacement method with 20 cm dia density cone. Three density holes shall be made at locations equally spaced along a diagonal the bisects the trial length; average of these densities shall be determined. These main density holes shall not be made in the strip 50 cm from the edges. The average density obtained from the three samples collected shall be the reference density and is considered as 100 per cent. The field density of regular work will be compacted with this reference density in accordance with clauses 600.1.5.5 and 900.3.5.1. A few cores may be cut as per the instructions of the engineer to check segregation or any other deficiency.

The hardened concrete shall be cut over 3 m width and reversed to inspect the bottom surface for any segregation taking place. The trial length shall be constructed after making necessary changes in the gradation of the mix to eliminate segregation of the mix. The lower surface shall not have honey-combing and the aggregates shall not be held loosely at the edges.

The trial length shall be outside the main works. The main work shall not start until the trial length has been approved by the engineer. After approval has been given, the materials, mix proportions, moisture content, mixing, laying, compaction plant and construction procedures shall not be changed without the approval of the engineer.

600.1.8. **Tolerances for surface regularity, level, thickness, density and strength -**The tolerances for surface regularity, level, thickness density and strength shall conform to the requirements given in clause 900.3.5. Control of quality of materials and works shall be exercised by the engineer in accordance with Section 900.

600.1.9. **Traffic -** No heavy commercial vehicles like trucks and buses shall be permitted on the lean concrete sub-base after its construction. Light vehicles if unavoidable may, however, be allowed after 7 days of its construction with prior approval of the engineer.

600.1.10. **Measurements for payment -**The unit of measurement for dry lean concrete pavement shall be the cubic metre of concrete placed, based on the net plan areas for the specified thickness shown on the drawings or as directed by the engineer.

600.1.11. **Rate -** The contract unit rate payable for dry lean concrete sub-base shall be payment in full for carrying out the required operations including full compensation for all labour, materials and equipment, mixing, transport, placing, compacting, finishing, curing, testing and incidentals to complete the work as per specifications, all royalties, fees, storage and rents where necessary and all

4. SPECIFICATIONS FOR CEMENT CONCRETE PAVEMENT

600.2.1. Scope -The work shall consist of construction reinforced, dowel jointed, plain cement concrete pavement in accordance with the requirements of these specifications and in conformity with the lines, grades and cross sections shown on the drawings. The work shall include furnishing of all plant and equipment, materials and labour and performing all operations in connection with the work, as approved by the engineer.

The design parameters, viz., thickness of pavement slab, grade of concrete, joint details etc. shall be as stipulated in the drawings.

600.2.2. Materials

600.2.2.1. Source of materials - The contractor shall indicate to the engineer the source of all materials to be used in the concrete work with relevant test data sufficiently in advance, and the approval of the engineer for the same shall be obtained at least 45 days before the scheduled commencement of the work. If the contractor later proposes to obtain materials from a different source, he shall notify the engineer for his approval, at least 45 days before such materials are to be used with relevant test data.

600.2.2.2. Cement - Any of the following types of cement capable of achieving the design strength may be used with prior approval of the engineer, but the preference should be to use at least the 43 Grade or higher.

Ordinary Portland Cement, 33 Grade, IS 269 (Annexure 400-A.1)

Ordinary Portland Cement, 43 Grade IS 8112 (Annexure 600-A.7)

Ordinary Portland Cement, 53 Grade, IS 12269 (Annexure 600-A.8)

If the soil around has soluble salts like sulphates in excess to 0.5 per cent, the cement used shall be sulphate resistant and shall conform to IS: 12330(1988). Copy enclosed as Annexure 600-A.9.

Guidance may be taken from IS : 23, "Handbook for Concrete Mixes" for ascertaining the minimum 7 days strength of cement required to match with the design concrete strength. Cement to be used may preferably be obtained in bulk form. If cement in paper bags are proposed to be used, there shall be bag-splitters with the facility to separate pieces of paper bags and dispose them of suitably. No paper pieces shall enter the concrete mix. Bulk cement shall be stored in accordance with clause 1000.14. The cement shall be subjected to acceptance test just prior to its use.

600.2.2.3. **Admixtures -** Admixtures conforming to IS 6925 and IS 9103 copies enclosed an Annexure 600-A.10 & 600-A.11 shall be permitted to improve workability of the concrete or extension of setting time, on satisfactory evidence that they will not have any adverse effect on the properties of concrete with respect to strength, volume change, durability and have no deleterious effect on steel bars. The particulars of the admixture and the quantity to be used, must be furnished to the engineer in advance to obtain his approval to be used, must be furnished to the engineer in advance to obtain his approval before use. Satisfactory performance of the admixtures should be proved both on the laboratory concrete trial mixes and in trial paving works. If air entraining admixture is used, the total quantity of air in air-entrained concrete as a percentage of the volume of the mix shall be 5 ± 1.5 per cent for 25 mm nominal size aggregate.

600.2.2.4. **Aggregates**

600.2.2.4.1. Aggregates for pavement concrete shall be natural material complying with IS: 383 but with a Los Angeles Abrasion Test result not more than 35 per cent. The limits of deleterious materials shall not exceed the requirements set out in IS: 383.

The aggregates shall be free from chert, flint, chalcedony or other silica in a form that can react with the alkalies in the cement. In addition, the total chlorides content expressed as chloride ion content shall not exceed 0.06 per cent by weight and the total sulphate content expressed as sulphuric anhydride (SO3) shall not exceed 0.25 per cent by weight.

600.2.2.4.2. **Coarse aggregate -** Coarse aggregate shall consist of clean, hard, strong, dense, non-porous and durable pieces of crushed stone or cruashed gravel and shall be devoid of pieces of

disintegrated stone, soft, flaky, elongated, very angular or splintery pieces. The maximum size of coarse aggregate shall not exceed 25 mm for pavement concrete. Continuously graded or gap aggregates may be used, depending on the grading more than 2 per cent shall be used in the concrete mix. The aggregates shall be tested for soundness in accordance with IS: 2386 (Part 5). After 5 cycles of testing the loss shall not be more than 12 per cent if sodium sulphate solution is used or 18 per cent if magnesium sulphate solution is used.

Dumping and stacking of aggregates shall be done in an approved manner. In case the engineer considers that the aggregates are not free from drift, the same may be washed and drained for at least 72 hours before batching as directed by the engineer.

600.2.2.4.3. **Fine aggregate -** The fine aggregate shall consist of clean natural sand or crushed stone sand or a combination of the two and shall conform to IS: 383. Fine aggregate shall be free from soft particles, clay, shale, loam, cemented particles, mica and organic and other foreign matter. The fine aggregate shall not contain deleterious substances more than the following

Clay lumps	4.0 per cent
Coal and lignite	1.0 per cent
Material passing IS Sieve No. 75 micron	4.0 per cent

600.2.2.5. **Water -** Water used for mixing and curing of concrete shall be clean and free from injurious amount of oil, salt, acid, vegetable matter or other substances harmful to the furnished concrete. It shall meet the requirements stipulated in IS: 456 Annexure 600-A.6.

600.2.2.6. **Mild steel bars for dowels and tie bars -** These shall conform to the requirements to IS: 432, IS: 1139 and IS: 1786. The dowel bars shall conform to Grade S 240 and tie bars to Grade S 415 of I.S.

600.2.2.7. **Premoulded joint filler -** Joint filler board for expansion joints which are proposed for use only at some abutting structures like bridges and culverts shall be of 20-25 mm thickness within a tolerance of ± 1.5 mm and of a firm compressible material and complying with the requirements of IS: 1838 or BS Specification clause 2630 or Specification for Highway Works, Vol. I clause 1015. It shall be 25 mm less in depth than the thickness of the slab within a tolerance of ± 3 mm and provided to the full width between the side forms. It shall be in suitable lengths which shall not be less than one lane width. Holes to accommodate dowel bars shall be accurately bored or punched out to give a sliding fit on the dowel bars.

600.2.2.8. **Joint sealing compound -** The joint sealing compound shall be of hot poured, elastomeric type or cold polysulphide type having flexibility, resistance to age hardening and durability. If the sealant is of hot poured type it shall conform to AASHTO M282 and cold applied sealant shall be in accordance with BS 5212 (Part 2).

600.2.2.9. **Storage of materials -** All materials shall be stored in accordance with the provisions of clause 1000.14 of the specifications and other relevant IS specifications. All efforts must be to store the materials in proper places so as to prevent their deterioration or contamination by foreign matter and to ensure their satisfactory quality and fitness for the work. The platform where aggregates are stock piled shall be levelled with 15 cm of watered, mixed and compacted granular sub-base material. The area shall have slope and drain to drain off rain water. The storage space must also permit easy inspection, removal and storage of the materials. Aggregates of different sizes shall be stored in partitioned stack-yards. All such materials even though stored in approved godowns must be subjected to acceptance test as per clause 900.3 of these specifications immediately prior to their use.

600.2.3. **Proportioning of concrete**

600.2.3.1. After approval by the engineer of all the materials to be used in the concrete, the contractor shall submit the mix design based on weighed proportions of all ingredients for the approval of the engineer. The mix design shall be submitted at least 30 days prior to the paving the trial length and the design shall be based on laboratory trial mixes using the approved materials and methods as per

IS: 10262, copy enclosed as Annexure 600-A-12, or on the basis of any other rational method agreed to by the engineer. Guidance in this regard can also be obtained from IS: SP 23 Handbook on Concrete Mixes. The target mean strength for the design mix shall be determined as indicated in clause 900.3.5.2. The mix design shall be based on the flexural strength of concrete.

600.2.3.2. **Cement content -** The cement content shall not be less than 350 kg per cu. m. of concrete. If this minimum cement content is not sufficient to produce in the field, concrete of the strength specified in the drawings / design, it shall be increased as necessary without additional compensation under the contract. The cement content shall, however, not exceed 425 kg per cu. m. of concrete.

600.2.3.3. **Concrete strength** - While designing the mix in the laboratory, correlation between flexural and compressive strengths of concrete shall be established on the basis of at least thirty tests on samples. However, quality control in the field shall be exercised on the basis of flexural strength. It may, however, be ensured that the materials and mix proportions remain substantially unaltered during the daily concrete production. The water content shall be the minimum required to provide the agreed workability for full compaction of the concrete to the required density as determined by the trial mixes or other means approved by the engineer and the maximum free water cement ratio shall be 0.50. The ratio between the 7 and 28 day strengths shall be established for the mix to be used in the slab in advance, by testing pairs of beams and cubes at each stage on at least six batches of trial mix. The average strength of the 7 day cured specimens shall be divided by the average strength of the 28 day specimens for each batch, and the ratio "R" shall be determined. The ratio 'R' shall be expressed to three decimal places.

If during the construction of the trial length or during normal working, the average value of any four consecutive 7 day test results falls below the required 7 day strength as derived from the value of 'R', then the cement content of the concrete shall, without extra payment, be increased by 5 per cent by weight or by an amount agreed by the engineer. The increased cement content shall be maintained at least until for four corresponding 28 day strengths have been assessed for its conformity with the requirements as per clause 602.3.1. Whenever the cement content is increased, the concrete mix shall be adjusted to maintain the required workability.

600.2.3.4**. Workability -** The workability of the concrete at the point of placing shall be adequate for the concrete to be fully compacted and finished without undue flow. The optimum workability for the mix to suit the paving plant being used shall be determined by the contractor and approved by the engineer. The control of workability in the field shall be exercised by the slump test as per IS: 1199, copy enclosed as Annexure 600-A.13.

The workability requirement at the Batching Plant and paving site shall be established by slump tests during trial paving. These requirements shall be established from season to season and also when the lead from Batching plant site to the paving site changes. The workability shall be established for the type to paving equipment available. A slump value in the range of 30 ± 15 mm is reasonable for paving works but this may be modified depending upon the site requirement and got approved by the engineer. These tests shall be carried out on every truck/dumper at Plant site and paving site initially when the work commences but subsequently the frequency can be reduced to alternate trucks or as per the instructions of the engineer.

600.2.3.5. **Design mix -** The contractor shall carry out laboratory trials of design mixes with the materials from the approved sources to be used. Trial mixes shall be made in presence of the engineer or his representative and the design mix shall be subject to the approval of the engineer. They shall be repeated if necessary until the proportions that will produce a concrete which complies in all respects with this specifications, and conforms to the requirement of the design / drawings have been determined.

The proportions determined as a result of the laboratory trial mixes may be adjusted if necessary during the construction of the trial length. Thereafter, neither the materials nor the mix proportions

shall be varied in any way except with the written approval of the engineer.

Any change in the source of materials or mix proportions proposed by the contractor during the course of work shall be assessed by making laboratory trial mixes and the construction of a further trial length unless approval is given by the engineer for minor adjustments like compensation for moisture content in aggregates or minor fluctuations in the grading of aggregate.

600.2.4. **Sub-base -** The cement concrete pavement shall be laid over the sub-base constructed in accordance with the relevant drawings and specifications contained in clause 600.1. If the sub-base is found damaged at some places or it has cracks wider than 10 mm, it shall be repaired with fine cement concrete or bituminous concrete before laying separation layer. Prior to laying of concrete it shall be ensured that the separation membrane as per clause 600.2.5 is placed in position and the same is clean of dirt or other extraneous materials and free from any damage.

600.2.5. **Separation membrane -** A separation membrane shall be used between the concrete slab and the sub-base. Separation membrane shall be impermeable plastic sheeting 125 micron thick laid flat without creases. Before placing the separation membrane, the sub-base shall be swept clean of all the extraneous materials using air compressor. Wherever overlap of plastic sheets is necessary, the same shall be at least 300 mm and any damaged sheeting shall be replaced at the contractor's expense. The separation membrane may be nailed to the lower layer with concrete nails.

600.2.6. **Joints -** The location and type of joints shall be as shown in the drawing. Joints shall be constructed depending upon their functional requirement as detailed in the following paragraphs. The location of the joints should be transferred accurately at the site and mechanical saw cutting of joints done as per stipulated dimensions. It should be ensured that the full required depth of cut is made from edge to edge of the pavement. Transverse and longitudinal joints in the pavement and sub-base shall be staggered so that they are not coincident vertically and are at least 1 m and 0.3 m apart respectively. Sawing of joints shall be carried out with diamond studded blades soon after the concrete has hardened to take the load of the sawing machine and personnel without damaging the texture of the pavement. Sawing operation could start as early as 6-8 hours of depending upon the season.

Transverse joints - Transverse joints shall be contraction and expansion joints constructed at the spacing described in the Drawings. Transverse joints shall be straight within the following tolerances along the intended line of joints which is the straight line transverse to the longitudinal axis of the carriageway at the position proposed by the contractor and agreed to by the engineer, except at road junctions or roundabouts where the position shall be as described in the drawings

(1)Deviations of the filler board in the case of expansion joints from the intended line of the joint shall not be greater than ± 10 mm. (2) The best fit straight line through the joint grooves as constructed shall be not more than 25 mm from the intended line of the joint. (3) Deviations of the joint groove from the best fit straight line of joint shall not be greater than 10 mm. (4) Transverse joints on each side of the longitudinal joint shall be in line with each other and of the same type and width. Transverse joints shall have a sealing groove which shall be sealed in compliance with clause 600.2.11.

Contraction joints - Contraction joints shall consist of a mechanical sawn joint groove, 3 to 5 mm wide and ¼ to 1/3 depth of the slab ± 5 mm or as stipulated in the drawings and dowel bars complying with clause 600.2.6.5. and as detailed in the drawings. The contraction joints shall be cut as soon as the concrete has undergone initial hardening and is hard enough to take the load of joint sawing machine without causing damage to the slab.

Expansion joints - The expansion joints shall consist of a joint filler board complying with clause 600.2.2.7. And dowel bars complying with clause 600.2.6.5. and as detailed in the drawings. The filler board shall be positioned vertically with the prefabricated joint assemblies along the line of the joint within the tolerances given in clause 600.2.6.2.1. and at such depth below the surface as will not impede the passage of the finishing straight edges or oscillating beams of the paving machines. The

adjacent slabs shall be completely separated from each other by providing joint filler board. Space around the dowel bars, between the sub-base and the filler board shall be packed with a suitable compressible material to block the flow of cement slurry.

Transverse construction joint - Transverse construction joint shall be placed whenever concreting is completed after a day's work or is suspended for more than 30 minutes. These joints shall be provided at the regular location of contraction joints using dowel bars. The joint shall be made butt type. At all construction joints, steel bulk heads shall be used to retain the concrete while the surface is finished. The surface of the concrete laid subsequently shall conform to the grade and cross sections of the previously laid pavement. When positioning of bulk hard / stop-end is not possible, concreting to an additional 1 or 2 m length may be carried out enable the movement of joint cutting machine so that joint grooves may be formed and the extra 1 or 2 m length is cut out and removed subsequently after concrete has hardened.

Longitudinal joint - The longitudinal joints shall be saw cut as per details of the joints shown in the drawing. The groove may be cut after the final set of the concrete. Joints should be sawn to at least 1/3 the depth of the slab $\pm$ 5 mm as indicated in the drawing.

Tie bars shall be provided at the longitudinal joints as per dimensions and spacing shown in the drawing and in accordance with clause 600.2.6.6.

600.2.6.5. **Dowel bars -** Dowel bars shall be mild steel rounds in accordance with clause 600.2.2.6 with details/dimensions as indicated in the drawing and free from oil, dirt, loose rust or scale. They shall be straight, free of irregularities and burring restricting slippage in the concrete. The sliding ends shall be sawn or cropped cleanly with no protrusions outside the normal diameter of the bar. The dowel bar shall be supported on cradles/dowel chairs in pre-fabricated joint assemblies positioned prior to the construction of the slabs or mechanically inserted with vibration into the plastic concrete by a method which ensures correct placement of the bars besides full re-compaction of the concrete around the dowel bars. Unless shown otherwise on the drawings, dowel bars shall be positioned at mid depth of the slab within a tolerance of ± 20 mm, and centred equally about intended lines of the joint within a tolerance of ± 25 mm. They shall be aligned parallel to the finished surface of the slab and to the centre line of the carriageway and to each other within tolerances given hereunder, the compliance of which shall be checked as per clause 600.2.10.7.

(1) For bars supported on cradles prior to the laying of the slab ;

(a) All bars in a joint shall be within ± 3 mm per 300 mm length of bar, (b) 2/3 rd of the bars shall be within ± 2 mm per 300 mm length of bar (c) No bar shall differ in alignment from an adjoining bar by more than 3 mm per 300 mm length of bar in either the horizontal or vertical plane (d) Cradles supporting dowel bar shall not extend across the line of joint i.e. no steel bar of the cradle assembly shall be continuous across the joint.

(2) For all bars inserted after laying of the slab ;

(a) Twice the tolerance for alignment as indicated in (i) as above

Dowel bars, supported on cradles in assemblies, when subject to load of 110 N applied at either end in either the vertical or horizontal direction (upwards and downwards and both directions horizontally) shall conform to be within the following limits

(1) Two-thirds of the number of bars of any assembly tested shall not deflect more than 2 mm per 300 mm length of bar (2) The remainder of the bars in that assembly shall not deflect more than 3 mm per 300 mm length of bar.

The assembly of dowel bars and supporting cradles, including the joint filler board in the case of expansion joints, shall have the following degree of rigidity when fixed in position -

(1) For expansion joints, the deflection of the top edge of the filler board shall be not greater than 13 mm, when a load of 1.3 kN is applied perpendicular to the vertical face of the joint filler board and distributed over a length of 600 mm by means of a bar or timber packing, at mid depth and midway

between individual fixings, or 300 mm from either end of any length of filler board, if a continuous fixing is used. The residual deflection after removal of the load shall be not more than 3 mm.

(2) The joint assembly fixings to sub-base shall not fail under the 1.3 kN load applied for testing the rigidity of the assembly but shall fail before the load reaches 2.6 kN.

(3) The fixings for contraction joint shall not fail under 1.3 kN load and shall fail before the load reaches 2.6 kN when applied over a length of 600 mm by means of a bar or timber packing placed as near to the level of the line of fixings as practicable.

(4) Fixings shall be deemed to fail when there is displacement of the assemblies by more than 3 mm with any form of fixing, under the test load. The displacement shall be measured at the nearest part of the assembly to the centre of the bar or timber packing.

Dowel bars shall be covered by a thin plastic sheath for at least two-thirds of the length from one end for dowel bars in contraction joints or half the length plus 50 mm for expansion joints. The sheath shall be tough, durable and of an average thickness not greater than 1.25 mm. The sheathed bar shall comply with the following pull-out tests

(1) Four bars shall be taken at random from stock and without any special preparation shall be covered by sheaths as required in this clause. The ends of the dowel bars which have been sheathed shall be cast centrally into concrete specimens 150 x 150 x 600 mm, made of the same mix proportions to be used in the pavement, bar with a maximum nominal aggregate size of 20 mm and cured in accordance with IS: 516. At 7 days a tensile load shall be applied to achieve a movement of the bar of at least 0.25 mm. The average bend stress to achieve this movement shall not be greater than 0.14 Mpa.

600.2.6.5.6. For expansion joints, a closely fitting cap 100 mm long consisting of waterproofed cardboard or an approved synthetic material like PVC or GI pipe shall be placed over the sheathed end of each dowel bar. An explosion space at least equal in length to the thickness of the joint filler board shall be formed between the end of the cap and the end of the dowel bar by using compressible sponge. To block the entry of cement slurry between dowel and cap it may be taped.

600.2.6.6. **Tie bars -** Tie bars is longitudinal joints shall be deformed steel bars of strength 415 Mpa complying with IS: 1786 and in accordance with the requirements given below. The bars shall be free from oil, dirt, loose rust and scale.

Tie bars projecting across the longitudinal joint shall be protected from corrosion for 75 mm on each side of the joint by a protective coating of bituminous paint with the approval of the engineer. The coating shall be dry when the tie bars are used.

Tie bars in longitudinal joints shall be made up into rigid assemblies with adequate supports and fixings to remain firmly in position during the construction of the slab. Alternatively, tie bars at longitudinal joints may be mechanically or manually inserted into the plastic concrete from above by vibration using a method which ensures correct placement of the bars and recompaction of the concrete around the tie bars.

Tie bars shall be positioned to remain within the middle third of the slab depth as indicated in the drawings and approximately parallel to the surface and approximately perpendicular to the line of the joint, with the centre of each bar on the intended line of the joints below the joint groove.

600.2.7. **Weather and seasonal limitations**

600.2.7.1. **Concreting during monsoon months -** When concrete is being placed during monsoon months and when it may be expected to rain, sufficient supply of tarpaulin or other proof cloth shall be provided along the line of the work. Any time when it rains, all freshly laid concrete which had not been covered for curing purposes shall be adequately protected. Any concrete damaged by rain shall be removed and replaced. If the damage is limited to texture, it shall be retextured in accordance with the directives of the engineer.

600.2.7.2. **Concreting in hot weather -** No concreting shall be done when the concrete temperature

is above 30 degree Centigrade. Besides, in adverse conditions like high temperature, low relative humidity, excessive wind velocity, imminence of rains etc., if so desired by the engineer, tents on mobile trusses may be provided over the freshly laid concrete for a minimum period of three hours as directed by the engineer. The temperature of the concrete mix on reaching the paving site shall not be more than 30 degree Centigrade. To bring down the temperature, if necessary, chilled water or ice flakes should be made use of.

No concreting shall be done when the concrete temperature is below 5 degree centigrade and the temperature is descending.

600.2.8. **Side Forms, rails and guide wires**

600.2.8.1. **Side forms and rails -** All side forms shall be of mild steel of depth equal to the thickness of pavement or slightly less to accommodate the surface regularity of the sub-base. The forms can be placed on series of steel packing plates or shims to take care of irregularity of sub-base. They shall be sufficiently robust and rigid to support the weight and pressure caused by paving equipment. Side forms for use with wheeled paving machines shall incorporate metal rails firmly fixed at a constant height below the top of the forms. The forms and rails shall be firmly secured in position by not less than 3 stakes / pins per each 3 m length so as to prevent movement in any direction. Forms and rails shall be straight within a tolerance of 3 mm in 3 m and when in place shall not settle in excess of 1.5 mm in 3 mm while paving is being done. Forms shall be cleaned and oiled immediately before each use. The forms shall be bedded on a continuous bed of low moisture content lean cement mortar or concrete and set to the line and levels shown on the drawings within tolerances ± 10 mm and ± 3 mm respectively. The bedding shall not extend under the slab and there shall be no vertical step between adjacent forms of more than 3 mm. The forms shall be got inspected from the engineer for his approval before 12 hours on the day before the construction of the slab shall not be removed until at least 12 hours afterwards.

600.2.8.2. At all times sufficient forms shall be used and set to the required alignment for at least 200 m length of pavement immediately in advance of the paving operations, or the anticipated length of pavement to be laid within the next 24 hours whichever is more.

600.2.8.3. **Use of guide wires -** Where slip form paving is proposed, a guide wire shall be provided along both sides of the slab. Each guide wire shall be at a constant height above and parallel to the required edges of the slab as described in the contract/drawing within a vertical tolerance of ± 3 mm. Additionally, one of the wires shall be kept at a constant horizontal distance from the required edge of the pavement as indicated in the contract / drawing within a lateral tolerance of ± 10 mm.

The guide wires shall be supported on stakes not more than 8 m apart by connectors capable of fine horizontal and vertical adjustment. The guide wire shall be tensioned on the stakes so that a 500 gram weight shall produce a deflection of not more than 20 mm when suspended at the mid point between any pair of stakes. The ends of the guide wires shall be anchored to fixing point or winch and not on the stakes.

The stakes shall be positioned and the connectors maintained at their correct height and alignment from 12 hours on the day before concreting takes place until 12 hours after finishing of the concrete. The guide wire shall be erected and tensioned on the connectors at any section for at least 2 hours before concreting that section.

The contractor shall submit to the engineer for his approval of line and level, the stakes and connectors which are ready for use in the length of road to be constructed by 12 hours on the working day before the day of construction of slab. Any deficiencies noted by the engineer shall be rectified by the contractor who shall then re-apply for approval of the affected stakes. Work shall not proceed until the engineer has given his approval. It shall be ensured that the stakes and guide wires are not affected by the construction equipment when concreting is in progress.

600.2.9. **Construction**

600.2.9.1. **General -** A systems approach may be adopted for construction of the pavement, and the

Method Statement for carrying out the work, detailing all the activities including indication of time-cycle, equipment, personnel, etc., shall be got approved from the engineer before the commencement of the work. The above shall include the type, capacity and make of the batching and mixing plant besides the hauling arrangement and paving equipment. The capacity of paving equipment, batching plant as well as all the ancillary equipment shall be adequate for a paving rate of atleast 300 m in one day.

600.2.9.2. **Batching and mixing -** Batching and mixing of the concrete shall be done at a central batching and mixing plant with automatic controls, located at a suitable place which takes into account sufficient space for stockpiling of cement, aggregates and stationery water tanks. This shall be, however, situated at an approved distance, duly considering the properties of the mix and the transporting arrangements available with the contractor.

600.2.9.3. **Equipment for proportioning of materials and paving -** Proportioning of materials shall be done in the batching plant by weight, each type of material being weighed separately. The cement from the bulk stock may be weighed separately from the aggregates and water shall be measured by volume. Wherever properly graded aggregate of uniform quality cannot be maintained as envisaged in the mix design, the grading of aggregates shall be controlled by appropriate blending techniques. The capacity of batching and mixing plant shall be at least 25 per cent higher than the proposed capacity of the laying / paving equipment.

Batching plant and equipment

(1) **General** - The batching plant shall be include minimum four bins, weighing hoppers, and scales for the fine aggregate and for each size of coarse aggregate. If cement is used in bulk, a separate scale for cement shall be included. The weighing hoppers shall be properly sealed and vented to preclude dust during operation. Approved safety devices shall be provided and maintained for the protection of all personnel engaged in plant operation, inspection and testing. The batch plant shall be equipped with a suitable non-reset table batch counter which will correctly indicate the number of batches proportioned.

2) **Bins and hoppers** - Bins with minimum number of four adequate separate compartments shall be provided in the batching plant.

3) **Automatic weighing devices** – Batching plant shall be equipped to proportion aggregates and bulk cement by means of automatic weighing devices using load cells.

4) **Mixers** – Mixers shall be pan type, reversible type of any other mixer capable of combining the aggregates, cement, and water into a thoroughly mixed and uniform mass within the specific mixing period, and of discharging the mixture, without segregation. Each stationery mixer shall be equipped with an approved timing device which will automatically lock the discharge lever when the drum has been charged and release it at the end of the mixing period. The device shall be equipped with a bell or other suitable warning device adjusted to give a clearly audible signal each time the lock is released. In case of failure of the timing device, the mixer may be used for the balance of the day while it is being repaired, provided that each batch is mixed 90 seconds or as per the manufacturer's recommendation. The mixer shall be equipped with a suitable non-reset table batch counter which shall correctly indicate the number of batches mixed.

The mixers shall be cleaned at suitable intervals. The pick up and throw-over blades in the drum or drums shall be repaired or replaced when they are worn down 20 mm or more. The contractor shall (1) have available at the job site a copy of the manufacturer's design, showing dimensions and arrangements of blades in reference to original height and depth, or (2) provide permanent marks on blade to show points of 20 mm wear from new conditions. Drilled holes of 5 mm diameter near each end and at midpoint of each blade are recommended. Batching plant shall be calibrated in the beginning and thereafter at suitable interval not exceeding 1 month.

(5) **Control cabin** – An air-conditioned centralised control cabin shall be provided for automatic operation of the equipment.

Paving equipment - The concrete shall be placed with an approved fixed form or slip from paver with independent units designed to (1) spread, (ii) consolidate, screed and float-finish, (iii) texture and cure the freshly placed concrete in one complete pass of the machine in such a manner that a maximum of hand finishing will be necessary and so as to provide a dense and homogeneous pavement in conformity with the plans and specifications. The paver shall be equipped with electronic controls to control / sensor line and grade from either or both sides of the machine.

Vibrators shall operate at a frequency of 8300 to 9600 impulses per minute under load at a maximum spacing of 60 cm. The variable vibration setting shall be provided in the machine.

Concrete saw - The contractor shall provide adequate number of concrete saws with sufficient number of diamond – edge saw blades. The saw machine shall be either electric or petrol/diesel driven type. A water tank with flexible hoses and pump shall be made available in this activity saw in good working condition. The concreting work shall not commence if the saws are not in working condition.

600.2.9.4. **Hauling and placing of concrete**

Freshly mixed concrete from the central batching and mixing plant shall be transported to the paver site by means of trucks/tippers of sufficient capacity and approved design in sufficient numbers to ensure a constant supply of concrete. Covers shall be used for protection of concrete against the weather. The trucks/tippers shall be capable of maintaining the mixed concrete in a homogeneous state and discharging the same without segregation and loss of cement slurry. The feeding to the paver is to be regulated in such a way that the paving is done in an uninterrupted manner with a uniform speed throughout the days work.

Placing of concrete - Concrete mixed in central mixing plant shall be transported to the site without delay and the concrete which, in the opinion of the engineer, has been mixed too long before laying will be rejected and shall be removed from the site. The total time taken from the addition of the water to the mix, until the completion of the surface finishing and texturing shall not exceed 120 minutes when concrete temperature is less than 25 degree centigrade and 90 minutes when the concrete temperature is between 25 degree centigrade to 30 degree centigrade. Trucks/tippers delivering concrete shall not run on plastic sheeting nor shall they run on completed slabs until after 28 days of placing the concrete. The paver shall be capable of paving the carriageway as shown in the drawings, in a single pass and lift.

Where fixed form pavers are to be used, forms shall be fixed in advance as per clause 600.2.8. of the specifications. Before any paving is done, the site shall be shown to the engineer, in order to verify the arrangement for paving besides placing of dowels, tie-bars etc., as per the relevant clauses of this Specification. The mixing and placing of concrete shall progress only at such a rate as to permit proper finishing, protecting and curing of the pavement.

In all cases, the temperature of the concrete shall be measured at the point of discharge from the delivery vehicle.

The addition of water to the surface of the concrete to facilitate the finishing operations will not be permitted except with the approval of the engineer when it shall be applied as a mist by means of approved equipment.

If considered necessary by the engineer, the paving machines shall be provided with approved covers to protect the surface of the slab under construction from direct sunlight and rain or hot wind.

While the concrete is still plastic, its surface shall be brush textured in compliance with clause 600.2.9.8. and the surface and edges of the slab cured by the application of a sprayed liquid curing membrane in compliance with clause 600.2.9.9. After the surface texturing, but before the curing compound is applied, the concrete slab shall be marked with the chainage at every 100 m interval.

600.2.9.4.8. As soon as the side forms are removed, edges of the slabs shall be corrected wherever irregularities have occurred by using fine concrete composed of one part of cement to 3 parts of fine chips and fine aggregate under the supervision of the engineer.

If the requirement of clause 900.2.4. for surface regularity fails to be achieved on two consecutive working days, then normal working shall cease until the cause of the excessive irregularity has been identified and remedied.

600.2.9.5. **Construction by fixed form paver**

The fixed form paving train shall consist of separate powered machines which spread, compact and finish the concrete in a continuous operation.

The concrete shall be discharged without segregation into a hopper spreader which is equipped with means for controlling its rate of deposition on to the sub-base. The spreader shall be operated to strike off concrete upto a level requiring a small amount of cutting down by the distributor of the spreader. The distributor or spreader shall strike off the concrete to the surcharge adequate to ensure that the vibratory compactor thoroughly compacts the layer. If necessary, poker vibrators shall be used adjacent to the side forms and edges of the previously constructed slabs. The vibratory compactor shall be set to strike off the surface slightly high so that it is cut down to the required level by the oscillating beam. The machine shall be capable of being rapidly adjusted for changes in average and differential surcharge necessitated by change in slab thickness or crossfall.

600.2.9.6. **Construction by slip form paver**

The slip form paving train shall consist of power machine which spreads compacts and finishes the concrete in a continuous operation. The slip form paving machine shall compact the concrete by internal vibration and shape it between the sides forms with either a conforming plate or by vibrating and oscillating finishing beams. The concrete shall be deposited without segregation in front of slip form paver across the whole width and to a height which at all times is in excess of the required surcharge. The deposited concrete shall be struck off to the necessary average and differential surcharge by means of the strike off plate or a screw auger device extending across the whole width of the slab. The equipment for striking off-the concrete shall be capable of being rapidly adjusted for changes of the average and differential surcharge necessitated by change in slab thickness or crossfall.

The level of the conforming plate and finishing beams shall be controlled automatically from the guide wires installed as per clause 600.2.8 by sensors attached at the four corners of the slip form paving machine. The alignment of the paver shall be controlled automatically from the guide wire by at least one set of sensors attached to the paver. The alignment and level of ancillary machines for finishing, texturing and curing of the concrete shall be automatically controlled relative to the guide wire or to the surface and edge of the slab.

Slip-form paving machines shall have vibrators of variable output, with a maximum energy output of not less than 2.5 KW per metre width of slab per 300 mm depth of slab for a laying speed upto 1.5 m per minute or pro-rata for higher speeds. The machines shall be of sufficient mass to provide adequate reaction during spreading and paving operations on the traction units to maintain forward movements during the placing of concrete in all situations.

If the edges of the slip formed slab slump to the extent that the surface of the top edge of the slab does not comply with the requirements of clause 600.2.14, then special measures approved by the engineer shall be taken to support the edges to the required levels and work shall be stopped until such time as the contractor can demonstrate his ability to slip form the edges to the required levels.

600.2.9.7. **Construction by hand-guided method -** Areas in which hand-guided methods of construction become indispensable shall be got approved by the engineer in writing in advance. Such work may be permitted only in restricted areas in small lengths. Work shall be carried out by skilled personnel as per methods approved by the engineer. The acceptance criteria regarding level, thickness, surface regularity, texture, finish, strength of concrete and all other quality control measures shall be same as in the case of machine laid work.

600.2.9.8. **Surface texture -** After the final regulation of the slab and before the application of the curing membrane, the surface of concrete slab shall be brush-textured in a direction at right angles to

the longitudinal axis of the carriageway.

The brushed surface texture shall be applied evenly across the slab in one direction by the use of a wire brush not less than 450 mm wide but longer brushes are preferred. The brush shall be made of 32 gauge tape wires grouped together in tufts spaced at 10 mm centres. The tufts shall contain an average of 14 wires and initially be 100 mm long. The brush shall have two rows of tufts. The rows shall be 20 mm apart and the tufts in the other row. The brush shall be replaced when the shortest tuft wears down to 90 mm long.

The texture depth shall be determined by the Sand Patch Test as described in clause 600.2.12. This test shall be performed at least once for each day's paving and wherever the engineer considers it necessary at times after construction as under

Five individual measurements of the texture depth shall be taken at least 2 m apart anywhere along a diagonal line across a lane width between points 50 m apart along the pavement. No measurement shall be taken within 300 mm of the longitudinal edges of a concrete slab constructed in one pass.

Texture depths shall not be less than the minimum required when measurements are taken as given in Table 2 nor greater than a maximum average of 1.25 mm.

Table 2 Texture depth

Time of test	Number of measurements	Required texture depth (mm)	
		Specified value	Tolerance
1. Between 24 hours and 7 days after the constn. of the slab or until the slab is first used by vehicles.	An average of 5 measurements	100	± 0.25
2. Not later than 6 weeks before the road is opened to public traffic.	An average of 5 measurements	1.00	+ 0.25 - 0.35

After the application of the brushed texture, the surface of the slab shall have a uniform appearance.

Where the texture depth requirements are found to be deficient, the contractor shall make good the texture across the full lane width over length directed by the engineer, by retexturing the hardened concrete surface in an approved manner.

600.2.9.9. **Curing -** Immediately after the surface texturing, the surface and sides of the slab shall be cured by the application of approved resin-based aluminised reflective curing compound which hardens into an impervious film or membrane with the help of a mechanical sprayer.

Curing compounds shall contain sufficient flake aluminium in finely divided dispersion to produce a complete coverage of the sprayed surface with a metallic finish. The compound shall become stable and impervious to evaporation of water from the surface of the concrete within 60 minutes of application and shall be of approved type. The curing compounds shall have a water retention efficiency index of 90 per cent in accordance with BS: 7542.

The curing compound shall not react chemically with the concrete and the film or membrane shall not crack, peel or disintegrate within three weeks after application. Immediately prior to use, the curing compound shall be thoroughly agitated in its containers. The rate of spread shall be in accordance with the manufacturer's instructions checked during the construction of the trial length and subsequently whenever required by the engineer. The mechanical sprayer shall incorporate an efficient mechanical device for continuous agitation and mixing of the compound during spraying.

In addition to spraying of curing compound, the fresh concrete surface shall be protected for at least 3 hours by covering the finished concrete pavement with tents as described in clause 600.2.7.2. during adverse weather conditions as directed by the engineer. After three hours, the pavement shall be covered by moist hessian and the same shall then be kept damp for a minimum period or 14 days after which time the hessian may be removed. The hessian shall be kept continuously moist. All damaged/torn hessian shall be removed and replaced by new hessian on a regular basis. Code of practice for curing of cement concrete pavements is given in Annexure 600 – A.14.

The contractor shall be liable at his expense to replace any concrete damaged as a result of incomplete curing or cracked on a line other than that of a joint.

600.2.10. **Trial length -** The trial length shall be constructed at least one month in advance of the proposed start of concrete paving work. At least one month prior to the construction of the trial length, the contractor shall submit for the engineer's approval a detailed method statement giving description of the proposed materials, plant, equipment and construction methods. All the major equipments like paving train, batching plant, tippers, etc., proposed in the construction are to be approved by the engineer before their procurement. No trials of new materials, plant, equipment or construction methods, nor any development of them shall be permitted either during the construction of trial length or in any subsequent paving work, unless they form part of further, approved trials. These trial lengths shall be constructed away from the carriageway but with at least a sub-base layer below it.

The contractor shall demonstrate the materials, plant, equipment and methods of construction that are proposed for concrete paving, by first constructing a trial length of slab, at least 60 m but not more than 300 m long for mechanised construction and at least 30 m long for hand guided methods. If the first trial is unsatisfactory, then contractor shall have to demonstrate his capability to satisfactorily construct the pavement in subsequent trials.

The trial length shall be constructed in two parts over a period of comprising at least part of two separate working days, with a minimum of 30 m constructed each day for mechanised construction and a minimum of 15 m on each day for hand guided construction. The trial length shall be constructed at a similar rate (speed, around 1m/hr) to that which is proposed for the main work.

Transverse joints and longitudinal joints of each type that are proposed for dowel-jointed un-reinforced concrete slabs in the main work shall be constructed and assessed in the trial length. If in the trial length the construction of expansion joint and longitudinal joint is not demonstrated, the first 2 expansion joints and at least the first 150 m of longitudinal construction joint for mechanized paving in the main work, shall be considered as the trial length for these joints.

The trial length shall comply with the Specification in all respects, with the following additions and exceptions

Surface levels and regularity

(1) In checking for compliance with clause 900.3.5 the levels shall be taken at intervals at the location specified in this clause along any time or lines parallel to the longitudinal centre line of the trial length.

(2) The maximum number of permitted irregularities of pavement surface shall comply with the requirements of clause 900.2.4. Shorter trial lengths shall be assessed pro-rata based on values for a 300 m length.

Joints

(i) Alignment of dowel bars shall be inspected as described in clause 602.10.7 in any two consecutive transverse joints. If the position or alignment of the dowel bars at one of these joints does not comply with clause 600.2.6.5, if that joint remains the only one that does not comply after the next 3 consecutive joints of the same type have been inspected, then the method of placing dowels shall be deemed to be satisfactory. In order to check sufficient joints for dowel bar alignment without extending the trial length unduly, the contractor may, by agreement with the engineer, construct joints at more frequent joint intervals than the normal spacing required in the contract.

(ii) If there are deficiencies in the first expansion joint there is constructed as a trial, the next expansion joint shall be a trial joint. Should this also be deficient, further trial expansion joints shall be made as part of the trial length which shall not form part of the permanent works, unless agreed by the engineer.

Density

(iii) Density shall be assessed as described in clause 602.3.3. from at least 3 cores drilled from each part of the trial length.

Position of tie bars

(iv) Compliance with clause 600.2.6.6. for the position and alignment of tie bars shall be checked by drilling additional cores from the slab unless they can be determined from cores from the slab unless they can be determined from cores taken for density.

Approval and acceptance

Approval of the materials, plant, equipment and construction methods shall be given when a trial length complies with the Specification. The contractor shall not proceed with normal working until the trial length has been approved and any earlier defective trial lengths have been removed, unless that can be remedied to the satisfaction of the engineer. If the engineer does not notify the contractor of any deficiencies in any trial length within 10 days after the completion of that trial length, the contractor may assume that the trial length, and the materials, plant, equipment and construction methods adopted are acceptable.

When approval has been given, the materials, plant, equipment and construction methods shall not thereafter be changed, except for normal adjustments and maintenance of plant, without the approval of the engineer. Any changes in materials, plant, equipment, and construction methods shall entitle the engineer to require the contractor to lay a further trial length as described in the clause to demonstrate that the changes will not adversely affect the permanent works.

Trial lengths which do not comply with the Specification, with the exception of areas which are deficient only in surface texture and which can be remedied in accordance with clause 600.2.9.8. shall be removed immediately upon notification of deficiencies by the engineer and the contractor shall construct a further trial length.

600.2.10.7. **Inspection of dowel bars**

Compliance with clause 600.2.6.5. for the position and alignment of dowel bars at construction and expansion joints shall be checked by measurements relative to the side forms or guide wires.

When the slab has been constructed, the position and alignment of dowel bars and any filler board shall be measured after carefully exposing them in the plastic concrete across the whole width of the slab. When the joint is an expansion joint, the top of the filler board shall first be exposed sufficiently in the plastic concrete to permit measurement of any lateral or vertical displacement of the board. During the course of normal working, these measurements shall be carried out in the pavement section at the end of day's work by extending slab length by 2 m. After sawing the transverse joint groove, the extended 2 m slab shall be removed carefully soon after concrete has set to expose dowels over half the length. These dowels can be tested for tolerances.

If the position and alignment of the bars in a single joint in the slab is unsatisfactory then the next two joints shall be inspected. If only one joint of the three is defective, the rate of checking shall be increased to one joint per day until the engineer is satisfied that compliance is being achieved. In the event of non-compliance in two or more successive joints, the contractor shall revert to the construction of fresh trial lengths and make any necessary alteration to concrete mix, paving plant or methods until the dowel bar position and alignment are satisfactory.

After the dowel bars have been examined, the remainder of the concrete shall be removed over a width of 500 mm on each side of the line of the joint and reinstated to the satisfaction of the engineer. The dowels shall be inserted on both sides of the 1 m wide slab by drilling holes and grouting with epoxy mortar. Plastic sheath as per clause 600.2.6.5.5. shall be provided on dowels on one of the joints. The joint groove shall be widened and sealed as per clause 600.2.11.

600.2.11. **Preparation and sealing of joint grooves**

600.2.11.1. **General -** All transverse joints in surface slabs shall be sealed using sealants described in clause 600.2.2.8. Joints shall not be sealed before 14 days after construction.

600.2.11.2. **Preparation of joint grooves for sealing**

Joint grooves usually are not constructed to provide the minimum width specified in the drawings when saw cut joints are adopted. They shall be widened subsequently by sawing before sealing. Depth/width gauges shall be used to control the dimension of the groove.

If rough arises develop when grooves are made, they shall be ground to provide a chamfer approximately 5 mm wide. If the groove is at an angle up to 10 degree from the perpendicular to the surface, the overhanging edge of the sealing groove shall be sawn or ground perpendicular. If spalling occurs or the angle of the former is greater than 10 degrees, the joint sealing groove shall be sawn wider and perpendicular to the surface to encompass the defects up to a maximum width, including any chamfer, of 35 mm for transverse joints and 20 mm for longitudinal joints. If the spalling cannot be so eliminated then the arrises shall be repaired by an approved thin bonded arris repair using cementitious materials.

All grooves shall be cleaned of any dirt or loose material by air blasting with filtered, oil-free compressed air. If need arises the engineer may instruct cleaning by pressurised water jets. Depending upon the requirement of the sealant manufacturer, the sides of the grooves may have to be sand blasted to increase the bondage between sealant and concrete. The groove shall be cleaned and dried at the time of priming and sealing. Before sealing the temporary seal provided for blocking the ingress of dirt, soil etc., shall be removed. A highly compressible heat resistant paper-backed debonding strip as per drawing shall be inserted in the groove to serve the purpose of breaking the bond between sealant and the bottom of the groove and to plug the joint groove so that the sealant may not leak through the cracks. The width of debonding strip shall be more than the joint groove width so that it is held tightly in the groove. In the case of longitudinal joints, heat resistant tapes may be inserted to block the leakage through bottom of the joint.

600.2.11.3. **Sealing with sealants -** When sealants are applied, an appropriate primer shall also be used if recommended by the manufacturer and it shall be applied in accordance with their recommendation. The sealant shall be applied within the minimum and maximum drying times of the primer recommended by the manufacturer. Priming and sealing with applied sealants shall not be carried out when the naturally occurring temperature in the joint groove to be sealed is below 7 degree centigrade.

If hot applied sealant is used it shall be heated and applied from a thermostatically controlled, indirectly heated preferably with oil jacketed melter and pourer having recirculating pump and extruder. For large road projects, sealant shall be applied with extruder having flexible loose hose and nozzle. The sealant shall not be heated to a temperature higher than the safe heating temperature and not for a period longer than the safe heating period, as specified by the manufacturer. The dispenser shall be cleaned out at the end of each day in accordance with the manufacturer's recommendations and reheated material shall not be used.

Cold applied sealants with chemical formulation like polysulphide may be used. These shall be mixed and applied within the time limit specified by the manufacturer. If primers are recommended they shall be applied neatly with an appropriate brush. The Movement Accommodation Factor (MAF) shall be more than 10 per cent.

He sealants applied at construction phase of the slabs would result in bulging of the sealant over and above the slab. Therefore, the contractor in consultation with the engineer shall establish the right temperature and time for applying the sealant. Thermometer shall be hung on a pole in the site for facilitating control during the sealing operation. Sealant shall be applied, slightly to a lower level than the slab with a tolerance of 5 ± 2 mm. During sealing operation, it shall be seen that no air bubbles are introduced in the sealant either by vapours or by the sealing process.

600.2.11.4. **Testing of applied sealants -** Manufacturer's certificate shall be produced by the contractor for establishing that the sealant is not more than six months old and stating that the sealant complies with the relevant standard as in clause 600.2.2.8. The samples shall meet the requirement of AASHTO M 282 Annexure 600-A.21 for hot applied sealant or BS: 5212 (Part-2) for cold applied

sealant.

600.2.11.5. **Requirements of primer and sealing compound**

600.2.12. **Measurement of texture depth**

600.2.12.1. **Sand Patch Method**

The following apparatus shall be used

(1) A cylindrical container of 25 ml internal capacity (2) A flat wooden disc 64 diameter with a hard rubber disc, 1.5 mm thick, stuck to one face, the reverse face being provided with a handle. (3) Dry natural sand with a rounded particle shape passing a 300 micron IS sieve and retained on a 150 micron IS sieve.

600.2.12.2. **Method -** The surface to be measured shall be dried; any extraneous mortar and loose material removed and the surface swept clean using a wire brush both at right angles and parallel to the carriageway. The cylindrical container shall be filled with the sand, tapping the base 3 times on the surface to ensure compaction, and striking off the sand level with the top of the cylinder. The sand shall be poured into a heap on the surface to be treated. The sand shall be spread over the surface, working the disc with its face kept flat in a circular motion so that is spread into a circular patch with the surface depressions filled with sand to the level of peaks.

600.2.12.3 The diameter of the patch shall be measured to the nearest 5 mm. The texture depth of concrete surface shall be calculated from 31000/(DXD) mm where D is the diameter of the patch in mm.

600.2.13. **Opening to traffic -** No vehicular traffic shall be allowed to run on the finished surface of a concrete pavement within a period of 28 days of its construction and until the joints are permanently sealed. The road may be opened to regular traffic after completion of the curing period of 28 days and after sealing of joints is completed including the construction of shoulder, with the written permission of the engineer.

600.2.14. **Tolerances for surface regularity, level, thickness and strength -** The tolerances for surface regularity, level, thickness and strength shall conform to the requirements given in clause 900.3.5. Control of quality of materials and works shall be exercised by the engineer in accordance with Section 900.

600.2.15. **Measurements for payment**

600.2.15.1. Cement concrete pavement shall be measured as a finished work in square metres with specified thickness. The volume to be paid for will be calculated on the basis of thickness and plans shown on the project drawings and adjusted for the deficiency in thickness. No additional payment shall be made for extra thickness of the slab. The full payment will be made to this item after 28 days strength of the concrete is found to be satisfactory. The unit for measurement for concrete pavement shall be the cubic metre of concrete placed, based on the net plan areas for the specified thickness shown the Drawings or directed by the engineer. The rate shall include all provisions of this Specification and shall include the provision of all materials polythene film, concrete, stock piling, mixing, transport, placing, compacting, finishing, curing together with all formwork, and including testing and submission of test certificates and records. No deduction shall be made in measurement for openings provided that the area of each is less than 0.5 sq. m. The unit rate as entered in the Bill of Quantities shall also include the full costs of construction, expansion, contraction, and longitudinal joints. It shall also include joint filler, caulking rod, debonding strip, sealant primer, joint sealant, dowel bar and tie rod.

600.2.15.2. **Pavement thickness -** All precautions and care shall be taken to construct pavement having uniform thickness as called for on the plans. Thickness of the cement concrete pavement shall be calculated on the basis of level data of the cement concrete pavement and the underlying sub-base taken on a grid of 5m x 3.5m or 6.25 m x 3.5 m, the former measurement being in longitudinal direction. A day's work is considered as a 'lot' for calculating the average thickness of the slab. In

calculating the average thickness, individual measurements which are in excess of the specified thickness by more than 10 mm shall be considered as the specified thickness plus 10 mm. Individual areas deficient by more than 25 mm shall be verified by the engineer by ordering core cutting and if in his opinion the deficient areas warrant removal, they shall be removed and replaced with concrete of the thickness shown on the plans. When the average thickness for the lot is deficient by the extent shown in Table 600-3, the contract unit price will be adjusted as per this Table 3.

Table 3 Payment adjustments for deficiency in thickness

Deficiency in the average Thickness of day's work	Percent of contract Unit price payable
Upto 5 mm	100
6-10 mm	87
11-15 mm	81
16-20 mm	75
21-25 mm	70

In the stretch where deficiency of average thickness is more than 25 mm, the section whose thickness is deficient by 26 mm or more is identified with the help of cores. Such slabs shall be removed and reconstructed at the cost of the contractor. During such rectification work, care shall be taken to replace full slab and to the full depth.

600.2.16. **Rate -** The contract unit rate for the construction of the cement concrete shall be payment is full for carrying out the operations required for the different items of the work as per these specifications including full compensation for all labour, tools, plant, equipments, testing and incidentals to complete the work as per specifications, providing all materials to be incorporated in the work including all royalties, fees, storage, rents where necessary and all leads and lifts.

5. EARTHWORK FOR FOUNDATIONS

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.

2.1.2. Hard and dense soil - All soils classified in soil groups as per IS: 1498-1970 other than what is covered in (a) above; gravel, cobblestone, hard shale, soft Laterite, or any other nodular material having max. diameter in any one direction between 75 mm & 300 mm soft conglomerate, where the stone can be detached from the matrix with pick axes and shovels. This includes soling of roads, paths etc., and hard core, stiff heavy clay, hard shale or compact moorum requiring grafting tool or pick or both and shovel closely applied. Any material, which requires the close application of picks or scarifiers to loosen and not affording resistance to digging greater than the hardest of any soil, mentioned above.

2.1.3. Ordinary or soft rock - (i) Rock types such as laterites, shales and conglomerates, varieties of limestone and sandstone etc., which may be quarried or split with crow bars, also including any rock which in dry state may be hard, requiring blasting but which, when wet, becomes soft and manageable by means other than blasting ;

(ii) Macadam surfaces such as water bound and bitumen/tar bound; compact moorum or stabilised soil requiring grafting tool or pick or both and shovel, closely applied ;

(iii) Lime concrete, stone masonry in lime mortar and brick work in lime/cement mortar below ground level, reinforced cement concrete which may be broken up with crow bars or picks and stone masonry in cement mortar below ground level; and

(iv) Boulders which do not require blasting having maximum dimension in any direction of more than 300 mm, found lying loose on the surface or embedded in river bed, soil, talus, slope wash and terrace material of dissimilar origin.

Ordinary rock does not require blasting, wedging or similar means. It may be required a split with crow bars or picks. If required blasting may be resorted to, for loosening the materials but this does not be any way entitle the material to be classified as 'Hard Rock'.

2.1.4. Hard rock - Any rock (excluding Laterite and hard conglomerate) or boulder for the excavation of which the use of mechanical plant and/or blasting is required; reinforced cement concrete (reinforcement cut through but not separated from the concrete) below ground level.

Hard rock requires blasting but where blasting is prohibited for any reason, excavation has to be carried out by chiseling, wedging or any other agreed method.

2.1.5. Marshy soil - This shall include soils like soft clays and peat excavated below the original ground level of marshes and swamps and soils excavated from other areas requiring continuous pumping or bailing out of water.

2.2 Authority for classification - The engineer shall decide the classification of excavation and his decision shall be final and binding on the contractor. Merely the use of explosives in excavation will not be considered, as a reason for higher classification unless blasting is clearly necessary in the opinion of the engineer.

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.

6. CONCRETE WORK

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	Percentage passing (by weight) for nominal size of

Designation	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 50º 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 40º 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.

4.2.8**. Concreting under special conditions**

4.2.8.1 **Work in extreme weather conditions** - During hot and cold weather, the concreting shall be done as per the procedure set out in IS: 7861(Part-I) and IS: 7861(Part II) respectively. Concreting shall not be done when the temperature falls below 4.5º C. In cold weather, the concrete placed shall be protected against frost. During hot weather, it shall be ensured that the temperature of wet concrete does not exceed 38ºC.

4.2.8.2 **Under water concreting -** Concrete shall not be deposited under water if it is practicable to de-water the area and place concrete in the regular manner. The concrete shall contain at least 10%

more cement than that required for the same mix placed in dry conditions, the quantity of extra cement varying with conditions of placing with prior written permission of the engineer. Such extra cement will be paid extra. The volume of coarse aggregate shall not be less than 1½ times nor more than twice the fine aggregate and slump not less than 100 mm nor more than 180 mm. Where found necessary to deposit any concrete under water, the method, equipment, materials and mix shall first be got approved by the engineer. Concrete shall be deposited continuously until it is brought to required height. While depositing, the top surface shall be kept as nearly level as possible and the formation of heaps shall be avoided. The concrete shall be deposited under water by one of the approved methods such as Tremie method, drop bottom bucket, bags, grouting etc. as per details given in IS: 456-2000. If it is necessary to raise the water after placing the concrete, the level shall be brought up slowly without creating any waves or commotion tending to wash away cement or to disturb the fresh concrete in any 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.

c) Shelves

d) Slabs

e) Chajjas including portions bearing on the wall

f) Lintels, beams and Bressemmers

g) Columns, piers abutments, pillars, post and struts

h) Stair case including stringer beams but excluding landings.

i) Balustrades, newels and sailing

j) Spiral staircase (including landing)

k) Arches

l) Domes, vaults

m) Shell roof, arch ribs and folded plates

n) Chimneys and shaft.

o) Breast walls, retaining, walls, return walls

p) Concrete filling to precast components

q) Kerbs, steps and the like

r) String or lacing courses, parapets, copings, bed block, anchor blocks, plain window sills and the like

s) Cornices and moulded windows sills.

t) Louvers, fins, fascia.

4.2.13.6. **Precast cement concrete** solid articles shall be measured separately and shall include muse of moulds, finishing the top surfaces even and smooth with wooden trowel, before setting in position in cement mortar 1:2 (1 cement -2 coarse sand). Plain and moulded work shall be measured separately and the work shall be classified and measured as under -

Classification	Method of measurement
a. Wall panels	In square meters stating the thickness
b. String or lacing courses, coping, bed plats, plain windows sills, shelves, louvers, steps etc.	In cubic meters
c. Kerbs, edgings etc. In cubic meters	In cubic meters
d. Solid block work	In square meters stating the thickness or in cubic meters.

e. Hollow block work	In square meters stating the thickness or in cubic meters.
f. Light weight Partitions	In square meters stating the thickness or in cubic meters.

4.2.14. **Rate -** The rate is inclusive of the cost of labour and materials involved in all the operations described above.

7. SPECIFICATIONS FOR REINFORCED CEMENT CONCRETE WORK

General - Reinforced cement concrete work may be cast-in-situ or Precast as may be directed by engineer according to the nature of work. Reinforced cement concrete work shall comprise of the following which may be paid separately or collectively as per the description of the item of work.

a) Form work (Centering and shuttering)
b) Reinforcement
c) Concreting - 1) Cast-in-situ 2) Precast

4.6.1 **Materials**

4.6.1.1 Water, cement, fine and coarse aggregate shall be as specified under respective clauses of mortars and section 04-concrete work as applicable.

4.6.1.2 **Steel for reinforcement**

The steel used for reinforcement shall be any of the following types -

a) Mild steel sand medium tensile bars conforming to IS: 432 (part I)
b) Hard drawn steel write conforming to IS: 432 (part II)
High strength deformed steel bars conforming to IS: 1786
c) Hard drawn steel wire fabric conforming to IS: 1566
d) Structural steel section conforming to IS: 2062-1999

Types and grades - Reinforcement supplied in accordance with this standard shall be classified into the following types -

a) Mild steel bars - It shall be supplied in the following two grades
i) Mild steel bars grade I designated as Fe 410-S
ii) Mild steel bars grade II designated as Fe 410-O.
b) Medium tensile steel bars, grade II designated as Fe-540-W-HT.

Mild steel and medium tensile steel - Physical requirement are given in Table 11.

Table 11

Sl No	Type and nominal size Of bars	Ultimate tensile stress N/mm^2 minimum	Yield stress N/mm^2 minimum	Elongation Percent
1	Mild steel grade I For bars up to and including 20 mm	410	250	23
	For bars over 20 mm up to and Including 50 mm	410	240	23
2	Mild steel grade I For bars up to and including 20 mm	370	225	23
	For bars over 20 mm up to and Including 50 mm	370	215	23
3	Medium tensile steel For bars up to & including 16 mm	540	350	20
	For bars over 16 mm, up to And including 32 mm	540	340	20
	For bars over 32 mm, up to And including 50 mm	510	330	20

Elongation percent on gauge length 5.65 √so where so is the cross section area of the test piece.

Note-1. Grade (II) Mild steel bars are not recommended for the use in structures located in the earthquake zone subjected to serve damage and for structures subjected to dynamic loading (other than wind loading) such as railway and highway bridges.

2. Welding of reinforcement bars covered in this specification shall be done in accordance with the requirements of IS: 2751.

Nominal mass / weight - The tolerance on mass/weight for round and square bars shall be the percentage given in Table.12 of the mass/weight calculated on the basis that the masses of the bar/wire of nominal diameter and of density 0.785 kg / cm^3 or 0.00785 kg / mm^3.

Table 12 (Tolerance on nominal mass)

Nominal size In mm	Tolerance on the nominal mass percent		
	Batch	Individual Sample +	Individual sample for coil(-x-)
a) up to and including 10	± 7	± 8	± 8
b) over 10, up to and including 16	+5	-6	+6
c) over 16	± 3	-4	± 4

+ for individual sample plus tolerance in not specified

(x) for coil batch tolerance is not applicable

Tolerance shall be determined in accordance with method given in IS 1786-1985

Tests - Following type of lab test shall be carried out

1) Tensile test - This shall be done as per IS: 1608
2) Bend test - This shall be done as per IS: 1599
3) Re-test - This shall be done as per IS: 1786
4) Rebend test -This shall be done as per IS: 1786

Should any one of the test pieces first selected fail to pass any of the tests specified above, two further samples shall be selected for testing in respect of each failure. Should the test pieces from both these additional samples pass, the materials represented by the test samples shall be deemed to comply with the requirement of the particular test. Should the test piece from either of these additional samples fail, the material represented by the test samples shall be considered as not having complied with standard. High strength deformed bars & wires shall conform to IS: 1786. The physical properties for all sizes of steel bars are mentioned below in Table 13.

Table 13

Sl. No	Property	Grade		
		Fe 415	Fe 500	Fe 550
1	0.2% proof Stress/Yield stress, in. N/mm²	415	500	550
	Elongation, percent min. on gauge Length 5.65 √A, Where A is the X-sectional Area of the test piece	14.5	12	8
3	Tensile strength	10 % more than actual 0.2 % proof stress but not less than 465 N/mm²	8 % more than actual 0.2 % proof stress but not less than 545 N/mm²	6 % more than actual 0.2 % proof stress but not less than 585 N/mm²

Tests - Selection and preparation of test sample. All the tests pieces shall be selected by the engineer or his authorised representative either-

a) From cutting of bars *or*

b) If he so desires, from any after it has been cut to the required or specified size and the test piece taken from any part of it.

In neither case, the test pieces shall be detached from the bar or coil except in the presence of the engineer or his authorised representative.

The test pieces obtained in accordance with as above shall be full sections of the bars as rolled and subsequently cold worked and shall be subjected to physical tests without any further modifications. No deductions in size by machining or otherwise shall be permissible. No test piece shall be enacted or otherwise subject to heat treatment. Any straightening which a test piece may require shall be done cold.

Tensile test - This shall be done as per IS: 1599.

Re-test -This shall be done as per IS: 1786.

4.6.1.3 **Stacking and storage** - Steel for reinforcement shall be stored in such a way as to prevent distorting and corrosion. Bars of different classifications, sizes and lengths shall be stored separately to facilitate issue in such sizes and lengths to cause to minimum wastage in cutting from standard length.

4.6.2 **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.

(a) Runner joints RS, MS Channel or any other suitable section of the required size shall be used as runners.

(b) 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. Some of the accessories used for wall forms are shown in Fig.3.

surrounding concrete or any fixture attached to the steel or concrete.

Fig. 1 Wall Form

Fig. 2 Adjustable curve wall form (Double sided)

g. 4 Typical standard units of form work

Fig. 5 Typical components of form work

Fig. 6 Typical arrangement of column form work

Fig. 7 Typical column shuttering

Fig. 8 Typical detail of beam head and stiffener

Fig. 9 Typical details of multi stage shuttering

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.

a) Any member which is to remain in position after the general dismantling is done, should be clearly marked.

b) Material used should be checked to ensure that, wrong items / rejects are not used.

c) 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.

ii) Sole plates shall be properly seated on their bearing pads or sleepers.

iii) The bearing plates of steel props shall not be distorted.

iv) 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.

4.6.3. **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.

a) 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.

b) 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

(a) Mandatory Lab. Test

(b) 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 / mm² 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.

8. STONE MASONRY

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.

5.1.2.1. Classification of rocks – Rocks are classified according to:-

(1)Geological formation and (2) Chemical composition.

Geological formation - The three classifications are:-

a) Igneous rocks - These are the result of consolidation of molten material or at below the surface of earth, e.g., Granite, Basalt and Trap.

b) Aqueous or sedimentary rocks - These are precipitated by the deposition of sand, gravel, clay, etc., generally by precipitation in water, subsequently cemented together by silica, lime, potash, etc., sided by the pressure of superincumbent layers of material and water, e.g., sandstones, limestone's, etc.

c) Metamorphic rocks - These are rocks originally formed in either of the two processes mentioned above, but subsequently changed or metamorphosed in colour, structure and texture, having been subjected to either intense heat or pressure exerted by the movements in and below earth's crust or both, e.g., Slates, schist, marble, etc.

Chemical composition **– This classification is made on the basis of the chief constituent material in the rock.**

(a) Siliceous rocks - Where silica in the form of sand, quartz, or flint, predominates, e.g., granite, trap, sand stone.(b) Calcareous rocks - Where calcium carbonate lime is the main constituent,e.g. limestone, marble, etc.(c) Argillaceous rocks-In this argile (clay) forms the base, e.g., Slate, Laterite, etc.

Quality of good stone and comparative strength - A stone of igneous origin is stronger than one of sedimentary formation. Stones with silicates as binding material will weather better than those with calcareous binding material. Generally, crystalline stones are hard and compact and are superior to non-crystalline stones. Finer the crystalline structure, stronger and more durable is the stone. An examination of old structure, where it has been used will indicate durability. If tool marks are visible, the edges or corners are still sharp and true and the surface hard showing no signs of deterioration, the stone may be regarded as satisfactory. A fresh fracture of good stone, suitable for structural work should be bright, clean and sharp, free from loose grains, and should not have an earthy smell.

For dressing, stone should be comparatively soft, yet durable, compact grained and homogeneous in texture, rather than crystalline, free from veins and planes of cleavage.

The specific gravity of a good stone should not be less than 2.7.

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.

(f) Schists - Metamorphic rock belonging to group of foliated rocks. Finer in texture than gneiss. Derived either from igneous or sedimentary rocks. Varieties are named according to the abundance of ferro-magnesium mineral. Chief among the members of this family that are found in this State are hornblende schists, chlorite schists, calcite schists, and mica schists. The rocks are generally dark in colour.

(g) Lime stones - are those in which calcium carbonate forms the base. Sand Stones – are those in which silica constitutes the base.

(h) Slates - are fine grained compact argillaceous rocks with planes of cleavage, independent of the original beds, often crossing them at a great angle.

(j) Pot stones - Impure form of Talc, composition being chiefly silicate of magnesia and is not useful for structural work. It is very easy to work. The best variety is red variety. Mottled and streamed colours pervading it should not be very unevenly distributed. It should not be used in places where it is subjected to any great pressure and liable to be soaked with water.

Ornamental building stones - The following varieties can take fine polish and are mainly used as ornamental building stones

(a)Grey rocks - Which include the medium to fine grained and coarse grained granite gneisses and granites. These are useful for decorative purposes and are available from Sarakki quarries and Malsandra quarries near Bangalore.

(b) Porphyritic granite - coarse grained granite having grayish colour with slightly pinkish tinge. The polished surface of the rock gives a mottled appearance with large plates of dull white plagioclase and pale pink orthoclase occurring in a grayish ground mass having quartz and biotite. These are available from certain quarries in Chitradurga District.

(c) Pink rocks - This group has been divided into (a) non-Porphyritic and (b) coarse porphyritic types, the former occurring near Ramnagaram, Magadi and Chamundi Hills, and the latter near Ellikal and

Sivaganga.

(d) Green rocks - These rocks are available in Chikmagalur Taluk.(

e)Black rocks - Occurs as an outcrop about two miles east of Mysore on the Mysore-Mahadevapur Road. It is compact and soft and takes good and lasting polish.

(f) Black trap (Turuvekere Stone) - Occurs in the form of a huge dyke to the east of Kadehalli, a village 6 miles south of Turuvekere. The rock is soft compact and black when fresh. It has a grayish appearance on weathered surface; Quarries near Banasandra also yield good samples.

(g) Felsites and porphyry - Occurring in the form of dykes of quite a great range of texture and colour. Outcrop conspicuously in the Srirangapatnam and Mandya Taluks; when cut and polished they form ornamental building stones.

(h) Marble - It is a compact, crystalline and the strongest and most durable variety of limestone formed by the metamorphic action. It is obtainable in a variety of colours, white, grey, blue, green, yellow. It can be easily sawn and carved; it takes high polish.

(i) Artificial Stones - Processes have been invented for the manufacture of artificial stones for use in localities where natural stones cannot be had. Some of the processes produce of high quality. Comparative cost of producing artificial stones for use in any locality should determine its adoption. The facility with which it can be moulded to most intricate forms, however, makes it more economical than carvings in natural stone.

Artificial stones are practically forms of good setting mortar or of concrete.

(1) Artificial stone is made by mixing dry sand with silicate of soda (dissolved flint) and a small proportion of powdered stone or chalk. These are thoroughly mixed together in a pug or mortar mill, and forced by hand into moulds. A cold solution of chloride of calcium is poured over the blocks turned out, which are then immersed in a boiling solution of the same, sometimes under pressure, so as to entirely fill the pores of the material with the solution. After this the blocks are found to be as hard as most building stones. The excess of sodium chloride is washed off to prevent efflorescence. This stone has been used for a variety of purposes.

(2) Victoria stone - A mixture of four parts of crushed granite with one of Portland cement is allowed to set for three days or more into a hard block moulded to the required shape. It is then immersed in silicate of soda for some seven or eight weeks. This stone also has been used for various purposes.

(3) Silicated stone - Is made in the same way as Victoria stone, and used for paving slabs and drain pipes.

(4) Artificial paving slabs and paving stones - of many kinds are used nowadays. They are often composed of Portland cement concrete very carefully made. Silicates are sometimes added to give hardness to the mass.

5.1.6. Quarrying stones - The open part of natural rock, from which useful material is obtained by loosening or blasting or both is called a quarry, and the process, quarrying. There is not much difference between quarrying and mining, except that a quarry is open at surface, whereas mining is done underground.

The quarrying should be done in quarries approved by the Executive engineer and the methods of quarrying should be as per standard procedures.

The rock loosened shall be cut into the required sizes by weight, chisels or butt hammers as per requisitions. Quarry chips shall be removed and stacked separately.

The quarrying for face and cut stones shall be made in selected quarries.

Stones required for dimensioned work to be quarried true and square and as near the dimensions given as possible.

5.1.7. Methods of quarrying - The methods commonly adopted for quarrying stones are as follows:-

1) Quarrying stones

a) by wedging and splitting and

b) by chiseling.

2) Quarrying stones by burning.
3) Quarrying stones by blasting.
(1).Quarrying stones.
(a). By wedging and splitting - Wooden or steel wedges are used along lines of cleavage. When these wedges are driven and hammered, the rock yields along the lines of cleavage and blocks are then chiseled and taken out.
(b) By Chiseling - This is done by boring small holes at suitable intervals, one inch to three inches deep with the chisel, inserting steel wedges into the holes and gradually hammering the wedges. A crack then appears along the line of the holes, and the boulder is split. The same process is repeated until the stones are cut to the required smaller sizes.
When the stone is a huge boulder, a whole varying from three feet to six feet in depth is drilled and blasted with gun powder only. It is further split into sizes with chisels and wedges.
(3). Quarrying stones by burning and splitting - Lines of cleavage are created by burning rock and cooling it and then wedging along such cleavages. But such stones are naturally weaker. The thickness of stone got depends upon the area exposed to heat and intensity of heat applied. This causes the layer to expand and separate from the lower mass. This is usually attended with a dull bursting sound. This method could be adopted in the case of taking out slabs of fairly large size from 50 mm.
(4). Quarrying of Stones by blasting – See Section 2.
5.1.8 - Dressing of stones - After quarrying, stones are to be wrought or dressed to varying degrees, depending on the kind of work on which they are used. It is better to do as much dressing as is possible at the quarry.
Dressing of stone is done in three operations.
(1) While sorting out stone for different useful purposes such as bases, caps of pillars. Arch stones, corner stones, coping, etc., a stone are roughly hewn with a quarry hammer of about 3kgs weight to reduce its weight to minimum by knocking out unwanted materials.
(2) It is then hauled up and it is given the rough shape (by a mason's hammer of weight 1 to 1.5 Kgs), of a rectangular block for which it was originally sorted out.
(3) Final dressing is done on the site of works by tools such as pitching tool, point chisel, plane or toothed chisels.
5.1.8.1. Blocks of stone, which are to be put into the masonry, should be dressed with horizontal beds and vertical faces, or very nearly so to have proper joints for the specified distance from the face. If not carefully superintended, masons will chip off the edges of stone with a hammer leaving full joint for perhaps half an inch from the face.
5.1.8.2. Chisel drafted margin - The dressing done with a drafting chisel in narrow strips of width generally 2 to 5 cm. Chisel drafted margin shall be punch dressed.
5.1.8.3. Hammer dressed surface - A hammer dressed stone shall have no sharp and irregular corners and shall have a comparatively even surface so as to fit well in masonry. Hammer dressed stone is also known as hammer faced, quarry faced and rustic faced. The bushing from the general wall face shall not be more than 40 mm on exposed face and 10 mm on faces to be plastered (Fig.1).
5.1.8.4. Rock faced surface - A rock faced stone shall have a minimum of 25 mm wide chisel drafted margin at the four edges, all the edges being in the same plane (Fig.2).
5.1.8.5. Rough tooled surface - A rough tooled surface shall have a series of bands, made by means of a plane chisel 4 to 5 cm wide, more or less parallel to tool marks all over the surface. These marks may be either horizontal, vertical or at an angle of 450 as directed (Fig.3). The edges and corners shall be square and true. The depth or gap between the surface and straight edge, held against the surface shall not be more than 3 mm (Rough tooled stones are used where fairly regular plane faces are required for masonry work).
5.1.8.6. Punched dressed surface - A rough surface is further dressed by means of punch chisel to

show series of parallel ridges. The depth of gap between the surface and a straight edge held against the surface shall not exceed 3 mm (Fig.4). Punched dressed stones are used where even surfaces are required.

5.1.8.7. Close picked surface - A punched stone is further dressed by means of point chisel so as to obtain a finer surface, ridges or chisel marks left over being very tiny. The depth of gap between the surface and a straight edge kept over the surface shall not exceed 1.5 mm (Fig.5).

5.1.8.8. Fine tooled surface - Close picked surface is further dressed so that all the projections are removed and fairly smooth surface is obtained. The surfaces shall have 3 to 4 lines per centimeters width depending on the degree of hardness of stone and degree of fineness required (Fig.1 to 6). This type of dressing is commonly adopted for ashlar work.

5.1.8.9. Polished surface - Surfaces having a high gloss finish. Polishing of stones shall be done by rubbing them with suitable abrasive, wetting the surface where necessary with water. Alternatively polishing of stones shall be done by holding them firmly on the top of revolving table to which some abrasive material like sand or carborundum is fed. The final polishing shall be performed by rubber or felt, using oxide of lime (called by trade name as putty powder) as a polishing medium.

5.1.8.10. Moulded - Cut to profile of a moulding with punched dressed surfaces, unless otherwise specified.

5.1.9. Weathering of stones - The effect of weather on building stones.

5.1.9.1. “Weathering” is understood to mean the gradual wear or decay brought about by any cause and a ‘perfect ‘ material would resist these decaying agencies and remain always in original state. There is, of course, no ‘perfect’ material, but many forms of stones get very close to the state of perfection as witness the ancient monuments that have withstood the ravages of times for thousands of years.

5.1.9.2. Chief agents of destruction or cause of failure in building stone.

(1) Frost or severe and sudden changes in temperature.- Frost causes the water that has penetrated into the pores of stones or between the laminations to expand on freezing. The expansion has a loosening effect on the particles. Sudden changes in temperature have a somewhat similar effect on the particles, of which the stone is composed.

(2) Failure of the structure of the stone - This may happen in untried qualities particularly, sandstone, where grains of practically indestructible silica may be held together by a weak cementing material.

(3) Drawing rain - Rain (and atmospheric moisture generally) is charged with sulphurous acids which act on the carbonate of lime in a limestone setting up chemical action which gradually eats the stone away. The action is very gradual of course but care should be taken to choose a good limestone for use in Industrial towns where decay from this cause may be most expected.

(4). Dust and sand laden winds- This may be only a minor cause excepting for a few isolated stones that are in such a position as to be always affected by dust. Sand - in really sandy districts can however leave a very marked effect on work, a very famous example being the sphinx in Egypt.

(5) Vegetation - Clinging mosses, lichens, and similar parasitic vegetations look very beautiful on stone work but they have a disintegrating effect if only through the retention of moisture. There are however other causes which may be very serious. They are not included under “chief causes” as they are due (a) to misuse of the material, and (b) bad design. Under (a) comes the grave fault of using sedimentary rock, the wrong way of the bed. The use of iron clamps, rods or dowels, etc., is also liable to cause failure due to the expansion of metal during oxidisation.

5.1.10. Preservation and restoration of stones - There is in fact no distinct dividing line between preservation and restoration. The ultimate finish required also plays a large part, as for example, a domestic residence must be treated quite differently from an ancient monument.

(1). Preservation - To apply a preservative to a stone with the object of making it permanently weather – resisting whilst at the same time retaining its natural colour and appearance is practically impossible. Certain measures can however be taken to increase the life of a stone and arrest decay.

There is no such thing as a single solution, which can be universally adopted for preserving any kind of stone. It stands to reason that stones of different chemical composition and physical properties must receive separate and distinct treatment. However, there are a number of preservatives in the market.

(a). Chemical and patent preservatives - There are now many of these in the market, most of which are efficient for a few years if applied carefully. Silicate of soda is the basis of many of them. The object aimed at in these liquids is to produce a substance that will combine with the carbonate of lime and make an impervious surface. Best results are obtained if the solution is applied when the work is new. The silicate of soda in solution when applied penetrates the pores in the surface and reacts chemically with the free lime. Insoluble calcium silicate and silica are formed and as a result the pores in the surface layer are “sealed”.

A good preventive, which is better than a preservative is the frequent, washing down of the work with, cleans water. This removes the acids before they act on the stone. But this process should not be adopted in frost weather. Both organic and inorganic preservatives are subject to decay and must be renewed from year to year. Before applying any preservative the faces of the work should be well cleaned and any loose particles removed by forced water or brushing and the liquid applied when the stone is dry. Paint is a good preservative but it has a limited life and also the great disadvantage of destroying the appearance of the material. Boiled linseed oil is also very good but destroys the colour of the stone.

(b). Paraffin wax - Effective to a degree if it can be applied hot and driven well into the intestacies of the stone.

Coal tar and bitumen are very good preservatives but their colour is objectionable and besides they absorb the sun’s heat.

(2) Restoration - Failure in stones can be prevented if sufficient care is taken in the original choice and use of the stone itself. Faults as fractures caused by the oxidization of iron, cannot be successfully repaired by an application of a preservative. Affected stone should be cut out and replaced. When considering the restoration of stone work, the method or methods used depend entirely on the class of work and the extent to which it has decayed and worn. If the decay is not serious, all dust and dirt can be cleaned off with wire brushes or water and the surface then coated with a stone preserving liquid when the work dries. Another method is to cut out the defective part to

A depth of not less than 20 mm and render them over with a mixture of cement and stone dust. 2 to 2 ½ of stone dust and 1 of white cement usually make a suitable mix for limestone. The bottom of the sinking should be roughened and several undercut holes drilled in it to give a key for the cement. For large restoration jobs, where it is desirable to restore the work to its original condition, by far the best method is to cut out any defective stones and replace them with new ones of the same material.

The cutting one should be to a depth of 75 to 100 mm or more if the stone in question has a large projection and the new stones should be dowelled to the one next to it or clamped back to the wall itself. The joints can then be painted up and grouted solid. This grouting is essential and it is important that it should be solid. To ensure this, two holes should be left at the top of the block either by leaving out the pointing or better by making holes for the purpose. One hole is to pour the grout into and the other to let the air out and prevent an air lock (which would make the joint appear to be full when it is really not so). A suitable grout is composed of 4 parts of stone dust to one part of cement. When small pieces are put in for such purposes these also should be dowelled where possible and dove tailed into the main block as an additional security.

5.1.11. Seasoning of stones - Stone freshly quarried contains some moisture which is called “quarry sap” particularly in the case of limestone, sandstone and laterites. In this state it is more easily worked. As the quarry sap evaporates, the stone becomes harder. It is therefore desirable to expose the stone to open air at least for two seasons before it is used in masonry.

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.

5.1.12.3. Random Rubble Masonry shall be uncoursed or brought to courses as specified (Fig 7 and 8). Uncoursed random rubble masonry shall be constructed with stones of sizes as referred and shapes picked at random from the stones brought from the approved quarry. Stones having sharp corners or round surfaces shall, however, not be used.

5.1.12.4. Random rubble masonry brought to the course is similar to uncoursed random rubble masonry except that the courses are roughly leveled at intervals varying from 30 cm to 90 cm in height according to the size of stones used.

Fig. 7 – Random Rubble Masonry

5.1.12.5. Dressing - Each stone shall be hammer dressed on the face, the sides and bed. Hammer dressing shall enable the stones to be laid close to neighboring stones such that the bushing in the face shall not project more than 40 mm on the exposed face and 10 mm on the face to be plastered.

Note: Dressing is classified ordinarily as: - Single line, two line, or three line according to the degree of fineness to which they have to be dressed. In single line dressing the maximum projection or depression with reference to the mean plane should not be more than 3 mm, and 1.5 mm in double line and 1 mm in three line dressing. Dressing of stones finer than three lines dressing is known as pal mane, which is adopted in special cases, and especially where the surfaces are not to the plane desired even after fine dressing.

5.1.12.6. Mortar - The mortar used for joining shall be as specified.

5.1.12.7. Laying - All stones shall be wetted before use. Each stone shall be placed close to the stones already laid so that the thickness of the mortar joints at the face is not more than 20 mm. Face stones shall be arranged suitably to stagger the vertical joints and long vertical joints shall be avoided.

Stones for hearing or interior filling shall be hammered down with wooden mallet into the position firmly bedded in mortar. Chips or sprawls of stones may be used for filing of interstices between the adjacent stones in heartening and these shall not exceed 20% of the quantity of stone masonry. To form a bond between successive courses plum stones projecting vertically by about 15 to 20 cm shall be firmly embedded in the heartening at the interval of about one meter in every course. No hollow space shall be left any where in the masonry.

The masonry work in wall shall be carried out true to plumb or to specified batter.

Random rubble masonry shall be brought to the level course at plinth, windowsills, lintel and roof levels. Leveling shall be done with concrete comprising of one part of the mortar as used for masonry and two parts of graded stone aggregate of 20 mm nominal size.

The masonry in structure shall be carried out uniformly. Where the masonry of one part is to be delayed, the work shall be raked back at an angle not steeper than 45 degree.

5.1.12.8. Bond stones - Bond or through stones running right through the thickness of walls, shall be provided in walls up to 60 cm thick and in case of wall above 60 cm thickness, a set of two or more bond stones overlapping each other by at least 15 cm shall be provided in a line from the face of the wall to the back. In case of highly absorbent types of stones (porous lime stone and sand stone etc.) single piece bond stones may give rise to dampness. For all thickness of such walls, a set of two or more bond stones overlapping each other by at least 15 cm shall be provided. Length of each such bond stone shall not be less than two-third of the thickness of the wall.

Where bond stones of suitable lengths are not available precast cement concrete block of 1:3:6 mix (1cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) of cross section not less than 225 square centimeters and length equal to the thickness of wall shall be used in lieu of bond stones. (This shall be applicable only in masonry below ground level and where masonry above ground level is finally required to be plastered). At least one bond stone or a set of bond stones shall be provided for every 0.5 sq m of the area of wall surface. All bond stones shall be marked suitably with paint as directed by the engineer.

5.1.12.9. Quoin and jamb stones - The quoin and jamb stones shall be of selected stones neatly dressed and hammer or chisel to form the required angle. Quoin stones shall not be less than 0.01 cum in volume. Height of quoins and jamb stones shall not be less than 15 cm.. Quoins shall be laid header and stretcher alternatively.

5.1.12.10. Joints - Stone shall be so laid that all joints are fully packed with mortar and chips. Face joints shall not be more than 20 mm thick.

The joints shall be struck flush and finished at the time of laying when plastering or pointing is not to be done. For the surfaces to be plastered or pointed, the joints shall be raked to a minimum depth of 20 mm when the mortar is still green.

5.1.12.11. Scaffolding - Single scaffolding having one set of vertical support shall be allowed. The supports shall be sound and strong, tied together by horizontal pieces, over which the scaffolding planks shall be fixed. The inner end of the horizontal scaffolding member may rest in a hole provided in the masonry. Such holes, however, shall not be allowed in pillars under one meter in width or near the skew back of arches. The holes left in masonry work for supporting scaffolding shall be filled and made good with cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 stone aggregate 20 mm nominal size).

5.1.12.12. Curing - Masonry work in cement or composite mortar shall be kept constantly moist on all faces for a minimum period of seven days. In case of masonry with fat lime mortar curing shall commence two days after laying of masonry and shall continue for at least seven days thereafter.

5.1.12.13. Protection - Green work shall be protected from rain by suitable covering. The work shall also be suitably protected from damage, mortar dropping and rain during construction.

5.1.12.14. Measurements

5.1.12.14.1 The length, height and thickness shall be measured correct to a cm. The thickness of wall

shall be measured at joints excluding the bushing. Only specified dimensions shall be allowed; anything extra shall be ignored. The quantity shall be calculated in cubic metre nearest to two places of decimal.

5.1.12.14.2. The work under the following categories shall be measured separately.

From foundation to plinth level (level one): (a) Work in or under water and /or liquid mud, (b) Work in or under foul positions.

From plinth level (Level one) to floor two level.

From floor two levels to floor three level and so on.

Stone masonry in parapet shall be measured together with the corresponding item in the wall of the storey next below.

Note :(1) Floor I is the lowest floor above ground level in the building unless otherwise specified in a particular case. The floors above floor 1 shall be numbered in sequence as floor 2, floor 3 and so on. Number will increase upwards. (2) For floor 1, top level of finished floor shall be the floor level and for all other floors above floor 1, top level of structural slab shall be the floor level. (3) Floor level or 1 or 1.2 m above the ground level whichever is less shall be the plinth level.

5.1.12.14.3. No deduction shall be made nor extra payment made for the following

Ends of dissimilar materials (that is joists, beams, lintels, posts, girders, rafters purlins, trusses, corbels, steps etc.) up to 0.1 sqm in section.(ii)Openings each up to 0.1 sqm in area. In calculating the area of openings, any separate lintels or sills shall be included along with the size of opening but the end portions of the lintels shall be excluded and the extra width of rebated reveals, if any, shall also be excluded. (iii) Wall plates and bed plates, and bearing or chajjas and the like, where the thickness does not exceed 10 cm and the bearing does not extend over the full thickness of the wall.

Note: The bearing of floor and roof shall be deducted from wall masonry. (iv) Drain holes and recess for cement concrete blocks to embed hold fasts for doors, windows, etc.(v) Building in masonry, iron fixture, pipes up to 300 mm dia, hold fasts of doors and windows etc. (vi)Forming chases in masonry each up to section of 350 sq cm.

Masonry (excluding fixing brick work) in chimney breasts with smoke of air flues not exceeding 20 sq dm (0.20 sq m) in sectional area shall be measured as solid and no extra payment shall be made for pargetting and coring such flues. Where flues exceed 20 sq dm (0.20 sq m) sectional area, deduction shall be made for the same and pargetting and coring flues shall be measured in running meters stating size of flues and paid for separately. Aperture for fire place shall not be deducted and no extra payment made for splaying of jambs and throatings.

5.1.12.14.4. Apertures for fireplaces shall not be deducted and extra labour shall not be measured for splaying of jambs, throating and making arch to support the opening.

5.1.12.14.5. Square or rectangular pillars - These shall be measured as walls, but extra payment shall be allowed for stone work in square or rectangular pillars over the rate for stone work in walls. Rectangular pillar shall mean a detached masonry support rectangular in section, such that its breadth does not exceed two and a half times the thickness.

5.1.12.14.6. Circular pillars (columns) - These shall be measured as per actual dimensions, but extra payment shall be allowed for stone work in circular pillars over the rate for stone work in walls. The diameter as well as length shall be measured correct to a cm.

5.1.12.14.7. Tapered walls - shall be measured net, as per actual dimensions and paid for as other walls.

5.1.12.14.8. Curved masonry - Stone masonry curved on plan to a mean radius exceeding 6 meters shall be measured and included with general stone work. Stone work circular on plan to a mean radius not exceeding 6 meters shall be measured separately and shall include all cuttings and waste and templates. It shall be measured as the mean length of the wall.

5.1.12.15. Rate - The rate shall include the cost of materials and labour required for all the operations

described above and shall include the following:

Raking out joints for plastering or pointing done as a separate item, or finishing flush as the work proceeds. (b)Preparing tops and sides of existing walls for raising and extending.(c) Rough cutting and waste for forming gables cores, skew backs or spandrels of arches, splays at eaves and all rough cutting in the body of willing unless otherwise specified.(d) Bond stones or cement concrete bond blocks. (e) Leading and making holes for pipes etc. (f) Bedding and pointing wall plates, lintels, sills etc., in or on walls, bedding roof tiles and corrugated sheets in or on walls.(g) Building in ends of joists, beams, lintels etc.

5.1.13. SPECIFICATIONS FOR COURSED RUBBLE MASONRY FIRST SORT (FIG. 9)

5.1.13.1. Stone: Shall be as specified in 5.1.12.1

5.1.13.2. Size of Stone: Shall be as specified in 5.1.12.2

5.1.13.3. Dressing - Face stones shall be hammer dressed on all beds, and joints so as to give them approximately rectangular block shape. These shall be squared on all joints and beds. The bed joint shall be rough chisel dressed for at least 8 cm back from the face, and side joints for at least 4 cm such that no portion of the dressed surface is more than 6 mm from a straight edge placed on it. The bushing on the face shall not project more than 4 cm as an exposed face and one cm on a face to be plastered. The hammer dressed stone shall also have a rough tooling for minimum width of 2.5 cm along the four edges of the face of the stone, when stone work is exposed.

5.1.13.4. Mortar - The mortar for jointing shall be as specified.

5.1.13.5. Laying - All stones shall be wetted before use. The walls shall be carried up truly plumb or to specified batter. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical. The height of each course shall not be less than 15 cm nor more than 30 cm.

Face stones shall be laid alternate headers and stretchers. No pinning shall be allowed on the face. No face stone shall be less in breadth than its height and at least one third of the stones shall tail into the work for length not less than twice their height. The hearting or the interior filling of the wall shall consist of stones carefully laid on their proper beds in mortar ; chips and spalls of stone being used where necessary to avoid thick beds of joints of mortar and at the same time ensuring that no hollow spaces are left anywhere in the masonry. The chips shall not be used below the hearting stone to bring these up to the level of face stones. The use of chips shall be restricted to the filling of interstices between the adjacent stones in hearting and these shall not exceed 10% of the quantity of stone masonry. The masonry in a structure shall be carried up uniformly but where breaks are unavoidable, the joints shall be raked back at angle not steeper than 45 degree. Toothing shall not be allowed.

5.1.13.6. Bond stones - Shall be as specified except that a bond stone or a set of bond stones shall be inserted 1.5 to 1.8 meters apart, in every course.

5.1.13.7. Quoins - The quoins shall be of the same height as the course in which these occur. These shall be at least 45 cm long and shall be laid stretches and headers alternatively. These shall be laid square on the beds, which shall be rough-chisel dressed to a depth of at least 10 cm. In case of exposed work, these stones shall have a minimum of 2.5 cm wide chisel drafts at four edges, all the edges being in the same plane.

5.1.13.8. Joints - All bed joints shall be horizontal and all side joints vertical. All joints shall be fully packed with mortar, face joints shall not be more than one cm thick.

When plastering or pointing is not required to be done, the joints shall be struck flush and finished at the time of laying. Otherwise, joints shall be raked to a minimum depth of 20 mm by raking tool during the progress of work, when the mortar is still green.

5.1.13.9. Curing, scaffolding, measurements and rates - Shall be as specified under 5.1.12

5.1.14. SPECIFICATIONS FOR COURSED RUBBLE MASONRY – SECOND SORT (FIG. 8):-

5.1.14.1. Stone - Shall be as specified in 5.1.12.1

5.1.14.2. Size of stone - Shall be as specified in 5.1.12.2

5.1.14.3. Dressing - Shall be as specified in 5.1.13.3 except that no portion of dressed surface shall exceed 10 mm from a straight edge placed on it.

5.1.14.4. Mortar - The mortar for jointing shall be as specified.

5.1.14.5. Laying - Shall be as specified in 5.1.13.5 except that the use of chips shall not exceed 15% of the quantity of stone masonry and stone, in each course need not be of the same height but not more than two stones shall be used in the height of a course.

5.1.14.6. Bond stone, quoins - Shall be as specified in 5.1.13.6 and 5.1.13.7

5.1.14.7. Joints - All bed joints shall be horizontal and all side vertical. All joints shall be fully packed with mortar, face joints shall not be more than 2 cm thick.

When plastering or pointing is not required to be done, the joints shall be struck flush and finished at the time of laying. Otherwise, the joints shall be raked to a minimum depth of 20 mm by raking tool during progress of work, where the mortar is still green.

5.1.14.8. Curing, scaffolding, measurement and rates - Shall be as specified in 5.1.12

5.1.15. SPECIFICATIONS FOR PLAIN ASHLAR MASONRY (FIG. 9)

5.1.15.1. Stone shall be of the type specified. It shall be hard, sound, durable and tough, free from cracks, decay and weathering and defects like cavities, cracks, flaws, sand holes, veins, patches of soft or loose materials etc. Before starting the work, the contractor shall get the stones approved by engineer.

5.1.15.2. Size of stone - Normally stones used should be small enough to be lifted and placed by hand. The length of the stone shall not exceed three times the height and the breadth on base shall not be greater than three – fourth of the thickness of wall not less than 15 cm. The height of stone may up to 30 cm.

5.1.15.3. Dressing - Every stone shall be cut to the required size and shape, so as to be free from waviness and to give truly vertical and horizontal joints. In exposed masonry, the faces that are to remain exposed in the final position and the adjoining faces to a depth of 6 mm shall be the fine chisel dressed so that when checked with 60 cm straight edge, no point varies from it by more than 1 mm. The top and bottom faces that are to form the bed joints shall be chisel dressed so that variation from 60 cm straight edge at no point exceeds 3 mm. Faces which are to form the vertical joints should be chisel dressed so that variation at any point with 60 cm straight edge does not exceed 6 mm. Any vertical face that is to come against backing of masonry shall be dressed such that variation from straight edge does not exceed 10 mm. All angles and edges that are to remain exposed in the final position shall be true, square and free from chippings. A sample of dressed stone shall be prepared for approval of engineer. It shall be kept at the worksite as a sample after being approved.

5.1.15.4. Mortar - The mortar for jointing shall be as specified.

5.1.15.5. Laying - All stones shall be wetted before placing in position. These shall be floated on mortar and bedded properly in position with wooden mallets without the use of chips or under pinning of any sort. The walls and pillars shall be carried up truly plumb or battered as shown in drawings. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical.

In case of ashlar work without backing of brick work or coursed rubble masonry, face stone shall be laid headers and stretchers alternatively unless otherwise directed. The headers shall be arranged to come as nearly as possible in the middle of stretchers above and below. Stone shall be laid in regular courses of not less than 15 cm in height and all the courses shall be of same height, unless otherwise specified. For ashlar facing with backing of brick work or coursed rubble masonry (See Fig. 10) face stone shall be laid in alternate courses of headers and stretches unless otherwise directed. Face stone and bond stone course shall be maintained throughout. All connected masonry in a structure shall be carried up nearly at one uniform level throughout, but where breaks are avoidable, the joint shall be made in good long steps so as to prevent cracks developing between new and old work. Bond stone provided in the masonry shall be payable in the item of ashlar masonry. Neither any

deduction will be made from the brick masonry for embedding the bond stone in neither the backing nor any extra payment shall be made for any extra labour involved in making holes in brick masonry backing. When necessary, jib crane or other mechanical appliances shall be used to hoist the heavy pieces of stones and place these into correct positions, care being taken that the corners of the stone are not damaged. Stone shall be covered with gunny bags, before tying chain or rope is passed over it, and it shall be handled carefully. No piece which has been damaged shall be used in work.

5.1.15.6. Bond stones - Shall be as specified in 5.1.12.8.

5.1.15.7. Joints - All joints shall be full of mortar. These shall be not more than 6 mm thick. Face joints shall be uniform throughout and a uniform recess of 20 mm depth from face shall be left with the help of the steel plate during the progress of work.

5.1.15.8. Pointing - All exposed joints shall be pointed with mortar as specified. The pointing when finished shall be sunk from stone face by 5 mm or as specified. The depth of mortar in pointing work shall not be less than 15 mm.

5.1.15.9. Curing - Masonry work in cement or composite mortar shall be kept constantly moist on all faces for a minimum period of seven days. In case of masonry with fat lime mortar, curing shall commence two days after laying of masonry and shall continue for at least seven days thereafter.

5.1.15.10. Protections - Green work shall be protected from rain by suitable covering. The work shall also be suitably protected from damage, mortar dropping and rain during construction.

5.1.15.11. Scaffolding - Double scaffolding having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed.

5.1.15.12. Measurements - The finished work shall be measured correct to a centimeter in respect of length, breadth and height. The cubical contents shall be calculated in cubic meter nearest to two places of decimal.

5.1.15.12.1. No deduction nor any extra payment shall be made for the following:

(1)Ends of dissimilar materials (that is joists, beams, lintels, posts, girders, rafters, purlins, trusses, corbels, steps etc.) up to 0.1 sqm in section. (2)Openings up to 0.1 sqm in area. In calculating the area of opening, any separate lintels or sills shall be included along with the size of the opening but the end portion of the lintels shall be excluded and extra width of rebated reveals, if any, shall also be excluded. (3) Wall plates and bed plates and bearing of chajja and the like, where the thickness does not exceed 10 cm and the bearing does not extend over the full thickness of the wall.

Note: The bearing of floor and roof slabs shall be deducted from wall masonry.

Drainage holes and recesses left for cement concrete blocks to embed hold-fasts for doors and windows, building in the masonry iron fixture and pipes up to 300 mm diameter.

Stone walls in chimney breasts, chimney stacks, smoke or air flues not exceeding 0.20 sqm in sectional area shall be measured as solid and no extra measurement shall be made for pargetting and coring such flues. Where flues exceed 0.20 sqm in sectional area, deduction shall be made for the same and pargetting and coring flues paid for separately.

5.1.15.12.2. Square, rectangular or circular pillars - Shall be measured and paid for as walls, but extra payment shall be allowed for such pillars and columns over the rate for stone work in walls.

Rectangular pillars shall mean a detached masonry support, rectangular in section, such that its breadth shall not exceed two and half times the thickness.

5.1.15.12.3. Curved stone work - Stone work curved on a plan to a mean radius exceeding six meters shall be measured net and included with general stone work. Stone work circular on a plan to a mean radius not exceeding six meters shall be measured separately and extra payment shall be allowed and shall include all cutting and waste and templates. It shall be measured as the mean length of wall.

5.1.15.13. Rate - The rate shall include the cost of materials and labour required for all the operations described above. Stone facing or wall lining up to and not exceeding 8 cm thickness shall be paid for

under “Stone work for wall lining etc. (Veneer work)”. The stone work of thickness exceeding 8 cm shall be paid under relevant items of work.

5.1.16. SPECIFICATIONS FOR PUNCHED ASHLAR (ORDINARY) MASONRY

5.1.16.1. Stone - Shall be as specified in 5.1.15.1

5.1.16.2. Size of stone - Shall be as specified in 5.1.15.2

5.1.16.3. Dressing - Shall be as specified in 5.1.15.3 except that the faces exposed in view shall have a fine dressed chisel draft 2.5 cm wide all round the edges and shall be rough tooled between the drafts, such that the dressed surface shall not be more than 3 mm from a straight edge placed over it.

5.1.16.4. Other details - The specifications for mortars, laying and fixing, bond stone, joints, pointing, curing, protections, scaffolding, measurements and rates shall be same as specified in 5.1.15.

9. SPECIFICATIONS FOR CEMENT PLASTER

15.1.1. Scaffolding - For all exposed brick work or tile work, double scaffolding independent of the work having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed.

For all other brick work in buildings, single scaffolding shall be permitted. In such cases the inner end of the horizontal scaffolding pole shall rest in a hole provided only in the header course for the purpose. Only one header for each pole shall be left out. Such holes for scaffolding shall, however, not be allowed in pillars/columns less than one meter in width or immediately near the skew backs of arches. The holes left in masonry works for scaffolding purposes shall be filled and made good before plastering.

Note - In case of special type of brick work, scaffolding shall be got approved from engineer in advance.

15.1.2. Preparation of Surface - The joints shall be raked out properly. Dust and loose mortar shall be brushed out. Efflorescence if any shall be removed by brushing and scrapping. The surface shall then be thoroughly washed with water, cleaned and kept wet before plastering is commenced.

In case of concrete surface if a chemical retarder has been applied to the form work, the surface shall be roughened by wire brushing and all the resulting dust and loose particles cleaned off and care shall be taken that none of the retarders is left on the surface.

15.1.3. Mortar - The mortar of the specified mix shall be used. Lime mortar shall be as specified.

15.1.4. Application of Plaster

15.1.4.1. Ceiling plaster shall be completed before commencement of wall plaster.

15.1.4.2. Plastering shall be started from the top and worked down towards the floor. All put-log holes shall be properly filled in advance of the plastering as the scaffolding is being taken down. To ensure even thickness and a true surface, plaster about 15 x 15 cm shall be first applied, horizontally and vertically, at nor more than 2 meters intervals over the entire surface to serve as gauges. The surfaces of these gauged areas shall be truly in the plane of the finished plaster surface. The mortar shall then be laid on the wall, between the gauges with trowel. The mortar shall be applied in a uniform surface slightly more than the specified thickness. This shall be beaten with thin strips of bamboo about one meter long to ensure through filling of the joints, and then brought to a true surface, by working a wooden straight edge reaching across the gauges, with small upward and side ways movements at a time. Finally the surface shall be finished off true with trowel or wooden float according as a smooth or a sandy granular texture is required. Excessive toweling or over working the float shall be avoided. During this process, a solution of lime putty shall be applied on the surface to make the later workable.

15.1.4.3. All corners, arises, angles and junctions shall be truly vertical or horizontal as the case may be and shall be carefully finished. Rounding or chamfering corners, arises, provision of grooves at junctions etc. where required shall be done without any extra payment. Such rounding, chamfering or grooving shall be carried out with proper templates or battens to the sizes required.

15.1.4.4. When suspending work at the end of the day, the plaster shall be left, cut clean to line both horizontally and vertically. When recommencing the plastering, the edge of the old work shall be scrapped cleaned and wetted with lime putty before plaster is applied to the adjacent areas, to enable the two to properly joint together. Plastering work shall be closed at the end of the day on the body of wall and not nearer than 15 cm to any corners or arises. It shall not be closed on the body of the features such as plasters, bands and cornices, nor at the corners of arises. Horizontal joints in plaster work shall not also occur on parapet tops and copings at these invariably lead to leakages.

No portion of the surface shall be left out initially to be patched up later on.

15.1.5. Finish - The plaster shall be finished to a true and plumb surface and to the proper degree of smoothness as required. The work shall be tested frequently as the work proceeds with a true straight

edge not less than 2.5 m long and with plumb bobs. All horizontal lines and surfaces shall be tested with a level and all jambs and corners with a plumb bob as the work proceeds.

15.1.6. Thickness - The thickness of the plaster specified shall be measured exclusive of the thickness of key i.e., grooves or open joints in brick work. The average thickness of plaster shall not be less than the specified thickness, here 12 mm. The minimum thickness over any portion of the surface shall not be less than specified thickness by more than 3 mm. The average thickness should be regulated at the time of plastering by keeping suitable thickness of the gauges. Extra thickness required in dubbing behind rounding of corners at junctions of wall or in plastering of masonry cornices etc. will be ignored.

15.1.7. Curing - Curing shall be started 24 hours after finishing the plaster. The plaster shall be kept wet for a period of seven 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.

15.1.8. Precaution - Any cracks which appear in the surface and all portions which sound hollow when lapped, or are found to be soft or otherwise defective, shall be cut out in rectangular shape and redone as directed by the engineer.

i) When ceiling plaster is done, it shall be finished to chamfered edge at an angle at its junction with a suitably tool when plaster is being done. Similarly when the wall plaster is being done, it shall be kept separate from the ceiling plaster by a thin straight groove not deeper than 6 mm drawn with any suitable method with the wall while the plaster is green.

ii) To prevent surface cracks appearing between junctions of column/ beam and walls, 150 mm wide chicken wire mesh should be fixed with U nails 150 mm centre to centre before plastering the junction. The plastering of walls and beam/column in one vertical plane should be carried out in one go. For providing and fixing chicken wire mesh with U nails payment shall be made separately.

15.1.9. Measurements

15.1.9.1. Length and breadth shall be measured correct to a cm and its area shall be calculated in square meters correct to two places of decimal.

15.1.9.2. Thickness of the plaster shall be exclusive of the thickness of the key i.e., grooves, or open joints in brick work.

15.1.9.3 The measurement of wall plaster shall be taken between the walls or partitions (the dimensions before the plaster shall be taken) for the length and from the top of the floor or skirting to the ceiling for the height. Depth of coves or cornices if any shall be deducted.

15.1.9.4. The following shall be measured separately from wall plaster.

a) Plaster bands 30 cm wide and under

b) Cornice beadings and architraves or architraves moulded wholly in plaster.

c) Circular work not exceeding 6 m in radius.

15.1.9.5. Plaster over masonry plasters will be measured and paid for as plaster only.

15.1.9.6. A coefficient of 1.63 shall be adopted for the measurement of one side plastering on honey comb work having 6 x 10 cm. opening.

15.1.9.7. Moulded cornices and coves

a) Length shall be measured at the centre of the girth.

b) Moulded cornices and coves shall be given in square meters the area being arrived at by multiplying length by the girth.

c) Flat or weathered top to cornices when exceeding 15 cm in width shall not be included in the girth but measured with the general plaster work.

d) Cornices which are curved in their length shall be measured separately.

15.1.9.8. Exterior plastering at a height greater than 10 m from average ground level shall be measured separately in each storey height. Patch plastering (in repairs) shall be measured as

plastering new work, where the patch exceed 2.5 sqm extra payment being made for preparing old wall, such as dismantling old plaster, raking out the joints and cleaning the surface. Where the patch does not exceed 2.5 sqm in area it shall be measured under the appropriate item under sub head 'Repairs to Buildings'.

15.1.9.9. Deductions in measurements, for opening etc. will be regulated as follows

a) No deduction will be made for openings or ends of joists, beams, posts, girders, steps etc. up to 0.5 sqm in area and no additions shall be made either, for the jambs, soffits and sills of such openings. The above procedure will apply to both faces of wall.

b) Deduction for opening exceeding 0.5 sqm but not exceeding 3 sqm each shall be made for reveals, jambs, soffits sills, sills, etc. of these openings.

1) When both faces of walls are plastered with same plaster, deductions shall be made for one face only.

2) When two faces of walls are plastered with different types of plaster or if one face is plastered and other is pointed or one face is plastered and other is unplastered, deduction shall be made from the plaster or pointing on the side of the frame for the doors, windows etc. on which width of reveals is less than that on the other side but on deduction shall be made on the other side.

Where width of reveals on both faces of wall is equal, deduction of 50% of area of opening on each face shall be made from area of plaster and / or pointing as the case may be.

3) For opening having door frame equal to or projecting beyond thickness of wall, full deduction for opening shall be made from each plastered face of wall.

Note - Different qualities of plastering referred in this para shall not include '18 mm plastering with terrazzo finish' as given in para 15.13 as the method of measurement in the case of the later is different. In such cases where the plaster on the other face consists of a plaster with terrazzo finish method of addition and deductions for the ordinary plaster face shall be regulated as if that face alone is plastered and the other is given an entirely different type of non-comparable treatment.

c) For opening exceeding 3 sqm in area, deduction will be made in the measurements for the full opening of the wall treatment on both faces, while at the same time, jambs, sills and soffits will be measured for payment.

In measuring jambs, sills and soffits, deduction shall not be made for the area in contact with the frame of doors, windows etc.

15.1.10. Rate - The rate shall include the cost of all labour and materials involved in all the operations described above.

10. SPECIFICATIONS CEMENT PLASTERING

15 mm thick lime plaster shall be done on rough side of single or half brick work. The average thickness of plaster shall not be less than 15 mm and the minimum thickness of the plaster at any place shall not be less than 10 mm. All other details shall be as specified in 15.1.

15.3. SPECIFICATIONS FOR 18 MM LIME PLASTER (TWO COATS WORK)

15.3.1. The details of scaffolding and preparation of surface and mortar shall be as specified in 15.1.

15.3.2. Application of Plaster - The plaster shall be applied in two coats. I.e., 12 mm under coat and then 6 mm finishing coat and shall have an average final thickness of not less than 18 mm.

15.3.2.2. 12 mm under coat - This shall be applied in the same manner as specified under 12 mm lime plaster except that (a) the finishing after the mortar has been brought to a level with the wooden straight edge, shall be done with wooden float only (b) during the process lime putty solution shall not be applied.

The surface shall be further roughened by furrowing about 2 mm deep with a scratching tool diagonally both ways to form a key for the finishing coat. The scratched lines shall be at not more than 15 cm apart. The surface shall be kept wet till the finishing coat is applied.

15.3.2.3. 6 mm Finishing Coat - The finishing coat shall be applied a day or two after the under coat has set. The latter shall not be allowed to dry out, before the finishing coat is laid on. The finishing coat shall be applied in a uniform thickness of slightly more than 6 mm. The method of application shall be as described except that the surface shall not be beaten with bamboo strips. The final thickness of the top coat shall be 6 mm.

15.3.3. Thickness - The thickness of the under coat of plaster specified shall be exclusive of the thickness of key. The average thickness of the under coat shall not be less than 12 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 not be less than 10 mm while in the case of stone work, the minimum thickness over the bushing shall not be less than 6 mm.

15.3.4. 26 mm finishing coat shall be uniformly 6 mm thick over the under coat in the case of both brick and stone masonry.

15.3.5. Specifications for other details such as Finish, Curing, Precautions, Measurements, and Rate etc. shall be as described.

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.

15.7. SPECIFICATIONS FOR 18 MM CEMENT PLASTER (TWO COAT WORK)

15.7.1. The specification for scaffolding and preparation of surface shall be as described in 15.5

15.7.2. Mortar - The mix and type of fine aggregate specified in the description of the item shall be used for the respective coats. It shall be as specified in section 0.5. Generally the mix of the finishing coat shall not be richer than the under coat unless otherwise described in item.

Generally coarse sand shall be used for the under coat and fine sand for the finishing coat, unless otherwise specified for external work and under coat work, the fine aggregate shall conform to grading zone IV. For finishing coat work the fine aggregate conforming to grading zone V shall be used.

15.7.3. Application

15.7.3.1. The plaster shall be applied in two coats i.e. 12 mm under coat and then 6 mm finishing coat and shall have an average total thickness of not less than 18 mm.

15.7.3.2. 12 mm under coat -This shall be applied as specified except that when the plaster has been brought to a true surface a wooden straight edge and the surface shall be left rough and furrowed 2 mm deep with a scratching tool diagonally both ways, to form key for the finishing coat is applied.

15.7.3.3. 6 mm finishing coat - The finishing coat shall be applied after the under coat has sufficiently set but not dried and in any case within 48 hours and finished in the manner as specified.

15.7.4. Specifications for Curing, Finishing, Precautions, Measurements and Rate shall be as described in 15.5

15.8. SPECIFICATIONS FOR 6 MM CEMENT PLASTER ON CEMENT CONCRETE AND REINFORCED CEMENT CONCRETE WORK

15.8.0 Scaffolding - Stage scaffolding shall be provided for the work. This shall be independent of the walls.

15.8.1. Preparation of Surface - Projecting burrs of mortar formed due to the gaps at joints in shuttering shall be removed. The surface shall be scrubbed clean with wire brushes. In addition concrete surface to be plastered shall be pock marked with a pointed tool, at spacing of not more than 5 cm centers, the pock being made not less than 3 mm deep. This is to ensure a proper key for the plaster. The mortar shall be washed off and surface, cleaned of all oil, grease etc. and well wetted before the plaster is applied.

15.8.2. Mortars - Mortar of the specified mix using the types of sand described in the item shall be used. It shall be as specified.

15.8.3. Application -To ensure even thickness and a true surface, gauges of plaster 15 x 15 cm, shall be first applied at not more than 1.5 m intervals in both directions to serve as guides for the plastering. Surface of these gauged areas shall be truly in the plane of the finished plaster surface. The plaster shall be then applied in a uniform surface to a thickness slightly more than the specified thickness and shall then be brought to true and even surface by working a wooden straight edge reaching across the gauges. Finally the surface shall be finished true with a trowel or with wooden float to give a smooth or sandy granular texture as required. Excess trowel ling or over working of the floats shall be avoided. The plastering and finishing shall be completed within half an hour of adding water to the dry mortar.

15.8.4. Plastering of ceiling shall not be commenced until the slab above has been finished and

centering has been removed. In case of ceiling of roof slabs, plaster shall not be commenced until the terrace work has been completed. These precautions are necessary in order that the ceiling plaster is not disturbed by the vibrations set up in the above operations.

15.8.5. Finish - The plaster shall be finished to a true and plumb surface and to the proper degree of smoothness as required. The work shall be tested 15.8.5 frequently as the work proceeds with a true straight edge not less than 2.5 m long and with plumb bobs. All horizontal lines and surfaces shall be tested with a level and all jambs and corners with a plumb bob as the work proceeds.

15.8.6. Thickness - The average thickness of plaster shall not be less than 6 mm. The minimum thickness over any portion of the surface shall not be less than 5 mm.

15.8.7. Curing - The specifications shall be as detailed in 15.5

15.8.8. Precautions - These shall be as described in 15.1.8.

15.8.9. Measurements

15.8.9.1. Length and breadth shall be measured correct to a cm. and its area shall be calculated in sq.m correct to two places of decimal. Dimensions before plastering shall be taken.

15.8.9.2. Thickness of plaster shall be exclusive of the thickness of the key i.e., depth or rock marks and hacking.

15.8.9.3. Plastering on ceiling at height greater than 5 m above the corresponding floor level shall be so described and shall be measured separately stating the height in stages of 1 m or part thereof.

15.8.9.4. Plastering on the sides and soffits of the projected beams of ceiling at a height greater than 5 m above the corresponding floor level shall be measured and added to the quantity as measured under 15.8.9.3.

15.8.9.5. Plastering on spherical and groined ceiling and circular work not exceeding 6 m in radius, shall be measured and paid for separately.

15.8.9.6. Flowing soffits (Viz. portion under spiral stair case etc.) shall be measured and paid for separately.

15.8.9.7. Ribs and mouldings on ceiling shall be measured as for cornices; deductions being made from the plastering on ceiling in case the width of the moulding exceed 15 cm.

15.8.9.8. The mode of measurement of exterior plaster and patch plastering (in repairs) shall be as laid down in 15.1.9.8

15.8.9.9. Deduction shall not be made for openings or for ends of columns, or columns caps of 0.5 sqm each in area and under. No additions will be made either for the plastering of the sides of such openings. For openings etc. of areas exceeding 0.5 sqm deduction will be made for the full opening but the sides of such openings shall be measured for payment.

15.8.10. Rate - The rate shall include the cost of all labour and materials involved in all the operations described above.

15.9. SPECIFICATIONS FOR 6 MM CEMENT PLASTER FOR SLAB BEARING

15.9.0. Cement plaster shall be 6 mm thick finished with a floating coat of neat cement and thick coat of lime wash on top of walls for bearing of slabs.

15.9.1. Application - The plaster shall be applied over the cleaned and wetted surface of the wall. When the plaster has been brought to a true surface with a wooden straight edge (Clause 15.5.3) 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 described in 15.5.3 shall apply.

15.9.2. Lime wash - This shall be applied in a thick coat after curing the plaster for three day

15.9.3. Measurements - Length and breadth shall be measured correct to a cm and area worked out in sqm correct to two places of decimal.

15.9.4. Rate - The rate shall include the cost of all labour and materials involved in all the operations

described above.

11. SPECIFICATION OF PAINTING

15.25. SPECIFICATIONS FOR WHITE WASHING WITH LIME

Scaffolding

15.25.1.1. Wherever scaffolding is necessary, it shall be erected on double supports tied together by horizontal pieces, over which scaffolding planks shall be fixed. No ballies, bamboos or planks shall rest or touch the surface which is being white washed.

15.25.1.2. For all exposed brick work or tile work double scaffolding having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed.

Note: In case of special type of brick work, scaffolding shall be got approved from Engineer in advance.

15.25.1.3. Where ladders are used, pieces of all gunny bags shall be tied on their tops to avoid damage or scratches to walls.

15.25.1.4. For white washing the ceiling, proper scaffolding shall be erected.

15.25.2. Preparation of surface - Before new work is white washed, the surface shall be thoroughly brushed free from mortar droppings an foreign matter.

In case of old work, all loose particles and scales shall be scrapped off and holes in plaster as well as patches of less than 50 cm area shall be filled up with mortar of the same mix. Where so specifically ordered by the Engineer, the entire surface of old white wash shall be thoroughly removed by scrapping and this shall be paid for separately where efflorescence is observed the deposits may be brushed clean and washed. The surface shall then be allowed to dry for at least 48 hours before white washing is done.

15.25.3. Preparation of lime wash

15.25.3.1. The lime wash shall be prepared from fresh stone white lime. The lime shall be thoroughly slaked on the spot, mixed and stirred with sufficient water to make a thin cream. This shall be allowed to stand for a period of 24 hours and then shall be screened through a clean coarse cloth. 40 gm of gum dissolved in hot water, shall be added to each 10 cubic decimeter of the cream. The approximate quantity of water to be added in making the cream will be 5 litres of water to one kg of lime.

Indigo (Neel) up to 3 gm per kg of lime dissolved in water, shall then be added and stirred well. Water shall then be added at the rate of about 5 litres per kg. of lime to produce a milky solution.

15.25.4. Application

15.25.4.1. The white wash shall be applied with brushes to the specified number of coats. The operation for each coat shall consist of a stroke of the brush given from the top downwards, another from the bottom upwards over the first stroke, and similarly one stroke horizontally from the right and another from the left before it dries.

15.25.4.2. Each coat shall be allowed to dry before the next one is applied. Further each coat shall be inspected and approved by the Engineer before the subsequent coat is applied. No portion of the surface shall be left out initially to be patched up later on.

15.25.4.3. For new work, three or more coats shall be applied till the surface presents a smooth and uniform finish through which the plaster does not show. The finished dry surface shall not show any signs of cracking and peeling nor shall it come off readily on the hand when rubbed.

15.25.4.4. For old work, after the surface has been prepared as described, a coat of white wash shall be applied over the patches and repairs. Then a single coat or two or more coats of white wash as stipulated in the description of the item shall be applied over the entire surface. The white washed surface should present a uniform finish through which the plaster patches do not appear. The washing on ceiling should be done prior to that on walls.

Note: In case of Hessian ceiling, on no account, lime shall be used as it rots cloth and Hessian.

15.25.5. Protective Measures - Doors, Windows, floors, articles of furniture etc. and such other parts of the building not to be white washed, shall be protected from being splashed upon. Splashings and droppings, if any shall be removed by the contractor at his own cost and the surfaces cleaned. Damages if any to furniture or fittings and fixtures shall be recoverable from the contractor.

15.25.6. Measurements

15.25.6.1 Length and breadth shall be measured correct to a cm. and area shall be calculated in sqm correct to two places of decimals.

15.25.6.2 Measurements for jambs, Soffits, and Fills etc. for openings shall be as described.

15.25.6.3 Corrugated surfaces shall be measured flat as fixed and the area so measured shall be increased by the following percentages to allow for the girthed area.

Corrugated asbestos cement sheet	-	20%
Semi corrugated asbestos cement sheet	-	10%

15.25.6.4. Cornices and other such wall or ceiling features, shall be measured along the girth and included in the measurements.

15.25.6.5. The number of coats of each treatment shall be stated. The item shall include removing nails, making good holes, cracks, patches etc. not exceeding 50 sq. cm. each with material similar in composition to the surface to be prepared.

15.25.6.6. Work on old treated surfaces shall be measured separately and so described.

15.30. SPECIFICATIONS FOR OIL EMULSION (OIL BOUND) WASHABLE DISTEMPERING

15.30.1. Materials - Oil emulsion (Oil Bound) washable distemper (IS-428) of approved brand and manufacture shall be used. The primer where used as on new work shall be cements primer or distemper primer as described in the item. These shall be of the same manufacture as distemper. The distemper shall be diluted with water or any other prescribed thinner in a manner recommended by the manufacturer. Only sufficient quantity of distemper required for day's work shall be prepared.

The distemper and primer shall be brought by the contractor in sealed tins in sufficient quantities at a time to suffice for a fortnight's work, and the same shall be kept in the joint custody of the contractor and the Engineer. The empty tins shall not be removed from the site of work, till this item of work has been completed and passed by the Engineer.

15.30.2. Preparation of the Surface

15.30.2.1. For new work the surface shall be thoroughly cleaned of dust, old white or colour wash by washing and scrubbing. The surface shall then be allowed to dry for at least 48 hours. It shall then be sand papered to give a smooth and even surface. Any unevenness shall be made good by applying putty, made of plaster of pairs mixed with water on the entire surface including filling up the undulations and then sand papering the same after it is dry.

15.30.2.2 In the case of old work, all loose pieces and scales shall be removed by sand papering. The surface shall be cleaned of all grease dirt etc.

Pitting in plaster shall be made good with plaster of paris mixed with the colour to be used. The surface shall then be rubbed down again with a fine grade sand paper and made smooth. A coat of the distemper shall be applied over the patches. The patched surface shall be allowed to dry thoroughly before the regular coat of distemper is applied.

15.30.3. Application

15.30.3.1. Priming Coat - The priming coat shall be with distemper primer or cement primer, as required in the description of the item. The application of the distemper primer shall be as described.

Note: If the wall surface plaster has not dried completely, cement primer shall be applied before distempering the walls. But if distempering is done after the wall surface is dried completely, distemper primer shall be applied.

Oil bound distemper is not recommended to be applied, within six months of the completion of wall plaster. However, newly plastered surfaces if required to be distempered before a period of six

months shall be given a coat of alkali resistant priming coat conforming to IS - 109 and allowed to dry for at least 48 hours before distempering is commenced.
For old work no primer coat is necessary.
15.30.3.2. Distemper Coat - For new work, after the primer coat has dried for at least 48 hours, the surface shall be lightly sand papered to make it smooth for receiving the distemper, taking care not to rub out the priming coat. All loose particles shall be dusted off after rubbing. One coat of distemper properly diluted with thinner (water or other liquid as stipulated by the manufacturer) shall be applied with brushes in horizontal strokes followed immediately by vertical ones which together constitute one coat.
The subsequent coats shall be applied in the same way. Two or more coats of distemper as are found necessary shall be applied over the primer coat to obtain an even shade.
A time interval of at least 24 hours shall be allowed between successive coats to permit proper drying of the preceding coat.
For old work the distemper shall be applied over the prepared surface in the same manner as in new work. One or more coats of distemper as are found necessary shall be applied to obtain an even and uniform shade. 15 cm double bristled distemper brushes shall be used. After each days work, brushes shall be thoroughly washed in hot water with soap solution and caked with distemper shall not be used on the work.
15.30.4. The specifications in respect of scaffolding, protective measures and measurements shall be as described.
15.30.5. Rate - The rate shall include the cost of all labour and materials involved in all the above operations (including priming coat) described above.

15.31. SPECIFICATIONS FOR CEMENT PRIMER COAT
15.31.0. Cement primer coat is used as a base coat on wall finish of cement, lime or lime cement plaster or on asbestos cement surfaces before oil emulsion distemper paints are applied on them. The cement primers is composed of a medium and pigment which are resistant to the alkalis present in the cement, lime or lime cement in wall finish and provides a barrier for the protection of subsequent coats of oil emulsion distemper paints.
Primer coat shall be preferably applied by brushing and not by spraying. Hurried priming shall be avoided particularly on absorbent surfaces. New plaster patches in old work should also be treated with cement primer before applying oil emulsion paints etc.
15.31.1. Preparation of the surface: The surface shall be thoroughly cleaned of dust, old white or colour wash by washing and scrubbing. The surface shall then be allowed to dry for at least 48 hours. It shall then be sand papered to give a smooth and even surface. Any unevenness shall be made good by applying putty, made of Plaster of Paris mixed with water on the entire surface including filling up the undulations and then sand papering the same after it is dry.
15.31.2. Application: The cement primer shall be applied with a brush on the clean dry and smooth surface. Horizontal strokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving no brush marks. It shall be allowed to dry for at least 48 hours, before oil emulsion paint is applied.
The specifications in respect of scaffolding, protective measures, measurements and rate shall be as described under 15.25

15.32. SPECIFICATIONS FOR CEMENT PAINT
15.32.1. Material -The cement paint shall be (conforming to IS: 5410) of approved brand and manufacture.

The cement paint shall be brought to the site of work by the contractor in its original containers is 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.

15.32.2. Preparation of surface - For new work, the surface shall be thoroughly cleaned of all mortar dropping, dirt dust, algae grease and other foreign matter by brushing and washing. Pitting in plaster shall be made good and a coat of water proof cement paint shall be applied over patches after wetting them thoroughly.

15.32.3. Preparation of mix - Cement paint shall be mixed in such quantities as can be used up within an hour of its mixing as otherwise the mixture will set and thicken, affecting flow and finish. Cement paint shall be mixed with water in two stages. The first stage shall comprise of 2 parts of cement paint of one part of water stirred thoroughly and allowed to stand for 5 minutes. Care shall be taken to add the cement paint gradually to the water and not vice versa. The second stage shall comprise of adding further one part of water to the mix and stirring thoroughly to obtain a liquid of workable and uniform consistency. In all cases the manufacturer's instructions shall be followed meticulously.

The lids of cement paint drums shall be kept tightly closed when not in use, as by exposure to atmosphere the cement paint rapidly becomes air set due to its hygroscopic qualities.

In case of cement paint brought in gunny bags, once the bag is opened, the contents should be consumed in full on the day of its opening. If the same is not likely to be consumed in full, the balance quantity should be transferred and preserved in an airtight container to avoid its exposure to atmosphere.

15.32.4. Application

15.32.4.1. The solution shall be applied on the clean and wetted surface with brushes or spraying machine. The solution shall be kept well stirred during the period of application. It shall be applied on the surface which is on the shady side of the building so that the direct heat of the sun on the surface is avoided. The method of application of cement paint shall be as per manufacturer's specification. The completed surface shall be watered after the day's work.

15.32.4.2. The second coat shall be applied after the first coat has been set for at least 24 hours. Before application of the second or subsequent coats, the surface of the previous coat shall not be wetted.

15.32.4.3. For new work, the surface shall be treated with three or more coats of water proof cement paint as found necessary to get a uniform shade.

15.32.4.4. For old work, the treatment shall be with one or more coats as found necessary to get a uniform shade.

15.32.5. Precaution - Water proof cement paint shall not be applied on surfaces already treated with white wash, colour wash, distemper dry or oil bound, varnishes, paints etc. It shall not be applied on gypsums, would and metal surfaces.

15.32.6. The specifications in respect of scaffolding, protective measures, measurements and rate shall be as described in 15.25. The coefficient for cement paint on RCC jalli shall be the same as provided in Sl. No. 7 of Table 1 under para 15.33.6.4 for painting trellis work.

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,	- do -	1.10 (for each

	side cladding etc. or Nainital pattern using plain sheets		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.

15.34. SPECIFICATIONS FOR PAINTING PRIMING COAT ON WOOD, IRON OR PLASTERED SURFACES

15.34.1. Primer

15.34.1.1. The primer for wood work, iron work or plastered surface shall be as specified in the description of item.

15.34.1.2. Primer for plaster / wood work/ Iron & Steel / Aluminium surfaces shall be as specified below:

S. No.	Surfaces	Primer to be used
1	Wood work (hard and soft wood)	Pink conforming to IS: 3536
2	Resinour wood and plywood	Aluminium primer conforming to IS: 3585
3	(A) Aluminium and light alloys	Zinc chromate primer conforming to IS: 104
	(B) Iron, Steel and Galvanized steel	Red Oxide Zinc chromate Primer conforming to IS: 2074
4	Cement / Concrete / RCC / Brick work, Plastered surfaces, asbestos surfaces to receive Oil bound distemper or paint finish	Cement primer conforming to IS: 109

15.34.1.3. The primer shall be ready mixed primer of approved brand and manufacture.

15.34.1.4. Where primer for wood work is specified to be mixed at site, it shall be prepared from a mixture of red lead, white lead and double boiled linseed oil in the ratio of 0.7 kg: 0.7 kg: 1 litre.

15.34.1.5. Where primer for steel work is specified to be mixed at site, it shall be prepared from a mixture of red lead, raw linseed oil and turpentine in the ratio of 2.8 kg: 1 litre: 1 litre.

15.34.1.6. The specifications for the base vehicle and thinner for mixed on site primer shall be as follows:

a) White lead - The White lead shall be pure and free from adulterants like barium sulphate and whiting. It shall conform to IS: 103-1962

b) Red lead - This shall be in powder form and shall be pure and free from adulterants like brick dust etc. It shall conform to IS: 102-1962

c) Raw linseed oil - Raw linseed oil shall be lightly viscous but clear and of yellowish colour with light brown tinge. Its specific gravity at a temperature of 30 degree C shall be between 0.923 and 0.928.

Note - The oil shall be mellow and sweet to the taste with very little smell. The oil shall be of sufficiently matured quality. Oil turbid or thick, with acid and bitter taste and rancid odour and which remains sticky for a considerable time shall be rejected. The oil shall conform in all respects to IS: 75-1973. The oil shall be of approved brand and manufacture.

d) Double boiled linseed oil - This shall be more viscous than the raw oil, have a deeper colour and specific and specific gravity between 0.931 and 0.945 at a temperature of 30 degree C. It shall dry with a glossy surface. It shall confirm in all respects to IS: 77-1976. The oil shall be of approved brand and manufacture.

e) Turpentine: Mineral turpentine i.e., petroleum distillate which has the same rate of evaporation as vegetable turpentine shall be used. It shall have no grease or other residue when allowed to evaporate. It shall conform to IS: 533-1998

15.34.1.7. All the above materials shall be of approved manufacture and brought to site in their original packing in sealed condition.

15.34.2. Preparation of Surface

15.34.2.1. Wooden Surface: The wood work to be printed shall be dry and free from moisture.

The surface shall be thoroughly cleaned. All unevenness shall be rubbed down smooth with sand paper and shall be well dusted. Knots if any, shall be covered with preparation of red lead made by grinding red lead in water and mixing with strong glue sized and used hot. Appropriate filler material conforming to IS: 345-1952 with same shade as paint shall be used where specified. The surface treated for knotting shall be dry before paint is applied. After obtaining approval of engineer for wood work, the priming coat shall be applied before the wood work is fixed in position. After the priming coat is applied, the holes and indentation on the surface shall be stopped with glazier's putty or wood putty respectively. Stopping shall not be done before the priming coat is applied as the wood will absorb the oil in stopping and the latter is therefore liable to crack.

15.34.2.2. Iron & Steel Surface - All rust and scales shall be removed by scrapping or by brushing with steel wire brushes. Hard skin of oxide formed on the surface of wrought iron during rolling which becomes loose by rusting, shall be removed.

All dust and dirt shall be thoroughly wiped away from the surface.

If the surface is wet, it shall be dried before priming coat is undertaken.

Plastered Surface - The surface shall ordinarily not be painted until it has dried completely. Trial patches of primer shall be laid at intervals and where drying is satisfactory, painting shall then be taken in hand. Before primer is applied, holes and undulations shall be filled up with plaster of paris and rubbed smooth.

15.34.2.3. Application - The primer shall be applied with brushes, worked well into the surface and spread even and smooth. The painting shall be done by crossing and laying off as described in 15.33.4

15.35.2. SPECIFICATION FOR PAINTING ON OLD SURFACE

The surface which has been painted earlier shall be considered.

15.35.2.1. Preparation of Surface

a) Wood work - If the old paint is sound and firm and its removal is considered unnecessary, the surface shall be rubbed down with pumice stone after it has been cleaned of all smoke and grease by washing with lime and rinsing with water and drying. All dust and loose paint shall be completely removed. The surface shall then be washed with soap and water.

If the old painted surface is blistered or flaked badly old paint shall be completely removed as described and such removal shall be paid for separately. Holes and cracks if any shall be stopped with glazier's putty or wood putty conforming to IS: 419-1967. Further the painting itself shall be treated as on new surface and paid for, accordingly.

b) Iron and steel work - If the old paint is sound and firm and its removal is considered unnecessary, it shall be rubbed with wire brushes and any loosened paint taken off. All dust shall then be thoroughly wiped away. The surface shall then be wiped finally with mineral turpentine to remove grease and perspiration of hand marks etc. and then allowed to dry.

If the old painted surface is in bad condition and blistered and flaked, the old paint shall be completely

removed and the surface prepared, as described. Such removal shall be paid for separately. The painting including the priming coat shall be treated as on nee work and paid for accordingly.

c) Plastered surface - It shall be as specified for wood work. If before painting any portion of the wall shows signs of dampness, the causes shall be investigated and the damp surface shall be properly treated. Such treatment shall be paid for separately. A thin coat of white lead if so required shall be applied on the wet or patchy portion of the surface before painting is undertaken and this shall be paid extra.

15.35.2.2. Application - The specifications as described shall hold good as far as possible. The number of coats to be given shall be as stipulated in the description of the item.

The specifications described 15.3.3 shall hold good in so far as they are applicable.

15.42. SPECIFICATIONS FOR WALL PAINTING WITH PLASTIC EMULSION PAINT

15.42.0. The plastic emulsion paint is not suitable for application on external, wood and iron surface and surfaces which are liable to heavy condensation. These paints are to be used on internal surfaces except wooden and steel.

15.42.1. Plastic emulsion paint as per IS: 5411 of approved brand and manufacture and of the required shade shall be used.

15.42.2. Painting on new surface

15.42.2.1. The wall surface shall be prepared as specified in 15.33.3.

15.42.2.2. Application - The number of coats shall be as stipulated in the item. The paint will be applied in the usual manner with brush, spray or roller. The paint dries by evaporation of the water content and as soon as the water has evaporated the film gets hard and the next coat can be applied. The time of drying varies from one hour on absorbent surfaces to 2 to 3 hours on non-absorbent surfaces.

The thinning of emulsion is to be done with water and not with turpentine. Thinning with water will be particularly required for the under coat which is applied on the absorbent surface. The quantity of water to be added shall be as per manufacturer's instructions.

The surface on finishing shall present a flat velvety smooth finish. If necessary more coats will be applied till the surfaces presents a uniform appearance.

15.42.2.3. Precautions

a) Old brushes if they are to be used with emulsion paints should be completely dried of turpentine or oil paints by washing in warm soap water. Brushes should be quickly washed in water immediately after use and kept immersed in water during break periods to prevent the paint from hardening on the brush.

b) In the preparation of wall for plastic emulsion painting, no oil base putties shall be used in filling cracks, holes etc.

c) Splashes on floors etc. shall be cleaned out without delay as they will be difficult to remove after hardening.

d) Washing of surfaces treated with emulsion paints shall not be done within 3 or 4 weeks of application.

Other details shall be as specified as far as they are applicable.

15.42.3. Painting on old surface

15.42.3.1. Preparation of surface

This shall be done, generally as specified except that the surface before application of paint shall be flattened well to get the proper flat velvety finish after painting.

15.42.3.2. Application: The number of coats to be applied shall be as in description of item.

The application shall be as specified in 15.42.2.2 except that thinning with water shall not normally be required.

15.42.3.3 Other details shall be as specified in 15.33 as far as applicable.

15.43. SPECIFICATIONS FOR PAINTING WITH ENAMEL PAINT

15.43.1. Enamel paint (conforming to is: 2933) of approved brand and manufacture and of the required colour shall be used.

For the under coat, the paint of same quality but of shade to suit that of the top coat shall be used.

15.43.2. Preparation of surface and application shall be as specified under 15.35 for painting on new surfaces or old surfaces, as the case may be.

15.43.3. Other details shall be as specified in 15.33 as far as applicable.

15.44. SPECIFICATIONS FOR PAINTING WITH SYNTHETIC ENAMEL PAINT

15.44.1. Synthetic enamel paint (conforming to IS: 2932) of approved brand and manufacture and of the required colour shall be used for the top coat and an undercoat of ordinary paint of shade to match the top coat as recommended by the same manufacturer shall be used.

15.44.2. Painting on new surface

15.44.2.1 Preparation of surface shall be as specified in 15.35.1.1(a) and (b) as the case may be.

15.44.2.2. Application: The number of coats including the undercoat shall be as stipulated in the item.

a) Under coat: One coat of the specified ordinary paint of shade suited to the shade of the top coat, shall be applied and allowed to dry overnight. It shall be rubbed next day with the finest grade of wet abrasive paper to ensure a smooth and even surface, free from brush marks and all loose particles dusted off.

b) Top coat: Top coats of synthetic enamel paint of desired shade shall be applied after the undercoat is thoroughly dry. Additional finishing coats shall be applied if found necessary to ensure properly uniform glossy surface.

15.44.2.3. Other details shall be as specified in 15.33 as far as they are applicable.

15.44.3. Painting on old surface

15.44.3.1. Preparation of surface - Where the existing paint is firm and sound it shall be cleaned of grease, smoke etc. and rubbed with sand paper to remove all loose particles dusted off. All patches and cracks shall then be treated with stopping and filler prepared with the specified paint. The surface shall again be rubbed and made smooth and uniform.

If the old paint is blistered and flaked it will be necessary to completely remove the same as described in 15.54. Such removal shall be paid for separately and the painting shall be treated as on new surface.

15.44.3.2. Painting - The number of coats as stipulated in the item shall be applied with synthetic enamel paint. Each coat shall be allowed to dry and rubbed down smooth with very fine wet abrasive paper, to get an even glossy surface. If however, the surface is not satisfactory additional coats as required shall be applied to get correct finish.

15.44.3.3. Other details shall be specified in 15.33 as far as they are applicable.

12. SPECIFICATIONS FOR ALUMINIUM WINDOWS

(Extract of IS: 1949-1961)

1. **Scope –** Deals with aluminium windows suitable for use in industrial buildings and designed to suit openings based on a module of 10 cm.

2. **Designation –** By symbols IN (to indicate industrial window) x Width expressed in number of modules x Type (F = fixed sash; C = centre hung sash; B = bottom-hung sash; T = top-hung sash) x Height expressed in number of modules.

Examples:

a) IN 10 C 15 indicate window for opening 10 module wide (100 cm) by 15 module high (150 cm) with centre-hung ventilator.

b) Composite windows

IN 10 C 10/IN 10 C 10

IN 10 C 15/IN 10 C 15

Indicates the combination of four windows, two of the type IN 10 C 10 on top and two of the type IN 10 C 15 at bottom, all the four of them coupled both horizontally and vertically.

3. **Sizes and tolerances**

a) Sizes

IN10C10	IN22C10	IN16C15	IN10C20	IN22C20	IN16F10
IN10T10	IN22T10	IN16T15	IN10T20	IN22T20	IN16F15
IN10B10	IN22B10	IN16B15	IN10B20	IN22B20	IN16F20
IN16C10	IN10C15	IN22C15	IN16C20	IN10F10	IN22F10
IN16T10	IN10T15	IN22T15	IN16T20	IN10F15	IN22F15
IN16B10	IN10B15	IN22B15	IN16B20	IN10F20	IN22F20

b) Ventilators (opening part of a sash) shall be of one size and designed to fit into outer frame of IN 10 C 10 and with 1.2-mm clearance.

c) Tolerance for overall dimensions $\pm$ 3 mm.

Note – The overall width and height of window is smaller than dimensions of modular opening by 2.5 cm, allowing a clearance of 1.25 cm all round. Thus, width and height of INC10C5 = 97.5 x 147.5 cm.

4. **Material**

a) Aluminium extruded section: IS Designation HE9 – WP. Hollow sections shall conform to IS Designation HV9 – WP.

b) Cord-eyes, pulleys, brackets and catch plates shall be of aluminium or galvanized or cadmium plated steel.

c) Pivots, peg stays and spring catches shall be of non-ferrous metal.

d) Glass panes - Shall weigh 7.5 kg/m2. Sizes of glass panes shall be as given below:

Pane Designation	a	b	c	d	e	f
Width (mm)	265	300	290	300	300	290
Height (mm)	420	420	455	455	490	490

Note: For number of glass panes for each type of window sees Fig.5 of the standard.

5. **Holes for fixing, coupling and glazing –** Holes for fixing and coupling sashes shall be provided in the web of the outside frame sections and of outer ventilator frame sections where these occur at the perimeter of the sash. Holes for glazing chips shall also be provided, one hole being located in web of the section or tee, on each side of each pane.

6. **Fitting and fixing materials**

6.1. Centre-hung ventilators shall be mounted on a pair of cup-pivots made out of aluminium alloy sheet or chromium plated brass and each pivot consisting of a inner and outer cup, permitting the swinging of the ventilator through at least 85°. The ventilator shall be so balanced that it can remain open in any desired position.

6.2. Centre–hung and bottom-hung ventilators shall have cast aluminium or bronze spring catch in the centre of the top section, suitable for operation by hand or pole (chord in case of centre-hung).

6.3. Bottom-hung and top-hung ventilators shall be hung on aluminium alloy hinges. The former shall be provided with a pair of aluminium alloy folding side arms (to limit the opening) and the latter with a 300 mm long peg stay. Alternatively, top-hung ventilator may be provided with 30-cm cam opener.

6.4. Two spring glazing clips per pane shall be provided

7. **Composite windows –** Shall be dispatched unassembled, but complete with necessary components. Each coupling member will increase the overall height or width by 25 mm.

8. **Finish -** Matt, scratch-brush or polished may be anodized additionally. A thick layer of transparent lacquer, based on methacrylates or cellulose butyrate, shall be applied, by the suppliers, to protect the surface from action of wet cement during installation. This lacquer coating shall be removed after installation is completed.

13. SPECIFICATIONS FOR GLAZED TILE FLOORING

14.15.1. White glazed tiles - The tiles shall be of approved make and shall generally conform to IS: 777. They shall be flat, and true to shape and free from blisters crazing, chips, welts, crawling or other imperfections detracting from their appearance. The tiles shall be tested as indicated in Appendix of IS: 777.

The tiles shall be square or rectangular of nominal size such as 150 x 150 mm, 100 x 100 mm, 100 x 200 mm or as directed by the engineer. The thickness of the tiles shall be 5 mm, or 6 mm as specified. The length of all four sides shall be measured correct to 0.1 mm and average length breadth shall not vary more than $\pm$ 0.8 mm from specified dimension. The variation of individual dimension from average value of length/breadth shall not exceed $\pm$ 0.5 mm. Tolerance in thickness shall be $\pm$ 0.4 mm.

Note 1: Where tiles of nominal sizes of 150 x 150 mm or 100 x 100 mm are not available tiles of nominal sizes 152 mm x 152 mm or 108 mm x 108 mm may be allowed to be used with prior approval of the engineer.

Note 2: The actual size of tiles supplied shall be 1 mm less so that with 1 mm joint, the tile when laid shall conform to the nominal size.

The top surface of the tiles shall be glazed and glaze shall be either glossy or matt as specified. The underside of the tiles shall not have glaze on more than 5% of the area in order that the tile may adhere properly to the base. The edges of the tiles shall be preferably free from glaze. However, any glaze if unavoidable, shall be permissible on only up to 50 per cent of the surface area of the edges.

14.15.2. Coloured tiles - Only the glaze shall be coloured as specified. The sizes and specifications shall be the same as for the white glazed tiles.

14.15.3. Decorative tiles - The type and size of the decorative tiles shall be as follows

Decorated white black ground tiles

The size of these tiles shall be 152 x 152 x 6 mm and / or 108 x 108 x 6 mm.

ii) Decorated and having coloured back ground

The sizes of the tiles shall be 152 x 152 x 6 mm and / or 108 x 108 x 6 mm.

14.15.4. Preparation of surface and laying

Base concrete or the RCC slab on which the tiles are to be laid shall be cleaned, wetted and mopped. The bedding for the tile shall be with cement mortar 1:3 (1cement: 3 coarse sand) or as specified. The average thickness of the bedding shall be 10 mm while the thickness under any portion of the tiles shall not be less than 5 mm.

Mortar shall be spread, tamped and corrected to proper levels and allowed to harden sufficiently to offer a fairly rigid cushion for the tiles to be set and to enable the mason to place wooden plank across and squat on it.

Over this mortar bedding neat grey cement slurry of honey like consistency shall be spread at the rate of 3.3 kg of cement per square meter over such an area as would accommodate about twenty tiles.

Tiles shall be soaked in water washed clean and shall be fixed in this grout one after another, each tile gently being tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. The joints shall be kept as thin as possible and in straight lines or to suit the required pattern.

The surface of the flooring during laying shall be frequently checked with a straight edge about 2 m long, so as to obtain a true surface with the required slope.

Where full size tiles cannot be fixed these shall be cut (sawn) to the required size, and their edge rubbed smooth to ensure straight and true joints.

Tiles which are fixed in the floor adjoining the wall shall enter not less than 10 mm under the plaster, skirting or dado. After tiles have been laid surplus cement slurry shall be cleaned off.

14.15.5. Pointing and finishing - The joints shall be cleaned off the grey cement slurry with wire / coir brush or trowel to a depth of 2 mm to 3 mm and all dust and loose mortar removed. Joints shall then be flush pointed with white cement added with pigment if required to match the colour of tiles. The floor shall then be kept wet for 7 days. After curing, the surface shall be washed and finished clean. The finished floor shall not sound hollow when tapped with a wooden mallet.

14.15.6. Measurements - Length and breadth shall be measured correct to a cm before laying skirting, dado or wall plaster and the area calculated in square meter correct to two places of decimal. Where coves are used at the junctions, the length and breadth shall be measured between the lower edges of the coves.

No deductions shall be made not extra paid for voids not exceeding 0.20 square metre. Deductions for ends of dissimilar materials or other articles embedded shall not be made for areas not exceeding 0.10 square meter.

Areas, where glazed tiles or different types of decorative tiles are used will be measured separately.

14.15.7. Rate - The rate for flooring shall include the cost of all materials and labour involved in all the operations described above. Nothing extra shall be paid for the use of cut (sawn) tiles in the work.

Extra over and above the normal rate for white tiles shall be paid where coloured or any other type of decorative tiles have been used.

14.16. SPECIFICATIONS FOR GLAZED TILES IN SKIRTING AND DADO

14.16.1. The tiles shall be of approved make and shall generally conform to IS: 777. The tiles shall be of earthenware covered by a glaze thoroughly matured and fitted to the body. The tiles shall be sound, true to shape, flat and free from flaws and other manufacturing defects affecting their utility.

The top surface of the tiles shall be glazed. The underside of the tiles shall not have glaze on more than 5% of the area that the tile may adhere properly to the base. The edges of the tiles shall be free from glaze; however, any glaze if unavoidable shall be permissible on only up to 50 per cent of the surface area of edges.

The glaze shall be free from welts, chips, craze, specks, crawling or other imperfections detracting from the appearance when viewed from a distance of one meter. The glaze shall be either glossy or matt as specified. The glaze shall be either glossy or matt as specified. The glaze shall be white in colour except in the case of coloured tiles when colours shall be specified by the engineer. There may be more than one colour on a tile.

14.16.1(a) Dimensions and tolerances - Glazed earthenware tiles shall be made square or rectangular in sizes such as 149 x 149 mm and 99 x 99mm or 99 x 199 mm or as specified and shall

Half tiles for use as full tiles shall have dimensions which shall be such as to make the half tiles when jointed (with 1 mm joint) match with dimensions of full tiles. Tiles may be manufactured in sizes other than those specified above.

Note: Commonly manufactured sizes include 108 x 108 mm, 152 x 152 mm, 200 x 200 mm, 200 x 150 mm and 200 x 100 mm.

The thickness of the tiles shall be 5 mm or 6 mm as specified.

The dimensions of fittings associated with the glazed tiles namely cove base, round edge tile, angles corner cups, ridge and legs, cornices and capping beads shall be of the shape and dimensions as required and the thickness of fittings shall be the same as the thickness of tiles given above.

14.16.1 (b) Tolerances

Facial dimensions – The lengths of all the four sides of the tile shall be measured to the nearest 0.1 mm. The average value of lengths / breadth shall not vary more than ± 0.8 mm from the above specified dimension.

The variation of individual dimensions from average value of length / breadth shall not exceed ± 0.5 mm. Tolerances on thickness shall be ± 0.4 mm.

Tiles shall be checked for squareness and warpage as described thereafter.

Method of checking squareness of tiles

Fig. A – Trueness of Shape (Squareness) [Clause 14.16.1(c)]

14.16.1 (c) Trueness of shape (Squareness) - Any variation from a right angle in the angle contained by any two adjoining sides shall be limited so that if a builder's steel square is placed against the angle, the distance between the inner edge of the square and the adjacent side of the tile or fitting shall not be more than 0.5 mm per 100 mm run.

14.16.1 (d) Warpage - The tiles when tested for warpage on the edges and on the diagonal as per Appendix – A of IS: 777 shall not have warpage exceeding the value as specified below

Size of tile (mm)	Warpage (mm)
149 x 149	- 0.4 + 0.7
99 x 99	- 0.3 + 0.5

14.16.1 (e) Performance requirements water absorption - The average water absorption of the tiles when tested and evaluated in accordance with IS: 777 shall not exceed 20 per cent.

Crazing - Tiles subjected to two cycles of crazing test as per IS: 777 shall not show any sign of crazing.

Impact resistance - Tiles when tested for impact resistance as per IS: 777 shall remain intact, apart from surface marking.

Chemical resistance - When tested as per IS: 777, the glazed surface of tiles and / or the fittings having a white or cream coloured glossy glaze shall show no modification.

14.16.2. Preparation of surfaces - The joints shall be raked out to a depth of at least 15 mm in masonry walls.

In case of concrete walls, the surface shall be hacked and roughened with wire brushes. The surface shall be cleaned thoroughly, washed with water and kept wet before skirting is commenced.

14.16.3. Laying - 12 mm thick plaster of cement mortar 1:3 (1cement: 3 coarse sand) mix as specified shall be applied and allowed to harden. The plaster shall be roughened with wire brushes or by scratching diagonal at closed intervals.

The tiles should be soaked in water, washed clean, and a coat of cement slurry applied liberally at the back of tiles and set in the bedding mortar. The tiles shall be tamped and corrected to proper plane and lines. The tiles shall be set in the required pattern and jointed. The joints shall be as fine as possible. Top of skirting or dado shall be truly horizontal and joints truly vertical except where otherwise indicated. Skirting and dado shall rest on the top of the flooring. Where full size tiles cannot be fixed these shall be cut (sawn) to the required size and their edges rubbed smooth.

14.16.4. Curing and finishing - The joints shall be cleaned off the grey cement grout with wire / coir brush or trowel to a depth of 2 mm to 3 mm and all dust and loose mortar removed. Joints shall then be flush pointed with white cement added with pigments if required to match the colour of tiles. The work shall then be kept wet for 7 days.

After curing, the surface shall be washed and finished clean. The finished work shall not sound hollow when tapped with a wooden mallet.

14.16.5. Measurements - Length shall be measured correct to a cm. Height shall be measured correct to a cm in the case of dado and 5 mm in the case of riser and skirting. The area shall be calculated in square meter, correct to two places of decimal. Length and height shall be measured along the finished face of the skirting or dado including curves where specials such as coves, internal and

external angles and beads are used. Where cornices are used the area of dado shall be measured excluding the cornices. Nothing extra will be paid for cutting (sawn) the tiles to sizes.

In addition to payment for areas of skirting and dado, specials such as coves, internal and external angles and beads shall be measured separately and paid for in running meters. Cornices shall also be similarly measured for payment in running meters. Areas where coloured tiles or different types of decorative tiles are used will be measured separately to be paid extra over and above the normal rate for white tiles.

14.16.6. Rates - The rate shall include the cost of all materials and labour involved in all the operations described above. The specials such as coves, internal and external angles and beading shall be measured and paid for separately. The rate shall not include cost of cornices which shall be measured and paid for in running meters separately.

14.17. SPECIFICATIONS FOR GLAZED TILE SPECIALS

14.17.1. Specials - The specials consist of coves, internal and external angles, beads cornices and their corner pieces.

Cover beads and angles shall be of thickness not less than the thickness of the tiles with which they are used. The size of coves, beads, angles refer to the greatest width of the special measured in a straight line. The stipulated size of cornices is their height. The lengths of specials shall be 15 cm, 10 cm or other standard size available conforming to the size of tiles available.

In other respects the general specifications as described in 14.15.1 shall be applicable.

14.17.2. Preparation of surface, laying, curing and finishing shall be as specified in 14.16.2, 14.16.3, 14.16.4 as far as applicable.

14.17.3. Measurements - Special tiles to form coved internal angles of any radius, rounded external angles, architraves moulding, ceiling ribs, cornices and the like shall each be measured in running meters correct to a cm. Railing members and vertical members shall each be so described. Ends, angles and internal sections shall be enumerated separately.

14.17.4. Rate - It shall include the cost of all materials and labour involved in all the operations described above. Nothing extra shall be paid for corner pieces at junctions of coves, beads, cornices etc. or for using cut lengths of specials.

14. DRAINAGE WORKS

12.1. General requirements

12.1.1. In designing a drainage system for building(s), the aim shall be to provide self cleansing conduits for the conveyance of soil, waste, surface or sub-surface waters, and for the removal of such wastes speedily and efficiently to a sewer or other outlet, without risk of nuisance and hazard to health.

12.1.2. The discharge of water through a domestic drain is intermittent and limited in quantity and therefore, small accumulations of solid matter are liable to form in the drains between the building and the public sewer. There is usually a gradual shifting of these deposits as discharges take place. Gradients shall be sufficient to prevent these temporary accumulations building up and blocking the drains.

12.1.3. Normally, the sewer shall be designed for discharging three times the dry weather flow flowing half-full with a minimum self cleansing velocity of 0.75 metre per second. The approximate gradients which give this velocity for the sizes of pipes likely to be used in building drainage, and the corresponding discharges when flowing half-full are given in Table 1. The sizes and slopes shall conform to Local Municipal Bye Laws.

12.1.4. In cases, where it is practically not possible to conform to the minimum gradients, a flatter gradient may be used but the minimum velocity in such cases shall on no account be less than 0.61 metres per second.

12.1.5. On the other hand, it is undesirable to employ gradients giving velocity of flow greater than 2.4 metres per second. Where it is unavoidable, cast iron pipes shall be used. The approximate

gradients which give a velocity of 2.4 metres per second for the various sizes of pipes and the corresponding discharge when flowing half-full are given in Table 1.

12.2. Specifications for materials

12.2.1. Flushing tank (Fig. 1): Subject to the minimum size of 100 mm, the sizes of pipes shall be decided in relation to the estimated quantity of flow and the available gradient.

12.2.2. C. I. Cover: C. I. Cover shall be 560 mm dia and shall be medium duty or heavy duty depending upon the locations of the tank. It shall conform in all respects to IS: 1726-91 (Part IV and Part II) respectively. Weight of cover and frame shall conform is IS: 1726-91.

12.2.3. Siphon shall be automatic siphon made of cast iron with trapped outlet for flushing. The siphon for flushing a sewer line shall be as 65 mm, 80 mm or 100 mm dia as specified.

12.2.2. Manholes

12.2.2.1. C. I. Covers - The covers and frames shall conform to IS: 1726-91 and shall be of the following grades and types:

a) Heavy duty - These shall be denoted by the letters HD circular solid type for use under heavy vehicular traffic condition and shall conform to IS: 1726-91 (Part-II).

b) Medium duty - These shall be denoted by the letter MD circular or rectangular solid type for use under light traffic condition such as foot paths, carriage drives and cycle tracks. These shall conform to IS: 1726-91 (Part – IV & V).

c) Light duty - These shall be denoted by the letter LD of rectangular size for use in domestic premises or where they are not subjected to wheeled traffic loads. These shall conform to IS : 1726-91 (Part-IV) – Square types shall conform to IS : 1726-91(Part-VII). The covers and frames shall be cleanly cast and they shall be free from air and sand holes and from cold shuts. They shall be neatly dressed and carefully trimmed. All castings shall be free from voids whether due to shrinkage, gas inclusion or other causes. Covers shall have a raised Chequered design on the top surface to provide an adequate non-slip grip.

FLUSHING TANK

The cover shall be capable of easy opening and closing and it shall be fitted in the frame in workmanship like manner.

Table 1 Gradient for sewers

Diameter mm	Minimum Gradient		Maximum Gradient	
	Gradients	Discharge cum / Min.	Gradients	Discharge cum / Min.
100	1 in 57	0.18	1 in 5.6	0.59
150	1 in 100	0.42	1 in 9.7	1.32
200	1 in 145	0.73	1 in 14	2.4
230	1 in 175	0.93	1 in 17	2.98
250	1 in 195	1.10	1 in 19	3.60
300	1 in 250	1.70	1 in 24.5	5.30

The cover shall be gas tight and water tight.

The covers used in manholes in sewer lines shall invariably bear the word ‘SEWER’ on the top and those used for storm water drains shall bear the word ‘STORM’. These markings shall be done during casting of the covers.

The sizes of covers specified shall be taken as the clear internal dimensions of the frame. The approximate weights of the various types of manhole covers and frames shall be as per IS: 1726-91.

Covers and frames shall be coated with a black bituminous composition. The coating shall be smooth

and tenacious. It shall not flow when exposed to a temperature of 63 degree centigrade and shall not be brittle as to chip off at temperature of 0 degree centigrade.

12.2.2. Precast concrete manhole covers & frames - Precast reinforced cement concrete manhole covers intended for use in sewerage and water works shall generally conform to IS : 12592 (Part 1 & 2). Detailed specifications are as under:

12.3.2.2.1. Grades: Types & Uses - Manhole covers and frames shall be of the following four grades and types

Grades	Grade Designation	Type / shape of cover
Light Duty	LD – 2.5	Rectangular, Square, Circular
Medium Duty	MD – 10	Rectangular, Circular
Heavy Duty	HD – 20	Circular, Square, Rectangular, (Scrapper Manhole)
Extra Heavy Duty	EHD – 35	Circular, Square, Rectangular, (Scrapper Manhole)

12.4.2.2.2. The different grades and types of manhole covers may be used as follows

a) LD – 2.5 Rectangular, Square or Circular types -These are suitable for use within residential and institutional complexes/areas with pedestrian but occasional LMV traffic. These covers may also be used for Inspection Chambers.

b) MD – 10 - These are suitable for use in service lanes/roads, car parking areas etc.

c) MD – 20 - Suitable for use in institutional/commercial areas/carriage ways with heavy duty vehicular traffic like buses, trucks, etc.

d) EHD – 35 - Circular, square, or rectangular (scrapper manhole) types – These are suitable for use on carriage way in commercial industrial/port areas/near warehouses/godowns where frequent loading and unloading of trucks/trailers are common, with slow to fast moving vehicular traffic of the types having wheel loads up to 11.5 tonnes, irrespective of the location of the manhole chambers.

12.2.2.3. Materials

Cement - Cement used for the manufacture of precast concrete manhole covers shall be 33 grade Portland cement conforming to I: 269 or 1489 (part 1 & 2) or IS: 8041 or IS: 8112 or IS: 155.

Aggregates - The aggregates used shall be clean and free from deleterious matter and shall conform to the requirements of IS: 383-79. The aggregates shall be well graded and the nominal maximum size of coarse aggregate shall not exceed 20 mm.

Concrete - The mix proportions of concrete shall be determined by the manufacturer and shall be such as will produce a dense concrete without voids, honey combing etc. The minimum cement content in the concrete shall be 360 kg/m3 with a maximum water cement ratio of 0.45. Concrete weaker than grade M-30 (design mix) shall not be used. Compaction of concrete shall be done by machine vibration.

12.2.2.4. Reinforcement

a) The reinforcement steel shall conform to IS: 226 or IS: 432 (Part I) or IS: 832 (Part II) or IS: 1566 or IS: 1786 as specified.

Reinforcement shall be clean and free from loose mill scale, loose rust, and mud, oil, grease or any other coating which may reduce or destroy the bond between the concrete and steel. A light film of rust may not be regarded as harmful but steel shall not be visibly pitted by rust.

b) Fibre steel - In association with the main steel bars reinforcement steel fibres of appropriate types and forms may also be used as secondary reinforcement (up to 0.5% by volume).

Plastics - Plastic fibre of polypropylene fibrillated film of suitable type and form (0.55 by weight) may also be used as reinforcement in line of steel reinforcement.

Shapes and Dimensions

Shapes - The shapes of precast concrete manhole covers shall be square, rectangular or circular as

specified.

Dimensions - Dimensions of precast concrete manhole covers shall be as given in Table 2, the minimum clearance at top between the frame and cover shall be 5 mm.

Table - 2

S L No	Description	Heavy / Extra Heavy duty HD / EHD	Medium duty M. D.	Light duty L. D.
1	Clear opening matching the top opening of manhole	560 mm dia or 600 mm dia or square or 560 mm	450 mm dia. 480 mm dia. 500 mm dia. dia or square	600x450 mm (rectangular) 450 mm dia or350 mm dia or square
2	Precast slab with Integral frame (D/T)	900mm dia x 180mm or square corners cut1000mm dia x 200 or square corner cut	800 mm. dia x 130 mm 800 mm dia x 150 mm	850 mm x 700mm x 100 mm 625 mm dia x100 mm or575 mm dia x100 mm or square
3	Thickness of cover depth of frame (TI)	100 mm or110/120 mm	70/80 mm	50 mm
4	Matching manhole cover (B)	685/660 mm or 735/710 mm dia or square	585 mm dia or 645 mm dia or square	685 x 535mm 515 mm dia or square 435 mm dia or square
5	Edge protection oF covers/lifting facility	Precast manhole covers are designed and provided with MS rims of 2.5 mm thickness welded around with provision of two lifting hooks welded at appropriate locations.		
6	Chequered pattern on operative surface	The MS rims along with the edges of precast manhole covers and their operative surface are suitably coated/ finished using corrosion resistant paint.		
7	Marking on the covers	Precast manhole covers/precast slabs are suitably marked on the operative surface with the following letters, unless specified otherwise Name of the Department/Sewer or SWD/Grade/Date of MFR/Trade Name etc.		
8	Performance requirements	When tested for ULTIMATE breaking load using 300 mm dia block as per the method described in IS : 12592 (Part1) manhole covers shall be within the following range :		
9	Test Load	Light – duty 2.5 tonnes (L. D. – 2.5) Heavy Duty – 20 tonnes (HD –20) Medium duty: 10 tonnes (MD-10) Extra heavy duty : 35 tonnes (EHD-35).		

12.2.5. Lifting Device:

The minimum diameter of mild steel rod used as lifting device shall be 10 mm for light and 12 mm for medium duty covers and 16 mm for heavy and extra heavy duty covers. The lifting device shall be protected from corrosion by not galvanising or epoxy coating or any other suitable.

12.2.2.6. Finishing & coating - To prevent any possible damage from corrosion of steel the underside of the covers shall be treated with anticorrosive paint. The top surface of the covers shall be given a Chequered finish.

In order to protect the edges of the covers from possible damage at the time of lifting and handling it is

necessary that the manhole covers shall be cast with a protective mild steel of minimum 2.5 mm thickness around the periphery of the covers. Exposed surface of mild steel sheet shall be given suitable treatment with anticorrosive paint or coating.

12.2.2.7. Physical requirements

a) General - All units shall be sound and free from cracks and other defects which interface with the proper placing of the unit or impair the strength or performance of the units. Minor chipping at the edge/surface resulting from the customary methods of handling during delivery shall not be deemed for rejecting.

b) Load Test - The breaking load of individual units when tested in accordance with the method described in IS: 12592-91 shall be not less than the values specified in Table 3.

12.2.2.8. Fixing - The frames of manhole shall be firmly embedded to correct alignment and level in RCC slab or plain concrete as the case may be on the top of masonry which shall be paid as extra unless specified otherwise.

12.2.2.9. Measurements - The manhole covers shall be enumerated under relevant items.

12.2.2.10. Rates - The rate shall include the cost of materials and labour involved in all the operation described above except fixing of frames and covers which shall be paid as extra unless specified otherwise in the item.

12.2.3. Foot Rests - Foot rests shall be of 20 mm M. S. square or round bars as specified.

12.2.3.1. Pipes and Specials - Cast iron (centrifugally cast) pipes and specials shall conform to the specifications as described in 12.2.13.

Table 3.

Grade of cover	Type	Load in Tonnes	Diameter of Blocks in mm
EHD – 35	Circular, square or Rectangular	35	300
HD – 20	Circular, Square or Rectangular	20	300
MD – 10	Circular or Rectangular	10	300
LD – 2.5	Rectangular, Square or Circular	2.5	300

12.2.3.2. Cement Concrete Pipes (with and without reinforcement) - The pipes shall be with or without reinforcement as required and shall be of the specified class. These shall conform to IS: 458-88. The reinforced cement concrete pipes shall be manufactured by centrifugal (or spun) process

while un-reinforced cement concrete pipes by spun or pressure process. All pipes shall be true to shape, straight, perfectly sound and free from cracks and flaws. The external and internal surface of the pipes shall be smooth and hard. The pipes shall be free from defects resulting from imperfect grading of the aggregate mixing or moulding.

Concrete used for the manufacture of un-reinforced and reinforced concrete pipes and collars shall not be leaner than 1:2:4 (1 cement: 2 coarse and 4 graded stone aggregate). The maximum size of aggregate should not exceed one third of the thickness of the pipe or 20 mm whichever is smaller. The reinforcement in the reinforced concrete pipes shall extend throughout the length of the pipe. The circumferential and longitudinal reinforcements shall be adequate to withstand the specified hydrostatic pressure and further bending stresses due to the weight of water when running full across a span equal to the length of pipe plus three times its own weight.

Table 4 Concrete pipes

Class	Description	Test Pressure (Hydrostatic)	Conditions where normally used.
NP1	Unreinforced concrete non pressure pipes	0.7 Kg/sq. cm. (7 meter head)	For drainage and irrigation 8520/ use, above ground or in shallow trenches.

NP2	Reinforced concrete light duty, non-pressure pipes	- do -	For drainage and irrigation use, for culverts carrying light traffic.
NP3	Reinforced concrete, medium-duty non-pressure pipes	- do -	For drainage and irrigation use, for culverts, carrying heavy traffic.
NP4	Reinforced concrete, heavy duty non-pressure pipes	- do -	For drainage and irrigation use for culverts carrying very heavy traffic, such as railway loading.
P1	Reinforced concrete pressure pipes	2.0 Kg/sq. cm. (20 metre head)	For use on gravity mains, the design pressure not exceeding two-third of the test pressure.
P2	Reinforced concrete Pressure pipes.	4.0 Kg/sq. cm. (40 metre head)	For use on pumping mains, the design pressure not exceeding half of the test pressure.
P3	Reinforced concrete Pressure pipes.	6.0 Kg/sq. cm. (60 metre head)	- do -

The dimensional requirements of concrete pipes are given in Annexure 12-A.1

The minimum cover for reinforcement of spun pipes and for all other pipes shall be as given in Table 5.

Table 5

Pipe Thickness	Cover for	
	Spun Pipes(mm)	Other than spun pipe (mm)
Less than 30 mm	9	12
30 mm to 75 mm	12	16
75 mm and over	18	18

12.2.4. Road gully grating (Fig. 2)

12.2.4.1. Horizontal gully grating - The casting of the grating and frames shall be the same as that of manhole covers as described. The gully grating cover shall be hinged to the frame to facilitate its opening for cleaning and repairs. A typical grating is shown in Fig. 2 & 3. The weight of grating shown in Figure shall be minimum 75 kg. In case of R. C. C. horizontal gully grating it shall be in cement concrete 1:1:2 (1 cement : 1 coarse sand : 2 graded stone aggregate 20 mm nominal size) as shown in Fig. 3

12.2.4.2. Vertical gully grating - The chamber shall be of brick masonry, 12 mm dia, round bar shall be fixed in cement concrete block at the bottom. The bars at the top shall be welded or riveted to M. S. flat 40 x 6 mm as shown in Fig. 3

12.2.4.3. Horizontal and vertical gully grating - The details of typical road gully chamber of brick masonry with horizontal and vertical grating shall be as given in Fig. 3

12.2.5. Stone ware pipes and fittings - All pipes with spigot and socket ends and fittings shall conform to IS: 651-92. These shall be sound, free from visible defects such as fire cracks or hair cracks. The glaze of the pipes shall be free from crazing. The pipes shall give a sharp clear tone when struck with a light hammer. There shall be no broken blisters. The thickness of pipes shall be as given in the Table 6.

Table 6 Stoneware pipes

Internal diameter mm	Thickness of the barrel and socket mm
100	12
150	16

200	17
230	19
250	20
300	25
350	30
400	35
450	38

R.C.C. ROAD GRATING

The length of pipes shall be 60, 75, 90 cm exclusive of the internal depth of the socket. The pipes shall be handled with sufficient care to avoid damage to them.

12.2.6. S. W. Gully trap (Fig. 4) - Gully traps shall conform to IS: 651-92. These shall be sound, free from visible defects such as fire cracks, or hair cracks. The glaze of the traps shall be free from crazing. They shall given a sharp clear tone when struck with light hammer. There shall be no broken blisters.

Each gully trap shall have one C. I. grating of square size corresponding to the dimensions of inlet of gully trap. It shall also have a water tight C. I. cover with frame inside dimensions 300 x 300 mm the cover weighing not less than 4.50 kg and the frame not less than 2.70 kg. The grating, cover and frame shall be of sound and good casting and shall have truly square machined seating faces.

15. SPECIFICATIONS FOR WATER SUPPLY WORK

13.1. General

13.1.1. Any damage caused to the building, or to electric, sanitary water supply or other installations etc. therein either due to negligence on the part of the contractor, or due to actual requirements of the work, shall be made good and the building or the installations shall be restored to its original condition by the contractor. Nothing extra shall be paid for it, except where otherwise specified.

13.1.2. All water supply installation work shall be carried out through licensed plumbers.

13.1.3. It is most important to ensure that wholesome water supply provided for drinking and culinary purposes, is in no way liable to contamination from any less satisfactory water. There shall, therefore, be no cross connection whatsoever between a pipe or fitting for conveying or containing wholesome water and a pipe or fitting for conveying or containing impure water or water liable to contamination or of uncertain quality of water which has been used for any purpose. The provision of reflux or non-return valves or closed and sealed valves shall not be construed a permissible substitute for complete absence of cross connection.

13.1.4. Where a supply of wholesome water is required as an alternative or stand by to supply of less satisfactory water or is required to be mixed with the latter, it shall be delivered only into a cistern, and by a pipe or fitting discharging into the air gap at a height above the top edge of the cistern equal to twice its nominal bore, and in no case less than 15 cm.

13.1.5. No piping shall be laid or fixed so as to pass into, through or adjoining any sewer, scour outlet or drain or any manhole connected therewith nor through any ashpit or manure-pit or any material of such nature that would be likely to cause undue deterioration of the pipe.

13.1.6. Where the laying of any pipe through fouled soil or previous material is unavoidable, the piping shall be properly protected from contact with such soil or material by being carried through an exterior cast iron tube or by some other suitable means. Any piping or fitting laid or fixed, which does not comply with the above requirements, shall be removed and re-laid in conformity with the above requirements.

13.1.7. The design of the pipe work shall be such that there is no possibility of back flow towards the source of supply from any cistern or appliance whether by siphonage or otherwise, and reflux or non-return valves shall not be relied upon to prevent such back flow.

13.1.8. All pipe work shall be so designed, laid or fixed, and maintained as to be and to remain completely watertight, thereby avoiding waste of water, damage to property and the risk of contamination of the water conveyed.

13.1.9. In designing and planning the layout of the pipe work, due attention shall be given to the maximum rate of discharge, required economy in labour and materials, protection against damage and corrosion, protection from frost, if required, and to avoidance of airlocks, noise transmission and unsightly arrangement.

13.1.10. To reduce frictional losses, piping shall be as smooth as possible inside. Methods of jointing shall be such as to avoid internal roughness and projection at the joints, whether of the jointing materials or otherwise.

13.1.11. Change in diameter and in direction shall preferably be gradual rather than abrupt to avoid undue loss of head. No bend or curve in piping shall be made so as to materially diminish or alter the cross-section.

13.1.12. Underground piping shall be laid at such a depth that it is unlikely to be damaged by frost or traffic loads and vibrations. It shall not be laid in ground liable to subsidence, but where such ground cannot be avoided, special precautions shall be taken to avoid damage to the piping. Where piping has to be laid across recently disturbed ground, the ground shall be thoroughly consolidated so as to provide a continuous and even support.

13.1.13. Where the service pipe is of diameter less than 50 mm the stop valves shall be of the screw-down type and shall have loose washer plates to act as non-return valves. Other stop valves in the service line may be of the gate type.

13.1.14. In flats and tenements supplied by a common service pipe a stop tap shall be fixed to control the branch each separately occupied part. In large buildings a sufficient number of stop valves shall be fixed on branch pipes, and to control groups of ball valves and draw off taps, so as to minimize interruption of the supply during repairs, all such stop valves shall be fixed in accessible positions and properly protected from being tampered with, they may be of the gate type to minimize loss of head by friction.

13.1.15. Water for drinking or for culinary purposes as far as possible shall be on branch pipes connected directly to the service pipe.

13.1.16. Pumps shall not be allowed on the service pipe as they cause a drop of pressure on the suction side thereby affecting the supply to the adjoining properties. In cases where pumping is required, a properly protected storage tank of adequate capacity shall be provided to feed the pump.

13.1.17. Service pipes shall be so designed and constructed as to avoid air-locks, so that all piping and fittings above ground can be completely emptied of water to facilitate repairs. There shall be draining taps or draw – off taps (not underground) at the lowest points, from which the piping shall rise continuously to draw-off taps, ball valves, cisterns, or vents (where provided at the high points).

13.1.18. Service pipes shall be designed so as to reduce the production and transmission of noise as much as possible. Appliances which create noise shall be installed as far distant as possible from the living rooms of the house. High velocity of water in piping and fittings shall be avoided. Piping shall be confined, as far as possible, to rooms where appliances are fixed, it shall have easy bends, and where quietness is particularly desired, holder bats or clamps shall be insulated from the piping by suitable pads.

13.1.19. The rising pipe to the storage cistern, if any, or any feed cistern shall be taken as directly as possible to the cistern and shall be fixed away from windows or ventilators.

All pipe work shall be planned so that the piping is accessible for inspection, replacement and repair. To avoid its being unsightly, it is usually possible to arrange it in or adjacent to cupboards, recesses, etc. provided there is sufficient space to work on the piping with the usual tools. Piping shall not be buried in walls or solid floors. Where unavoidable, piping may be buried for short distances provided that adequate protection is given against damage and that no joints are buried. If piping is laid in

ducts or chases, these shall be roomy enough to facilitate repairs and shall be so constructed as to prevent the entry of vermin. To facilitate removal of pipe casing, floor boards covering piping shall be fixed with screws or bolts.

13.1.21. When it is necessary for a pipe to pass through a wall or floor, a sleeve shall be fixed therein for reception of the pipe and to allow freedom for expansion and contraction and other movement. Piping laid in wood floors shall, where possible, be parallel with the joists.

13.1.22. Where storage tanks are provided to meet overall requirements of water connection of service pipe with any distributing pipe shall not be permitted except one direct connection for culinary or drinking requirements.

13.1.23. No service pipe shall be connected to any water closet or urinal. All such supplies shall be from flushing cisterns which shall be supplied form storage tank.

13.1.24. No service or supply pipe shall be connected directly to any hot-water system or to any apparatus used for heating other than through a feed cistern thereof.

13.2. Materials - The standard size of brass or gun metal fittings shall be designated by the nominal bore or the pipe outlet to which the fittings are attached. A sample of each kind of fittings shall be got approved from the engineer and all supplies made according to the approved samples. All cast fittings shall be sound and free from laps, blow holes and pitting. Both internal and external surfaces shall be clean, smooth and free from sand etc. Burning, plugging, stopping or patching of the casting shall not be permissible. The bodies, bonnets, spindles and other parts shall be truly machined so that when assembled the parts shall be axial, parallel and cylindrical with surface smoothly finished. The area of water way of the fittings shall not be less than area of the nominal bore, chromium plating wherever specified shall be of 0.3 micron conforming to IS : 4827-83. The chromium shall never be deposited on brass unless a heavy coating of nickel is interposed. In the case of iron a thick coat of copper shall first be applied, then one of nickel and finally the chromium. In finish and appearance the plated articles when inspected shall be free from plating defects such as blisters, pits roughness and unplated areas and shall not be stained or discoloured. Before a fitting is plated, the washer plate shall be removed from the fittings, the gland packing shall be protected from the plating solution.

13.2.1. Ball Valve (Brass) - The ball valve shall be of Brass or Gun metal as specified conforming to IS: 1703-89 (Fig. 1). The ball valve shall be of following two classes

a) High Pressure - Indicated by the abbreviation ‘HP’ for use on mains having pressure of 1.75 kg/sq. cm. or above. These shall remain closed at a test pressure of 13.5 kg/sq. cm.

Table .1

Sl. No.	Diameter of spherical float	Nominal size of ball valve					
		15 mm	20 mm	25 mm	32 mm	40 mm	50 mm
1	High Pressure (mm)	127	152	203	229	254	305
2	Low Pressure	114	127	178	203	203	254
3	Minimum weight of ball valve including back nut, body and piston (gms)	283	446	823	1149	1589	1852

b) Low pressure - Indicated by the abbreviation ‘LP’ for use on mains having a pressure up to 1.75 kg/sq. cm. These shall remain closed at a test pressure of 3.5 kg/sq. cm. The ball valves shall be of following nominal sizes 15 mm, 20 mm, 25 mm, 32 mm, 40 mm and 50 mm. The nominal size shall correspond with the nominal bore of the inlet shanks. Polyethylene floats shall conform to IS: 9762-94 (See Table 1)

13.2.2. Bib cock and Stop cock - Brass (Fig. 2) : A bib cock (bib tap) is a draw off tap with a horizontal inlet and free outlet and a stop cock (stop tap) is a valve with a suitable means of connections for insertion in a pipe line for controlling or stopping the flow. They shall be of specified size and shall be

of screw down type and shall conform to IS: 781-84. The closing device shall work by means of disc carrying a renewable non-metallic washer which shuts against water pressure on a seating at right angles to the axis of the threaded spindle which operates it. The handle shall be either crutch or butterfly type securely fixed to the spindle. Valve shall be of the loose leather seated pattern. The cocks (taps) shall open in anti-clock wise direction.

The bib cock and stop cock shall be polished bright. The minimum finished weights of bib tap (cock) and stop tap (cock) shall be as specified in Table 20.2.

In case these are required to be nickel plated, the plating shall be of the first quality with a good thick deposit of silvery whiteness capable of taking high polish which will not easily tarnish or scale.

13.2.3. Ferrules (Fig. 1) - The ferrules for connection with C. I. main shall generally conform to IS : 2692-89 It shall be of non ferrous materials with a C. I. bell mouth cover and shall be of nominal bore as specified. The ferrule shall be fitted with a screw and plug or valve capable of completely shutting off the water supply to the communication pipe, if and when required.

13.2.4. Fire hydrants (Fig. 1) - The hydrants shall be of spindle type with 65 mm outlet combined with sluice valve, unless otherwise specified. The hydrant shall conform to IS : 909-92 and shall consist of the following components :

(a) One sluice valve class 1 type, conforming to IS: 780-84.(b) A duck foot bend.(c) A 65 cm male coupling instantaneous pattern; and (d) Cast iron cap permanently secured to the duck foot-bend by means of a chain. Where the fire service requirement of coupling differs from the above, the requisite coupling shall be provided at no extra cost.

Size (mm)	Minimum finished weight	
	Bib tap (Kg.)	Stop tap (Kg.)
8	0.25	0.25
10	0.30	0.35
15	0.40	0.40
20	0.75	0.75

The body and cover shall be of good quality cast iron, spindle of bronze and the nut and the valve seat of leaded tin bronze. The bodies, spindle and other parts shall be truly machined with surface smoothly finished.

13.2.5. Full way valve brass (Fig. 2) - Full way valve is a valve with suitable means of connection for insertion in a pipe line for controlling or stopping the flow. The valve shall be of brass fitted with a cast iron wheel and shall be of gate valve type conforming to IS : 780-84 opening full way and of the size as specified.

The valves shall be of best quality as approved by the Engineer and shall approximately have the weights specified in Table 3 with a tolerance of 5 percent.

13.2.6. Full way valve with wheel – Gun metal (Fig. 2) - These shall be of the gun metal fitted with wheel and shall be of gate valve type opening full way and of the size as specified. These shall generally conform to IS: 778-84 and their weights shall be as specified in Table 13.3.

13.2.7. Pig lead - Pig lead shall be of uniform quality; clean and free from foreign materials. It shall be of uniform softness and capable of being easily caulked or driven. It shall conform to IS: 782-78 for caulking lead in all respects.

13.2.8. Lead wool - Lead wool shall conform to IS: 782-78 in all respects. Lead wool shall consist of fine strands or plated ribbons of lead. The cross-section of the individual strands shall be flat. The dimensions in the sectional plane shall not be less than 0.13 mm and not more than 0.90 mm and the rope shall be supplied in minimum lengths of two metres and the maximum length in any one package shall be such that the package does not weigh more than 50 kg.

Table 3

Mm	Flanged ends (Kg.)	Screwed ends (Kg.)
15	1.021	0.567
20	1.503	0.680
25	2.495	1.077
32	3.232	1.559
40	4.082	2.268
50	6.691	3.232
65	13.149	6.804
80	13.381	8.845

13.2.9. Non-return valve or check valve-brass (Fig. 2) - A non-return valve permits water to flow in one direction only and is provided on the ascending part of the main to check return flow. The non-return valve shall be of brass and shall be of horizontal or vertical flow type as specified. The valve shall be of quality approved by the Engineer and shall have the weights specified in Table 4 with a tolerance of 5 percent.

13.2.10. Non-Return valve or check valve – Gun Metal (Fig. 2) - Specification as described shall apply except that the non-return valve shall be of gun metal and shall generally conform to IS: 778-84

13.2.11. Pipes and Specials - Pipes and specials may be of any of the following types as specified (a) Asbestos cement pressure pipes – IS: 1592-89(b) Cast iron centrifugally cast (spun) – IS: 1536-89(c) Galvanized steel – IS: 1239 & IS: 4736-86 (d) Plastic unplasticised rigid PVC – IS: 4981-84 & IS : 4985-88. In choosing the material for piping and fittings, account shall be taken of the character of the water to be conveyed through it, the nature of the ground in which the pipes are to be laid and the relative economics.

16. RELEVANT BIS CODE FOR TECHNICAL SPECIFICATION

S. No.	IS Code	Description
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.

IS NO.	TITLE
292 :1983	Specification for leaded brass ingots and castings
318:1981	Specification for leaded tin bronze ingots and castings
319:1989	Specification for free cutting leaded brass bars, roads and sections
407:1989	Specification for brass tubes for general purpose
410:1977	Specification for cold rolled brass sheets, strip and foil
554:1985	Dimensions for pipe threads where pressure – tight joints are made on threads
742:1981	Specification for zinc base alloys die casting
781:1984	Specification for cast copper alloys screw down bib taps and stop valves for water services
1264:1989	Specification for brass gravity die castings (ingots and castings)
1795:1982	Specification for pillar taps for water supply purpose
2643 : 1975	Dimensions for pipe threads for fastening purpose
4454 (part 4): 1975	Steel wires for cold formed springs : part 4 stainless spring steel wire for normal corrosion resistance (first revision)
4694 : 1968	Basic dimension of square threads
4827:1983	Electroplated coatings of nickel and chromium on copper and

	copper alloys
4828:1983	Electroplated coatings of copper nickel and chromium on zinc alloys
4905:1986	Methods for random sampling
5192:1975	Specification for vulcanized natural rubber based compounds
6912:1975	Specifications for copper and copper alloys forging stock and forgings
6912:1985	ISO metric trapezoidal screw threads : Part I Basic profile and maximum material profile (first revision)
7008(part 1) :1988	ISO metric trapezoidal screw threads: Part 2 Pitch diameter combinations (first revision)
7008(part 2):1988	ISO metric trapezoidal screw threads: Part 2 Pitch diameter combinations (first revision)
7008(part 3):1988	ISO metric trapezoidal screw threads :Part 3 Basic dimensions (first revision)
7008(part 4):1988	ISO metric trapezoidal screw threads: part 4 Tolerances (first revision)
7450 : 1974	Specification for vulcanized styrene – butadiene rubber (SBR) based compounds
7608 :1975	Specification for phosphor bronze wire (for general engineering Purposes)
7814 : 1985	Specification for phosphor bronze sheets and strip
8376 : 1988	Electroplated coatings of nickel and chromium on plastics for decorative purpose
9844:1981	Method of testing corrosion resistance of electroplated and anodized of electroplated and anodized aluminum coatings by neutral salt spray test
9975 :1981	Specification for “O” rings
10446 : 1983	Glossary of terms relating to water supply and sanitation
10773:1983	Copper tubes for refrigeration purposes

SL. NO.	IS. NO.	Subject
1	458-2003	Precast concrete pipes (with and without reinforcement) (3rd Revision) (Amendment 2)
2	651-1992	Specification for salt glazed stoneware pipes and fittings(5th revision)
3	1726-1991	Specification for cast iron manhole covers and frames(3rd revision)
4	1729-2002	Specification for sand cast iron spigot and socket soil waste and ventilating pipes, fitting and accessories1st revision) (Amendments 4) (Reaffirmed 19

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. a) Part 1 particle size and shape (Amendments 2) Reaffirmed 1990
		b) Part 2 Estimation of deleterious materials and organic impurities (Amendments 1) Reaffirmed 1990.
		c) Part 3 Specific gravity, density, voids, absorption and builking – Reaffirmed 1990.I
		d) 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.

LIST OF BUREAU OF INDIAN STANDARDS (IS)

IS: 737-1986	Wrought aluminium and aluminium alloy, steel and strip for general engineering purpose. (3rd Revision)
IS: 1121-(Part I) 1974	Methods of test for determination of properties and strengths of Natural building stones (Part I-compressive strength). (1st Revision) (Amendment I)
IS: 1122-1974	Methods of test for determination of specific gravity of natural Building stones. (1st Revision)
IS: 1123-1975	Methods of identification of natural building stones. (1st Revision)
IS: 1124-1974	Methods of test for determination of water absorption, apparent Specific gravity and porosity of natural building stones. (1st Revision)
IS: 1125-1974	Methods of test for determination of weathering of natural building stones (1st Revision)
IS: 1126-1974	Methods of test for determination of durability of natural Building stones. (1st Revision) (Amendment I)
IS: 1128-1974	Lime stones (slab & tiles). (1st Revision)
IS: 1129-1972	Recommendations for dressing of natural building stones. (1st Revision) Reaffirmed 1993
IS: 1200 (Part 4) -1976	Methods of measurements of building and Civil engineering works: Part 4 : Stone masonry. (3rd Revision) Reaffirmed 1992

IS: 1597 (Part 1)-1992	Code of practice for construction of rubble stone masonry : Part 1 : Rubble Stone masonry (1st Revision)
IS: 1597 (Part 2)-1992	Code of practice for construction of ashlar stone masonry : Part 2 : Ashlar masonry (1st Revision)
IS: 1805-1973	Glossary of terms relating to stones, quarrying and dressing. (1st Revision)
IS: 2185-(Part1)-1979	Concrete masonry units: Part 1: Hollow and solid concrete blocks. (2nd Revision) (Amendment 1) 2005
IS: 2572-1963	Code of practice for construction of hollow concrete blocks Masonry. 2005
IS: 3620-1979	Laterite stone block for masonry. (1st Revision) 1993
IS: 3622-1977	Sand stone (slab & tiles) (1st Revision)
IS: 4101-(Part 1)-1967	Code of practice for external facings and veneers: Part 1: Stone facing, Reaffirmed 1990
IS: 4101-(Part 2) 1967	Code of practice for external facings and veneers: Part 2: Cement concrete facing. 1990
IS: 12440-1988	Precast concrete stone masonry blocks.
IS: 269-1989	33 grade Ordinary Portland Cement. (4th Revision) (Amendments 3)
IS: 1489-1991	Part 1: Portland Pozzolana Cement: Part 1: Fly ash based (3rd Revision) Part 2: Portland Pozzolana Cement: Part 2: Calcined Clay based. (3rd Revision)
IS: 6909-1990	Specification for Super sulphated Cement. (Amendments 2)
IS: 8041-1990	Rapid hardening Portland cement. (2nd Revision) (Amendments 2)
IS: 8043-1991	Hydrophobic Portland cement. (2nd Revision) (Amendments 2)
IS: 3812-1981	Fly ash for as Pozzolana and admixture. (1st Revision) Part I & II 2003
IS: 383-1970	Coarse and fine aggregate from natural sources for concrete. (2nd Revision) Reaffirmed 1990
IS: 453-1993	Double acting spring hinges. (3rd Revision)
IS: 1122-1974	Method of test of determination of true specific gravity of natural building stones. (1st Revision) Reaffirmed 1993
IS: 1124-1974	Method of test for determination of water absorption, apparent Specific gravity and porosity of natural building stones. (1st Revision) Reaffirmed 1990.
IS: 1130-1969	Marble (blocks, slabs and tiles). Reaffirmed 1993
IS: 4101(Part-1) -1967	Code as practice for external facing and veneers: Part 1 Stone facing. Reaffirmed 1990.

SECTION V

DRAWINGS

Brief Description of drawing

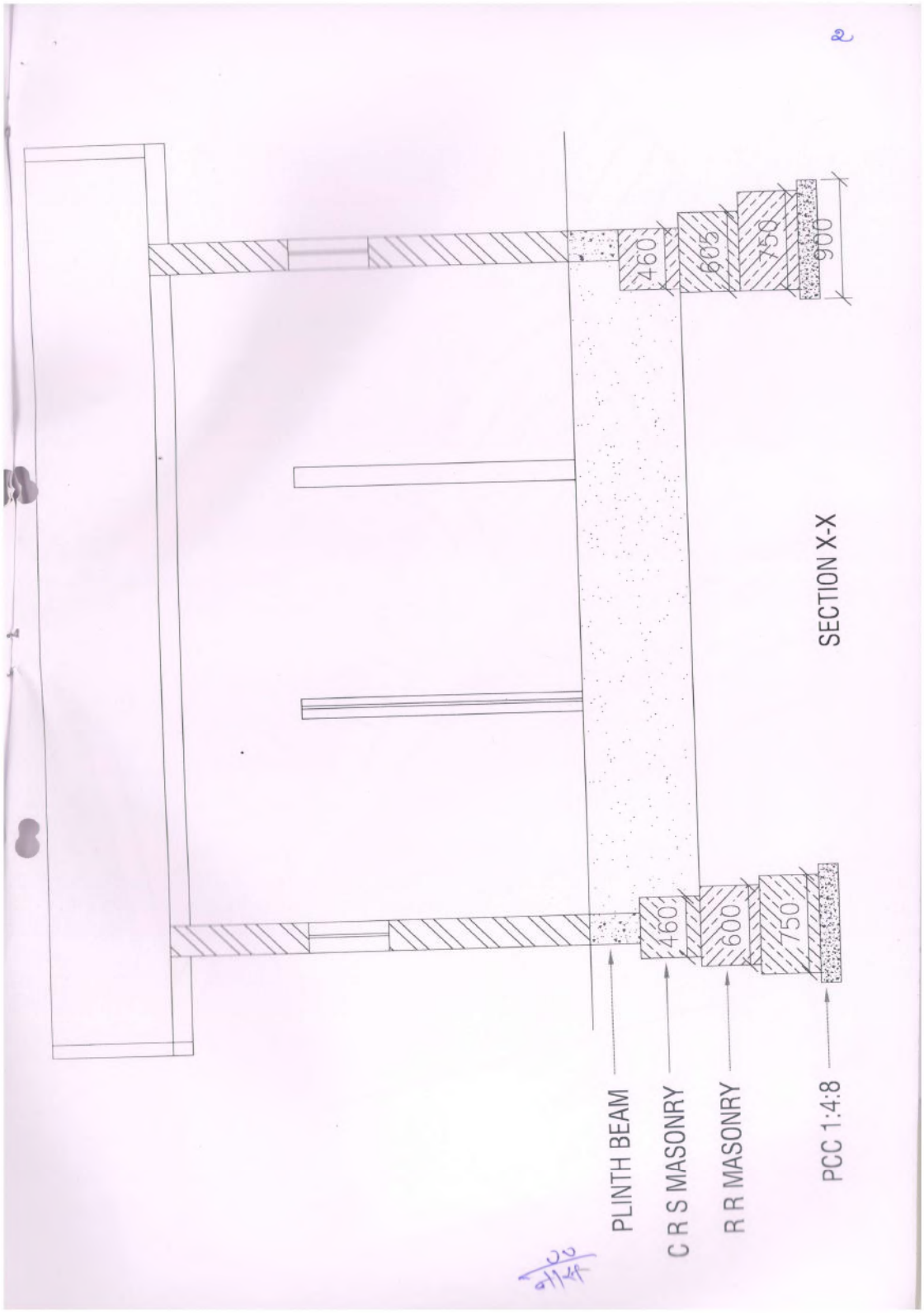
The Works are shown in the following drawings that are issued as a part of the Tender Documents:

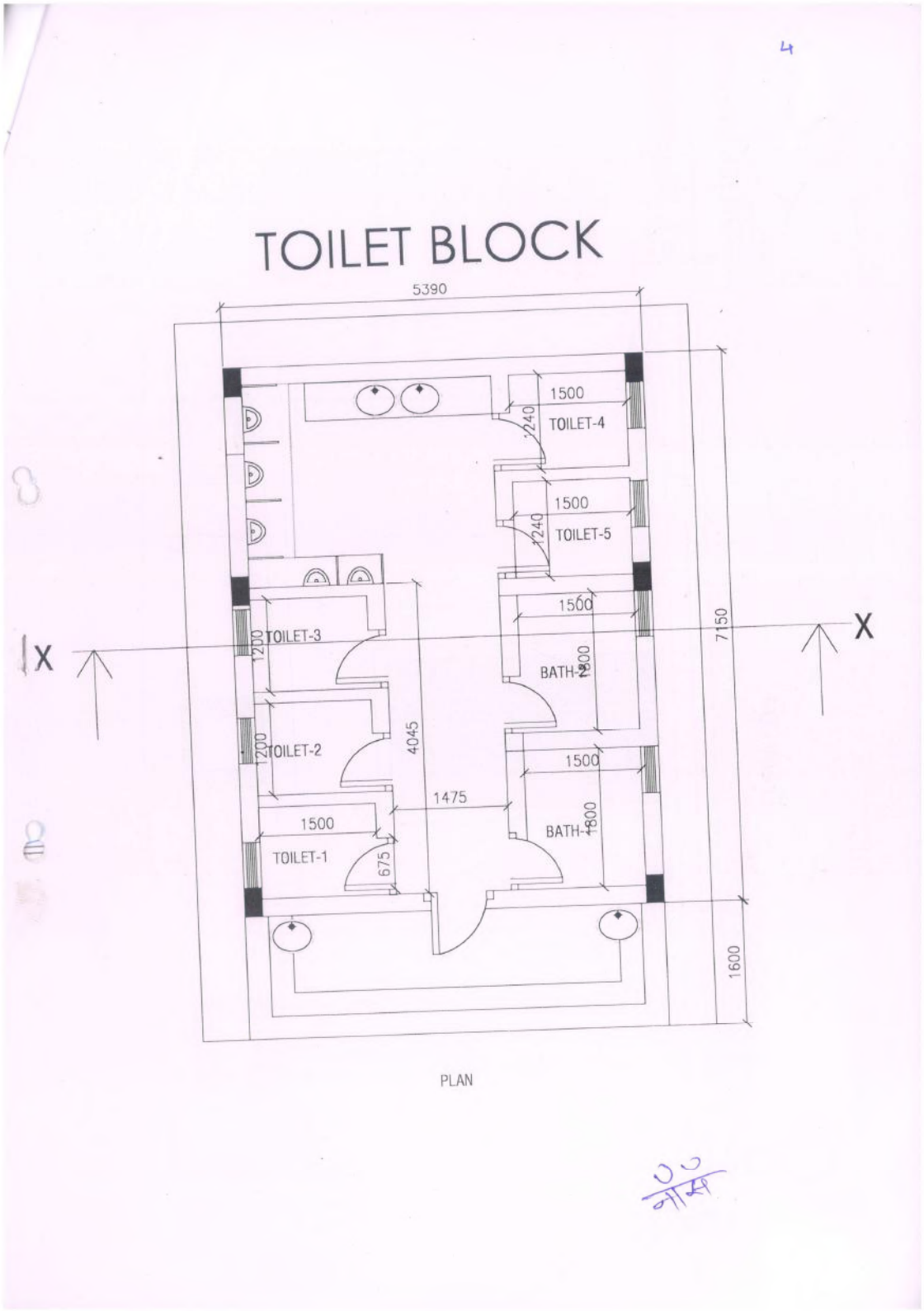
Sl. No	Drawing No.	Description
1	3/6/2022-23- PQC TP/EE(MW)-LP	LOCATION PLAN
2	3/6/2022-23- PQC TP/EE(MW)	Section X-X for Toilet Block
3	3/6/2022-23- PQC TP/EE(MW)	Toilet Block Plan
4	3/6/2022-23- PQC TP/EE(MW)	Section X-X for Shops and Clinic
5	3/6/2022-23- PQC TP/EE(MW)	1st floor plan for Shops and Clinic
6	3/6/2022-23- PQC TP/EE(MW)	Ground floor Plan for Shops and Clinic
7	3/6/2022-23- PQC TP/EE(MW)	Section X-X Canteen
8	3/6/2022-23- PQC TP/EE(MW)	1st floor plan for Dormitory
9	3/6/2022-23- PQC TP/EE(MW)	Ground Floor for Canteen
10	3/6/2022-23- PQC TP/EE(MW)	Cross section of PQC Road
11	3/6/2022-23- PQC TP/EE(MW)	Area proposed for PQC

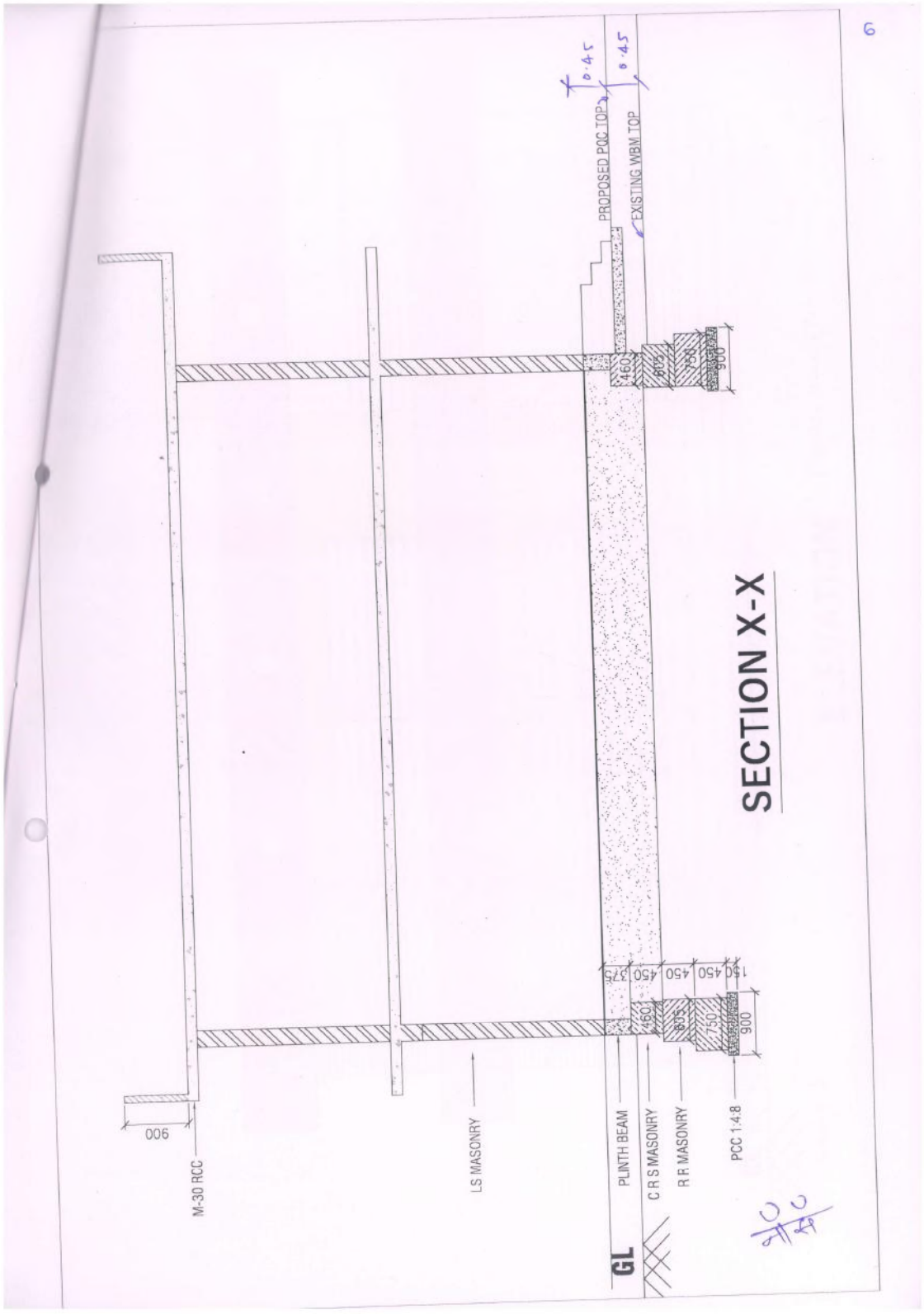
Providing PQC to Existing Truck parking Terminal Near K-K gate (TP-1)

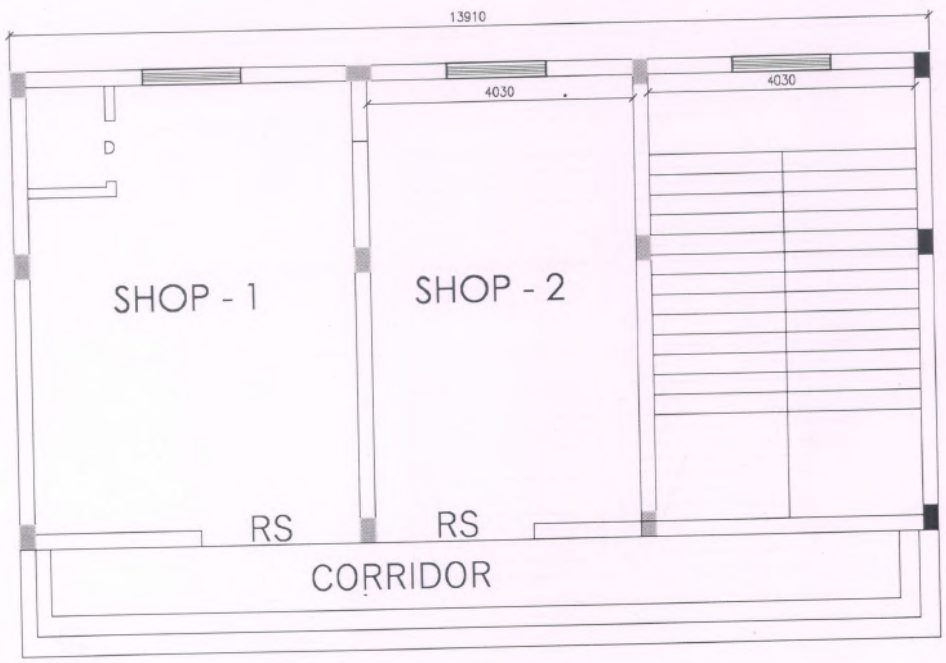
18 17

1


2
460
600
750
900
SECTION X-X
PLINTH BEAM
C R S MASONRY
R R MASONRY
PCC 1:4:8
460
600
750


TOILET BLOCK
5390
1500
240
TOILET-4
1500
240
TOILET-5
1500
TOILET-3
1200
BATH-2
1800
7150
X
X
TOILET-2
1200
4045
1500
1475
1500
TOILET-1
675
BATH-1
1800
1600
PLAN


6
SECTION X-X
PROPOSED PCC TOP
EXISTING WBM TOP
0.45
0.45
460
600
750
900
150
450
450
375
460
600
750
900
900
M-30 RCC
LS MASONRY
PLINTH BEAM
C R S MASONRY
R R MASONRY
PCC 1:4:8
GL

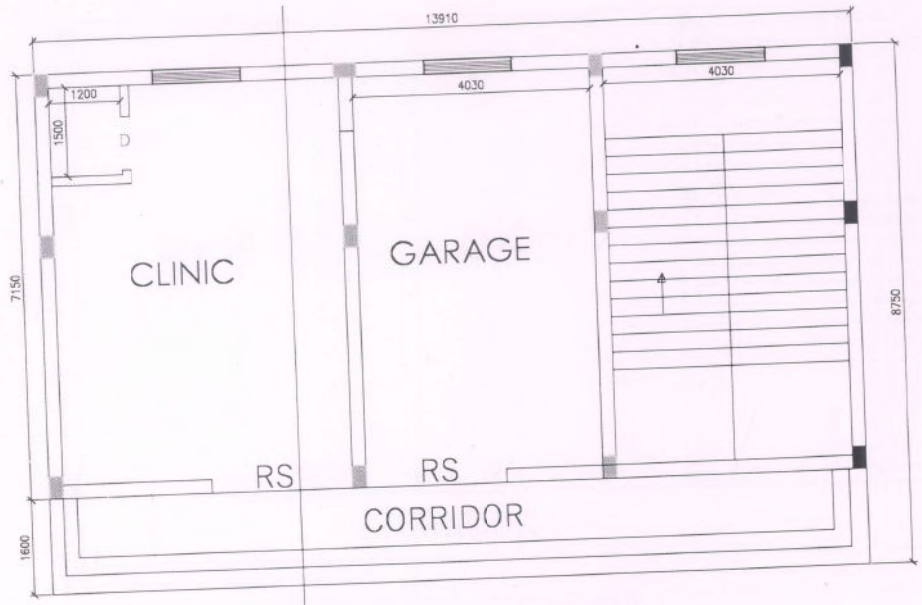


W- WINDOW 1.50x1.50

RS- ROLLING SHUTTER 2.40x2.50

FIRST FLOOR

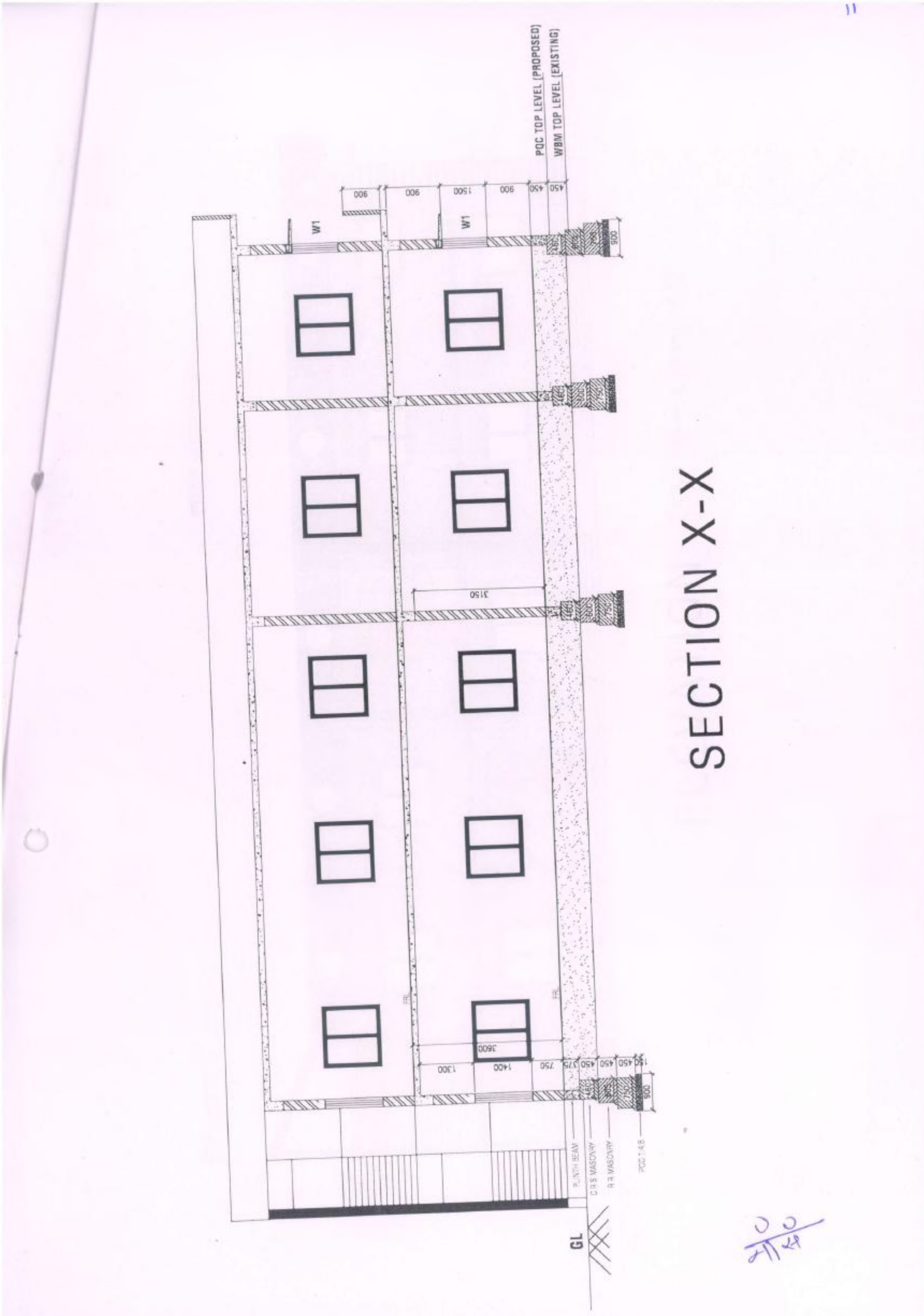
SHOPS AND CLINIC BUILDING



W- WINDOW 1.50x1.50

RS- ROLLING SHUTTER 2.40x2.50

GROUND FLOOR

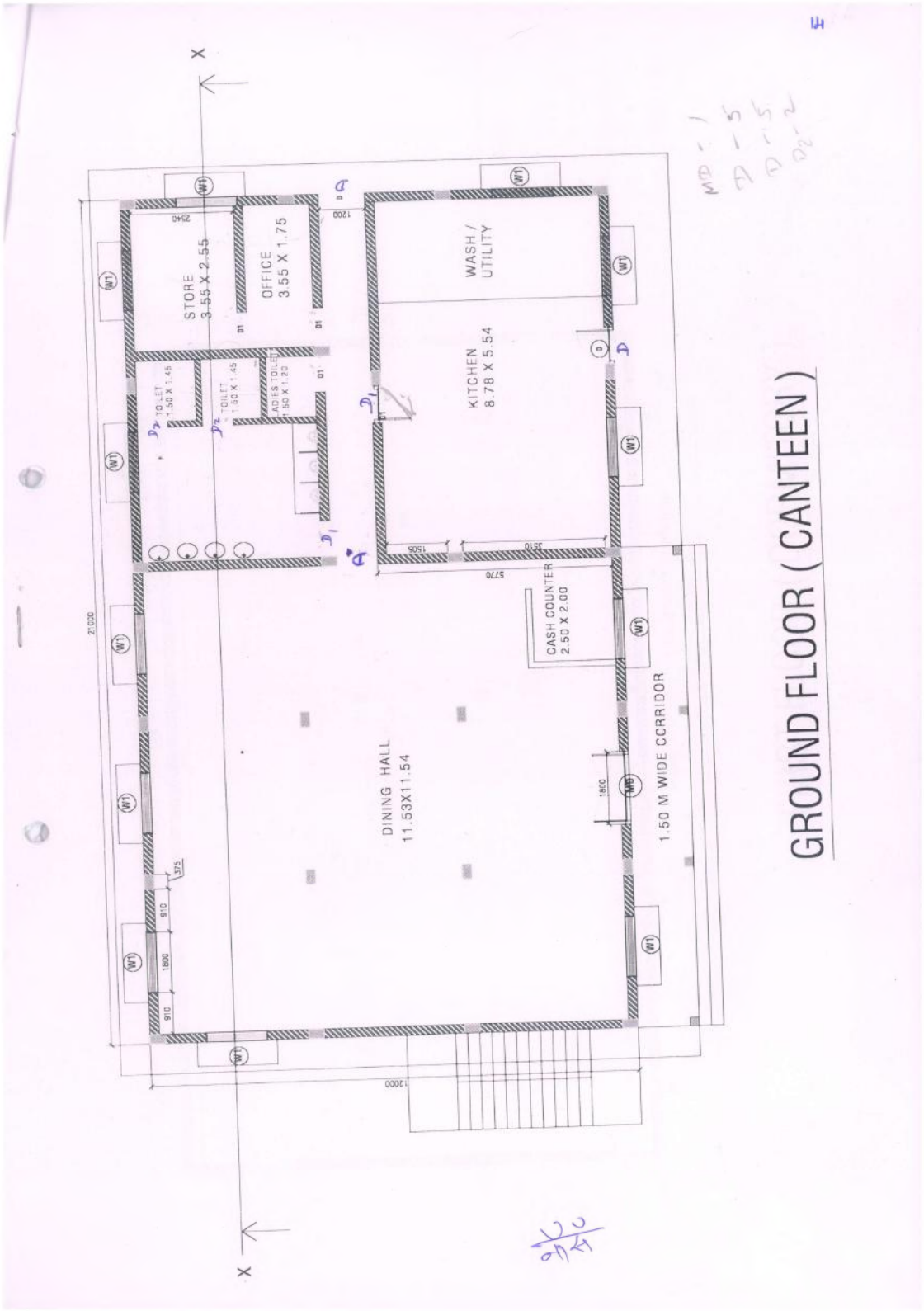

PCC TOP LEVEL (PROPOSED)
WBM TOP LEVEL (EXISTING)
W1
W1
3150
3600
GL

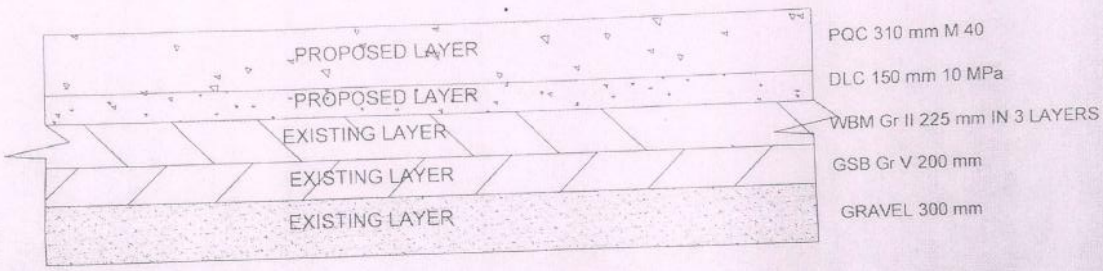
SECTION X-X

INDEX

MD - 1.80 X 2.10
D - 1.20 X 2.10
D1 - 0.90 X 2.10
D2 - 0.75 X 2.10
W1 - 1.80 X 1.50

FIRST FLOOR (DORMITORY)


STORE
3.55 X 2.55
OFFICE
3.55 X 1.75
WASH / UTILITY
KITCHEN
8.78 X 5.54
CASH COUNTER
2.50 X 2.00
DINING HALL
11.53X11.54
1.50 M WIDE CORRIDOR
GROUND FLOOR (CANTEEN)



TYPICAL CROSS SECTION

NAME OF WORK: PROVIDING PQC TO THE TRUCK PARKING TERMINAL ADJACENT TO TOILET BLOCK NEAR K.K GATE (15980 SQM)

AEE(S)

AEE

NEW MANGALORE PORT AUTHORITY
Panambur, Mangalore

"PROVIDING PAVEMENT QUALITY CONCRETE TO THE EXISTING TRUCK PARKING TERMINAL NEAR K. K. GATE ADJACENT TO TOILET BLOCK AND CONSTRUCTION OF CANTEEN, DORMITORY, SHOPS, CLINIC BUILDING AND TOILET BLOCK IN TRUCK PARKING TERMINAL."

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:PROVIDING PAVEMENT QUALITY CONCRETE TO THE EXISTING TRUCK PARKING TERMINAL NEAR K. K. GATE ADJACENT TO TOILET BLOCK AND CONSTRUCTION OF CANTEEN, DORMITORY, SHOPS, CLINIC BUILDING AND TOILET BLOCK IN TRUCK PARKING TERMINAL.					
Item No.	**DESCRIPTION OF ITEM**	**QTY**	**UNIT**	**RATE IN figures**	**AMOUNT (Rs. Ps.)**
1	KSRRB 500-1. Cleaning the existing WBM road surface including removing of binding materials and other foreign matter with wire brushes and small picks, sweeping with brooms or soft brushes and finally dusting with old gunny bags and I or compressed air, to receive bituminous treatment including cost of all materials, labour, HOM complete as per specifications. Clause 501 of MORTH V revision	16050	Sqm		
2	KSRRB M400-17. Providing, laying, spreading and compacting cushed stone aggregates of granite I trap I basalt to wet mix macadam specifications including pre mixing the material with water at OMC in mechanical mix plant carriage of mixed materials by tipper to site, laying in uniform layers manually in sub-base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density complete as per specifications.	40	Cum		
3	Construction of Dry lean cement concrete sub base over a prepared sub grade with coarse and fine aggregate confirming to IS 383, the size of coarse aggregate not exceeding 25 mm, aggregate cement ratio not to exceed 15.: 1 , aggregate gradation after blending to be as per table 600 - 1 , cement content not to be less tha, 150 kg	2,410	Cum		

	per m3, optimum moisture content to be determined during trial length construction, concrete strength not to be less than 10 Mpa at 7 days, mixed in a batching plant, transported to site , compacting with 8 - 10 T vibratory roller, finishing and curing.				
4	Construction of M40 grade unreinforced, Dowel jointed, plain cement concrete pavement over a prepared sub base with cement at 420 kg per m3, coarse and fine aggregate conforming to IS 383, 2016, maximum size of coarse aggregate not exceeding 25 mm, mixed in a batching and mixing plant as per approved mix design, transported to site, spread, compacted and finished in a continuous operation including provision of contraction and expansion, construction and longitudinal joints, joint filler, separation membrane, sealant primer, joint sealant, debonding strip, dowel bar, tie rod , admixures as approved, curing compound , finishing to lines and grades as per drawing.	4970	Cum		
5	Earth work in surface excavation for stripping, seating of bund, Road way, by manual means for lowering & leveling the ground for all works other than foundation & depth in all kinds of soil not exceeding 300mm 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 and lift upto 1.5 m including cost of labour, tools, usage & other appurtenances required to	90	Cum		

	complete the work. In all kinds of soils Depth upto 1.5 m				
6	Construction of **RCC Machinehole** chambers of 1:1.5:3 proportion or approved type Cast-insitu / Pre-cast RCC Machinehole chambers, constructed using form vibrators of standard type, with barricading, danger lighting and using of sight rails and boning rods wherever necessary, shoring and strutting wherever required using Ordinary Port Land Cement, using 1:1.5:3 proportion RCC with 20 mm and down graded jelly, well graded sand and steel of approved quality, 200 mm thick top concrete slab, having wall thickness and raft thickness as in approved drawings and with an offset in raft alround the chamber as in approved drawing, benching concrete with 1:6 slope towards the central drain finished smooth, including fixing and grouting of pipes, including conveying to work spot supply and fixing SFRC Machinehole cover and frame (Heavy duty) conforming to IS:12592 with latest amendments, on a bed of CC 1:2:4 supplying and fixing of minimum 3 mm thick encapsulated plastic footsteps (as per IS 10910) on 12 mm dia. Grade Fe-500 steel bar (as per IS 1786) staggered at 300 mm apart as detailed in Technical specifications, including stone grit beding wherever required, watering, curing, engraving Machinehole number with flow direction on the inner cylindrical surface etc., complete including cost of reinforcement steel and fabrication charges and also cost and conveyance of all materials, labour with all lead and lifts. The	3	Nos		

	Pre-cast RCC Machinehole are for various diamters and depths as stated below and as per detailed drawings, specifications and direction of the Engineer. **For 1.2m dia** Machinehole: Constructing Pre-cast RCC Machinehole **1.2 m internal dia**., **2.0M depth**& SFRC cover & frame				
7	Supplying UNPLASTICISED PVC pipes conforming to IS 16098:2013 with latest amendments ended with integral sockets with ISI mark and conveying to worksite, rolling and lowering into trenches, laying true to line and level and perfect linking at joints, testing and commissioning, including loading and unloading at both destinations and cuts of pipes wherever necessary including jointing of UPVC pipes (with cost of elastomeric sealing rings) and specials (excluding cost of specials) with jointing of approved type, with all labour, lead & lifts, including encasing the pipes alround to a depth of not less than 15 cms. with soft gravel or selected earth available from the excavation etc. complete and giving necessary hydraulic test to the required pressure as per ISS (contractor will make his own arrangements for procuring water for testing) etc. for: Pipes of **SN 8, 160mm dia.**	75	Rm		
8	Providing 12 mm cement plaster with cement mortar 1:6 (1 cement: 6 fine sand) including rounding off corners wherever required smooth rendering, providing and removing scaffolding, including cost of materi- als, labour, curing complete as per specifications and as per directions of Engineer-in-charge.	12	Sqm		

9	Earth work in surface excavation by mechanical means for lowering & leveling the ground for all works other than foundation in all kinds of soils & upto depth not exceeding 300mm 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 levelling the excavated earth or sorting & stacking the selected earth for reuse in a radius of 50 m and lift upto 1.5 m including cost of labour, tools, usage of machinery & other appurtenances required to complete the work.	120	Cum		
10	Earth work excavation for Foundation by mechanical means for all works & depth upto 3 m, as per drawing and technical specifications, including setting out, shoring, strutting, barricading, caution lights, including dressing of excavated surfaces, disposing off or levelling the excavated earth or sorting & stacking the selected earth for reuse in a radius of 50 m and lift upto 1.5 m including cost of labour, tools, usage of machinery & other appurtenaces required to complete the work. In all kinds of soils Depth upto 3 m	910	Cum		
11	Providing and injecting chemical emulsion for Pre-constructional Anti-Termite Treatment, creating continuous chemical barrier under and around the column pits, walls, trenches, basement excavation, top surface of the plinth filling, junction of wall and floor, along the external perimeter of building, expansion joints, over the top surface of consolidated earth on which apron is to be laid, surrounding	510	Sqm		

	of pipes and conduits with Chlorpyriphos 20% E.C. / Lindane 20% E.C. @ 3.19 ltr/m2 including cost of chemical, diluting in water to one percent concentration, labour, usage charges of machinery, complete as per specifications.				
12	Providing and Filling in foundation with granite / trap broken metal 100mm and down size with approved M-Sand including hand packing, ramming, watering including cost of all materials and labour with all lead and lift complete as per specifications.	135	Cum		
13	Providing and laying in position **plain** cement concrete for levelling course for all works in foundation. The granite/trap/basalt crushed graded coarse aggregates and fine aggregates as per relevant IS Codes machine mixed, laid in layers not exceeding 150 mm thickness, well compacted using plate vibrators, including all lead & lifts, cost of all materials of quality, labour, Usage charges of machineries, curing, and all the other appurtenances required to complete the work as per technical specifications. (The cost of steel reinforcement & formwork shall be paid separately) Mix 1:3:6 (M10) Using 20 mm and down size graded crushed coarse aggregates	80	Cum		
14	Providing and laying in position Reinforced cement concrete for all Super structures of building, Road works, Water works, Irrigation works & super structure works of bridges upto 3.50 m height. The granite/ trap/basalt crushed graded coarse aggregates and fine aggregates as per relevant IS Codes machine mixed with super	90	Cum		

	plasticisers laid in layers, well compacted using needle vibrators. The cost includes all lead & lifts, cost of all materials, quality confirming to the requirements of relevant IS codes , labour, Usage charges of machinery, curing and all other appurtenances required to complete the work as per technical specifications. (The cost of steel reinforcement, dowel bars & formwork to be paid separately) M30 Design Mix Using 20 mm and down size graded crushed coarse aggregates (Footings and foundation) including shuttering				
15	Providing and laying in position Reinforced cement concrete for all Super structures of building , Road works, Water works, Irrigation works & super structure works of bridges upto 3.50 m height. 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. The cost includes all lead & lifts, cost of all materials, quality confirming to the requirements of relevant IS codes , labour, Usage charges of machinery, curing and all other appurtenances required to complete the work as per technical specifications. (The cost of steel reinforcement, dowel bars & formwork to be paid separately) M30 Design Mix Using 20 mm and down size graded crushed coarse aggregates **(Beams and lintels) including shuttering**	65	Cum		
16	Providing and laying in position Reinforced cement concrete for all Super structures of building , Road works, Water works,	36	Cum		

	Irrigation works & super structure works of bridges upto 3.50 m height. 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. The cost includes all lead & lifts, cost of all materials, quality confirming to the requirements of relevant IS codes , labour, Usage charges of machinery, curing and all other appurtenances required to complete the work as per technical specifications. (The cost of steel reinforcement, dowel bars & formwork to be paid separately) **M30** Design Mix Using 20 mm and down size graded crushed coarse aggregates **(Columns) including shuttering**				
17	Providing and laying in position Reinforced cement concrete for all Super structures of building, Road works, Water works, Irrigation works & super structure works of bridges upto 3.50 m height. 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. The cost includes all lead & lifts, cost of all materials, quality confirming to the requirements of relevant IS codes , labour, Usage charges of machinery, curing and all other appurtenances required to complete the work as per technical specifications. (The cost of steel reinforcement, dowel bars & formwork to be paid separately) M30 Design Mix Using 20 mm and down size graded crushed coarse aggregates	165	Cum		

	(Floors, landing) including Shuttering, ceiling plastering and ceiling painting				
18	Providing and laying in position Reinforced cement concrete for all Super structures of building, Road works, Water works, Irrigation works & super structure works of bridges upto 3.50 m height. 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. The cost includes all lead & lifts, cost of all materials, quality confirming to the requirements of relevant IS codes, labour, Usage charges of machinery, curing and all other appurtenances required to complete the work as per technical specifications. (The cost of steel reinforcement, dowel bars & formwork to be paid separately) M30 Design Mix Using 20 mm and down size graded crushed coarse aggregates **(Chejjas) including shuttering**	5	Cum		
19	Supplying, fitting and placing TMT bar reinforcement Fe 500 and above to super structure complete as per specification.	37	MT		
20	Providing Size Stone masonry with hard stone in foundation & plinth with Cement mortar 1:6 (1 cement : 6 coarse sand)	188	Cum		
21	Providing and constructing laterite size stone masonry in CM 1:6 including cost and conveyance of all materials curing etc complete as per specification. I.S. 3620/1979 having compressive strength not less then 3.5 N/mm2 for saturated dry samples	370	Cum		
22	Providing Mathi/Nandi wood frames of doors, windows, clerestory windows, ventilators	1.60	Cum		

	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 including all fittings and fixures				
23	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 wide as per drawing and panels of 25mm thick including cost of materials, labour, usage charges complete as per specifications.(including cost of all fittings and fixtures)	32	Sqm		
24	Providing & fixing factory made PVC Door frame of size 50x47mm with a wall thickness of 5mm, made out of extruded 5mm rigid PVC foam sheet metered cut at corners & jointed 2 No.s of 150mm long brackets of 15x15mm M.S Square tube, the entire door frame to be reinforced with 19x19mm M.S Square tube of 19 gauge. The door frame to be fixed to the wall using M.S. Screws of 65/80mm size complete as per manufacturers specification & direction of Engineer-in-charge. including all fixures and fittings	42	Sqm		
25	Providing & fixing 30mm thick factory made rigid foam Prelam Panelled Door Shutters made from M.S. tube of 19x19mm, 19 gauge for stiles and 15x15mm for top & bottom rails, covered with heat moulded Prelaminated PVC C Channel of 5mm thick sheet & 30x50mm wide to form stiles & 5mm thick & 75mm wide Prelaminated PVC Sheets for top rail, lock rail & bottom rail on either side & 5mm thick, 20mm wide cross PVC sheet as gap insert for top rail & bottom rail,	16	Sqm		

	Panelling of 5mm thick PVC sheet Prelaminated on either side fitted in the M.S. frame, Sealed to the stiles & rails with PVC Designer beading on either side & joined together with solvent cement adhesive etc., Complete as per manufacturers specification & direction of Engineer-in-charge fixed to frames with 3 nos of 75mm Aluminium hinges. including all fixures and fittings				
26	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 : Anodised aluminium (anodised transparent or dyed to required shade according to IS: 1868, Minimum anodic coating of grade AC 15) including cost of materials, labour, usage charges of machinery complete as per specifications. including all fittings and fixures	2550	Kgs		
27	Providing and fixing glazing in aluminium door, window, ventilator shutters and partitions etc. with EPDM rubber /	85	Sqm		

	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 4.0 mm thickness (weight not less than 10kg/ m²) including cost of materials, labour, usage charges of machinery complete as per specifications and as per directions of the Engineer-in-Charge. including all fixures and fittings				
28	Providing and fixing M.S. grills of required pattern in frames of windows etc. with M.S. flats, square or round bars etc. including priming coat with approved steel primer all complete. Fixed to steel windows by welding	1800	Kgs		
29	Providing and laying water proofing treatment to the Roof with PU based single component elastomeric pure polyurethane based coating on New terrace/Chajjas/Sunken portion of WC:Bathroom, cold applied PU waterproofing membrane that is highly elastic with elongation greater than 400% and tensile strength greater than 2MPa as per ASTM D412. The waterproofing membrane to be applied in 2coats @ 1.6kg per m2 to achieve final DFT (dry film thickness) of 1mm including prime coat of epoxy primer @150 g per m2 and protection with 120gsm Geo-textile over the waterproofing membrane. The finished cost to include surface preparation, making coving at Junction, Bore Packing, treatment of construction joints completely as per specification & with a 10 years warranty on product & work from certified manufacturers as per the direction of the Engineer In	525	Sqm		

	charge.				
30	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.	2635	Sqm		
31	Extra for providing and mixing water proofing material in cement plaster work in proportion recommended by the manufacturers including cost of material etc as per specifications and as per directions of the Engineer-in-Charge.	160	Kgs		
32	Providing 15 mm cement plaster on the rough side of single or half brick wall of mix :1:6 (1 cement: 6 fine sand) 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.	175	Sqm		
33	Providing and applying white cement based putty of average thick- ness 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.	1070	Sqm		
34	KSRB 15-15.1 • Providing and applying painting in two coats with plastic emulsion paint of approved brand on wall surface to give an even approved shade after thoroughly brushing the surface, free from mortar drops and other foreign matter including preparing the surface even and sand paper smooth, cost of materials, labour,	2240	Sqm		

	complete as per specifications.do- with primer				
35	KSRB 15-16.1 • Providing and finishing external walls in two coats with waterproof cement paint of approved brand and shade to give an even shade after throughly brooming the surface to remove all dirt and loose powdered material, free from mortar drops and other foreign matter cost of materials, labour, complete as per specifications.do- with primer	1580	Sqm		
36	Painting with synthetic enamel paint of approved brand and manufacture to give an even shade :Two coats on new work 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.	115	Sqm		
37	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 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.	90	Sqm		
38	Providing and laying vitrified floor tiles in different sizes (thickness to be specified by the manufacturer) 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	600	Sqm		

	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				
39	Providing and fixing 1st quality ceramic glazed floor tiles conforming to IS : 15622 (thickness to be specified by the manufacturer) of approved make in all colours, shades except burgundy, bottle green, black of any size as approved by Engineer-in-Charge in skirting, risers of steps and dados over 12 mm thick bed of cement Mortar 1:3 (1 ce- ment: 3 coarse sand) and jointing with grey cement slurry @ 3.3kg per m2 including pointing in white cement mixed with pigment of matching shade complete.	120	Sqm		
40	Providing skirting, dadooing, rises of steps with white 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.	240	Sqm		
41	Providing and fixing 18 mm thick gang saw cut granite of any color and shade, mirror polished, premoulded and prepolished, machine cut for kitchen platforms, vanity counters, window sills, facias and similar locations of required size, approved shade, colour and texture laid over 20 mm thick base cement mortar 1:4 (1 cement : 4 coarse sand), joints treated with white cement, mixed with matching pigment, epoxy touch up, including rubbing, curing, moulding and polishing to edges to give high gloss finish etc. complete at all levels.	20	Sqm		

	Area of slab over 0.50 m2				
42	Providing and laying Polished Granite stone flooring in required design and patterns, in linear as well as curvilinear portions of the building all complete as per the architectural drawings with 18 mm thick stone slab over 20 mm (average) thick base of cement mortar 1:4 (1 cement : 4 coarse sand) laid and jointed with cement slurry and pointing with white cement slurry admixed with pigment of matching shade including rubbing , curing and polishing etc. all complete as specified and as directed by the Engineer-in-Charge. ** Polished Granite stone slab Black, Cherry Red, Brown, Cat Eye, Lakared, River Pink, Orissa Blue or equivalent.	220	Sqm		
43	Providing edge moulding to 18mm thick Granite stone counters, vanities etc including machine polishing to edge to give high gloss finish etc. complete as per design approved by Engineer-in-charge.	380	Rm		
44	Providing and fixing wash basin with C.I. brackets, 15 mm C.P. brass pillar taps, 32 mm C.P. brass waste of standard pattern, including painting of fittings and brackets, cutting and making good the walls wherever require:White Vitreous China Flat back wash basin size 450x 300 mm with single 15mm C.P. brass pillar tap	17	Nos		
45	Providing and fixing brass bib cock of approved quality :20 mm nominal bore	28	Nos		
46	Providing and fixing brass stop cock of approved quality :20 mm nominal bore	31	Nos		
47	Providing and fixing Brass full way valve gate with C.I. wheel of approved quality (screwed end) :32 mm nominal bore	15	Nos		
48	Providing and fixing Brass full	11	Nos		

	way valve gate with C.I. wheel of approved quality (screwed end) :25 mm nominal bore				
49	KSRB 13-11 : Providing and placing on terrace, polyethylene water storage tanks as per IS12701 : 1996 with manhole lid and suitable locking arrangements, making holes of suitable diameter for inlet, outlet and over flow pipes, including cost of all materials, labour, transport charges, HOM and testing complete as per specifications. (For 1000 litre capacity) Specification No.KBS 13.22	11	Nos		
50	Providing and fixing Stainless Steel A ISI 304 (18/8) kitchen sink as per IS:13983 with C.I. brackets and stainless steel plug 40 mm, including painting of fittings and brackets, cutting and making good the walls wherever required : 510x1040 mm bowl depth 250 mm	3	Nos		
51	Providing and fixing Cl Nahani trap 10x7.5 cms of approved make conforming to lSI specifications and construction of Cistern in M-15 as per directions (Rate is inclusive of cost of materials and fixtures and conveyance of materials to work spot).	22	Nos		
52	Providing and fixing to wall, ceiling and floor unplasticised PVC pipes 6.00 kgs/sqcm working pressure with pipe fittings, wall clips etc., and making good the wall, ceiling and floor for sanitary pipelines including cost of all materials, labour charges, HOM and testing complete as per specifications. - 110 mm dia	200	Rm		
53	Constructing brick masonry chamber of internal dimension 600x600mm and depth of 600mm (inner dimensions) with modular bricks of CD 75 in	12	Nos		

	cement mortar 1:6, bed concrete 150mm thick with 1:3:6, plastering 12 mm thick with cement mortar 1:4, CC 1:2:4 coping 75mm thk for fixing CI cover & frame etc. excluding the cost of CI frame and cover..				
54	Constructing brick masonry chamber of internal dimension 450x450mm and depth of 600mm (inner dimensions) with modular bricks of CD 75 in cement mortar 1:6, bed concrete 150mm thick with 1:3:6, plastering 12 mm thick with cement mortar 1:4, CC 1:2:4 coping 75mm thk for fixing CI cover & frame etc. excluding the cost of CI frame and cover..	12	Nos		
55	Providing and fixing to wall , ceiling, and floor Unplasticised Poly Vinyl Chloride (UPVC) pipes 10 kg / sqcm working pressure of outside diameter with pipe fittings, wall clips, making good the wall, ceiling and floor, including cost of all materials , labour charges, HOM and testing complete as per specifications. **20 mm dia**	180	Rm		
56	Providing and fixing to wall , ceiling, and floor Unplasticised Poly Vinyl Chloride (UPVC) pipes 10 kg / sqcm working pressure of outside diameter with pipe fittings, wall clips, making good the wall, ceiling and floor, including cost of all materials , labour charges, HOM and testing complete as per specifications. **25 mm dia**	335	Rm		
57	Providing and fixing to wall , ceiling, and floor Unplasticised Poly Vinyl Chloride (UPVC) pipes 10 kg / sqcm working pressure of outside diameter with pipe fittings, wall clips, making good the wall, ceiling and floor, including cost of all materials , labour charges, HOM and testing complete as per specifications. **32**	200	Rm		

	mm dia				
58	Providing and fixing to wall , ceiling, and floor Unplasticised Poly Vinyl Chloride (UPVC) pipes 10 kg / sqcm working pressure of outside diameter with pipe fittings, wall clips, making good the wall, ceiling and floor, including cost of all materials , labour charges, HOM and testing complete as per specifications. **50 mm dia**	60	Rm		
59	Providing and fixing PVC pipes of outside diameter with pipe fittings, wall clips, making good the wall, ceiling and floor, including cost of all materials , labour charges, HOM and testing complete as per specifications. **75 mm dia**	60	Rm		
60	Providing and fixing gun metal non- return valve of approved quality (screwed end) : Horizontal	6	Nos		
61	Providing and fixing C.P. brass shower rose with 15 or 20 mm inlet :150 mm diameter	4	Nos		
62	Providing and fixing 600x450 mm beveled edge mirror of superior glass (of approved quality) complete with 6 mm thick hard board ground fixed to wooden cleats with C.P. brass screws and washers complete.	12	Nos		
63	Providing and fixing PTMT towel rail complete with brackets fixed to wooden cleats with CP brass screws with concealed fittings arrange- ment of approved quality and colour. 450 mm long towel rail with total length of 495 mm, 78 mm wide and effective height of 88 mm, weighing not less than 170 g.	14	Nos		
64	Providing and laying in position plain cement concrete for levelling course for all works in foundation. The granite/trap/basalt crushed graded coarse aggregates and fine aggregates as per relevant IS Codes machine mixed, laid in	90	Cum		

	layers not exceeding 150 mm thickness, well compacted using plate vibrators, including all lead & lifts, cost of all materials of quality, labour, Usage charges of machineries, curing, and all the other appurtenances required to complete the work as per technical specifications. (The cost of steel reinforcement & formwork shall be paid separately) Mix 1:3:6 (M10) Using 20 mm and down size graded crushed coarse aggregates				
65	Providing and fixing white vitreous china pedestal type water closet (European type) with seat and lid, 10 litre low level white vitreous china flushing cistern & C.P. flush bend with fittings & C.I. brackets, 40 mm flush bend, overflow arrangement with specials of standard make and mosquito proof coupling of approved municipal design complete, including painting of fittings and brackets, cutting and making good the walls and floors wherever required :W.C. pan with ISI marked white solid plastic seat and lid	9	Nos		
66	Providing and fixing white vitreous china flat back or wall corner type lipped front urinal basin of 430x260x350 mm and 340x410x265 mm sizes respectively with automatic flushing cistern with standard flush pipe and C.P. brass spreaders with brass unions and G.I clamps complete, including painting of fittings and brackets, cutting and making good the walls and floors wherever required :One urinal basin with 5 litre white P.V.C. automatic flushing cistern	9	Nos		
67	Supplying and fixing rolling shutters of approved make, made of required size M.S. laths,	25	Sqm		

	interlocked together through their entire length and jointed together at the end by end locks, mounted on specially designed pipe shaft with brackets, side guides and arrangements for inside and outside locking with push and pull operation complete, including the cost of providing and fixing necessary 27.5 cm long wire springs manufactured from high tensile steel wire of adequate strength conforming to IS: 4454 - part 1 and M.S. top cover of required thickness for rolling shutters. 80x1.25 mm M.S. laths with 1.25 mm thick top cover including cost of materials, labour, usage charges of machinery complete as per specifications and as per directions of the Engineer-in-Charge.				
68	Providing detailed structural design and drawing inlcuding validation and certification through a Structural designer	1	LS		
				TOTAL 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 Trust
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
(See sub rule (1) of Rule 36)

Sl. 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 which is higher	Rs.600 per MT	Rs.350 per MT
	C)Grey and White Granites	15% of SaleValue or of Average Selling		

	and their varieties: (i) Very fine grained Grey granite (SiragreyVariety) Price on Chintanmi, SiddlaghattaofChikkaballapuraDistrictHoskote of Bangalore District.	Price on advalorembasisor Rs.1,350 per m3 which is higher.	Rs.500 per MT	Rs.350 per MT
	(ii) Greyandwhite granites 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%	Rs.60 per MT	Rs.70 per MT	

	of permit issued For Fullers Earth		
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, which is not suitable for ornamental purpose (used for making aggregates and m-sand) Entire State.	60 per MT	40 per MT
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	110per MT	150 per MT

	face-Entire State.		
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	100 per MT

		sale value whichever is higher on ad-valorem basis	
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 value as specified by IBM from time to time) ii) For use as building stone (below threshold value as specified by IBM)	Rs.60 per MT	160 per MT 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	200perMT

		whichever is higher on ad-valorem basis	
	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 ***01.04.2022***

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	695.00	581.00	466.00
Semiskilled/ Unskilled Supervisory	770.00	656.00	544.00
Skilled/Clerical	846.00	770.00	656.00
Highly Skilled	919.00	846.00	770.00

(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.1/4 (3)/2022-LS-II dated 29.07.2022.)

"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'	695.00
'B'	581.00
'C'	466.00

"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'	846.00	919.00
'B'	770.00	846.00
'C'	656.00	770.00

For further details log on to Ministry of Employment