



**NEW MANGALORE PORT AUTHORITY**  
**(Ministry of Ports, Shipping & Waterways, Govt. Of India)**

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**NIT NO.:** 8/6/2022/EE(E)/Lift

**Date :** 29.09.2022

**TENDER DOCUMENT**  
**FOR**  
**SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF**  
**PASSENGER LIFT AT ADMINISTRATIVE BUILDING, NMPA**

(NIT, GENERAL TERMS & CONDITIONS, SPECIAL TERMS & CONDITIONS  
TECHNICAL SPECIFICATION & BOQ)

## LIST OF DOCUMENTS

Sl. No.	Description	Part	Page No.
1	Special Instructions to the Bidders for the E-Submission of the Bids Online Through E-Procurement Portal	<b>PART – I</b>	3-6
2	Tender Document	<b>PART – II</b>	8 - 180
3	Price Bid	<b>PART– III</b>	181-184
4	NMPA Bank Details	<b>PART – IV</b>	185
5	Checklist	<b>PART – V</b>	186

**SPECIAL INSTRUCTIONS TO THE BIDDERS FOR THE E-SUBMISSION OF THE BIDS ONLINE THROUGH E-PROCUREMENT PORTAL**

**N.I.T. No. 8/6/2022/EE(E)/Lift**

**Date: 29.09.2022**

**Name of Work: "SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF PASSENGER LIFT AT ADMINISTRATIVE BUILDING, NMPA".**

1. बोलीदाता को होम पेज में उपलब्ध क्लिक हियर टू एनरोल का उपयोग करके पोर्टल में ऑनलाइन नामांकन करना चाहिए। फिर पोर्टल पर लॉग इन करने के बाद ई-टोकन के साथ डिजिटल सिग्नेचर एनरोलमेंट करना होगा। 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. तत्पश्चात बोलीधारक नामांकन के दौरान चुने गए उपयोगकर्ता आईडी / पासवर्ड पोर्टल में लॉग इन कर पाएंगे। Bidder then logs into the portal giving user id / password chosen during enrollment.
3. दूसरों द्वारा दुरुपयोग न करते हुए पंजीकृत ई-टोकन का उपयोग बोलीदाता द्वारा ही किया जाना चाहिए The e-token that is registered should be used by the Bidder and should not be misused by others.
4. किसी खाते में मैप किए जाने पर DSC को किसी अन्य खाते में दोबारा नहीं भेजा जा सकता है। यह केवल निष्क्रिय हो सकता है  
DSC once mapped to an account cannot be remapped to any other account. It can only be inactivated.
5. बोलीदाता अग्रिम रूप से अद्यतन कर सकते हैं, दस्तावेज़ जैसे प्रमाणपत्र, खरीद आदेश विवरण आदि, मेरे दस्तावेज़ विकल्प के तहत और इन्हें निविदा आवश्यकताओं के अनुसार चुना जा सकता है और फिर बोली जमा करने के दौरान बोली दस्तावेज़ों के साथ संलग्न किया जा सकता है। यह बोली दस्तावेज़ों के कम अपलोड को सुनिश्चित करेगा। 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 requirement and then attach them along with bid documents during bid submission. This will ensure easier upload of bid documents.
6. निविदा कार्यक्रम डाउनलोड करने / प्राप्त करने के बाद, बोलीदाता को सावधानीपूर्वक उनके माध्यम से जाना चाहिए और फिर निविदा दस्तावेज़ के अनुसार दस्तावेज़ जमा करना चाहिए; अन्यथा, बोली अस्वीकार कर दी जाएगी After downloading / getting the tender schedules, the Bidder should go through them carefully and then submit documents as stated in the tender document; otherwise, the bid will be rejected.
7. बीओक्यू टेम्पलेट को बोलीदाता द्वारा संशोधित / प्रतिस्थापित नहीं किया जाना चाहिए और संबंधित कॉलम भरने के बाद उसे अपलोड किया जाना चाहिए, अन्यथा बोलीदाता उस निविदा के लिए अस्वीकार किए जाने के लिए उत्तरदायी है। बोलीदाताओं को केवल बिडर नाम और वैल्यू दर्ज करने की अनुमति है।

The BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevant columns, else the bid is liable to be rejected. Bidders are allowed to enter the Bidder Name and Values only.

8. यदि कोई स्पष्टीकरण हैं, तो यह ई-प्रोक्योरमेंट पोर्टल के माध्यम से या निविदा दस्तावेज में दिए गए संपर्क विवरण के माध्यम से ऑनलाइन प्राप्त किया जा सकता है। बोलीदाता को पोर्टल पर ऑनलाइन या <http://eprocure.gov.in/eprocure/app> or <http://www.newmangaloreport.gov.in> पर बोली प्रस्तुत करने से पहले प्रकाशित किए गए कोरिगेंडम को ध्यान में रखना चाहिए, बोलीदाता को अग्रिम में बोली दस्तावेज तैयार करने चाहिए। निविदा अनुसूची में दर्शाए अनुसार प्रस्तुत किया जाना चाहिए और वे पीडीएफ प्रारूपों में होने चाहिए। If there are queries connected with this tender, have to be clarified online through the e-Procurement Portal, or through the contact details given in the tender document. Bidder should take into account the corrigendum published before submitting the bids online on the portal or on <http://eprocure.gov.in/eprocure/app> or <http://www.newmangaloreport.gov.in>. All documents to be submitted, as indicated in the tender schedule should be in PDF formats.
9. बोलीदाता को निविदा में निर्दिष्ट बोली सुरक्षाकी व्यवस्था करनी (जैसा लागू हो) ईएमडी और निविदा शुल्क/ चाहिए। मूल को निविदा के लिए बोली जमा करने की तिथि और समय के भीतर, निविदा आमंत्रित करने वाले प्राधिकारी को व्यक्तिगत रूप से पोस्टव्यक्तिगत रूप से दिया जाना चाहिए।/कूरियर। Bidder should arrange for the Bid Security/EMD & tender fee (as applicable) as specified in the tender. The original should be posted/couriered/given in person to the Tender Inviting Authority, within the bid submission date and time for the tender.
10. बोली लगाने वाले को नियमों और शर्तों को पढ़ना चाहिए और बोलियों को जमा करने के लिए आगे बढ़ने के लिए उसी को स्वीकार करना चाहिए |  
The Bidder should read the terms and conditions of the tender and accept the same before proceeding with submission to tender.
11. बोली प्रस्तुत करने की प्रक्रिया के दौरान किसी भी देरी या समस्या से बचने के लिए बोली लगाने वाले को निर्धारित समय से पहले निविदा दस्तावेजों को ऑनलाइन जमा करना चाहिए ।  
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. सर्वर के अंत में अपलोड की गई फ़ाइल के आकार की कोई सीमा नहीं है। हालाँकि, अपलोड क्लाइंट सिस्टम पर उपलब्ध मेमोरी के साथ-साथ उस समय क्लाइंट साइड पर उपलब्ध नेटवर्क बैंडविड्थ पर तय किया जाता है। फ़ाइल का आकार कम करने के लिए, बोलीदाताओं को 75-100 DPI में दस्तावेजों को स्कैन करने का सुझाव दिया जाता है ताकि स्पष्टता बनी रहे और फ़ाइल का आकार कम हो जाए। यह बहुत कम बैंडविड्थ की गति पर भी त्वरित अपलोड करने में मदद करेगा |  
There is no limit on the size of the file that can be uploaded at the server end. However, the upload is dependent 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 file size is optimum. This will help in quick uploading even at very low bandwidth speeds.
13. यह ध्यान रखना महत्वपूर्ण है कि, बोली लगाने वाले को फ्रीज बोली बटन पर क्लिक करना होगा, यह सुनिश्चित करने के लिए कि वह बोली प्रस्तुत करने की प्रक्रिया पूरी करता है। बोलियां, जो अवरूद्ध हुए नहीं हैं, को अपूर्ण / अमान्य बोलियों के रूप में मानकर तथा मूल्यांकन उद्देश्यों के लिए नहीं माना जायेगा ।  
It is important to note that, the bidder has to click on the Freeze Bid Button, to ensure that, Bid Submission Process is completed. Bids, which are not frozen, are considered as Incomplete/Invalid bids and are not considered for evaluation purposes.
14. स्थानीय मुद्दों के कारण बोलीदाताओं द्वारा ऑनलाइन बोली लगाने के दौरान किसी भी प्रकार की देरी या कठिनाइयों का सामना करने के लिए निविदा आमंत्रण प्राधिकरण (TIA) को जिम्मेदार नहीं ठहराया जाएगा।

The Tender Inviting Authority (TIA) will not be held responsible for any delay or the difficulties faced during submission of bids online by the bidders due to local issues.

15. बोलीदाता इस पोर्टल के माध्यम से ही बोली दस्तावेजों को ऑनलाइन मोड में जमा कर सकता है। इस प्रणाली के माध्यम से ऑफ़लाइन दस्तावेजों को संभाला नहीं जाएगा। तकनीकी बोली की केवल हार्ड कॉपी ईई (एम) III, एनएमपीटी को नियत तारीख से पहले पहुंचनी चाहिए। बोलीदाता यह सुनिश्चित करेगा कि न्यूनतम योग्यता से संबंधित सभी दस्तावेजों को तकनीकी बोली के साथ अनिवार्य रूप से अपलोड किया जाएगा, जिसमें असफल होने पर बोली को अस्वीकार कर दिया जाएगा।

The bidder may submit the bid documents in online mode only, through this portal. Offline documents will not be accepted. The bidder shall ensure that all the documents pertaining to minimum qualification shall be compulsorily uploaded along with the technical Bid failing which the bid shall be rejected.

16. बोली को फ्रीज़ करने के समय, ई-प्रोक्योरमेंट सिस्टम सभी बोली दस्तावेजों को अपलोड करने के बाद एक सफल बोली अपडेटिंग संदेश देगा और फिर बोली सारांश को बोली नंबर, तिथि और जमा करने के समय के साथ दिखाया जाएगा। अन्य सभी प्रासंगिक विवरणों के साथ बोली लगाएं। बोलीकर्ताओं द्वारा प्रस्तुत दस्तावेजों को बोलीदाता के ई-टोकन का उपयोग करके डिजिटल रूप से हस्ताक्षरित किया जाएगा और फिर प्रस्तुत किया जाएगा।

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 along with all other relevant details. The documents submitted by the bidder should then digitally signed using the e-token of the bidder and then submitted.

17. बोली प्रस्तुत करने के बाद, बोली सारांश को प्रिंट करना होगा और बोली प्रस्तुत करने के टोकन के रूप में एक एक्रॉलेजमेंट के रूप में रखना होगा। बोली सारांश निविदा निविदा के लिए बोली प्रस्तुत करने के प्रमाण के रूप में कार्य करेगा और बोली उद्घाटन कार्यक्रम में भाग लेने के लिए प्रवेश बिंदु के रूप में भी कार्य करेगा।

After the bid submission, the bid summary has to be printed and kept as proof of submission of the bid. Entry to bid opening event will be restricted to bidders having proof of bid submission of the subject tender.

18. सिस्टम से सफल बोली प्रस्तुत करने का मतलब है, कि बोलीदाता द्वारा अपलोड की गई बोलियां प्राप्त होकर सिस्टम में संग्रहीत कर ली गयी हैं; सिस्टम इसकी शुद्धता के लिए प्रमाणित नहीं करता है। Successful bid submission means, the bids as uploaded by the bidder is received and stored in the system. System does not certify for correctness of the bid.

19. बोली लगाने वाले को यह देखना चाहिए कि प्रस्तुत किए गए बोली दस्तावेज वायरस से मुक्त हैं और यदि निविदा खोलने के दौरान वायरस के कारण दस्तावेज नहीं खुल पा रहे हैं तो बोली अस्वीकार कर दी जाएगी। इसके लिए आर्गेनाइजेशन जिम्मेदार नहीं होगी। The bidder should ensure that the bid documents submitted are free from virus. If NMPA is unable to open documents due to virus or any other reason during tender opening, the bid is liable to be rejected. NMPA will not be responsible for rejection of such bids.

20. टेंडर पोर्टल के शीर्ष पर सर्वर घड़ी से प्रदर्शित होने वाला समय, ई-प्रोक्योरमेंट पोर्टल में बोली प्रस्तुत करने, बोली खोलने आदि के अनुरोध के सभी कार्यों के लिए मान्य होगा। इस पोर्टल में अनुवर्ती समय भारतीय मानक समय (IST) के अनुसार है जो GMT + 5: 30 है। बोली लगाने के दौरान बोलीदाताओं को इस समय का पालन करना होगा। The time 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. बोलीकर्ताओं से अनुरोध किया जाता है कि वे बोली प्रस्तुत करने की अंतिम तिथि और समय (सर्वर सिस्टम क्लॉक के अनुसार) से पहले निविदा प्रक्रिया के लिए ऑनलाइन ई-प्रोक्योरमेंट सिस्टम के माध्यम से निविदाएं प्रस्तुत करें। 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. भाग I- तकनीकी बीआईडी के साथ निविदा फार्म शुल्क, ईएमडी और बोली सुरक्षा घोषणा जमा किया जाएगा। फीस, बोली सुरक्षा घोषणा के बिना प्रस्तुत बीआईडी, जैसा कि ऊपर उल्लेख किया गया है, मूल्यांकन के लिए विचार नहीं किया जाएगा और सरसरी तौर पर खारिज कर दिया जाएगा। Tender form Fee, EMD and Bid security declaration shall be submitted with the Part I- Technical BID. BID submitted without fees and Bid security declaration, as mentioned above will not be considered for evaluation and shall be rejected.
23. बोली लगाने वाला / निविदाकार / ठेकेदार कर विभागों के साथ लागू रिटर्न समय में दाखिल करेगा और दस्तावेजी प्रमाण के रूप में प्रस्तुत करना होगा। The Bidder/Contractor shall file the applicable returns with Tax departments in time and submit the same as documentary proof.
24. पोर्ट को क्रेडिट करने के लिए जीएसटी लागू टैक्स चालान में एक अलग लाइन आइटम के रूप में दिखाया जाएगा। The GST applicable shall be shown as a separate line items in the Tax invoices to avail input credit to Port.
25. ईएमडी / एलडी / एसडी को जब्त करने की स्थिति में, जीएसटी लागू है; तथा जुर्माना लगाने के दौरान जीएसटी लागू किया जायेगा।  
In the event of forfeiting the EMD/SD GST is applicable and while imposing penalty/LD applicable GST shall be collected.

## सूचकांक /INDEX

Sl. No.	Description	Page No.
1	NOTICE INVITING TENDER.	8
2	INSTRUCTIONS TO BIDDERS	9
3	GENERAL TERMS & CONDITIONS OF CONTRACT	20
4	SPECIAL CONDITIONS OF CONTRACT	42
5	SCOPE OF WORK & TECHNICAL SPECIFICATIONS – <b>ELECTRICAL/LIFT</b>	46
6	SCOPE OF WORK & TECHNICAL SPECIFICATIONS – <b>CIVIL WORKS</b>	50
7	PARTICULARS OF BIDDER – ANNEXURE - 1	156
8	TENDER FORM – ANNEXURE - 2	157
9	FORM OF AGREEMENT – ANNEXURE -3	159
10	FORMAT OF PERFORMANCE SECURITY DEPOSIT BANK GUARANTEE – ANNEXURE - 4	161
11	FORMAT FOR DECLARATION – ANNEXURE - 5	164
12	FORMAT OF POWER OF ATTORNEY – ANNEXURE - 6	165
13	BANK INFORMATION FOR E-PAYMENT – ANNEXURE 7	167
14	DISPUTE REVIEW BOARD AGREEMENT – ANNEXURE 8	168
15	DETAILS OF ONGOING CONTRACTS WITH NMPA–ANNEXURE-9	173
16	VERIFICATION OF LOCAL CONTENT – ANNEXURE-10	173
17	UNDERTAKING ON INDEMNIFICATION – ANNEXURE-11	174
18	INDEMNITY BOND	175
19	COMPLIANCE OF TECHNICAL SPECIFICATIONS	177
20	BILL OF QUANTITIES	181
21	NMPA BANK DETAILS	185
22	CHECK LIST	186

**SCHEDULE OF TENDER (SoT)**

NIT No.: 8/6/2022/EE(E)/Lift

Date : 29.09.2022

**NOTICE INVITING TENDER**

(Through E-Procurement only)

E-Tenders are invited by New Mangalore Port Authority through electronic tendering system under two bid system through CPP Portal i.e. <http://eprocure.gov.in/eprocure/app>,

Name of the Work	<b>SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF PASSENGER LIFT AT ADMINISTRATIVE BUILDING, NMPA</b>
Mode of tender	E-Procurement System (Online Part I - Techno-Commercial Bid and Part II - Price Bid) through e-procurement portal <a href="https://eprocure.gov.in/cppp/">https://eprocure.gov.in/cppp/</a>
Estimated cost	Rs. 34,67,705/- (Rupees Thirty Four Lakhs Sixty Seven Thousand Seven Hundred Five only) excluding GST
Tender Fees	<b>Rs.560/-</b> (Rupees five Hundred sixty only) inclusive of 12% GST - Non-refundable <b>OR</b> exemption certificate as per clause No 2.2.1(n) of ITB
Earnest Money Deposit	<b>Rs. 81,838/-</b> (Rupees Eighty One Lakhs Eight Hundred Thirty Eight only) inclusive of 18% GST <b>'OR'</b> exemption certificate as per clause No 2.2.1(n) of ITB
Date of Tender Document available to parties to download	29.09.2022 at 18:00 Hrs.
Date of Starting of e-Tender for submission Bid on line at <a href="http://eprocure.gov.in/eprocure/cpp">http://eprocure.gov.in/eprocure/cpp</a>	29.09.2022 at 18:00 Hrs.
Date of closing of e-Tender for submission of Bid.	20.10.2022 at 15.00 Hrs.
Date & Time of opening of Technical Bids	21.10.2022 at 15.00 Hrs
Date & Time of opening of Price Bid	Will be communicated separately to the qualified Bidders
<b>Contract Period</b>	<b>4 Months</b> from the date of issue of LOA.
Validity of Tender	120 days from the date of opening of Tender (Technical Bids)

Amendments to the tender (if any) will be issued only through web site

<http://www.newmangaloreport.gov.in> and on [CPP Portal www.eprocure.gov.in/eprocure/app](http://www.eprocure.gov.in/eprocure/app)

Sd/-  
**Executive Engineer (Ele) I**



## 2. INSTRUCTIONS TO THE BIDDERS (ITB)

### 2.1 SCOPE OF BID

E-Tenders in Two Cover system (Techno-Commercial Bid and Price Bid) are invited by Executive Engineer (E) I on behalf of New Mangalore Port Authority for the work of “**SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF PASSENGER LIFT AT ADMINISTRATIVE BUILDING, NMPA**”.

### 2.2 TENDER SUBMISSION:

The Tender shall be uploaded as follows:

2.2.1 **Technical Bid** shall contain the following :

- a) EMD in the form of Insurance Surety Bonds **or** Account Payee Demand Draft **or** Fixed Deposit Receipt **or** Banker's Cheque **or** Bank Guarantee from any of the Commercial Banks or payment online is accepted.
- b) Earnest Money Deposit **of Rs. 81,838/-** (Rupees Eighty One Lakhs Eight Hundred Thirty Eight only) inclusive of 18% GST- proof of the same shall be uploaded along with the Technical Bid '**OR**' exemption certificate as per clause No 2.2.1(n) of ITB. Failure in submission of EMD will render the Bidders disqualified, except in the case as per clause No. 2.2.1 (n) below.
- c) TENDER FEE for Rs.560/- (Rupees five hundred sixty only) inclusive of 12% GST - non-refundable - NEFT Receipt shall be uploaded along with the Technical Bid '**OR**' exemption certificate as per clause No 2.2.1(n) of ITB. Failure in submission of Tender fee will render the Bidders disqualified, except in the case as per clause No. 2.2.1 (n) below.
- d) All the documents should be as per the MQC. Technical Bid should not contain Price Bid. “Disclosure/indication of Price in the Technical Bid shall render the tender disqualified and rejected.
- e) The Tender document duly signed and sealed by the Bidder on each page along with Annexure duly filled along with amendments issued by NMPA if any.
- f) Particulars of Bidder as per **Annexure – 1**.
- g) Supporting documentary evidence of work orders and also satisfactory completion certificate issued by the client,
- h) Tender Form as per **Annexure - 2**.
- i) Bank Details of the Bidder for E-Payment – **Annexure - 7**.
- j) Copies of the, GST Registration Certificate, ESI & PF Registration Certificate and PAN card to be submitted.
- k) Copies of profit and loss statements, balance sheet and Auditor's report for the last three years.
- l) Form of Declaration – **Annexure - 5**
- m) Power of Attorney: - **Annexure - 6**
- n) Micro and Small Enterprises (MSE) registered with District Industries Centre (DIC) or Khadi and Village Industries commission or Khadi & Industries Board (KVIB) or Coir Board or National Small Industries Corporation (NSIC) or Directorate of Handicrafts and Handlooms or Udyog Aadhar memorandum or any other body specified by Ministry of MSME shall be exempted of EMD & Tender Fee on producing self

attested supporting certificates and Bid Security Declaration as per Annexure-1 along with Technical Bid.

- o) Dispute review Board – **Annexure - 8**
- p) Details of ongoing contracts at NMPA – **Annexure - 9**
- q) Verification of Local Content – **Annexure - 10**
- r) Undertaking on Indemnification – **Annexure – 11**
- s) Indemnity Bond – **Annexure-12 (if applicable)**
- t) Compliance of Technical Specifications – **Annexure-13**

**2.2.2 Price Bid shall be uploaded only through ONLINE:** Technical Bid and Price Bid shall be uploaded through online only. Price bid should be quoted in the BOQ template available in the CPP portal only. 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. Any condition imposed in the price bid shall make the tender liable for out-right rejection. The contract shall be for the whole works as described in the scope of work based on the priced Bill of Quantities submitted through CPP portal by the Bidder. The Bidder shall fill in rates and prices for all items of the works described in the Bill of Quantities through CPP portal. Items for which no rate or price is entered by the Bidder will not be paid for by the Port when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities.

### **2.3 ELIGIBLE BIDDER:-**

- 2.3.1 The invitation for bids is open only to all eligible Bidders meeting the eligibility criteria as defined in clause No.2.4.
- 2.3.2 Tender Form information as per Annexure 2.
- 2.3.3 Government owned Enterprises may only participate if they are legally and financially autonomous operate under commercial law and are not a dependent agency of the employer subject to fulfillment of minimum qualifying criteria.
- 2.3.4 Bidders shall not be under a declaration of ineligibility for corrupt and fraudulent practices issued by the employer in accordance with clause No.2.21

### **2.4 MINIMUM QUALIFICATION CRITERIA OF THE BIDDERS: (MQC)**

#### **2.4.1 FINANCIAL CRITERIA**

The Bidder should have an average Annual financial turnover of **Rs. 10,40,312/-** for the last 3 financial years 2018-19, 2019-20 & 2020-21

- Note:-**
- 1. Documentary evidence duly self attested viz – **Auditor’s Certificates (with UDIN No)**/balance sheet / latest income tax return filed/profit and loss statement for the three years shall be uploaded along with the bid.
  - 2. If the bidder is already having ongoing contracts in NMPA, then his combined work order value of all the ongoing contracts shall be deducted from his Financial Capacity. The Financial Capacity of the bidder shall be assessed from the Average Annual Financial Turnover of the Bidder for the last three years ending **March 2021**.

The Bidder shall be technically qualified, only if his balance Financial Capacity after reduction, is equal to or more than the estimate put to tender.

{Example: If the Average Annual Turnover of the bidder is Rs.3,00,000/- (Rupees Three lakhs only), then the Financial Capacity of the Bidder is considered to be Rs.10,00,000/- (Rupees Ten lakhs only). If the contractor declares total ongoing works at NMPA of value Rs.4,00,000/- (Rupees Four lakhs only) in **Annexure-10**, then the contractor can Bid only for the remaining Financial Capacity i.e Rs.6,00,000/- (Rupees Six lakhs only)}

#### 2.4.2 **TECHNICAL CRITERIA**

- i) The Bidder shall have successfully completed **Similar Works** during last 7 (Seven) years ending last day of month previous to the one in which tenders are invited should be either of the following:

One similar completed work costing not less than **Rs. 27,74,164/-** (Excluding GST)

OR

Two similar completed works each costing not less than **Rs. 17,33,853/-** (Excluding GST).

OR

Three similar completed works each costing not less than **Rs.13,87,082/-** (Excluding GST).

**“Similar Work”** means **“Supply, Installation, Testing & Commissioning of lift and allied civil/electrical works”**.

#### **NOTE:**

The Tender work involves substantial Civil work. Hence the Contractor -

- a. Should have executed Civil structure work as part of Electrical Installations or as Independent structure with value not less than 50% of Civil works, i.e., Rs. 8,00,553/-
- b. If the civil work is executed through Sub-contractor, the Sub-contractor should have executed Civil structure work for the value not less than 50% of Civil Work, i.e., Rs. 8,00,553/- for which supporting documentary evidences such as work order, work completion certificate, undertaking obtained from sub contractor to carry out the civil work shall be submitted.
- ii) In order to meet the Technical criteria as per clause No.2.4.2.(i) above, the bidder shall submit the following documents along with the technical bid:-
- a. Self attested photo copies of LOA/Work Order/Agreements showing the awarded contract value for “similar works” and satisfactory Completion Certificates issued by the Client, indicating the date of Completion and completed Contract Value.

The Bidder shall also enclose detailed BOQ with rates and scope of work supporting the LOA/work order/agreements/completion certificates. TDS certificate clearly showing the tax deduction from client for related work orders/agreements shall be attached for verification.

**Note:** The BOQ & Scope of work supporting the LOA/Work order/Agreements should have Clients endorsement.

2.4.3 Even though the Bidders meet the qualifying criteria as per clause 2.4, they are subject to be disqualified and debarred for a period of three (3) years from participating for tenders at New Mangalore Port Authority duly informing the MSME authorities if applicable, if they have:

2.4.3.1 made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements; and/or

2.4.3.2 Record of poor performance such as abandoning the works, not properly completing the contract, inordinate delays in completion, litigation history with New Mangalore Port Authority or financial failures etc.

2.4.4 **LAST DATE FOR SUBMISSION OF TENDER:** NMPA may at its sole discretion reserves the right to extend the date for receipt of tender.

## **2.5 RATES TO BE INCLUDED FOR ALL OPERATIONAL EXPENSES:**

2.5.1 The contractor may visit the Port Authority area before quoting. The Bidder should quote the rate by taking into consideration all expenses.

2.5.2 The GST as applicable will be paid extra by the Port. The GST Registration Number of the Bidder shall be furnished invariably in the tender as well as the Bills/Invoices. Copy of GST registration certificate shall be enclosed along with the tender.

2.5.3 GST will be paid on production of documentary proof of registration with the Central Excise Department only.

## **2.6 AUTHORITY IN SIGNING TENDER DOCUMENTS:**

2.6.1 The tender, if submitted on behalf of a Partnership Firm should be signed either by all the partners or some of the partners or other person/s holding a valid "Power of Attorney" from other partners or all the partners constituting the firm.

2.6.2 In case of a Company, the tender should be signed by a person holding a valid Power of Attorney executed in his favour in accordance with the constitution of the Company.

## **2.7 ONE BID PER BIDDER**

2.7.1 Each bidder shall submit only one bid for one package. A bidder who submits or participates in more than one Bid (other than as a subcontractor or in cases of

alternatives that have been permitted or requested) will cause all the proposals with the Bidder's participation to be disqualified.

2.7.2 A Bidder shall not have a conflict of interest. All Bidders found to have conflict of interest shall be disqualified. Bidders may be considered to have a conflict of interest with one or more parties in this Tendering process, if they are or

1. have been associated in the past, with a firm or any of its affiliates which have been engaged by the Employer to provide consulting services for the preparation of the design, specifications, and other documents to be used for the services to be rendered under these Tendering Documents ; or
2. Submit more than one Tender in this Tendering process.

2.7.3 A Bidder that is under a declaration of ineligibility by the Employer in accordance with ITB Clause 2.21, at the date of contract award, shall be disqualified.

2.7.4 Bidders shall provide such evidence of their continued eligibility satisfactory to the Employer, as the Employer shall reasonably request.

## **2.8 BIDDER TO INFORM HIMSELF FULLY**

2.8.1 The Bidder is expected to examine carefully the contents of all the documents provided like instructions to the Bidders, Tender Conditions, Scope of work etc. Failure to comply with the requirements of the tender will be at the Bidders own risk. The Bidder to ensure to make a complete and careful examination of requirements and other information set out in the tender document. The Bidder shall be deemed to have, visited the site and surroundings and have obtained all necessary information in all the matters whatsoever that might influence while carrying out the Works as per the conditions of the tender and to satisfy himself to sufficiency of his tender etc.

2.8.2 The Bidder shall examine carefully the conditions of contract in the Tender documents supplied herewith. Though every effort is made herein to give basic data as exhaustively as possible, the Bidder is advised to visit the New Mangalore Port and its approaches and get himself thoroughly acquainted with all necessary data concerning weather conditions, working conditions, sea conditions, etc. for the purposes of making a correct offer. All costs, charges and expenses that may be incurred by the Bidder in connection with such investigations for the submission of his offer shall be borne by him and the Board accepts no liability or responsibility whatsoever therefore.

2.8.3 Bidder shall bear all costs associated with the preparation and submission of his tender and NMPA will in no case be responsible or liable for these costs, regardless of the conduct or outcome of the tendering process.

## **2.9 Earnest Money Deposit:**

- 2.9.1 The tender shall be accompanied by proof of Earnest Money deposit of **Rs. 81,838/-** (Rupees Eighty One Lakhs Eight Hundred Thirty Eight only) inclusive of 18% GST 'OR' exemption certificate as per clause No 2.2.1(n) of ITB. EMD in the form of Insurance Surety Bonds **or** Account Payee Demand Draft **or** Fixed Deposit Receipt **or** Banker's Cheque **or** Bank Guarantee from any of the Commercial Banks **or** payment online is accepted. The tender without EMD shall be rejected, except in the case as per clause No.2.2.1 (n).
- 2.9.2 In the event of Tenderer withdrawing his tender before the expiry of tender validity period of **120 days** from the date of opening, the tender shall be cancelled and EMD shall be forfeited. **Applicable GST shall be recovered on forfeiture of EMD.**
- 2.9.3 The Earnest Money Deposit of unsuccessful Tenderers shall be returned without interest as early as possible on award of Contract to the successful Tenderer. The Earnest Money Deposit of the successful Tenderer shall be refunded (without interest) only on receipt of **Security Deposit cum Performance Guarantee** as stipulated in the tender clause **2.20**. In the event of forfeiting of EMD/LD/SD and while imposing penalty GST shall be collected.
- 2.9.4 NMPA reserves the right to forfeit the Earnest Money Deposit in respect of successful Tenderer, if he fails to enter into a Contract and furnish the necessary Performance Guarantee towards performance within **28 days** from the date of issue of **Letter of Acceptance**, otherwise penalty @ 0.25% of the amount of the Performance Guarantee for each week or part thereof for the number of weeks delayed beyond the stipulated date of submission shall be levied maximum up to 2.5% of the amount of the Performance Guarantee.
- 2.9.5 In the event of forfeiting the Performance Security, GST is applicable and while imposing penalty & Liquidated damages GST as applicable shall be collected.
- 2.9.6 The bidder shall be disqualified/terminated duly forfeiting EMD (if applicable) and may be debarred for a period of three (3) years from participating for tenders at New Mangalore Port Authority duly informing the MSME authorities if applicable, if
- 2.9.6.1 The Bidder withdraws the Bid after Bid opening during the period of Bid Validity;
- 2.9.6.2 The successful Bidder fails within the specified time limit to:
- b. Sign the Agreement AND / OR furnish the required Performance security.
  - c. Fail to commence the work on the specified date as per LOA/Work order.
  - d. If the bid is varied or modified in a manner not acceptable to the Employer during the validity or extended validity period duly agreed by the Bidder.
  - e. If any information or representation submitted by Bidder is found to be false or incorrect.
  - f. Any effort by the Bidder to influence the Employer on bid evaluation, bid comparison or contract award decision.

- 2.10 TENDER VALIDITY:** The tender shall remain valid for acceptance for a period of 120 days from the date of opening of Technical Bid. NMPA reserves their right to extend the period of validity for a specific time. The request and the response, thereto, shall be made in writing by post or by Fax/e-mail. A bidder may refuse the request which may be accepted by NMPA. However, in the event of the Bidder agreeing to the request; he shall not be permitted to modify his tender.

## **2.11 AMENDMENTS:**

- 2.11.1 At any time, prior to the last date for submission of tenders, NMPA reserves the right to amend and modify the tender document by issuing Addendum/Corrigendum which shall be uploaded in the CPP/PORT Websites.
- 2.11.2 The Addendum/Corrigendum so issued shall form part of the Contract and shall be binding upon the Bidders. NMPA may at their discretion, extend the last date for submission of the tender, to enable the Bidders to have reasonable time to submit their tender after taking into consideration such amendments, which shall also be uploaded to the Websites. The Bidder shall acknowledge receipt of such Addenda/ Corrigenda and submit the same along with his Tender duly signed and sealed in all pages.

## **2.12 LANGUAGE OF TENDER :**

The Tender submitted by the Bidder and all correspondence and documents relating to the Tender exchanged by the Bidder and the NMPA shall be written in the English language. Any printed literature, other than English language, shall be accompanied by an English translation, in which case, for purpose of interpretation of the tender, the English translation shall govern.

## **2.13 MODIFICATION, SUBSTITUTION AND WITHDRAWAL OF PROPOSAL:**

No offer shall be modified, substituted or withdrawn by the Bidder after the closing time on due date. Withdrawal of a proposal during the interval between closing time on proposed due date and expiry of the proposal validity period would result in disqualification of the bidder as per clause 2.9 of Tender Document.

## **2.14 TENDERED CURRENCIES:**

Prices shall be quoted in Indian Rupees only and all payments will be made in Indian Rupees.

## **2.15 PRE BID QUERIES**

Not Applicable

## **2.16 TENDER OPENING AND EVALUATION:**

- 2.16.1 **OPENING OF TECHNICAL BID:** Technical bids of the Tender, received up to closing time on stipulated date, shall be opened as per the Important Instructions of CPP.

### **2.16.2 SCRUTINY AND EVALUATION OF THE TENDER**

- 2.16.2.1 Prior to the detailed evaluation of bid, the employer will determine whether each bid (a) meets the eligibility criteria defined at 2.3 & 2.4 above (b) has been properly signed by an authorized signatory holding Power of Attorney in his favor (c) accompanied by Tender fee (if applicable), EMD (if applicable) and (d) is responsive to the requirement of the bidding documents. If any of the above conditions are not satisfied, the bid shall be rejected outright.
- 2.16.2.2 Conditional offer or alternative offers will not be considered further in the process of tender evaluation.

- 2.16.2.3 A substantially responsive technical and Financial Bid is one which conforms to all the terms, conditions and specifications of the bidding documents, without material deviation. A material deviation or reservation is one (a) which affects in any substantial way the scope, quality or performance of the works; (b) which limits in any substantial way, the employers right or bidders obligations under the contract or (c) whose rectification would affect unfairly the competitive position of others bidders presenting responsive bids. The Bidder who does not fulfill the tender requirements shall not be considered for further evaluation.
- 2.16.2.4 After the tender opening, the whole process involving scrutiny, clarifications, evaluation and comparison of tenders and recommendations regarding award of Contract shall be confidential. Any efforts on part of any Bidder to influence the Port Authority in any way in the process of scrutiny, evaluation, comparison of tenders and decision concerning award of Contract may result in rejection of the Bidder's bid.
- 2.16.2.5 To assess the scrutiny, evaluation and comparison of tenders, the Port Authority may ask Bidder individually for clarifications. Clarifications shall be sought only on the documents submitted along with the bid. No new documents/work orders shall be entertained which was not part of the original submission whose acceptance would affect unfairly the competitive position of others bidders presenting responsive bids. Request for clarification and response thereto shall be in writing/email or through fax. If the Bidder fails to submit the requested documents within the time specified by the department, his bid is liable to be rejected. No change in Price or substance of the tender shall be sought, offered or permitted nor is the Bidder permitted to withdraw the tender before the expiry of the validity period of the tenders in the process of clarifications.
- 2.16.2.6 If a Technical Bid is not substantially responsive, it will be rejected by the employer, and may not subsequently be made responsive by correction or withdrawal of the non conforming deviation or reservation. The Price/Financial Bid of those bidders shall not be opened.

**2.16.3 OPENING OF PRICE BID:**

- i. Tenders, which are found to be in conformity with NMPA's Tender requirement, shall be considered for opening of Price Bid.
- ii. The Bidders found to be qualified and responsive shall be informed about the date and time of opening of their Price Bids. On the stipulated date and time the Price Bids of such Bidders shall be opened online.
- iii. The Bidders has to quote the rate for the subject work in the price Bid format- PART III excluding GST.
- iv. The evaluation shall be done on the basis of **lowest value (L1)** quoted. The GST element if any will **not be considered** for comparison.
- v. Further, in order to promote the Make in India Initiative by the Government of India, Class 1 Local suppliers shall get purchase preference over Class II local suppliers as well as non Local supplier as per the following procedure (Refer GCC Clause 3.1 definitions) :-
  - a. Among all qualified bids, the lowest bid will be termed as L1, if L1 is Class I Local supplier, the contract will be awarded to L1.
  - b. If L1 is not a Class-I Local Supplier, the lowest bidder among the Class-I local supplier, will be invited to match the L1 price subject to Class-I local Supplier's quoted price falling within the margin of Purchase preference, and the contract shall be awarded to such Class-I Local supplier subject to matching the L1 price.
  - c. In case such Lowest eligible Class- I local supplier fails to match the L1 price, the Class-I local supplier with the next higher bid within the margin of purchase preference shall be invited to match the L1 price and so on and contract shall be awarded accordingly. In case none of the Class I supplier within the margin of purchase preference matched the L1 price, the contract may be awarded to the



L1 bidder.

**Note:** The Class-I local supplier/Class-II Local Supplier shall submit the self attested copy of Annexure-10 compulsorily along with the Bid clearly indicating the percentage of local content (local staffs that the contractor shall be deploying, in case the contract is awarded to him) and provide self certification that the services/items offered meets the local content requirement for Class I supplier/Class II local supplier, as the case may be.

- vi. The Bidder, whose bid is accepted by the Port Authority, shall be duly informed in writing. Within 7 days of receipt of intimation, regarding acceptance of its bid, the Bidder shall submit draft Contract agreement in the format approved by the Port Authority as in the **ANNEXURE-3** of Tender Document, and within a week thereafter the Contract agreement shall be signed between the Port Authority and the successful Bidder.
- vii. If the Bid of the successful Bidder is seriously unbalanced in relation to the Engineer or his Representative's estimate of the cost of work to be performed under the contract, the Employer may require the Bidder to produce detailed price analysis for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the implementation/construction methods and schedule proposed.
- viii. Offers, deviations & other factors which are in excess of the requirement of the Tender document or otherwise result in the accrual of unsolicited benefits to the Employer shall not be taken into account in Tender evaluation.
- ix. **The price Bid with any counter conditions will be summarily rejected.**

## **2.17 AWARD OF CONTRACT:**

**Award Criteria:** The employer will award the contract to the L1 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 No.2.3 and (b) qualified in accordance with the provisions of clause No.2.4.

## **2.18 EMPLOYERS RIGHT TO ACCEPT ANY BID AND TO REJECT ANY OR ALL :**

Notwithstanding Clause No.2.17, the employer reserves the right to accept or reject any bid and to cancel the bidding process and reject all bids, at any time prior to the award of contract, without thereby incurring any liability to the affected bidder or bidders of the grounds for employer's action. Further, NMPA does not bind them to accept the lowest offer.

## **2.19 NOTIFICATION OF AWARD AND SIGNING OF AGREEMENT**

- 2.19.1 The bidder whose bid has been accepted will be notified of the award by the employer prior to expiration of the bid validity period. This letter (herein after 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").
- 2.19.2 The notification of award will constitute the formation of the contract subject only to the furnishing of a performance security in accordance with the provision of clause 2.20.
- 2.19.3 The agreement will incorporate all correspondence between the employer and the successful bidder. The Contractor shall enter into and execute the Contract

Agreement, to be prepared and completed at the cost of the Contractor, in the **Annexure-3** with such modifications as may be necessary within **14 Days** from the Date of issue of LOA. The agreement to be executed on a non-judicial Stamp paper of value Rs.100/-. The completion period of the contract shall be as mentioned in the LOA/Work order. **The Bidder shall submit 10 sets of Agreement copies at his own cost.**

## **2.20 PERFORMANCE SECURITY:**

Performance security for a sum equivalent of **3%** of the total contract value including GST shall be submitted in the form of Insurance Surety Bonds or Account Payee Demand Draft or Fixed Deposit Receipt from a Commercial Bank or Bank Guarantee from a Commercial Bank or online payment are accepted in the approved format **within 28 days** from the date of issue of LOA. The Performance security shall be kept valid for the total contract period and Guarantee for one year plus Three Months claim Period. Thereafter, the total of 3% of Performance Security shall be released to the Contractor after successful completion of the Guarantee Period, deducting any dues payable to the Port. Failure to comply with the above shall lead to termination of contract as per clause No. 2.9 of ITB. If the contract is extended on mutual consent at the same rates, terms and conditions of the contract, then the Performance security shall also be extended for the same period plus Three Months claim period.

**Note:-** i) The Penalty for the delay in submission of the Performance Guarantee within the stipulate date above 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.

ii) The performance security shall be complied as per the orders/amendments issued by the Authorities

## **2.21 CORRUPT OR FRAUDULENT PRACTICES**

The Employer requires that Bidders/Suppliers/Contractors under this contract, observe the highest standard of ethics during the procurement and execution of this contract. In pursuance of this policy, the Employer

i. defines, for the purpose of these provisions, the terms set forth below as follows:

a. "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; and

b. "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 among 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.

ii. Will reject a proposal for award of work if he determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in

question.

- iii. Will declare a Bidder ineligible, either indefinitely or for a stated period of time, to be awarded a contract/contracts if he at any time determines that the Bidder has engaged in corrupt or fraudulent practices in competing for, or in executing, the contract.

**2.22 THE LAW, WHICH APPLIES TO THE CONTRACT:** The Contract shall be governed by the Indian Contract Act and under the Indian Law. The Arbitration for settlement of disputes shall be held in Mangalore, Karnataka, India.

Apart from the above, conciliation through conciliation committees/ councils comprising of independent subject experts may also be explored to settle the disputes.

Executive Engineer (Ele)I

### 3 GENERAL CONDITIONS OF CONTRACT

#### A: GENERAL:

#### 3.1 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;

- i. **Bill of Quantities** means the priced and completed Bill of Quantities forming part of the Bid.
- ii. **Compensation Events** are those defined in Clause No.3.30.
- iii. The **Completion Date** is the date of completion of the Works as certified by the Engineer or his nominee in accordance with Clause No.3.36.
- iv. 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 No. 3.2(iii).
- v. The **Contract Data** defines the documents and other information which comprise the Contract.
- vi. The **Contractor** is a person or corporate body whose Bid to carry out the Works has been accepted by the Employer.
- vii. The **Contractor's Bid** is the completed Bidding documents submitted by the Contractor to the Employer.
- viii. The **Contract Price** is the price stated in the letter of acceptance and thereafter as adjusted in accordance with the provisions of the Contract.
- ix. **Days** are calendar days, **months** are calendar months.
- x. A **Defect** is any part of the Works not completed in accordance with the Contract.
- xi. The **Defects Liability Period** is the period named in the Contract Data and calculated from the Completion Date.
- xii. The **Employer** is the party who will employ the Contractor to carry out the Works.
- xiii. The **Site** is the area defined as such in the Contract Data.
- xiv. 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.
- xv. **Materials** are all supplies, including consumables, used by the contractor for incorporation in the Works.

- xvi. 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.
- xvii. **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.
- xviii. 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.
- xix. A **Variation** is an instruction given by the Engineer or his nominee which varies the Works.
- xx. The **Works** are what the Contract requires the Contractor to Supply, install and turn over to the Employer as defined in the Contract Data.
- xxi. **“Local Content”** means the amount of value added in India which shall unless otherwise prescribed by the Nodal Ministry, be the total value of the item procured (excluding net domestic indirect taxes) minus the value of imported content in the item (including all customs duties) as a proportion of the total value, in percent.
- xxii. **“Class – I local supplier”** means a supplier or service provider, whose goods, services or works offered for procurement , has local content equal to or more than 50%.
- xxiii **“Class – II Local Supplier“** means a supplier or service provider, whose goods, services or works offered for procurement, has local content more than 20% but less than 50%.
- xxiv **“Non Local supplier”** means a supplier or service provider, whose goods, services or works offered for procurement, has local content less than or equal to 20%.
- xxv **“Margin of purchase preference”** means the maximum extent to which the price quoted by a Class – I local supplier may be above the L1 for the purpose of purchase preference, which shall be 20%.
- xxvi **“L1”** means the lowest tender or lowest bid or the lowest quotation received in a tender, bidding process or other procurement solicitation as adjudged in the evaluation process as per the tender or other procurement solicitation.
- xxvii **“Nodal Ministry”** means the Ministry or Department identified pursuant to this order in respect of a particular item of goods or services or works.
- xxviii **“Procurement entity”** means a Ministry of Department or attached or subordinate office of or autonomous body controlled by, the Government of India and includes Government companies as defined in the companies act.

### **3.2 INTERPRETATION:**

- i. 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.
- ii. 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).
- iii. The documents forming the Contract shall be interpreted in the following order of priority:
  - a. Agreement
  - b. Letter of Intent and work order.
  - c. Contractors Bid
  - d. Contract Data
  - e. Conditions of Contract including Special Conditions of Contract.
  - f. Specifications
  - g. Drawings, if any
  - h. Bill of quantities and
  - i. any other documents listed in the Contract Data as forming part of the Contract.

### **3.3 LANGUAGE AND LAW:**

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

### **3.4 ENGINEER OR HIS NOMINEES DECISION:**

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.

### **3.5 DELEGATION:**

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.

**3.6 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).

**3.7 PERSONNEL:** The Contractor shall employ the personnel as Onsite Support Resource 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.

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.

### **3.8 EMPLOYERS AND CONTRACTORS RISKS:**

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.

### **3.9 EMPLOYERS RISKS:**

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:
  1. war and hostilities (whether war be declared or not), invasion, act of foreign enemies;
  2. rebellion, revolution, insurrection, or military or usurped power, or civil war;
  3. 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;
  4. pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds; and
  5. 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;
  6. 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:
  1. could not have reasonably foreseen, or
  2. 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.

### 3.10 CONTRACTORS RISKS:

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.

### 3.11 INSURANCE:

The insurance shall be as follows;

1. All the materials shall stand insured in the name of New Mangalore Port Authority from the time of arrival at site till commencement of installation against fire, pilferage and damage for the value of 90% of each item. The charges for the insurance shall be borne by the Contractor.
2. During erection and till the work is completed and satisfactory taken over by the N.M.P.T after testing the materials shall stand covered by suitable erection Insurance also for the value of 110% of the item. The charges for the insurance shall be borne by the Contractor.
3. All the men/women to be deployed by the Contractor for performing the contract shall be insured against injury/accidents/death by the Contractor at his own cost.
4. The Contractor shall indemnify New Mangalore Port Authority against all losses and claims In case of death or injury caused to any person by him during the execution of the work.
5. The Contractor shall effect and maintain the following policies at no cost to NMPA, during Contract period with an Indian Insurance Company approved by Insurance Regulatory Development Authority of India (IRDA).
  - i. **Commercial General Liability (CGL):** The Contractor is required to take a Commercial General Liability (CGL) Insurance policy during execution of contract work to the extent of 50% of the contract value to cover Third party Liability with cross liability extension. The following third party liabilities shall be covered;
    - a. Third party bodily injuries / death / disablement (persons not belonging to Employer and/or Contractors.
    - b. Third party Property damage which includes damages to others materials/pipeline/cargo/inventories/equipment/other facilities belonging to third party and inclusive of properties during construction/erection/ Government properties.
    - c. The value of third party legal liability for compensation for loss of human life or partial / total disablement as well as for damage to others equipment/material/property shall be of required statutory limit where applicable or as awarded by Court of Law.

The policy will be on claim made basis with retroactive date from the date of commencement of the contract and shall be valid throughout the tenure of the contract period (including defect liability period) and be also valid during the extended period if any.

The policy will be having claim series clause and extended notification clause with cross liability extension.



- ii. **Employer Liability Insurance:** The Contractor shall indemnify and keep indemnified the Employer 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 Contractor'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.

The Contractor shall be registered under ESI as per the relevant statute and act and shall continue such insurance till completion of the Contract covering all the employees/workers/casual labour/contract labour/outsourced persons under his supervision deputed for the said contract work. The Contractor shall also submit such policy of insurance as and when required by the Employer / Employers representatives.

- iii. **Automobile Liability Insurance** covering use of vehicles / mobile equipments used by Contractor or sub-contractor(s) (whether or not owned by them) in connection with the execution of the contract.
- iv. **Claim Lodgement:** In all cases the Contractor shall lodge the claim with the underwriters and also settle the claims. All claims shall be settled in India. However, the Contractor shall proceed with the repairs and/or replacement of the damaged structures / facilities without waiting for the settlement of the claims. In case seizure of materials by concerned authorities the Contractor shall arrange prompt release against bond, securities or cash as required.

The Contractor will indemnify to the fullest extent permitted by law and keep the Employer, its officers, employees and other related parties hold harmless from all claims for bodily injury and property damage that may arise from the performance of the work

**3.12 THE WORKS TO BE COMPLETED BY THE INTENDED COMPLETION PERIOD:**

The Contractor may commence execution of the works on the Start Date and shall carry out the works in accordance with the Bar Chart submitted by the contractor as updated with the approval of the Engineer or his nominee, and complete them by the Intended Completion Date.

**3.13 SAFETY:** The Contractor shall be responsible for the safety of all activities on the Site.

**3.14 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.

**3.15 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.

**3.16 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.

**3.17 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.

**3.17.1 SETTLEMENT OF DISPUTES:**

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].

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.

**3.17.2 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 CIDC-SIAC 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.

### **3.18 BAR CHART:**

1. Bar Chart showing stage wise activities of the work should be uploaded **along with the Technical Bid**. However, the successful Bidder shall review the Bar Chart & take prior approval from the Engineer before commencement of work.
2. An update of the Bar Chart 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.
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.
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.

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

### **3.19 EXTENSION OF INTENDED COMPLETION DATE:**

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.
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.

### **3.20 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.

### **3.21 MANAGEMENT MEETINGS:**

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.
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.

### **3.22 EARLY WARNING:**

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.

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.

## **B. QUALITY CONTROL:**

### **3.23 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.

### **3.24 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.

### **3.25 CORRECTION OF DEFECTS:**

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.
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.

### **3.26 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.

## **C. COST CONTROL:**

### **3.27 BILL OF QUANTITIES:**

1. The Bill of Quantities shall contain items for the supply, installation, testing and commissioning work.
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.

### **3.28 VARIATIONS AND ITS VALUATION:**

- i. The Quantities set out in the Bill of Quantities of the tender shall be treated as estimated quantities of the work and shall never be deemed as actual or correct quantities of the works to be executed by the contractor in fulfillment of his obligation under the contract.
- ii. The Engineer shall have the power to order the Contractor in writing to make any variation of the Quantity, quantity or form of the works or any part thereof that may, in his opinion, be necessary and the Contractor upon receipt of such an order shall act as follows;

- a. Increase or decrease the quantity of any work included in the Contract.
  - b. Omit any work included in the contract.
  - c. Change the routes, position and dimensions of any part of the work.
  - d. Execute extra and additional work of any kind necessary for completion of the works.
- iii. No such variation shall in any way vitiate or invalidate the contract or be treated as revocation of the contract, but the value (if any) of all such variations evaluated in accordance with the Engineer's sole decision shall be taken into account and the contract price shall be varied accordingly.
- iv. Provided variation in the quantity of any work will be permitted which is necessary to complete the works where such increase is not the result of any variation order given under this clause but is the result of the quantities exceeding those stated in the bill of quantities. Provided the variation shall be complied with by the Contractor and the Engineer's subsequent written confirmation of such variation shall be deemed to be an order in writing within the meaning of this clause
- v. No price escalation is allowed. The rate(s) quoted against the work shall remain firm during the entire contract period. Any change in Forex/rate shall not be considered for price variation.
- vi. The purpose of this document is to define the minimum requirements for the supply, design & engineering, manufacturing, installation, inspection, Commissioning and documentation of all the items and other activities as per BOQ (Bill of Quantities) attached with tender document, for the Job /construction contractor in performing the work of **"SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF PASSENGER LIFT AT ADMINISTRATIVE BUILDING, NMPA "**.
- vii. The Contractor shall note that all the activities that are required to be performed for completion and successful commissioning of the project needs to be considered in his scope of work. Any missing activities/ supplies in BOQ or in any other project issued documents, but essential for the completion and success full implementation of the project shall be the sole responsibility of the contractor at his cost.
- viii. a. The Contractor shall not be entitled to any claim of extra or additional work unless they have been carried out under the written orders of the Engineer.
- b. The Engineer shall solely determine the amount (if any) to be added to or deducted from the sum named in the tender in respect of any extra work done or work omitted by his order.
- c. All extra, additional or substituted work done or work omitted by order of the Engineer shall be valued on the basis of the rates and prices set out in the contract, if in the opinion of the Engineer, the same shall be applicable. If the contract does not contain any rates or prices directly applicable to the extra additional or substituted work, then the Engineer may decide the suitable rates on the basis of Schedule of Rates, if any thereon. In all other cases the

Engineer shall solely determine suitable rates in the manner deemed by him as fair and reasonable, and his decision shall be final, binding and conclusive.

### **3.29 PAYMENTS (for Electrical and LIFT works):**

Running bills will be paid for at quoted rates for the items in schedule, after acceptance of Performance Guarantee which shall be valid for whole contract period including Guarantee period. Payment will be made within 15 days from the date of receipt of bill, after receipt of items / satisfactory testing & commissioning of system.

**Running Account Bill claim shall be submitted separately and corresponding GST for the value of service shall be shown in the tax invoice/ Bill Claim.** Following are the stages of Payment;

- a. 70% (Seventy percent) of supplied Item rate against receipt of material at site in good condition and after inspection of the same.
- b. 20% (Twenty Percent) of supplied item rate after completion of Installation, Testing and commissioning etc. and 90 % (Ninety Percent) of payment against items covering only Installation, Testing and commissioning.
- c. 10% (ten percent) will be paid on successful completion of the work and issue of Taking Over Certificate in respect of the subject works (totally 100%) after acceptance of Performance Security Deposit (performance Guarantee) for 3% (Three percent) value of Contract Price to cover guarantee period.
- d. For BOQ items having "Supply and laying/installation/fixing/running/testing/commissioning etc.....", 70% of quoted rate will be considered for supply of items and balance 30% will be considered for laying/installation/fixing/running/testing/commissioning etc. and payment terms at a, b & c above will be applied accordingly.

### **PAYMENTS (Civil Works):**

The bills for other Construction/Renovation/Miscellaneous works which are not paid on monthly basis 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 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 / 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.

1. Interim of bill amount will be paid within 14 days of submission of the bill.
2. 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
3. The payment will be made to the contractor after deducting any dues payable to the Port statutory authorities etc
4. 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.
5. 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.

Running Account Bill claim shall be submitted separately and corresponding GST for the value of service shall be shown in the tax invoice/ Bill Claim. Following are the stages of Payment;

- |  |                           |
|--|---------------------------|
| i) Foundation works up to plinth beam    | - 20% of Civil Component. |
| ii) Up to Lintel beam, including windows | - 15% of Civil Component. |
| iii) Roof Slab Completion                | - 30% of Civil Component. |
| iv) Plastering / Flooring                | - 10% of Civil Component. |
| v) Painting / Final Finishing of Works   | - 25% of Civil Component. |

**Payment along with applicable GST will be released within 15 days subject to recoveries if any, from the date of submission of Tax Invoice after satisfactory completion of work in all respect.**

### **3.30 COMPENSATION EVENTS:**

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 gives an instruction for dealing with an unforeseen condition, caused by the Employer, or additional work required for safety or other reasons.
- f. 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.
- g. 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 in writing. If a compensation event would prevent the work being completed before the Intended Completion Date, the Intended Completion Date shall be extended. The Engineer or his nominee shall decide whether and by how much the Intended Completion Date shall be extended.

### **3.31 LIQUIDATED DAMAGES:**

- i. In case of delay in completion of the contract, liquidated damages (L.D) may be levied at the rate of 0.5% of the contract price plus applicable GST per week of delay or part thereof subject to a maximum of 10 per cent of the contract price.
- ii. 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 0.5% of the contract value plus applicable GST for each week or part thereof subject to the ceiling defined in Clause **3.31(i)**.
- iii. 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.
- iv. 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.

- v. In the event of such termination of the contract as described in clauses **3.31(iii) or 3.31(iv)** 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.
- vi. Contractor hereby agree after due assessment of damages that there will be definite loss to the Employer in case of delay in completion of work and the amount of Liquidated damages fixed above is genuine and reasonable to be recovered. Contractor hereby further agrees that Employer is not required to prove the loss suffered to him before recovery of LD.

### **3.32 OBLIGATIONS OF THE CONTRACTOR:**

- i. The Contractor shall exercise all reasonable care and diligence in the discharge of all technical, professional and contractual duties to be performed by them under this Contract within the Time for Completion. The Contractor shall be fully responsible to the NMPA for proper, efficient and effective discharge of their duties.
- ii. The Contractor shall when called upon so to do enter into and execute a Contract agreement as per clause **2.19** of this tender document.
- iii. The successful Tenderer shall furnish bond in the form of Performance Guarantee towards the performance of the work as per clause **2.20** of this tender document.
- iv. If the Board shall consider itself entitled to any claim under the performance Guarantee it shall forth with so inform the Contractor specifying the default of the Contractor upon which he relies. If the Contractor fails to remedy such default within 20 days after the receipt of such notice the Board shall be entitled to forfeit to the extent of the loss or damage incurred by reason of the default.
- v. The Contractor shall proceed with the Works in accordance with the decisions, instructions and orders given by the Engineer in accordance with the condition of the Contract.

### **3.33 EXECUTION:**

The Contractor shall execute and do the works set forth as described in the scope of the work and specifications, including any amendments.

### **3.34 EXTRAS:**

Any extra expenses incurred in connection to the Works by the NMPA in the performance of the Works owing to the neglect or omission on the part of the Contractor in any of the case mentioned in this Contract shall be deducted from any sum due or which may thereafter become due to the Contractor or from any amount lying with them or under their control or he may be called upon to pay the amount of such extra expense to such person or persons as the NMPA may appoint to receive the same and in the event of the Contractor failing to make such payment, the said amount shall be recoverable from him in such manner as the NMPA may determine.

**3.35 EXISTING SERVICES:** The Contractor shall not store any materials or otherwise occupy any part of the site in a manner likely to hinder the Port operation. Any damage/loss caused by the contractor to the Port property, same shall be rectified at his own cost without any delay with the satisfaction of the Engineer.

**3.36 COMPLETION PERIOD:**  
**SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF PASSENGER LIFT AT ADMINISTRATIVE BUILDING, NMPA** shall be completed within **Four (4) months** from the date of issue of Letter of Acceptance (LOA).

**3.37 INSPECTION & TESTS:**

- i. The Employer or his representative shall have right to inspect the work being carried out under this Contract and to test the system to confirm conformity with the specifications. The employer shall notify the Contractor in writing of the identity of a representatives retained for these purposes.
- ii. The tests may be conducted on the premises of the Contractor or its subcontractor (s) at point of delivery and at the final destination. Where conducted on the premises of the Contractor or its subcontractor (s), all reasonable facilities and assistance shall be furnished to the inspector at no discharge to the Employer.
- iii. Should any tested systems fail to conform to the specification, the Employer may reject them, and the Contractor shall make suitable alterations with prior approval of Employer to meet the requirements of the specifications, without any effect on cost of delivery times / project schedules.
- iv. The Employer's right to inspect, test and where necessary, reject the system shall be in no way limited or waived by reason of the systems having previously been tested and passed by the Employer or its representatives prior to dispatch of the system.
- v. The Contractor shall submit the Quality Assurance plan (QAP), Technical drawings for prior approval before commencement of Inspection / Test at manufacturer's work / Site to the Inspection Agencies / Engineers representatives.

**3.38 FINAL ACCEPTANCE:**

Upon completion of the work under the Contract a meeting shall be held for the purpose of accepting the system and services. Such meeting shall constitute the Final Acceptance Test under the Contract. In case defects or shortcomings or both which are considered essential, a new meeting shall be convened when the contractor has given notice of completion of the corrective work carried out. Otherwise NMPA may accept the system if the defects or shortcomings or both are not considered essential and the Contractor has agreed to carry out the modifications in conformity with this Contract.

**3.39 REJECTION OF DEFECTIVE WORK:**

- i. If the complete system at site or any portion thereof before being taken over, is defective, or fail to fulfill the requirements of the Contract, the Engineer shall give notice to the Contractor setting forth particulars of such defects and the Contractor shall forthwith make the defective supply/Installation good or alter the same to make it comply with the requirements of the Contract.
- ii. If Contractor fails to do so within a reasonable time, NMPA may reject and replace the same at the cost of Contractor, the whole, or any portion of the work, as the

case may be, which is defective or fails to fulfill the requirements of the Contract. The Contractor's fails and extreme liability under this clause shall be satisfied by the payment to NMPA, the extra cost, if any, of such replacement delivered and erected. Such extra cost being ascertained shall be deducted from the Contractor's bill.

- iii. If any supply of defective items shall have caused delay in the completion of the Contract so as to give rise to a claim for damage on the part of the NMPA under Clause **3.26** of Tender Document nothing contained in this clause shall interfere with or prejudice any rights of the Board of Directors with respect to such claim.

### **3.40 TAKING OVER CERTIFICATE:**

When the whole of the works have been substantially completed and have satisfactorily passed any tests on completion prescribed by the contract, the contractor may give a notice to that effect to the engineer, with a copy to the employer, accompanied by a written undertaking to finish with due expedition any outstanding work during the defects liability period. Such notice and undertaking shall be deemed to be a request by the contractor for the engineer to issue a taking over certificate in respect of the works. The Engineer shall, within 21 days of the date of delivery of such notice, either issue to the contractor, with a copy to the employer, a taking over certificate, stating the date on which, in his opinion, the works were substantially completed in accordance with the contract, or give instruction in writing to the contractor specifying all the work which in the engineer opinion, is required to be done by the contractor before the issue of such certificate. The Engineer shall also notify the contractor of the any defects in the works affecting substantial completion that may appear after such instructions and before completion of the works specified there in. The contractor shall be entitled to receive such taking over certificate within 21 days of completion, to the satisfaction of the engineer, of the works so specified and remedying any defects so noticed.

### **3.41 DEFECT LIABILITY PERIOD AFTER TAKING OVER:**

- i. In this condition the expression '**Defect liability period**' shall mean a period of **12 months** calculated from the date of Taking Over in accordance with clause **3.40** of Tender Document for **all works**.
- ii. The Contractor shall be responsible for making good with all possible speed at his expense any defect in or damage to any portion of the Works which may appear or occur during the defect liability period without extra cost to NMPA and which arises either;
  - a. From any defective materials, workmanship or Design or
  - b. From any act or omission of the Contractor done or omitted during the said period.

- iii. If any such defects shall appear or damage occur the Engineer shall forthwith inform the Contractor thereof stating in writing the nature of defect or damage. The provision of this clause shall apply to all replacements or renewals carried out by the Contractor to remedy defects and damage as if the said replacements and renewals had been taken over on the date they were completed to the satisfaction of Engineer but not so as to extend the Defects Liability Period in respect thereof beyond three years from the date of taking over decided by the Engineer as the respective case of remedying may warrant.
- iv. If any such defect or damages were not remedied within a reasonable time, NMPA may proceed to do the work at the Contractor's risk and expense provided that he does so in a reasonable manner.

**3.42 INCOME TAX DEDUCTION:**

Income Tax as at such rates applicable from time to time will be deducted at source from all running bills and Final Bill and a certificate to this effect will be issued. The deduction of Income Tax can, however, is waived if exemption certificate is produced from Income Tax Authorities. Deduction of income tax at reduced rate can be considered subject to production of valid certificate for the period from Income tax authorities.

The GST applicable shall be shown as a separate line item in the tax invoices, and shall be paid extra. Contractor should provide proper tax invoice as per GST act.

The Tenderer / Contractor shall file the applicable returns with tax departments in time and submit the same as documentary proof.

Contractor shall submit all the GST returns with in time specified. Any ITC lost by NMPA due to non filling of return will be recovered from the contractor.

- 3.43** The payment will be made through E-Payment. The Tenderers are required to furnish Bank details for making E-Payment as per the schedule- III of this Tender document.

**3.44 MAINTENANCE OF RECORDS/REGISTERS, INSTRUCTION BOOK:**

The Instruction Book is to be kept by the Contractor at the site. Any order or instructions issued by the EIC or his authorized representative shall be entered in the book. The Contractor shall sign each entry in token of having seen the same. This shall be returned to the EIC in good condition after the completion of the Contract period.

- 3.45 NO INTEREST ON ACCOUNT OF DELAYED PAYMENTS:** Any claim for interest will not be entertained by the NMPA with respect to any payment or balance which may be in their hands owing to any disputes between themselves and the Contractor or with respect to any delay on the part of the NMPA in making payment.

### **3.46 GUARANTEE PERIOD:**

- i. The items to be supplied under this Contract shall be guaranteed for a period of **12 (twelve)** months for **all works** towards satisfactory performance. The Contractor shall be responsible for any defects that may develop under proper use arising from faulty materials, Designs, workmanship in the work but not otherwise and shall at his own cost remedy such defects when called upon to do so by the Engineer who shall state in writing in what respect any portion is faulty.
- ii. If it becomes necessary for the Contractor to replace or renew any defective portions of the supply of the items under this clause, the provisions of this clause shall apply to the portions of the supply so replaced or renewed until the expiry of 12 months from the date of such replacement or renewal of the above mentioned **period of 12 months**, whichever may be later. If any defects are not remedied within a reasonable time, the Port may proceed to do the work at the Contractors' risk and expenses but without prejudice to any other rights, which the Port may have against the Contractor in respect of such defects.

### **3.47 EXTENSION OF COMPLETION PERIOD:**

If the quantum of total work increases due to additional work against the BOQ for the subject works “**SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF PASSENGER LIFT AT ADMINISTRATIVE BUILDING, NMPA** ” suitable extension of completion period shall be taken during the approval of additional work from the Competent Authority.

### **3.48 DEFAULT OF THE CONTRACTOR & TERMINATION:**

If the Contractor makes any default or on the happenings of anyone or more of the following events that is to say;

- a. If the Contractor without reasonable cause abandons the Contract or
- b. Suspends the carrying out of the Works for a reasonable time after receiving written notice from the NMPA without any lawful excuse or fails to make proper progress with Works after receiving written notice from the Engineer or
- c. Fails to proceed diligently with the work or
- d. Fails to give the NMPA proper facilities for inspection of the Works of any part thereof for three days after receiving notice in writing by the NMPA demanding the same or
- e. The Contractor has become insolvent or
- f. The Contractor has gone into liquidation or passes the resolution for winding up or
- g. Upon the Contractor making an arrangement with or assignment in favour of his creditor or Upon his assigning this contract or
- h. Upon an execution being levied upon the Contractor's good or

- i. Upon winding up order being passed by the court or a Receiver or manager is appointed in respect of any of the property of the Contractor or
- j. Possession is taken by or on behalf of any holder of any debentures secured by floating charges of any of the property of the Contractor or
- k. Fails to complete all or any part of the Works during the time specified for completion of the Contract or such extended time as may be granted by the NMPA.

### **3.49 TERMINATION OF THE CONTRACT**

In the event of repeated instances of unsatisfactory service or any failure at any time on the part of the contractor to comply with the terms and provisions of this contract to the satisfaction of NMPA (who shall be the sole judge and whose decision shall be final, it shall also be open to NMPA to terminate this contract by giving not less than 90 (ninety) days notice in writing to that effect and if the contractor, does not make good his default within the notice period, NMPA shall be entitled to terminate the contract as a whole or in part.

- i. In the event of such termination of the contract, NMPA shall be entitled to:
  - 1. forfeit the Performance Guarantee as it may consider fit;
  - 2. get the balance/remaining work done by making alternative arrangements as deemed necessary and until such time NMPA is able to appoint a new regular Contractor; and recover from the contractor (appointed under this tender) any extra expenditure incurred by NMPA in getting the work done and damages which NMPA may sustain as a consequence of such action.
- ii. If the extra expenditure incurred by NMPA on account of unsatisfactory performance of the contractor as mentioned in paragraphs above is more than the Security Deposit proposed to be forfeited, the expenditure over and in excess of the Security Deposit may be recovered by deducting the said amount from pending bills of the contractor under this tender or from money due to the contractor by NMPA under this or any other contract or otherwise. The contractor shall have no claim whatsoever against NMPA, in consequence on such recoveries or termination of the contract, as stated above.
- iii. if at any time the contractor becomes insolvent or files an application for insolvency or any creditor of his moves the court for adjudicating him as an insolvent or, if he is convicted by any court of law, withdraws from the contract, NMPA will have the absolute option of terminating the contract forthwith and he shall have no right for damages or compensations on this account. Further, NMPA reserves the right to terminate/pre-close the contract at its convenience, without assigning reasons to the contractor by giving a notice period of 90 days. The contractor shall not have right of any claim on NMPA on account of such termination.

### **3.50 DEBARRING OF BUSINESS DEALINGS:**

In the event of premature termination of contract in terms of provisions of clause 3.48 above, NMPA shall also be entitled to debar the Contractor for participation in future tenders of NMPA for a period of three (03) years.

Further, in case if it comes to the notice of NMPA that the Bidder/Contractor has used forged documents or misrepresented the facts in any manner either to get the contract or during the pendency of the contract, in such cases NMPA at its sole discretion may disqualify the bid / terminate the contract and debar such Bidder/Contractor for participation in future tenders of NMPA for a period of three (03) years.

### **3.51 NMPA's LIEN:**

The NMPA shall have a lien on and over all or any money that may become due and payable to the Contractor under this Contract or any other Contract or from any amount lying with them or under their control and in respect of any debt or sum that may become due and payable by the NMPA to the Contractor either alone or jointly with another or other and either under this Contract or under any other Contracts or transaction of any nature whatsoever the NMPA and the Contractor.

### **3.52 FORCE MAJEURE:**

If the supply, Commissioning and Testing of equipment/materials is hindered due to force majeure such as war, riots, civil commotion, fire, epidemics, natural calamities, heavy/continuous rain for 8 hrs in a day time during monsoon such period shall be exempted from **Liquidated Damages** as mentioned in clause **3.31** of this tender document.

### **3.53 LABOUR LAWS:**

The Contractor shall comply with all the provisions of the **Labour Laws and the rules and regulations** made there under as amended from time to time and as applicable from time to time with regard to the employees to be deployed by the Contractor for Electrification, Testing, Commissioning and Maintenance of the system.

### **3.54 ACTS & STATUTORY RULES:**

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 and abolition) Act 1970 and rules there under and the other enactments that may be applicable including ESI Act, the payment of wages Act, Provident Fund Act, the minimum wages Act, the factories Act, the workmen compensation act or any other applicable legislation and the Municipal by laws or other statutory rules and regulations whatsoever in force in so far as these are applicable. Any obligations finding or otherwise missed under any statutory enactments, rules and regulations there under shall be the responsibility of the contractor and the NMPA will take no responsibility for the same.

- i) The Tenderer must possess documents certifying registration under Employees State Insurance Act, EPF & MP Act and GST.**
- ii) If the Tenderer is not registered under ESI Act and EPF & MP Act for the reasons that he has not employed 10 or more workers as required under**



said laws, he shall submit an affidavit in this regard that he has never employed 10 or more workers on any given day preceding 12 months from the inception of its operations.

- iii) The Tenderer to whom ESI Act and EPF & MP Act does not apply, shall mandatorily cover his workers deployed at NMPA site/premises under Employees Compensation Act Policy declaring proper wages.
- iv) The Tenderer shall submit “Indemnity Bond” as per Annexure - 12 for undertaking to indemnify NMPA both loss/legal expenses incurred in case of any claims filed against NMPA by EPFO/ESIC authorities with regard to the workers of the bidder/contractor.

### **3.55 SAFETY GEARS:**

The Contractor shall at his own expenses provide all safety gears for all labours engaged during the work and failing to do so, the NMPA shall provide the same and recover the cost there of from any amount due or which may become due to the Contractor or from any amount lying with them or under their control.

### **3.56 INDEMNIFICATION:**

The Contractor shall agree and undertake (ANNEXURE-11) to indemnify, keep indemnifies, depended and hold harmless the NMPA and its Officers against all losses, penalties, costs and expenses, duties of any kind whatsoever which may arise on account of breach un-authorized act, fraud deed or any other acts of Contractor or any of its personnel. The Contractor shall also agree and undertake to indemnify and keep indemnifies against any order passed by any executive, quasi judicial or judicial authority wherein the NMPA is compelled to obey the order which arise due to breach of contract by the Contractor.

The Contractor shall indemnify, protect and defend at its own cost, New Mangalore Port Authority and its agents & employees from & against any/all actions, claims, losses or damages arising out of;

- i. Any violation by the Contractor in course of its execution of the contract of any legal provisions or any right of third parties.
- ii. Contractor’s failure to exercise the skill and care required for satisfactory execution of the contract.
- iii. The Contractor shall indemnify NMPA against all claims for compensation by or on behalf of any workman employed by him in connection with the contract, for injury or death by accident under the Workman Compensation Act (Act VIII of 1923) as amended from time to time.
- iv. The Contractor shall be responsible for all commissions and omissions on part of manpower engaged for the purpose. NMPA shall not be responsible in any manner whatsoever, in matters of injury/death/health etc. of the Contractor’s employees performing duties under the contract.

#### 4. SPECIAL CONDITIONS OF CONTRACT

- 4.1 The rates quoted shall be Firm and inclusive of all cost & Duties and exclusive of applicable GST. The Employer shall not provide any concessional "C" or "D" Form.
- 4.2 The Contractor should have **valid, GST & PAN** and the same should be uploaded along with the tender. GST will be paid on production of documentary evidences.
- 4.3 The Contractor shall carryout the work as a complete job i.e. Supply materials, their storage, keeping under safe custody, transporting to work site, fixing, testing and commissioning of the whole work. The Tenderers should satisfy themselves about the quantities indicated in the Schedule and it is the responsibility of the supplier to supply and make the system operational to the satisfaction of Engineer.
- 4.4 The supply items should have Test Certificates/warranty certificates and the same shall be submitted along with supply of materials.
- 4.5 Delay in making the execution site available to the Contractor will not form a cause for any claims. The Port Authority will inform the Contractor of such possible delay in advance and a suitable extension of time for completion shall be considered.
- 4.6 The Successful Contractor shall take approval from the Engineer in charge for technical datasheets, drawings etc. before procurement of material / fabrication of materials etc. and should supply all materials/equipments as per relevant standard & Tender specifications and carryout the complete work including Testing and commissioning as per applicable act.
- 4.7 Any part or whole of the system, which requires the approval of the statutory body, if any, should be arranged by the Contractor at his cost. It is the responsibility of the Contractor to submit the system drawings with all details to the statutory body and obtain their approval, if any.
- 4.8 All related Civil works shall be responsibility of the Contractor. The Contractor should take timely action to complete all civil works in all respects.
- 4.9 Power supply, if available, will be given to the Contractor **on free of cost**. Wherever such source is not available, the contractor has to make his own arrangements. Tapping of power from the source point of NMPA to the required location will have to be arranged by the Contractor at his cost conforming to IE Rules / Standards.
- 4.10 The Contractor has to make his own arrangement for engaging all tools & tackles, testing equipments etc.
- 4.11 The Equipment shall be insured in the name of Employer for 110% of Ex-works cost from the place of dispatch to the place of destination & till handing over / taking over of the Equipment to the satisfaction of the Employer.
- 4.12 The Contractor has to make his own arrangements for construction of temporary stores; office work sheds etc., for their requirements at his own cost. Land for such

temporary work sheds, stores, site office etc., till the work is completed will be given free of rent at spot approved by NMPA. The sheds shall be constructed with non-inflammable materials like G.I. sheets etc., and shall be removed in reasonable time after the work is completed. In case the Contractor fails to remove the same, the Department will remove the same and the cost of such removal will be recovered from any amount due from the Contractor.

- 4.13 **Site Register** is to be maintained by the Site Engineer (AE/AEE/EE) at site on daily basis with details of works carried out on that particular day, defects noticed by the Site Engineer (AE/AEE/EE) and instructions given to the Contractor etc. Any orders or instructions issued by the Engineer-in-Charge or Higher Authorities shall be entered in the book and shall be deemed to have been legally issued.
- 4.14 **Hindrance Register** is to be maintained by the Site Engineer (AE/AEE/EE) at site & should contain all the Hindrances to the work due to the reasons attributed either to the Contractor or Port date wise and date of resumption of work. The Contractor and Engineer in charge should sign each entry in token of having seen the same.
- 4.15 The Contractor is responsible for taking precautionary measures for the safety of the lives of the workmen working under him and the responsibility arising due to any mishap during the execution of work, the payment of any compensation etc., lies entirely on the part of the Contractor. Safety nets, life jackets, Helmets required while working in site and Danger Boards, barricades are to be provided by the Contractor without any extra cost to the Port Authority.
- 4.16 The Contractor should ensure, that all necessary arrangements for the safety of others and also his men and materials while performing the work, are well maintained at his cost, risk and responsibility. He should ensure proper watch of the signals by providing barricades, lights, vigils, precautionary measures etc., to ensure safety at his work.
- 4.17 The Port working hour is from 8.00 A.M. to 1.00 noon and from 2.00 P.M. to 5.00 P.M. If any work is carried out by the Contractor requiring supervision beyond Port working hours, the Contractor shall apply in writing well in advance of such work to the Engineer to arrange for such supervision.
- 4.18 All rules and regulations governing the New Mangalore Port Authority shall be applicable.
- 4.19 The site for the work will be handed over to the Contractor in phases for the execution as soon as the work order is given. In case the entire site is not handed over to the Contractor, he should programme his work in such a way so as not to hamper the progress in any way and a suitable extension of time shall be considered.
- 4.20 Any damages caused to the Port property either directly or indirectly shall be made good by the Contractor at his own cost.

4.21 The Tenderer(s) shall be required to quote his / their rates in figures as well as in words without any correction(s). If there is any correction(s) in the tender, such corrections should be attested by the Tenderer(s) before submission of the tender. However the rates shall be quoted in words and figures, in case of dispute, rates in words shall be taken as final.

4.22 Port entry passes to the Contractor and his workmen and vehicle during the period of work will be issued on a **chargeable basis to carry out the work as per rules.**

4.23 **Completion Drawing & Documentation:**

On the basis of drawings issued and additional drawings generated during the course of execution of works & documentation required for various components and sub-components, the Contractor should prepare completion documents generally as below but not limited to;

- a. Supply items - The contractor shall furnish one set of original manuals, leaflets etc. All drawings and documents are to be neatly filed in a heavy duty binder and indexed.
- b. Copy of all the Test reports and Guarantee/Warranty certificates are to be presented separately in a folder for records and reference.

4.24 The successful Bidder / Contractor shall furnish an undertaking on their Firm's letterhead for the following before executing the Contract agreement;

- a. We will ensure that our workforce will be provided with and use all necessary safety gears and equipments required for the job.
- b. We will follow all the required safety procedures while executing the job.
- c. We indemnify the Port for any accidents / incidents while carrying out the Contract.

4.25 The Department's Standard Operating Procedure (SOP) will be shared with the successful Bidder / Contractor at the time of signing of agreement. The successful Bidder / Contractor have to give an undertaking for complying with the same. In case if the successful Bidder / Contractor does have a defined SOP for carrying out the tendered work, the same shall be submitted to the Executive Engineer (E) for scrutiny and approval for its applicability before commencement of the work.

4.26 **Addition/Alteration:**

The Contractor shall not be entitled to any claim of extra or additional work unless they have been carried out under the written orders of the Engineer in charge.

4.27 **Others:**

- 1) Accommodation for the deployed staff shall be arranged by the Contractor at his own cost; however the Port quarters may be allotted on chargeable basis if available as per applicable rules of NMPA.
- 2) At the end of the period of contract, all the equipment under this tender shall be handed over to the Port on as is where basis is in good working condition.
- 3) The hardware, software and all related licenses thereto shall be under the ownership of the Port. The bidder shall obtain/issue licenses or such other certification/documentation required for the purpose in the name of the NEW MANGALORE PORT AUTHORITY.
- 4) The successful Bidder shall be responsible for insurance of all the manpower & hardware/network supplied and installed by vendor for risk coverage including accidental hazards, death & disability of person, material breakage due to negligence, theft, storm, fire or any other hazards which may occur due to trespassing of vehicles & /or natural adverse climatic conditions and calamities - War, Fire, Cyclone, salinity problems at shore etc.

## Scope of Work and Technical Specifications- ELECTRICAL/LIFT

### 1. SCOPE

The scope of Bid is to cover Design, Manufacture, Supply, Installation, Testing and Commissioning of 15 Passenger lift at Administrative Building of New Mangalore Port Authority. This includes obtaining all necessary statutory approval and maintenance of Lifts during the Guarantee Period in the Building. The scope also includes Civil and Structural steel works connected with the installation of Lifts. All electrical works connected with Lifts beyond power supply point shall also be included in the scope of the Bid. During the guarantee period, the Bidder shall carry out comprehensive maintenance of Lift free of cost. After this guarantee period, the Employer will reserve the right to enter into Annual Maintenance Contract as described in the Bid document.

The equipment supplied and erected shall be in accordance to updated version of IS-4666/1968, 1860/1968 & 1980 and IS: 14665-2001, IS: 3534/1979. Fire protection requirement as per IS and local authority's requirement shall also be complied with. The Lifts in accordance with any other International Standards, which are superior than IS standard, shall also be considered.

The current statutory requirement as per Lift Rules of Local Authority as applicable shall be complied with, no extra payment shall be considered either due to escalation or amendments / modifications to Local Authority Rules issued during the contract period. The Bidder/ Contractor shall be responsible to obtain necessary License from Lift Authority, Government of KARNATAKA. Necessary statutory fee will be reimbursed by NMPA based on submission of receipts.

#### **Electrical Works:**

Power supply – 1&3 Phase, 230/400 Volts 50 Hz Power supply will be provided at panel in ground floor by the NMPA by a main Switch in Main panel. The contractor scope will be to extend the power supply to the lift by laying suitable size cables/wires and DB's as required including earthing and shaft lights etc. complete.

The lift contractor's scope will be extending the power supply from panel at ground floor to motor with earthing (GI plate) & 2 no's 8SWG copper wire with pit etc. all as per IS 3043, MCB DB with MCBs / isolators in /at required place and further electrical works like wiring in lift shaft etc. All tenderers should visit the site before quoting. So it will be assumed that the work has been quoted considering present site condition and the work will be completed in all respect without claiming anything extra.

### 2. Technical Specifications for Lift:

Sl. No.	Particulars	Specifications
1.	Application	Passenger, handicap/Divyangjan friendly
2.	Type	Machine Room less
3.	Machine Type and location	Permanent Magnet, Gearless machine located inside the elevator shaft in the overhead

Sl. No.	Particulars	Specifications
4.	Capacity	15 Persons, 1020 kG
5.	level/stops	G+2 (3 levels and 3 openings)
6.	Speed	1.0 meter per second with jerk less acceleration, deceleration
7.	Drive and control	Simplex Collective Selective control, AC VVVF
8.	Power supply	AC 415 Volts, 3 phase/1 Phase, 50cycles/sec.
9.	Car design/enclosure	Stainless Steel Hair Line finish of 304 Grade SS with mirror finish SS panel on rear centered and handrail etc., Inner surface of Car door shall be Hairline finish stainless steel
10.	Car door	2 panel Automatic Centre Opening in Stainless Steel hairline finish with ACVF drive
12.	Car door protection	Multiband full height infra-red detector.
13.	Landing doors	2 panel Automatic Centre Opening in Stainless Steel hairline finish on all floors. Door shall match to the Car Door
14.	Direction & Position indicators	Large display LCD Car Position Indicator in COP at lower height
15.	Car Flooring	Anti-skid flooring slip resistant material having a slip resistance value of 45–70 (optimally 50–65), as measured with 4S to sugar rubber on a pendulum test.  Granite/marble flooring
16.	Car lighting	LED light with auto as well as manual control. Lighting levels in the lift minimum of 100 lux (approximately 50–75 lux at floor level and shall be confirmed using Lux meter)
17.	Ventilation	Cross flow blower fan in car for ventilation
18.	Travel	As per drg.
19.	COP suitable for physically handicap & Visually impaired	Protruding type Brail encrypted. Car buttons at a height easily accessible by wheelchair bound or visually impaired passenger.
20.	Hall Fixtures	LED/LCD hall position indicators to benefit visually impaired and physically handicap users. Hall indicators with car arrival gong at a height not more than 1200mm from floor.

Sl. No.	Particulars	Specifications
21.	Car Emergency backup	Emergency Battery operated power supply (EBOPS) for light, alarm and a fan to be provided with electric power supply to the light in the car, when the main power supply is not available.  The operation to be automatic and no need of manual intervention to be required.
22.	Safety Gear	Over speed Governor progressive type operating on Electro Mechanical basis.
23.	Car size	As per approved drawing and standard
24.	Door opening	As per approved drawing and standard (Centre)
25.	Pit depth	As per approved drawing and standard
26.	Overhead height	As per standard
27.	hoist way dimensions	As per standard
28.	entrance height	As per standard
29.	inside car height	As per standard
30.	<b>Special features</b>	<ul style="list-style-type: none"> <li>• Full length infrared safety light curtain infrared operated doors safety system</li> <li>• Large display LCD Car Position Indicator in COP at lower height</li> <li>• Hand rails on three sides with height not more than 900mm from floor</li> <li>• Voice announcement for all COP operations for visually impaired user Overload Warning with audio visual indicators</li> <li>• Auto fan and Light Cutoff, Automatic Rescue Device.</li> <li>• Door open/Door close button in car.</li> <li>• Provision for IP Addressable CCTV in the lift 2MP, fixed dome type, 120dB WDR, ON board storage with 128GB memory stick, vandal proof housing for the Lift Cabin</li> <li>• Anti-Nuisance Travel</li> <li>• 3 way intercom system</li> <li>• Full collective logic control system to facilitate the optimum function of the elevator</li> <li>• Adjustable Door opening time</li> <li>• Main entrance floor selection and home floor parking selection</li> <li>• Alarm button in Car operating panel with battery back up</li> <li>• Automatic operation for Car fan</li> <li>• Braille on Push buttons</li> <li>• Car call cancellation</li> <li>• Door close and door open buttons in car operating panels</li> <li>• Door Closing retries</li> <li>• Full load bypass</li> <li>• Red dot matrix scrolling display in Car operating panel</li> <li>• Red dot matrix scrolling display in landing operating panel on all floors</li> </ul>



Sl. No.	Particulars	Specifications
	<ul style="list-style-type: none"> <li>• Jammed landing operating panel call button by-pass</li> <li>• Motor overheat protection</li> <li>• Overload function with audio visual indication in car operating panel</li> <li>• Phase failure and phase reversal protection</li> <li>• Automatic rescue device in case of power failure</li> <li>• Fireman emergency return</li> <li>• Firemen control</li> <li>• Voice Synthesizer</li> <li>• Auto/Attendant function</li> <li>• 60 minutes Fire Retardant Landing Doors</li> </ul>	

**Note: Obtaining approval of statutory bodies i.e. Lift Licence or any other approval before and after and during the execution of work as required shall be the responsibility of the contractor duly preparing/approval of installation drawings within the quoted price of this turnkey work. However statutory fees/charges required to be paid to these bodies shall be paid to the Contractor by the NMPA on submission of documentary evidences as extra.**

## **Scope of Work and Technical Specifications- CIVIL WORK**

### **A. GENERAL**

#### ***INTRODUCTION***

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

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

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

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

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

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

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

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

#### **Brief Description of Works**

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

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

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

For deep excavations, necessary shoring is to be done, the design of which will be provided by the contractor, after assessing site and soil conditions, and work only to be commenced on site

after the same is duly approved by NMPT. Any approval if required from the Mineral department or any other statutory body that has jurisdiction on such excavations has to be obtained by the contractor.

All earth used for back filling should be of approved quality.

Portland Cement of IS 8112 shall be used for all cement & concrete works. This will supersede other specifications of cement to be used for the works.

For ready mixed cement concrete, in addition to the CPWD specification, the following also to be noted:

The cost towards cement quantity reduced from the specified quantity in the item due to mixing of fly ash shall be deducted as per relevant BOQ item. The design mix shall be submitted to Engineer in Charge for approval.

All hard ware fittings shall be of best quality and shall be selected as per the Instructions of Engineer in Charge.

#### Site location, Boundaries and Possession

The location and boundaries of the Site are shown on the Drawing No: 2/299/Mtc-I/01-LP. The Contractor shall confine his activities strictly to the allotted site area(s) and shall not allow his personnel to trespass upon any other areas occupied by the Employer.

#### 1.4 Site Datum and Base Lines

A base line shall be established within the working area by the Contractor. The base line shall be referenced to the site co-ordinate system (based on the Local Coordinates of New Mangalore Port). This bench mark and base line will be the basis for the setting-out for all the Works. The main levels and lines for each portion of the Works shall be established from the bench mark and base line by the Contractor.

#### 1.5 Site Conditions

##### 1.5.1 Location of Work

As per enclosed location plan.

##### 1.5.2 Climate

The climate at Mangalore is tropical with high humidity and a maximum shade temperature of 36°C. The average annual rainfall is approximately 3330 mm and concentrated in the south-west monsoon months of June, July, August and September during which period the average rainfall is as much as 82% of the total annual rainfall.

##### 1.5.3 Wind

The wind in the monsoon months of June, July and August are predominantly from south-west and west with a maximum intensity of 5 on the Beaufort Scale. The winds in the remaining months of the year are predominantly from the north-west and the maximum intensity during this period is also of 5 on the Beaufort Scale.

##### 1.5.4 Cyclones

Even though Mangalore is within the cyclonic area of storms originating in the Arabian Sea and those that enter across the Indian Peninsula from Bay of Bengal, cyclones are not as severe or frequent as in the Bay of Bengal. The maximum wind speed so far recorded in cyclonic storm, generally does not exceed 62 kmph (16.9 m/sec.) except one during 1965 when the maximum speed recorded was 97 kmph (26.9 m/sec.)

##### 1.5.5 Visibility

Thirty year period observations conducted by the Indian Meteorological Department reveal that poor visibility (visibility less than 4 Kms) is encountered for about 10 days in the south-west monsoon period. The maximum number of foggy days in a year is only 3.

#### 1.5.6 Site Preparation

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

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

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

#### 1.6 Site Information

The detailed drawing 2/299/MTC-I/-01 of the construction site for adaptation of methodology for the construction. However, on account of this change in the geographical profile of site, no extra cost for additional arrangement required to be made will be paid for.

#### 1.7 The Nature of Soil Profile

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

#### 1.8 Records

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

### WORKS

#### **EARTHWORK**

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

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

2.1.1. Ordinary or soft soil - Generally any soil which yields to ordinary application of pick axes, shovels or any other ordinary digging implements, such as organic soil, turf, gravel, sand, sandy soil, silt, clay, loam, mud, red earth, 'sudde', black cotton soil, soft shale, loose moorum and all soils having soil dry density less than 1.80 gm/cc. (IS: 1498-1970) copy enclosed via 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.

## 2.4 SPECIFICATIONS FOR PROTECTION DURING EXCAVATION.

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

The contractor shall take adequate protective measures to see that the excavation operations do

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

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

### **SPECIFICATIONS FOR DISMANTLING STRUCTURES**

**200.2.1. Scope** - This work shall consist of removing, as hereinafter set forth, existing culverts, bridges, pavements, kerbs and other structures like guard-rails, fences, utility services, manholes, catch basins, inlets, etc., which are in place but interfere with the new construction or are not suitable to remain in place and of salvaging and disposing of the resulting materials and back filling resulting trenches and pits. Existing culverts, bridges, pavements and other structures which are within the highway and which are designated for removal, shall be removed upto the limits and extent specified in the drawings or as indicated by the engineer.

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

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

**200.2.2. Dismantling culverts and bridges** - The structures shall be dismantled carefully and the resulting materials so removed as not to cause any damage to the serviceable materials to be salvaged, the part of the structure to be retained and any other properties or structures nearby.

Unless otherwise specified, the superstructure portion of culverts/bridges shall be entirely removed and other parts removed below the ground level or as necessary depending upon the interference they cause to the new construction. Removal of overlaying or adjacent material, if required in connection with the dismantling of the structures, shall be incidental to this item.

Where existing culverts/bridges are to be extended or otherwise incorporated in the new work, only such part or parts of the existing structure shall be removed as are necessary and directed by the engineer to provide a proper connection to the new work. The connecting edges shall be cut, chipped and trimmed to the required lines and grades without weakening or damaging any part of the structure to be retained. Due care should be taken to ensure that reinforcing bars which are to be left in place so as to project into a new work as dowels or ties are not injured during removal of concrete.

Pipe culverts shall be carefully removed in such a manner as to avoid damage to the pipes.

Steel structures shall, unless otherwise provided, be carefully dismantled in such a manner as to avoid damage to members thereof. If specified in the drawings or directed by the engineer that the structure is to be removed in a condition suitable for re-erection, all members shall be match-marked by the contractor with white lead paint before dismantling; end pins, nuts, loose plates, etc., shall be similarly marked to indicate their proper location; all pins, pin holes and machined surfaces shall be painted with a mixture of white lead and tallow and all loose parts shall be

securely wired to adjacent members or packed in boxes.

Timber structures shall be removed in such a manner as to avoid damage to such timber or lumber as is designated by the engineer to be salvaged.

**200.2.3. Dismantling pavements and other structures** - In removing pavements, kerbs, gutters, and other structures like guard-rails, fences, manholes, catch basins, inlets, etc., where portions of the existing construction are to be left in the finished work, the same shall be removed to an existing joint or cut and chipped to a true line with a face perpendicular to the surface of the existing structure. Sufficient removal shall be made to provide for proper grades and connections with the new work as directed by the engineer.

All concrete pavements, base courses in carriageway and shoulders etc., designated for removal shall be broken to pieces whose volume shall not exceed 0.02 cum. and stockpiled at locations if the material is to be used later or otherwise arranged for disposal as directed (see clause 200.2.5).

**200.2.4. Back-filling** - Holes and depressions caused by dismantling operations shall be backfilled with excavated or other approved materials and compacted to required density as directed by the engineer.

**200.2.5. Disposal of materials** - All materials obtained by dismantling shall be the property of government. Unless otherwise specified, materials having any salvage value shall be placed in neat stacks of like materials within the right-of-way, as directed by the engineer with all lifts and upto a lead of 1000 m.

Pipe culverts that are removed shall be cleaned and neatly piled on the right-of-way at points designated by the engineer with all lifts and lead upto 1000 m.

Structural steel removed from old structures shall, unless otherwise specified or directed, be stored in a neat and presentable manner on blocks in location suitable for loading. Structures or portions thereof which are specified in the contract for re-erection shall be stored in separate piles.

Timber or lumber from old structures which is designated by the engineer as materials to be salvaged shall have all nails and bolts removed therefrom and shall be stored in neat piles in locations suitable for loading.

All materials obtained from dismantling operations which, in the opinion of the engineer, cannot be used or auctioned shall be disposed off as directed by the engineer with all lifts and upto a lead of 1000 m.

**200.2.6. Measurements for payment** - The work of dismantling structures shall be paid for in units indicated below by taking measurements before and after, as applicable.

(i) Dismantling brick/stone masonry/ concrete (plain and reinforced)	cu.m
(ii) Dismantling flexible and cement concrete pavement	cu.m
(iii) Dismantling steel structures	tonne
(iv) Dismantling timber structures	cu.m
(v) Dismantling pipes, guard rails, kerbs, gutters and fencing	linear m
(vi) Utility services	Nos.

**200.3. 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,



equipment, safeguards and incidentals necessary to complete the work. These will also include excavation and backfilling where necessary to the required compaction and for handling, salvaging, piling and disposing of the dismantled materials within all lifts and upto a lead of 1000 m.

## **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.

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

#### Coarse aggregate

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

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

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

c) Brick aggregate - Brick aggregate shall be obtained by breaking well burnt or over burnt dense bricks / brick bats. They shall be homogenous in texture, roughly cubical in shape and clean. They shall be free from unburnt clay particles. Soluble salt, silt, adherent coating of soil vegetable matter and other deleterious substances. Such aggregate should not contain more than one percent of sulphate and should not absorb more than 10% of their own mass of water, when used in cement concrete and 20% when used in lime concrete. It shall conform to IS: 383 unless otherwise specified.

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

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

to

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

#### 4.1.2.3. Size and grading

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

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

Table 1 -Graded stone aggregate or gravel

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

Concrete work

(b). Normal sizes of single sized stone aggregate or gravel shall be 63, 40, 20, 16, 12.5 or 10 mm as specified. For any one of the nominal sizes the proportion of other sizes shall be in accordance with Table 2.

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

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

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

proportions by volume for mixing of different sizes of single size (ungraded) aggregate to obtain the required nominal size of graded aggregate are given in Table 3.

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

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

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

(ii) Brick aggregate - Nominal size of brick aggregate shall be 40 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 )

Determination of particle size and shape

Estimation of organic impurities (as per IS: 2386-Part II )

Surface moisture

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.

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/cm<sup>2</sup> and 210 kg / cm<sup>2</sup> 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 on 15 cm cube in Kg / cm <sup>2</sup>	
	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

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

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.

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

The clutch and brake control arrangements shall also be so designed that the operator can control the falling speed of the loader.

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 is 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 may also be ascertained by compacting factor test and vee-bee consistometer 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 or 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 4.5° 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 38°C.

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

At or near the ground level

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 -

At or near the ground level

Up to specified floor level

Between two specified floor levels

Up to specified height above or depth below plinth level/ defined datum level

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 -

Foundation, footings, bases for columns

Walls (any thickness) including attached pilasters, buttresses, plinth and string courses, fillets etc.

Shelves

Slabs

Chajjas including portions bearing on the wall

Lintels, beams and Bressemmers

Columns, piers abutments, pillars, post and struts

Stair case including stringer beams but excluding landings.

Balustrades, newels and sailing

Spiral staircase (including landing)

Arches

Domes, vaults

Shell roof, arch ribs and folded plates

Chimneys and shaft.

Breast walls, retaining, walls, return walls

Concrete filling to precast components

Kerbs, steps and the like

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

Cornices and moulded windows sills.

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	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.

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

## 4.5 SPECIFICATIONS FOR READY MIXED CONCRETE

4.5.1 Ready Mixed Concrete - Concrete delivered at site or into the purchaser's vehicle in a plastic condition and requiring no further treatment before being placed in the position in which it is to set and harden.

4.5.1.1 Agitation-The process of continuing the mixing of concrete at a reduced speed during transportation to prevent segregation.

4.5.1.2 Agitator-Truck mounted equipment designed to agitate concrete during transportation to the site of delivery.

4.5.1.3 Truck Mixer-A mixer generally mounted on a self-propelled chassis, capable of mixing the ingredients of concrete and of agitating the mixed concrete during transportation.

### 4.5.2 Types

For the purpose of this standard, the ready-mixed concrete shall be one of the two types, according to the method of production and delivery as specified in 4.5.3.1 and 4.5.3.2.

4.5.2.1 Centrally-mixed concrete – Concrete produced by completely mixing cement, aggregates, admixtures, if any and water at a stationary central mixing plant and delivered in containers fitted with agitating devices, except that when so agreed to between the purchaser and the manufacturer, the concrete may be transported without being agitated.

4.5.2.2 Truck-mixed concrete - Concrete produced by placing cement, aggregates and admixtures, if any, other than those to be added with mixing water, in a truck mixer at the batching plant, the addition of water and admixtures to be added along with mixing water, and the mixing being carried out entirely in the truck mixer either during the journey or on arrival at the site of delivery. No water shall be added to the aggregate and cement until the mixing of concrete commences.

### 4.5.3. Materials

4.5.3.1 Cement - The cement used shall be ordinary Portland cement or low heat Portland cement conforming to IS: 269-1989 or 8112-1989 or 1226:1987 or Portland slag cement conforming to IS: 455-1989 or 'Portland-pozzolana cement conforming to IS: 1489-1991 or rapid hardening Portland cement conforming to IS: 8041-1976 as may be specified by the purchaser at the time of placing the order. If the type is not specified, ordinary Portland cement shall be used. Fly ash when used for partial replacement of cement, shall conform to the requirements of IS:3812 -1981

4.5.3.2. Aggregates - Unless otherwise agreed to between the purchaser and the manufacturer, the aggregates shall conform to IS: 383-1970. Fly ash when used as fine aggregate shall conform to the requirements of IS: 3812-1981.

4.5.3.3. Water used for concrete shall conform to the requirements of IS: 456-2000.

4.5.3.4, Admixtures – Admixtures shall only be used when so agreed to between the purchaser and the manufacturer. The admixtures shall conform to the requirements of IS: 456-2000, and their nature, quantities and methods of use shall also be specified. Fly ash when used as an admixture for concrete shall conform to IS: 3812-1981.

4.5.3.5, Measurement and storage of materials – Measurement and storage of materials shall be done in accordance with the requirements of IS: 456-2000.

### 4.5.4 Basis of supply

4.5.4.1 Depending upon the agreement between the purchaser and the manufacturer, the ready-

mixed concrete shall be manufactured and supplied on either of the following basis:

a) Specified strength based on 28-day compressive strength of 15-cm cubes tested in accordance with IS: 456-2000.

b) Specified mix proportion.

Note - Under special circumstances and subject to the agreement between the purchaser and the supplier, strength of concrete in (a) above may be based on 28-day or 7-day flexural strength of concrete instead of compressive strength of 15-cm cube tested in accordance with IS: 456-2000.

When the concrete is manufactured and supplied on the basis of specified strength, the responsibility for the design of mix shall be that of the manufacturer and the concrete shall conform to the requirements.

When the concrete is manufactured and supplied on the basis of specified mix proportion, the responsibility for the design of the mix shall be that of the purchaser and the concrete shall conform to the requirements.

#### 4.5.4.2 Measurement of Ready-mixed concrete

The basis of purchase shall be the cubic meter of plastic concrete as delivered to the purchaser.

The volume of plastic concrete in a given batch shall be determined from the total mass of the batch divided by the actual mass per m<sup>3</sup> of concrete. The total mass of the batch shall be calculated either as the sum of the masses of all materials, including water, entering the batch or as the net mass of concrete in the batch as delivered. If the purchaser wishes to verify the total mass, of the batch, this shall be obtained from the gross and tare masses of the vehicle on a stamped weigh bridge. The mass per m<sup>3</sup> shall be determined in accordance with the method given in IS:1199-1959.

#### 4.5.5 General requirements

4.5.5.1. In addition to the requirements specified in this standard and subject to such modifications as may be agreed to between the purchaser and the manufacturer at the time of placing order, the ready-mixed concrete shall generally comply with the requirements of IS:456-2000.

Unless otherwise agreed to between the purchaser and the supplier, the minimum quantity of cement and the details regarding proportioning and works control shall be in accordance with IS:456-2000.

When a truck mixer agitator is used for mixing or transportation of concrete, no water from the truck-water system or from elsewhere shall be added after the initial introduction of the mixing water for the batch, except when on arrival at the site of work, the slump of the concrete is less than that specified; such additional water to bring the slump within required limits shall be injected into the mixer under such pressure and direction of flow that the requirements for uniformity specified in Appendix. A are met.

Unless otherwise agreed to between the purchaser and the supplier, when a truck mixer or agitator is used for transporting concrete, the concrete shall be delivered to the site of work and discharge shall be complete within 1½ hour (when the prevailing atmospheric temperature is above 20° C) and within 2 hours (when the prevailing atmospheric temperature is at or below 20° C) of adding the mixing water to the dry mix of cement and aggregate or of adding the cement to the aggregate, whichever is earlier.

4.5.5.2 Temperature - The temperature of the concrete at the place and time of delivery shall be not less than 5° C. Unless otherwise required by the purchaser, no concrete shall be delivered, when the site temperature is less than 2.5° C and the thermometer reading is falling.

The temperature of the concrete shall not exceed 5° C above the prevailing shade temperature, when the shade temperature is over 20° C. The temperature of concrete mass on delivery shall not exceed 40° C.

4.5.5.3. Sampling and testing - Adequate facilities shall be provided by the manufacturer for the purchaser to inspect the materials used, the process of manufacture and the methods of delivery of concrete. He shall also adequate facilities for the purchaser to take samples of the materials used.

Unless otherwise agreed to between the purchaser and the supplier, the sampling and testing of concrete shall be done in accordance with the relevant requirements of IS: 456-2000, IS:1199-1959 and IS: 516-1959

Consistency or workability – The tests for consistency or workability shall be carried out in accordance with requirements of IS: 1199-1959 or by such other method as may be agreed to between the purchaser and the manufacturer.

4.5.5.4. Strength test – The compressive strength, and flexural strength tests shall be carried out in accordance with the requirements of IS: 516-1959 and the acceptance criteria for concrete whether supplied on the basis of specified strength or on the basis of mix proportion, shall conform to the requirements mentioned below.

Compressive strength - The concrete shall be deemed to comply with the strength requirements when both the following conditions are met:

a) The mean strength determined from any group of four consecutive test results complies with the appropriate limits in col. 2 of Table.

b) Any individual test result complies with the appropriate limits in col.3 of Table.

Flexural strength - When both the following conditions are met, the concrete complies with the specified flexural strength.

a) The mean strength determined from any group of four consecutive test results exceeds the specified characteristic strength by at least 0.3 N/mm<sup>2</sup>.

b) The strength determined from any test result is not less than the specified characteristic strength less 0.3 N/mm<sup>2</sup>.

4.5.5.5. Quantity of concrete represented by strength test results - The quantity of concrete represented by a group of four consecutive test results shall include the batches from which the first and last samples were taken together with all intervening batches.

For the individual test result requirements given in col.2 of Table 9 or in item (b) of 16.2 only the particular batch from which the sample was taken shall be at risk.

Where the mean rate of sampling is not specified the maximum quantity of concrete that four consecutive test results represent shall be limited to 60m<sup>3</sup>.

f the concrete is deemed not to comply, the structural adequacy of the parts affected shall be investigated and any consequential action as needed shall be taken.

Concrete of each grade shall be assessed separately.

Concrete is liable to be rejected if it is porous or hone-combed, its placing has been interrupted without providing a proper construction joint, the reinforcement has been displaced beyond the

tolerances specified, or construction tolerances have not been met. However, the hardened concrete may be accepted after carrying out suitable remedial measures to the satisfaction of the engineer-in-charge.

Table 9 Characteristic compressive strength compliance requirement

Specified Grade	Mean of Group of 4 Non-Overlapping Consecutive Test Results in N/mm <sup>2</sup> .	Individual Test Results in N/mm <sup>2</sup> .
(1)	(2)	(3)
M15	$\geq f_{ck} + 0.825 \times$ established standard deviation (rounded off to nearest 0.5 N/mm <sup>2</sup> ).	$\geq f_{ck}$ N/mm <sup>2</sup> .
M 20 or above	$f_{ck} + 3$ N/mm <sup>2</sup> , whichever is greater + $0.825 \times$ established standard deviation (rounded off to nearest 0.5 N/mm <sup>2</sup> ) or +4 N/mm <sup>2</sup> , whichever is greater	$\geq f_{ck}$ N/mm <sup>2</sup> .
Note:- In the absence of established value of standard deviation, the value given in Table 8 of IS:456-2000 may be assumed, and attempt should be made to obtain results of 30 samples as early as possible to establish the value of standard deviation.		

4.5.5.6 Cost of testing – Unless otherwise agreed to between the purchaser and the manufacturer, the cost of the tests carried out in accordance with the requirements of this specification shall be borne as follows:

- a) By the manufacturer if the results show that the concrete does not comply with the requirements of this standard.
- b) By the purchaser if the results show that the concrete complies with the requirements of this standard.

4.5.5.7 Manufacturer's records and certificates – The manufacturer shall keep batch records of the quantities by mass of all the solid materials, of the total amount of water used in mixing and of the results of all tests. If required by the purchaser, the manufacturer shall furnish certificates, at agreed intervals, giving this information.

4.5.6. Concrete manufactured and supplied on the basis of specified strength

4.5.6.1 The purchaser shall supply the following information for guidance of the manufacturer :

- a) The type of cement to be used;
- b) The maximum size and type of the aggregate;
- c) The type of admixtures to be used;
- d) The minimum acceptable compressive strength or flexural strength or both, determined from samples of plastic concrete taken at the place and time of delivery, in accordance with requirements of IS:456-2000.
- e) The slump or compacting factor or both, or other requirements for consistency or workability at the place and time of delivery of the concrete;
- f) The ages at which the test cubes or beams are to be tested, and the frequency and the number of tests to be made; and
- g) Any other requirements.

4.5.6.2 Tolerances – Unless otherwise agreed to between the purchaser and the manufacturer,

the concrete shall be deemed to comply with the requirement of these standard, if the results of tests where applicable, lie within the tolerances specified.

4.5.6.3. Consistency of workability – The slump (average of two tests) shall not differ from the specified value by  $\pm 10$  mm for a specified slump of 75mm or less and  $\pm 25$ mm when the specified slump is greater than  $\pm 75$ m. The compacting factor average of two tests shall be within 0.03 of the value specified. If any other method of determining consistency is to be used, a suitable tolerance shall be agreed to between the purchaser and the manufacturer. The test for consistency or workability shall be completed within 15 minutes of the time of receipt of the ready-mixed concrete at the site.

4.5.6.4. Aggregates – When tested in accordance with IS: 2386(Part I)-1963, the quantity of aggregate larger than the maximum size specified by the purchaser shall not exceed 5 percent of the quantity of coarse aggregate and all such excess shall pass through sieve (conforming to IS: 460 (Part 1-3)-1985 of the next higher size.

4.5.7. Concrete manufactured and supplied on the basis of mix proportion

4.5.7.1 The purchaser shall supply the following information for guidance of the manufacturer:

- a) The type of the cement to be used;
- b) The sizes and types of the aggregate;
- c) The type of admixtures to be used;
- d) The proportions of the mix including the maximum water cement ration at the place and time of delivery of the concrete;
- e) The minimum mixing time after addition of the water; and
- f) Any other requirements.

Tolerances – Unless otherwise agreed to between the purchaser and the manufacturer, the concrete shall be deemed to comply with the requirements of this standard, if the result of tests where applicable, lie within the tolerance specified.

Cement content – The cement content, as shown by the samples taken, shall be not less than 95 percent of that specified.

Ratio of coarse to fine aggregates – The ratio of coarse to fine aggregates, as indicated by the sample taken, shall neither exceed nor fall below the ration specified by the purchaser by more than 10 percent.

Water/ cement ratio -  $\pm 5$  percent of the specified value.

Consistency or workability – The slump shall not differ from the amount specified by  $\pm 10$ mm for a specified slump of 75 mm or less and  $\pm 25$ mm when the specified a slump is greater than 75mm. The compacting factor shall be within  $\pm 0.03$  of the value specified. If any other method of determining consistency is used, a suitable tolerance shall be agreed to between the purchaser and the supplier.

## APPENDIX A

### Concrete uniformity requirement

#### A-1 Tests

A-1.1 The variation within a batch as provided in Table 10 shall determined for each property listed as the difference between the highest value and the lowest value obtained from the different portions of the same batch. For this specification the comparison shall be between two

samples, representing the first and last portions of the batch being tested. Test results conforming to the limits of five of the six tests listed in Table I shall indicate uniform concrete within the limits of this specification. Analysis of concrete samples shall be made in accordance with the relevant requirements of IS: 1159-1959.

### A.2. Coarse aggregate content

A-2.1 Coarse aggregate content shall be determined using the following equation:

$$p = \frac{c}{b} \times 100$$

Where

P= Percentage of coarse aggregate by mass in concrete;

c= saturated surface dry mass in kg of aggregate retained on 4.75 mm IS Sieve, resulting from washing all material finer than this sieve from the fresh concrete; and

b= mass of sample, in kg of fresh concrete in unit mass container.

Table 10 Requirements for uniformity of concrete

Sl. No.	Test	Requirement expressed as maximum permissible difference in results of tests or samples representing the first and last portions or concrete batch
1	2	3
i)	Mass per cubic meter calculated to an air-free basis	16 kg/m <sup>3</sup>
ii)	Air-content, percent by volume of concrete	1.0
iii)	Slump:	
	If average slump is 10cm or less	2.5 cm
	If average slump is 10 to 15 cm	3.8 cm
iv)	Coarse aggregate content, percent (portion by mass of each sample retained on 4.75-mm IS Sieve)	6.0
v)	Unit mass of air-free mortar, percent based on average for all comparative samples tested	1.6
VI)	Average compressive strength at 7 days for each comparative test specimens, percent	7.5

### A-3. Unit mass of air free mortar

A-3.1 Unit mass of air free mortar shall be calculated as follows:

$$M = \frac{b - c}{V = \left\{ \frac{V \times A}{100} + \frac{c}{1000 G} \right\}}$$



Where

M= Unit mass of air free mortar in Kg/m<sup>3</sup>

b= mass of concrete sample in unit mass container in kg,

c= saturated-surface-dry mass of aggregate in kg retained on 4.75mm IS Sieve,

V= Volume of unit mass container in m<sup>3</sup>

A= air content of concrete in percent measured in accordance with the relevant requirements of IS:1199-1959\*, and

G = specific gravity of coarse aggregate.

## **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.

Form work ( Centering and shuttering )

Reinforcement

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 -

Mild steel sand medium tensile bars conforming to IS: 432 (part I)

Hard drawn steel wire conforming to IS: 432 (part II)

High strength deformed steel bars conforming to IS: 1786

Hard drawn steel wire fabric conforming to IS: 1566

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 -

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 <sup>2</sup> minimum	Yield stress N/mm <sup>2</sup> 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	410	240	23

	Including 50 mm			
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  $5.65 \sqrt{so}$  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 severe 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<sup>3</sup> or 0.00785 kg / mm<sup>3</sup>.

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
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

Tensile test - This shall be done as per IS: 1608

Bend test - This shall be done as per IS: 1599

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

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/mm <sup>2</sup>	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/mm <sup>2</sup>	8 % more than actual 0.2 % proof stress but not less than 545 N/mm <sup>2</sup>	6 % more than actual 0.2 % proof stress but not less than 585 N/mm <sup>2</sup>

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

From cutting of bars or

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.

### **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  $1/50^{\text{th}}$  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.

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 form 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 excessive roughness before use.

4.6.2.7. Erection of form work (centering and shuttering) - Following points shall be borne in mind while checking during erection.

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

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

If there are any excavations nearby which may influence the safety of form works, corrective and strengthening action must be taken.

i) The bearing soil must be sound and well prepared and the sole plates shall bear well on the ground.

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

The bearing plates of steel props shall not be distorted.

The steel parts on the bearing members shall have adequate bearing areas.

d) Safety measures to prevent impact of traffic; scour due to water etc. should be taken. Adequate precautionary measures shall be taken to prevent accidental impacts etc.

e) Bracing, struts and ties shall be installed along with the progress of form work to ensure strength and stability of form work at intermediate stage. Steel sections (especially deep sections) shall be adequately restrained against tilting, over turning and form work should be restrained against horizontal loads. All the securing device and bracing shall be tightened.

f) The stacked materials shall be placed as catered for, in the design.

g) When adjustable steel props are used, they should -

i). Be undamaged and not visibly bent.

ii). Have the steel pins provided by the manufacturers for use.

- iii). Be restrained laterally near each end.
- iv). Have means for centralizing beams placed in the fork heads.
- h) Screw adjustment of adjustable props shall not be over extended.
- i) Double wedges shall be provided for adjustment of the form to the required position wherever any settlement / elastic shortening of props occur. Wedges should be used only at the bottom end of single prop. Wedges should not be too steep and one of the pair should be tightened / clamped down after adjustment to prevent their shifting.
- j) No member shall be eccentric upon vertical member.
- k) The number of nuts and bolts shall be adequate.
- l) All provisions of the design and / or drawings shall be complied with.
- m) Cantilever supports shall be adequate.
- n) Props shall be directly under one another in multistage constructions as far as possible.
- o) Guy ropes or stays shall be tensioned property.
- p) There shall be adequate provision for the movement and operation of vibrators and other construction plant and equipment.
- q) Required camber shall be provided over long spans.
- r) Supports shall be adequate, and in plumb within the specified tolerances.

#### 4.6.2.8 Measurements

4.6.2.8.1. General - The form work shall include the following;

- a) Splayed edges, notching, allowance for overlaps and passing at angles, sheathing battens, strutting, bolting, nailing, wedging, easing, striking and removal.
- b) All supports, struts, braces, wedges as well as mud sills, piles or other suitable arrangements to support the form work.
- c) Bolts, wire ties, clamps, spreaders, nails or any other items to hold the sheathing together.
- d) Working scaffolds ladders, gangways, and similar items.
- e) Filling to form stop chamfered edges of splayed external angles not exceeding 20 mm wide to beams, columns and the like.
- f) Where required, the temporary openings provided in the forms for pouring concrete, inserting vibrators, and cleaning holes for removing rubbish from the interior of the sheathing before concrete.
- g) Dressing with oil to prevent adhesion and
- h) Raking or circular cutting.

4.6.2.8.2. Classification of measurements - Where it is stipulated that the form work shall be paid for separately, measurements shall be taken of the area of shuttering in contact with the concrete surface. Dimensions of the form work shall be measured correct to a cm. The measurements shall be taken separately for the following -

- a). Foundations, footings, bases of columns etc. and for mass concrete and precast shelves,
- b). Walls (any thickness) including attached pilasters, buttresses, plinth and string courses etc.
- c). Suspended floors, roofs, landings, shelves and their supports and balconies. d). Lintels, beams, girders, Bressummers and cantilevers. e). Columns, pillars, posts and struts. f). Stairs (excluding landing) except Spiral staircase. g). Spiral staircase (including landing). h). Arches. i). Domes, vaults, shells roofs, arch ribs and folded plates. j). Chimneys and shafts. k). Well steining. l). Vertical and horizontal fins individually nor forming box, louvers and bands. m).

Waffle or ribbed slabs. n). Edges of slabs and breaks in floors and walls (to be measured in running meters where below 200 mm in width or thickness). o). Cornices and mouldings. p). Small surfaces, such as cantilevers ends, brackets and end of steps, caps and boxes to pilasters and columns and like. q). Chula hoods, weather shades, Chajjas, corbels etc. including edges and r). Elevated water reservoirs.

4.6.2.8.3 Centering, and shuttering where exceeding 3.5 meter height in one floor shall be measured and paid for separately.

4.6.2.8.4 Where it is not specifically stated in the description of the item that form work shall be paid for separately, the rate of the RCC item shall be deemed to include the cost of form work.

4.6.2.8.5. No deductions from the shuttering due to the openings / obstructions shall be made if the area of such openings / obstructions does not exceed 0.1 square meters. Nothing extra shall be paid for forming such openings.

4.6.2.8.7 Rate - The rate of the form work includes the cost of labour and materials required for all the operations described above.

## **SPECIFICATIONS FOR STEEL ROLLING GRILLS.**

### **7.1 Materials**

7.1.1. **Steel** - All finished steel shall be well and cleanly rolled to the dimensions and weight specified by Bureau of Indian Standards subject to permissible tolerances as per IS: 1852. A List of BI Standards applicable to this section is Annexure 7-A.1. The finished materials shall be reasonably free from cracks, surface flaws laminations, rough and imperfect edges and all other harmful defects.

7.1.2. Steel sections, shall be free from excessive rust, scaling and pitting and shall be well protected. The decision of the engineer regarding rejecting any steel section on account of any of the above defects shall be final and binding.

7.1.3. Structural steel work shall conform to the following requirements. The following varieties of steel should be used for structural purposes

7.1.4. **S.T. 42S** - The standard quality steel designated as ST-42S, conforming to IS: 226 shall be used for all types of structure (riveted or bolted) including those subject to dynamic loading and where fatigue, wide fluctuation of stresses are involved, as for example crane gantry girders, road and rail bridges etc. It is also suitable for welded structures provided that the thickness of materials does not exceed 20 mm.

7.1.5. **S.T. 42W** - The fusion welding quality steel designated as S.T. 42W, conforming to IS: 2062 shall be used for structures subject to dynamic loading (Wind load is not to be considered as dynamic load for this purpose) where welding is employed for fabrication and where fatigue, wide fluctuation of, stresses reversal of stress and great restraint are involved as for example, crane gantry girders and road and rail bridges.

7.1.6. **S.T. 420** - The ordinary quality steel designated as S. T. 420 conforming IS: 1977 shall be used for structures not subjected to dynamic loading other than wind loads where welding is not employed or / and structures not situated in earth quake zones or / and design has not been based on plastic theory.

7.1.7. **S.T. 320** - The ordinary quality steel designated as S. T. 420 conforming to IS: 1977 shall be used for doors, window frames, window bars, grills, steel gates, hand railing, builders hardware, fencing post, tie bars etc.



7.1.8. Casting shall be cast from cast iron of grade FG 150 conforming to IS: 210-1978, Specification for grey iron castings. The castings shall be sound, clean and free from porosity, blow holes, hard spots, cold shuts (i.e. irregularities due to casting at too low a temperature), distortion and other harmful defects. They shall be well dressed and fettled, accurately moulded in accordance with the pattern/drawing and shall be of uniform thickness except where the design necessitates variation. Abrupt changes in the section of adjoining members shall be avoided as far as possible. Unless otherwise indicated edges of castings shall be rounded and internal angles finished with an angle fillet. No welding or repairs shall be carried out, unless otherwise indicated.

7.1.9. **Rivets** - Rivets shall be made from rivet bars of mild steel as per IS: 1148-1982. High tensile rivet bars shall conform to IS: 1149-1982.

7.1.10. **Bolts** - These are of two types namely turned and fitted bolts and black bolts. Turned & fitted bolts are turned to exact diameter in automatic lathe. For these bolts, whether reamed or drilled bolts, the same unit stresses are allowed as for rivets. In case of black bolts which are not finished to exact sizes, a lower working stress other than for turned bolts is adopted. They shall conform to IS: 1367 Technical supply conditions for threaded steel fasteners.

7.1.11. **Electrodes** - The electrodes required for metal arc welding shall be covered electrodes and shall conform to IS: 814-1991.

## 7.2. **Workmanship – General**

7.2.1. Structural steel work riveted, bolted or welded shall be carried out described in IS: 800-1984, Code of practice for use of structural steel in general building construction.

7.2.2. **Straightening and bending** - All material shall be straight and if necessary, before being worked shall be straightened and flattened by pressure, unless required to be of curvilinear form and shall be free from twists. Straightening of steel by hammer blows is not permitted. All bending and cutting shall be carried out in cold condition, unless otherwise directed, in such manner as not to impair the strength of the metal.

7.2.3. **Cutting and machining** - Member shall be cut mechanically by saw or shear or by oxyacetylene flame. All sharp rough or broken edges and all edges of joints which are subjected to tensile or oscillating stresses shall be grounded. No electric metal arc cutting shall be allowed. All edges cut by oxyacetylene pores shall be cleaned of impurities and slag prior to assembly, cutting tolerance shall be as follows (a) For member connected at ends  $\pm 1$  mm. (b) Elsewhere  $\pm 3$  mm.

When compression members depend on contact surfaces for stress transmission, then ends of columns and bases together with gussets, angles and channels (after riveting / welding together) shall be accurately measured so that the parts connected butt over the entire surfaces of contact. Columns at bases or at caps or at butt joints need to be machined.

7.2.4. **Holes** - All holes shall be accurately marked and drilled. Holes through more than one thickness shall preferably be drilled together after the members are assembled and tightly clamped or bolted together. In such cases, if required, these parts shall be separated after drilling and burrs removed. For thickness of materials less than 16 mm the holes may be punched 3 mm less in diameter than the required size and may be reamed to the full diameter

after assembly. Finished holes for rivets and black bolts shall be more than 1.5 mm (2.0 mm for rivets and bolts of diameter more than 25 mm) in diameter larger than the diameter of rivets and bolts passing through them. All matching holes for rivets shall be so prepared that a gauge 0.8 mm diameter less than the hole can pass freely through the members assembled for riveting. Holes other than those required for close tolerance may be punched full size through material not less than 12 mm thick.

All holes shall have their axis perpendicular to the surface bored through. Holes through two or more members shall be truly concentric. No rivet or bolt hole shall be nearer the edge of the member than a distance equal to its own diameter. Holes shall not be formed by gas cutting process.

#### **7.2.5. Assembly**

**7.2.5.1. Laying out** - Steel structure shall be laid out on a level platform to full scale and to full size or in parts as shown on working drawings or as directed by engineer. Wooden templates 12 mm to 19 mm thick or metal sheet templates shall be made to correspond to each member and part; rivet holes shall be marked accurately on them and drilled. The templates shall be laid on the steel members and holes for riveting and bolting marked on them. The ends of the steel members shall also be marked for cutting. The base of steel columns and the positions of anchor bolts shall be carefully set out. The component parts shall be assembled in such a manner that they are neither twisted nor otherwise damaged and shall be so prepared that the specified cambers, if any, are provided. All box sections shall be sealed so as to prevent the access of moisture to the inside of the members.

Assembly shall be done by using assembly fixtures, jigs and stands which facilitate high quality assembly with proper safety. Misalignment and distortion of parts after assembly shall not be allowed; only thoroughly straightened parts free from burrs, grease, rust, etc. shall be allowed for assembly.

Temporary connection of parts during assembly shall be done in the following way:

- a) For welded structures joining shall be done by means of tack weld, fastening devices and fixtures.
- b) For riveted and bolted structures joining shall be done by adequate number of bolts. If tack welding is permitted, in such cases the same shall be removed after the work is over.
- c) For riveted structures in which holes are to be drilled after assembly, joining shall be done by appropriate fixtures.

Tack welding shall be done on the side and along the line of the weld. Tack weld dimension all be minimum, welding being carried out with similar electrodes as the final welding and the tacks shall completely fuse with the final weld metal. In case splicing is necessary, the individual members shall be spliced first before assembly and before final welding with other members.

For riveted structures, members shall be well tightened by assembly bolts in every third hole maximum distance between bolts shall not exceed 500 mm. To prevent stiffening drift pins shall be used 30 per cent of the assembly bolts. After tightening, the gap between members to be jointed shall be checked by 0.2 mm thick feeler gauge which should not go inside by more than 2 mm, looseness of bolts shall be checked by tapping with a test hammer.

### **7.2.6. Riveting**

Riveting shall be done by pneumatic riveting or hydraulic riveting equipment, riveting of diameter less than 10 mm may be fitted cold. In cold riveting the rivets are driven with the aid of powerful pneumatic or electrical clamps and the holes filled with sufficient tightness. However where such facilities are not available, hand riveting may be permitted by the engineer.

Members to be riveted shall be properly pinned, or bolted and rigidly held together while riveting. Rivets shall be heated uniformly throughout the length without burning or excess scaling and shall be of sufficient length to provide ahead of standard dimension. They shall, when driven, completely fill the holes and if countersunk, the countersinking shall be fully filled by the rivet. Any proudness of countersunk head shall be dressed off flush. All loose, burnt and badly formed or otherwise defective rivets shall be cut out and replaced before the structure is loaded. The heads of rivets shall be central to shanks and shall grip the assembled members firmly. In cutting out rivets care shall be taken so as not to injure the assembled members. Caulking or recupping shall not be permitted.

### **7.2.7. Bolting**

Bolt heads and nuts shall be of such length as to project one clear thread beyond the nuts when fixed in position, and these shall fit in the holes without any shake. The nuts shall fit in the threaded ends of bolts properly.

Round washers shall be placed under the heads and nuts of permanent bolts. Maximum two washers for one nut and one for each bolt head shall be used. Both threads shall be outside the limits of joining members and unthreaded portion of bolt shall not be outside the washer.

Where there is risk of the nuts being removed or becoming loose due to vibration or reversal of stresses, these shall be secured from slackening by the use of lock-nuts or spring washers, as directed by the engineer. Bolts, nuts and washers shall be thoroughly cleaned and dipped in double boiled linseed oil before use. Quality of lightening of bolts shall be inspected by tapping them with a hammer. The bolt shall not be shaken or shifted. The bolts shall be tightened starting from centre of the joint towards the edge.

### **7.2.8. Welding**

Welding shall be done by metal arc process unless otherwise permitted by the engineer, in writing, in accordance with IS: 816-1969 Code of Practice for use of metal arc welding of general construction in mild steel, and IS: 9595-1980. Recommendation of Metal Arc Welding, regarding workmanship welding method, welding procedure with suitable electrodes and wire flux, combinations, quality of welds, correction of weld faults etc.

### **7.2.9. Preparation of members for welding**

Assembly of structural members shall be made with proper jigs and fixtures to ensure correct positioning of members (angles, axis, nodes etc.).

Sharp edges, rust of cut edges, notches, irregularities and fissures due to faulty cutting shall be chipped or ground or filed over the length of the affected area, deep enough to remove faults completely. Edge preparation for welding shall be carefully and accurately made so as to facilitate a good joint. Generally no special edge preparation shall be required for members under 8 mm thick.

Edge preparation (beveling) denotes cutting of the same so as to result in V, X, K or U seam shapes as per IS: 9595-1980.

The members to be assembled shall be clean and dry on the welding edges. Under no circumstances shall wet, greasy rust or dirt covered parts be assembled. Joints shall be kept free from any foreign matter, likely to get into the gaps between members to be welded.

Before assembly, the edges to be welded as well as adjacent areas extending for at least 20 mm shall be cleaned (Until metallic polish is achieved). When assembling members proper care shall be taken of welding shrinkage and distortions, as the drawing dimensions cover finished dimensions of the structure. The elements shall be got checked and approved by the engineer before assembly wherever it is specified. The permissible tolerances for assembly of members preparatory to welding shall be as per IS: 9595. After assembly has been checked, temporary tack welding in position shall be done by electric welding; keeping in view finished dimensions of the structure. Preheating of members to be joined to be carried out as per standards wherever necessary.

#### 7.2.10. **Butt welds** (Fig. 1)

The form of joint, angle between fusion faces, gap between parts and the welding procedure shall be such that the welded joint shall comply with the design requirements. The ends of butt joints in plate shall be welded so as to provide full throat thickness. In the gas welded condition, the weld face shall be proud of the surface of the parent metal. Where a flush surface is required, the excess metal shall be dressed off. Where no dressing is to be carried out, the permissible weld profile shall be as specified in the relevant IS.

For butt weld, where these are to be welded for both sides, certain welding procedures allow this to be done without back going, but where complete penetration cannot be achieved, the back of the first run shall be gouged out to clean sound metal before welding is started on the gouged outside.

#### 7.2.11. **Fillet Welds** (Fig. 1)

A fillet weld as deposited shall be not less than the specified dimensions indicated as throat thickness and/or leg thickness taking into account penetration or partial penetration. For concave fillet welds the actual throat thickness shall be not less than 0.7 times the specified leg length. For convex fillet welds, the actual throat thickness shall be not less than 0.9 times the specified leg length.

#### 7.2.12. **Preparation of joint faces**

If preparation or cutting of material is necessary, this shall be done by shearing, chipping, grinding, machining, thermal cutting or thermal gouging. When shearing is used the effect of work hardening shall be taken care of to ensure that there is no cracking of the edges. Removal of 1 mm to 2 mm from a cut face normally eliminates the layer of hardness.

#### 7.2.13. **Fusion faces**

Fusion faces and adjacent surfaces shall be free from cracks, notches or other irregularities which might be the cause of defects or would interfere with the deposition of the weld. They shall also be free from heavy scale, moisture, oil, paint and any other substance which might affect the quality of weld or impede the progress of welding.

#### 7.2.14. **Assembly for welding**

Jigs and manipulators should be used, where practicable, so that the welding can be carried out in the most suitable position. Jigs shall maintain the alignment with the minimum restraint so as to reduce the possibility of lock in stresses.

#### **7.2.15. Alignment of butt joint**

The root edges or root faces of butt joints shall not be out of alignment by more than 25 per cent of the thickness of the thinner material for material up to 12 mm thick or by more than 3 mm for thicker material. For certain applications closer tolerances may be necessary for proper alignment.

#### **7.2.16. Fit up of parts jointed by fillet welds**

The edges and surfaces to be jointed by fillet welds shall be in as close contact as possible since any gap increases the risk of cracking but in no case should the gap exceed 3 mm.

#### **7.2.17. Tack welds (Fig.1)**

Tack welds shall be not less than the throat thickness or leg lengths of the root run to be used in the joint. The length of the tack weld shall not be less than four times the thickness of the thicker part or 50 mm whichever is similar. If smaller tack welds are desired, these shall be so indicated. Where the tack weld is incorporated in a welded joint, the shape of the tack shall be suitable for incorporation in the finished weld and it shall be free from cracks and other deposition faults.

#### **7.2.18. Protection from weather**

Surface to be welded shall be dry. When rain or snow is falling or during periods of high wind, necessary precautions shall be taken for outdoor welding arc. Warming shall be carried out at all ambient temperatures below 10 degree C.

#### **7.2.19. Inter-run cleaning**

Each run of weld bead and each layer of weld shall be thoroughly cleaned of slag, spatters, etc. before depositing subsequent bead or weld with particular reference to thorough cleaning of toes of the welds. Visible defects such as cracks, cavities and other deposition faults, if any, shall be removed to sound metal before depositing subsequent run or layer of weld.

#### **7.2.20. Welding procedure**

Welding shall be carried out only by fully trained and experienced welders as tested and approved by the engineer. Qualification tests for welders as well as tests for approval of electrodes will be carried out as per IS: 823-1964. The nature of test for performance qualification for welders shall commensurate with the quality of welding required on this work as judged by the engineer. The steel structures shall be automatically, semi automatically or manually welded. Welding shall be only after the checks have been carried out. Welding procedures and Tests for welders shall be conducted as per IS: 9595 and approved by the engineer. The welder shall mark with his identification mark on each element welded by him. When welding is carried out in open air steps shall be taken to protect the places of welding against wind or rain. The electrodes wire and parts being weld on shall be dry. Before beginning the welding operation each joint shall be checked to assure that the parts to be welded are clean and root gaps provided as per IS: 9595. For continuing the welding of seams discontinued due to some reasons the end of the discontinued seam shall be melted in order to obtain a good continuity. Before resuming the welding operation the groove as well as the adjacent parts shall be well cleaned for a length of approximately 50 mm. For single butt welds (in V, ½ V or U) and double butt welds (in K, double

U, etc.) the re-welding of the root butt is mandatory but only after the metal deposition on the root has been cleaned by back gouging or chipping. The welding seams shall be left to cool slowly. The contractor shall not be allowed to cool the welds quickly by any method. For multilayer welding before welding the following layer, the formerly welded layer shall be cleaned metal bright by light chipping and wire brushing. Backing strips shall not be allowed. The order and method of welding shall be so that (a) no unacceptable deformation appears in the welded parts. (b) due margin is provided to compensate for contraction due to welding in order to avoid any high permanent stresses. The defects in welds must be rectified according to IS: 9595-1980 and as per instruction of engineer.

**7.2.21. Approval and testing of welders**

The contractor shall satisfy the engineer that the welder is suitable for the work upon which they will be employed.

**7.2.22. Weld inspection**

The weld seems shall satisfy the following

- a) Shall correspond to design shapes and dimensions.
- (b) Shall not have any defects such as cracks, incomplete penetration and fusion under cuts, rough surfaces, burns, blow holes and porosity etc. beyond permissible. During the welding operation and approval of finished elements inspections and tests shall be made as shown in Table 1 below

Table 1 Extent of inspection and testing

Sl. No	Inspection of test	Coverage	Procedure	Evaluation and remedy of defects
1	Inspection of weld seam Appearance	All welds	Naked eye or lens	All faulty welds shall be rectified.
2	Checking of sizes	Atleast one for each weld seam	Ordinary measuring instruments (Rule template)	Should faulty weld be found, all welds shall be checked and all defects shall be rectified.

	Mechanical test for welding procedure, performance & electrodes.		As per IS: 9595	As per IS: 9595
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The mechanical characteristics of the welded joints shall be as in IS: 9595.

**7.2.23. Quality of welds and corrections**

Welded joints shall be from defects that would impair the service performance of the construction. All welds shall be free from incomplete penetration, incomplete fusion, slag inclusion, burns, un-welded crators, undercuts and cracks in the weld metal or in the heat affected zone, porosity etc. Unacceptable undercutting shall be made good by grinding. In case of shrinkage cracks, cracks in parent plate and crator, defective portions shall be removed down to sound metal and re-welded. Whenever corrections necessitate the deposition of additional

weld metal, electrode of a size not exceeding 4 mm may be used. Rectification of welds by caulking shall not be permitted.

**7.2.24. Cleaning** - All welds shall be cleaned of slag and other deposits after completion; till the work is inspected and approved, painting shall not be done.

#### **7.2.25. Plaining of ends**

Plaining of ends of members like Column ends shall be done by grinding where so specified.

Plaining of but welded member shall be done after these have been assembled and the edges be removed with grinding machine or file.

The following tolerances shall be permitted on members that have been plained

- a) The length of member having both ends plained  $\max \pm 2$  mm with respect to design.
- b) Level difference between plained surface = 0.3 mm.
- c) Deviation between plained surface and member axis =  $\max 1 / 5000$ .

#### **7.2.26. Safety and health**

The contractor shall ensure that the safety requirements and health provisions laid down in IS: 818-1968 Code of Practice for safety and health requirements in electric and gas welding and cutting operations are complied with during welding operations. The contractors shall also provide equipment for eye and face protection during welding as laid down in IS: 1179-1967. Fire precautions shall be taken in accordance with IS: 3016-1982 Code of Practice for fire precautions in welding and cutting operations.

#### **7.2.27. Erection**

Erection works shall be performed in accordance with the general construction schedule. A scheme shall be worked before the commencement of the erection which shall also contain rules for safety precautions as detailed in IS: 7205-1973. (Safety Code for erection of structural steel work).

Anchor bolts for fastening of steel structures shall be set in designed position and grouted along with foundations. Alternatively anchor bolts should be provided in the concrete foundations with bolt boxes and anchor channels for the purpose of flexibility and grouted after final alignment and leveling of column. The gaps between the bearing surface of foundation and bottom of the structures to be erected shall be filled properly by cement grouting. Grouting shall be done after the verification and proper positioning of the structures but before encasing the structures with concrete if specified. Damaged structural members shall be examined and rectified or replaced as directed. The erected parts of the structure shall be stable during all the stages of erection; and structural elements to be erected shall be stable and strong to bear erection loads. Working on the already erected structures is permitted only after they are finally fixed. Erection of structures of each tier high structures shall be executed only after the relevant fastening of lower tier by the permanent or temporary fastening devices as per schedule of execution of work and certified for safety. The joint and mating surface including the mating planes, strips and filler or spacers shall be cleaned of dust, rust and water.

Erected structural members shall be firmly fastened by bolts and drifts, permanent or provisional tacking, crossing bars and so on before the erection crane hook is removed. The trusses shall be lifted only at nodes. The trusses above 12 m span shall not be slinged at the apex, as it will develop compression stresses in the bottom tie member. It shall be lifted by slinging at two mid points of

rafters, which shall be temporarily braced by a wooden member of suitable section. After the trusses are placed in position, purlins and wind bracings shall be fixed as soon as possible. The end of truss which faces the prevailing winds shall be fixed with holding down bolts and the other end kept free to move. In case of small truss of span say up to 12 m the free end of the truss shall be laid on steel plate as per design and the holes for holding down bolts shall be made in the form of oblong slot so as to permit the free movement of the truss end. For large spans, the free end of the truss shall be provided with suitable rocker and roller bearing where indicated.

#### 7.2.28. Erection joints

While erecting, holes to be riveted shall be fitted with temporary bolts and drifts of diameters equal to those of the holes. It is necessary to initial drifts for accurate matching of holes. Number of bolts and drifts shall not be less than 40 per cent of total number of holes. Forces applied to drifts shall be same as approved for rivets. Number of drifts shall be 10 per cent of number of holes.

The number, size and length of tack welds in erection joints bearing erection forces shall be as indicated. For the erection joints which do not bear the erection forces the length of tack welds shall be minimum 10 per cent of the designed weld length of the joints.

Welding, riveting and final fastening or permanent bolts shall be done only after the inspection of the structural elements for their positions. Head bolts and nuts shall perfectly be in touch with the surfaces of structures and washers.

#### 7.2.29. Tolerance allowed in erection

**Building without crane** - The maximum Tolerance for line and level of steel structure shall be +/- 3.00 mm on any part of the structure. The structure shall not be out of plumb more than 5.00 mm each 10 metre section in height and not more than 7.00 mm per 30 metre section. These tolerances shall apply to all parts of structure unless otherwise specified.

Tolerance allowed in erection of steel structure containing cranes shall be as per following Table.

Table

Component	Description		Tolerance allowed
Main columns And roof posts	a	Shifting of columns axis at foundation level with respect to building line:	± 5.00 mm
	i	In longitudinal direction	
	ii	In lateral direction	± 5.00 mm
	b	Deviation of both major column axis from vertical between foundation and other member connection levels:	
	i	For a column upto and including 10 m height	± 5.00 mm from true vertical.



	ii	For a column greater than 10 m but less than 40 m height	± 5.00 mm from True vertical for any 10 M length measured between connection levels but not more than ± 8.00 mm for 30 m length.
	c	For adjacent pairs of columns across the width of the building prior to placing of truss.	± 5.00 on true span
	d	For any individual column deviation of any bearing or resting level from levels shown on drawings.	± 5.00 mm

	e	For adjacent pairs of columns either across the width of buildings or longitudinally level difference allowed between bearing or seating level supposed to be at the same level.	5.00 mm
Trusses	a	Deviation at centre of span or upper chord member from vertical plane running through centre of bottom chord.	1/500 of the span or 10 mm whichever is less.
	b	Lateral displacement of top chord at centre of span from vertical plane running through centre of supports.	1/250 of depth of truss or 20 mm whichever is less.

Rolling grill is meant to provide visibility or ventilation or both, the degree of protection and safety is less as compared to a rolling shutter. The situations where a certain amount of ventilation combined with safety is required rolling shutter-cum-grill may be provided in which the rolling shutter may have a rolling grill portion either at the top or at the bottom or at both places. In addition, the rolling grill portion may also be provided in the middle of the shutter. The total height of the grill portion in all the segments of rolling shutter –cum – grill shall not exceed 1.0 m and the height of the grill portion in any individual segment shall not be more than 0.5 m.

Rolling grills are similar in design, construction and operation of rolling shutters and all the provisions shall be applicable to rolling grills except in respect of the shutter portion, and shall conform to IS: 6248-1979.

#### 7.11.2. Shutters

Rolling grill shutter and the rolling grill portion of the rolling shutter – cum – grill shall be fabricated with 8 mm diameter mild steel round bars. Straight bars and bars bent to the required profile are placed alternatively and held in position with 20 mm wide and 5 mm thick mild steel flat links. Straight bars shall be spaced not exceeding 150 mm centre to centre and the bars bent

to required profile shall be placed symmetrically between two consecutive straight bars. Unless otherwise specified or directed by the engineer, bars placed alternatively with straight bars shall be bent to form a corrugated profile such that the pitch of the corrugation is 100 to 120 mm and the depth of corrugation is 80 to 100 mm. All the bent bars shall have uniform profile. Straight bar along with the adjoining bent bars on it both sides shall be held in position by passing the bars through holes in the links. Each link shall have three holes and the length of the links shall be such that the distance from the centre of the hole to the nearest edge of the flat is not less than the diameter of the hole. The corner of the links shall be rounded. All links shall be of uniform size and shape. The spacing of the links measured along the straight bar shall be of uniform size and shape. The spacing of the links measured along the straight bar shall be the same as centre to centre distance between two consecutive crests/troughs of the bars bent to the required profile. Each bar and link shall be a continuous single piece without any joint.

#### **7.11.3. Measurement and rate**

The measurements and rate shall be as specified in 7.9.8. In case of Rolling Shutter-cum-Grill, where the area of the grill portion is half or less than half the area of opening, it shall be measured and paid as rolling shutter and where the area of grill portion is more than half the area of opening, it shall be measured and paid as rolling grill.

### **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  $1 \frac{1}{4}$  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 in 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 strands 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 is 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 or hand tamped. It shall be determined by slump test as 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 consistency meter 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 is 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 covering. 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 form. The layers of concrete shall be so placed that the bottom layer does not finally set before the top layer is placed. The vibrators shall maintain the whole of concrete under treatment in an adequate state of agitation, such that de-aeration and effective compaction is attained at a rate commensurate with the supply of concrete from the mixers. The vibration shall continue during the whole period occupied by placing of concrete, the vibrators being adjusted so that the centre

of vibrations approximates to the centre of the mass being compacted at the time of placing.

Concrete shall be judged to be properly compacted, when the mortar fills the spaces between the coarse aggregate and begins to cream up to form an even surface. When this condition has been attained, the vibrator shall be stopped in case of vibrating tables and external vibrators. Needle vibrators shall be withdrawn slowly so as to prevent formation of loose pockets in case of internal vibrators. In case both internal and external vibrators are being used, the internal vibrator shall be first withdrawn slowly after which the external vibrators shall be stopped so that no loose pocket is left in the body of the concrete. The specific instructions of the makers of the particular type of vibrator used shall be strictly complied with. Shaking of reinforcement for the purpose of compaction should be avoided. Compaction shall be completed before the initial setting starts, i.e. within 30 minutes of addition of water to the dry mixture.

4.6.4.4 Construction joints - Concreting shall be carried out continuously up to the construction joints, the position and details of which shall be as shown in structural drawing or as indicated in Fig. 26 or as directed by engineer. Number of such joints shall be kept to minimum. The joints shall be kept at places where the shear force is the minimum. These shall be straight and shall be at right angles to the direction of main reinforcement.

In case of columns the joints shall be horizontal and 10 to 15 cm below the bottom of the beam running into the column head. The portion of the column between the stepping off level and the top of the slab shall be concreted with the beam.

When stopping the concrete on a vertical plane in slabs and beams, an approved stop-board (see Fig.26C) shall be placed with necessary slots for reinforcement bars or any other obstruction to pass the bars freely without bending. The construction joints shall be keyed by providing a triangular or trapezoidal fillet nailed on the stop-board. Inclined or feather joints shall not be permitted. Any concrete flowing through the joints of stop-board shall be removed soon after the initial set. When concrete is stopped on a horizontal plane, the surface shall be roughened and cleaned after the initial set.

When the work has to be resumed, the joint shall be thoroughly cleaned with wire brush and loose particles removed. A coat of neat cement slurry at the rate of 2.75 kg of cement per square meter shall then be applied on the roughened surface before fresh concrete is laid.

4.6.4.5 Expansion joints - Expansion joints shall be provided as shown in the structural drawings or as indicated in Fig. 10 to 25 or as directed by engineer, for the purpose of general guidance. However it is recommended that structures exceeding 45 m in length shall be divided by one or more expansion joints. The filling of these joints with bitumen filler, bitumen felt or any such material and provision of copper plate, etc. shall be paid for separately in running meter. The measurement shall be taken up to two places of decimal stating the depth and width of joint.

4.6.4.6 Curing - After the concrete has begun to harden i.e. about 1 to 2 hours after its laying, it shall be protected from quick drying by covering with moist gunny bags, sand, canvass Hessian or any other material approved by the engineer. After 24 hours of laying of concrete, the surface shall be cured of ponding with water for a minimum period of 7 days from the date of placing of concrete.

4.6.4.7 Finishing - In case of roof slabs the top surface shall be finished even and smooth with wooden trowel, before the concrete begins to set.

Immediately on removal of forms, the R.C.C work shall be examined by the engineer, before any

defects are made good.

The work that has sagged or contains honey combing to an extent detrimental to structural safety or architectural concept shall be rejected as given for visual inspection test.

Surface defects of a minor nature may be accepted. On acceptance of such a work by the engineer, the same shall be rectified as follows -

1) Surface defects which require repair when forms are removed, usually consist of bulges due to movement of forms, ridges at form joints, honey combed areas, damage resulting from the stripping of forms and bolt holes, bulges and ridges are removed by careful chipping or tooling and the surface is then rubbed with a grinding stone. Honey-combed and other defective areas must be chipped out, the edges being cut as straight as possible and perpendicularly to the surface, or preferable slightly undercut to provide a key at the edge of the path.

2) Shallow patches are first treated with a coat of thin grout composed of one part of cement and one part of fine sand and then filled with mortar similar to that used in the concrete. The mortar is placed in layers not more than 10 mm thick and each layer is given a scratch finish to secure bond with the succeeding layer. The last layer is finished to match the surrounding concrete by floating, rubbing or tooling on formed surfaces by pressing the form material against the patch while the mortar is still plastic.

3) Large and deep patches require filling up with concrete held in place by forms. Such patches are reinforced and carefully dowelled to the hardened concrete.

4) Holes left by bolts are filled with mortar carefully packed into places in small amounts. The mortar is mixed as dry as possible, with just enough water so that it will be tightly compacted when forced into place.

5) Tiered holes extending right through the concrete may be filled with mortar with a pressure gun similar to the gun used for greasing motor cars.

6) Normally, patches appear darker than the surrounding concrete, possibly owing to the presence on their surface of less cement laitance. Where uniform surface colour is important, this defect shall be remedied by adding 10 to 20 percent of white Portland cement to the patching mortar, the exact quantity being determined by trial.

7) The same amount of care to cure the material in the patches should be taken as with the whole structure. Curing must be started as soon as possible, after the patch is finished to prevent early drying. Damp Hessian may be used but in some locations it may be difficult to hold it in place. A membrane curing compound in these cases will be most convenient.

c). The exposed surface of R.C.C work shall be plastered with cement mortar 1 -3 (1 cement - 3 fine sand) of thickness not exceeding 6 mm to give smooth and even surface true to line and form. Any RCC surface which remains permanently exposed to view in the completed structure shall be considered exposed surface for the purpose of this specification.

Where such exposed surface exceeding 0.5 sq.m in each location is not plastered with cement mortar 1:3 (1 cement to 3 fine sand) 6 mm thick, necessary deduction shall be made for plastering not done.

d). The surface which is to receive plaster or where it is to be joined with brick masonry wall, shall be properly roughened immediately after the shuttering is removed, taking care to remove the laitance completely without disturbing the concrete. The roughening shall be done by hacking. Before the surface is plastered, it shall be cleaned and wetted so as to give bond between

concrete and plaster.

e). The surface of RCC slab on which the cement concrete of mosaic floor is to be laid shall be roughened with brushes while the concrete is green. This shall be done without disturbing the concrete.

4.6.4.8 Strength of concrete - The compressive strength on work tests for different mixes shall be as given in Table 15 below -

Table 15

Concrete mix (Nominal mix on volume basis)	Compressive strength in (kg/sq cm)	
	7 days	28 days
1:1:2	210	315
1:1 ½ : 3	175	265
1:2:4	140	210

#### 4.6.4.9 Testing of concrete

(1). Regular mandatory tests on the consistency and workability of the fresh concrete shall be done to achieve the specified compressive strength of concrete. These will be of two types

Mandatory Lab. Test

Mandatory Field Test

(3). Results of Mandatory Field Test will prevail over Mandatory Lab. Test.

a) Work Test-Mandatory Lab. Test shall be carried out as prescribed.

b) Mandatory Field Test (Hammer Test), shall be carried out as prescribe in Annexure 4.A.2

(4). Additional test - Additional test, if required, shall be carried out as prescribed in Annexure 4.A.7

(5). Slump test - This test shall be carried out as prescribed in Annexure 4.A.1

(6). Visual inspection test - The concrete will be inspected after removal of the form work as described. The question of carrying out mandatory test or other tests described in Annexure 4-A.2 and 4-A.4 will arise only after satisfactory report of visual inspection.

The concrete is liable to be rejected, if,

(i) It is porous or honeycombed.-

(ii) Its placing has been interrupted without providing a proper construction joint;

(iii) The reinforcement has been displaced beyond tolerance specified; or construction tolerance has not been met.

However, the hardened concrete may be accepted after carrying out suitable remedial measures to the satisfaction of the engineer at the risk and cost of the contractor.

#### 4.6.4.10 Standard of acceptance

(1). Mandatory lab test - For concrete sample and tested as prescribed in Annexure 4- A.2 the following requirement shall apply.

Out of six sample cubes, three cubes shall be tested at 7 days and remaining three cubes at 28 days, if found necessary.

(2). 7days' tests

(a). Sampling - The average of the strength of three specimens shall be accepted as the compressive strength of the concrete provided the variation In strength of individual specimen is



not more than  $\pm 15\%$  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 upto 30% 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 70% of specified strength, the concrete may be accepted at reduced rate at the discretion of engineer.

(e) If the actual average strength of accepted sample is less than 70% of specified strength, the engineer shall reject the defective portion of work represented by sample and nothing shall be paid for the rejected work. Remedial measures necessary to retain the structure shall be taken at the risk and cost of contractor. If, however, the engineer so desires, he may order additional tests (see Annexure 4-A.4) to be carried out to ascertain if the structure can be retained. All the charges in connection with these additional tests shall be borne by the contractor.

(4). Acceptance criteria of mandatory field test

(A) Preparation of standard test cubes for calibration of rebound hammer at site

(a) In the beginning the standard test cubes of specified mix shall be prepared by field units before undertaking any concrete work in each project.

(b) At least 18 standard cubes necessary for formation of one specimen of specified mix, shall be cast by site staff well in advance. From these 18 cubes any 3 cubes may be selected at random to be tested for crushing strength of 7 days. The crushing strength obtained should satisfy the specified strength for the mix as per specification or agreement. If the strength is satisfactory then the remaining cubes will form the standard samples for calibration of rebound hammer. In case of failure, the site staff should totally reject the samples and remove them also and then make another set of samples by fresh mixing or alternatively, out of the remaining 15 cubes 3 cubes will be tested on 28 days. If the 28 days' tests are found satisfactory then remaining 12 cubes will form the standard sample for calibration at 28 days' strength otherwise

all samples shall be rejected and whole procedure repeated to form a fresh specimen. All the results shall be recorded in a register.

(c) No concreting will be allowed unless the standard specimen cubes are obtained.

The criteria for acceptance and calibration of hammer will be 28 days' strength. the 7 days' strength is only to facilitate the work to start.

(d) No work (for the concrete cast between 8th day) shall be allowed to be paid unless 28 days' cube strength is obtained. For the concrete cast between 8th and 28th day, the decision to make the payment may be taken by the engineer on the basis of existing criteria. Concrete work will be rejected if 28 days' strength falls short as per acceptance criteria. No further work will be allowed till the acceptable standard cubes are obtained.

(e) Frequency - It will be once in each quarter or as per the direction and discretion of engineer. Whenever the acceptance criteria is changed or concrete mix or type of cement is changed or engineer feels it necessary for recorded reasons with the approval of the authority according technical sanction, fresh specimen shall be prepared.

(B) Calibration of hammer

(a) Simultaneously, same three cubes to be tested on 28 days as referred in para A (b) above shall be used to correlate the compressive strength of their concrete with rebound number as per procedure described in para 5.2 of the IS: 13311 (Part 2) "Indian standard for non-destructive testing of concrete Method of test by rebound hammer which is given below in para B (b). the average of values of the rebound number (minimum readings) obtained in respect of same three cubes passing on 28 days' work test shall form the datum reference for remaining cubes for the strength of cubes.

(b) The concrete cubes specimens are held in a compression testing machine under a fixed load, measurements of rebound hammer taken and then compressive strength determined as per IS: 516. The fixed load required is of the order of 7N / mm<sup>2</sup> 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  $\pm 25\%$  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 (l) 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 beam.

(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.

#### 4.6.8. SPECIFICATIONS FOR DESIGN MIX CONCRETE.

Definition - Design mix concrete is that concrete in which the design of mix i.e. the determination of proportions of cement, aggregate & water is arrived as to have target mean strength for specified grade of concrete.

It will be designed based on the principles given in IS 456-2000 and 23 "Hand book for design mix concrete".

In order to ensure that not more than the specification proportion of test results is likely to fall below the characteristic strength, the concrete mix has to be designed for higher average compressive strength for a specified grade of concrete is defined as target mean strength.

#### 4.6.8.1. Materials

Cement - One of the following types of cement as specified shall be used -

1. Ordinary Portland Cement 33 grade conforming to IS: 269.
2. Ordinary Portland Cement 43 grade conforming to IS: 8112.
3. Ordinary Portland Cement 53 grade conforming to IS: 2269.
4. Rapid hardening Portland Cement Conforming to IS: 8041.
5. Blast Furnace slag cement conforming to IS: 455.

However for severe conditions of sulphate content in sub soil water, special literature on use of sulphate resisting cement may be referred to.

Coarse aggregate - This shall be specified in para 4.1.2 and subparas.

Fine aggregate - This shall be grading zone I, II, or III as specified under para 3.1.4 and subparas.

Water - It shall conform to the requirement as laid down in IS: 456 para and para 4.6.1.1. of this section.

Grades of concrete - The compressive strength of various grades of designation concrete shall be as given in table 16 below -

Table 16

Grades designation	Compressive strength on 15 cm cubes min at 7 days (N/mm <sup>2</sup> )	Specified characteristic compressive strength at 28 days (N/mm <sup>2</sup> )
M 15	10.0	15
M 20	13.5	20
M 25	17.0	25
M 30	20.0	30
M 35	23.5	35

Note - In the designation of a concrete mix letter M refer the mix and the number to the specified characteristic compressive strength of 15 cm-cubes at 28 days expressed in N/mm<sup>2</sup>.

4.6.8.2 Scope - The procedure described below for design mix is for concrete up to grade M-35 which are generally used for reinforced concrete structure. Minimum grade of concrete for design mix will be M-20 normally. However in cases of projects having some parts of M-15 also in addition to M-20 to M-35 grade, then design mix concrete will cover M-15 grade as an exception only.

4.6.8.3 Data for mix design - The following basic data are required to be specified for design of concrete mix.

Characteristic compressive strength of concrete at 28 days.

- (1) Degree of workability desired.
- (2) Limitation on water cement ratio and minimum cement content to ensure adequate durability.
- (3) Type of maximum size of aggregate to be used.

(4) Standard deviation of compressive strength of concrete.

Minimum cement content required in Reinforced cement concrete to ensure durability under specified conditions of exposure, will be in accordance with IS: 456. However it shall not be less than 300 Kgs /m<sup>3</sup> of concrete for 33 grade cement.

(a). Standard Deviation of concrete for each grade shall depend upon the degree of quality control expected to be exercised at site. As per IS: 10262 the values of standard deviation for various grades of concrete for different degree of control shall be specified in Table. 17.

Table 17

Grade of concrete	Standard Deviation for different degree of control in N/mm <sup>2</sup>		
	Very good	Good	Fair
M-15	2.5	3.5	4.5
M-20	3.6	4.6	5.6
M-25	4.3	4.3	6.3
M-30	5.0	6.0	7.0
M-35	5.7	6.7	7.7

Degree of quality control expected under different site conditions are described in Table18

Table 18

Degree of	Condition of production of concrete
Very good	Fresh cement from single source and regular test, weigh batching of all materials, aggregates grading and moisture content, control of water added, frequent supervision, regular workability and strength tests and field laboratory facilities,
Good	Carefully stored cement and periodic test, weigh batching of all materials, controlled water, graded aggregate supplied, occasional grading and moisture tests, periodic check of workability and strength, intermittent supervision and experienced workers.
Fair	Proper storage of cement, volume batching of all aggregates allowing for bulking of sand, weigh batching of cement, water content controlled by inspection of mix and occasional supervision and tests

4.6.8.4. **Target strength for mix design** - The target mean strength for a specified grade concrete depends upon the quality control (expressed by standard deviation) and accepted proportion of results of the strength tests below the characteristic strength (Fck) and is given by relation,

$$T_{ck} = f_{ck} + t.s$$

T<sub>ck</sub> – target mean compressive strength at 28 days

F<sub>ck</sub> – characteristic compressive strength at 28 days

s – standard Deviation

t – a statistical figure depending upon the accepted proportion of low test results and number of tests.

Note - According to IS: 456 & IS: 1343 the characteristic strength is defined as that value below which not more than 5% (1 in 20) results are expected to fall. In such case value of t will be 1.65 and equation will reduce to  $T_{ck} = f_{ck} + 1.65 s$ .

**Selection of proportions** - Since different cement, aggregate, of different maximum size, grading surface texture shape, produce concrete of different compressive strength for the same free water cement ratio, the relationship between strength and free water cement ratio corresponding to 28 days' strength of cement of various grades is given in Fig.1 of IS: 10262 and is reproduced below in chart 1.

28 days strength of cement tested according IS: 4031-1968

A = 31.9 – 36.8 N/mm<sup>2</sup> (325-375 kg /cm<sup>2</sup>)

B = 36.8 – 41.7 N/mm<sup>2</sup> (375-425 kg /cm<sup>2</sup>)

C = 41.7 – 46.6 N /mm<sup>2</sup> (425-475 kg /cm<sup>2</sup>)

D = 46.6 – 51.5 N /mm<sup>2</sup> (475-525 kg /cm<sup>2</sup>)

E = 51.5 – 56.4 N/mm<sup>2</sup> (525-575 kg/cm<sup>2</sup>)

F = 56.4 - 61.3 N /mm<sup>2</sup> (575-625 kg /cm<sup>2</sup>)

Chart 1- Relationship between free water cement ratio and concrete strength for different cement strengths.

(a) **The free water cement ratio** selected from Chart 1 above should be checked against the limiting water cement ratio for requirement of durability as given in IS: 456 and the lower of the two values is to be adopted.

(b) **Estimate of air control** - The amount of entrapped air for normal mix (non air entrained) concrete as per IS: 10262 are given in Table 19.

Table 19.

Nominal maximum size of aggregate	Entrapped air as percentage of volume of concrete
10 mm	3.0
20 mm	2.0
40 mm	1.0

(c) **Selection of water content and fine to total aggregate ratio** - Based on experience, empirical relationship have been established between quantity of water per unit volume of concrete and ratio of fine aggregate to total aggregate by absolute volume for desired workability. The estimated values for concrete up to M35 grade are given in Table 20.

Table 20.

Nominal maximum size of aggregate in mm	Water content in kgs per cubic meter of concrete	Sand as % age of total aggregate by absolute volume
10	208	40



20	186	35
40	165	30

**A) The values given in Table 19. are based on the following conditions -**

- i) Crushed coarse aggregate conforming to IS: 383 and para 4.1.2 of this specification
- ii) Fine aggregate consisting of natural sand conforming to grading zone II of IS: 383 water cement ratio (by mass) of 0.6 and
- iii) Workability corresponding to compacting factor of 0.8.

B) For other conditions of workability, water cement ratio, grading of fine aggregate and for round aggregate, certain adjustment in quantities of mixing water and fine to total aggregate ratio as given in Table 19 are to be made as per IS: 10262. These are explained in Table 21 below - Table 21.

Change of conditions stipulated for	Adjustment required in	
	Water content	Percentage of fines to total aggregate
For sand conforming to grading Zone I & III of IS -383	0	+1.5% for Zone I -1.5% for Zone III
Increase or decrease in the value of compacting factor by 0.1		
For increase	+3.0 %	0
For decrease	-3.0%	
For each 0.05 increase or decrease in free water-cement ratio		
For increase		+1.0 %
For decrease	0	-1.0 %
	0	
For rounded aggregates	-15 kg / mm <sup>3</sup>	-7

**C) Comparison of consistency measurement by various methods-**

Workability description	Slump mm	Compacting factor
Extremely dry	--	--
Very stiff	--	0.70
Stiff	0-25	0.75
Stiff plastic	25-50	0.85

Plastic	75-100	0.90
Flowing	150-175	0.95

**Calculation of aggregate content** - With the quantities of water and cement per unit volume of concrete and ratio of fine to total aggregate content per unit volume of concrete to be calculated from the following equations -

$$V = \left\{ w + \frac{C}{S_c} + \frac{1}{p} \times \frac{f_a}{S_{fa}} \right\} \times \frac{1}{1000}$$

$$V = \left\{ w + \frac{C}{S_c} + \frac{1}{1-p} \times \frac{f_a}{S_{ca}} \right\} \times \frac{1}{1000}$$

V = absolute volume of fresh concrete which is equal to gross volume (m<sup>3</sup>), minus the volume of entrapped air.

W = mass of water (kg) per m<sup>3</sup> of concrete

C = mass cement (kg) per m<sup>3</sup> of concrete

P = ratio of fine aggregate to total aggregate by absolute volume

S<sub>c</sub> = specific gravity of cement

F<sub>a</sub>, C<sub>a</sub> = aggregate (kg) per m<sup>3</sup> of concrete respectively (total masses of fine aggregate and coarse aggregate )

S<sub>fa</sub>, S<sub>ca</sub> = Specific gravities of saturated surface dry fine aggregate and coarse aggregate respectively

**Calculation of batch masses** - The masses of various ingredients for concrete for design mix of a particular batch size may be calculate as described above.

**4.6.8.5 Production of controlled concrete** - The calculated mix proportion shall be checked by means of trial batches. Quantities of materials worked out as described above shall be termed as trial mix no.1. The quantities of materials for each trial mix shall be sufficient for at least three 150 mm size cube concrete specimens and concrete required to carry out workability test according to IS: 1199.

Workability of Trial Mix No.1 shall be measured. The mix shall be carefully observed for freedom from segregation and bleeding and its finishing properties. If the measured workability of Trial Mix No.1 is different from the stipulated value, the water content shall be adjusted according to Table 22 corresponding to the required changes in compacting factor. With this adjustment in water content, the mix proportions shall be recalculated keeping the free water-cement ratio at the preselected value which will comprise Trial Mix No.2. In addition, two more Trial Mixes No 3 and 4 shall be made with the water content same as Trial Mix No.2 and varying the free water cement ratio by (+) 10 per cent and (-) 10 per cent of the preselected value. For these two additional trial mixes No.3 and 4, the mix proportions are to be recalculated for the altered condition of free water-cement ratio with suitable adjustments in accordance with Table 22.

Fresh trial mixes are to be made for different types and brands of cement, alternative source of aggregates, maximum size and grading of aggregates.

4.6.8.6. **Batching** - In proportioning concrete, the quantity of both cement and aggregate should be determined by mass. Cement shall be used on the basis of mass and should be weighed separately from the aggregate. Water should be either measured by volume in calibrated tanks or weighed. Any solid admixture that may be added may be measured by mass. Liquid and paste admixture by volume or mass. Batching plant where used should conform to IS: 4925. All measuring equipment should be maintained in a clean serviceable condition and their accuracy periodically checked.

Except where it can be shown to the satisfaction of engineer that supply of properly graded aggregate of uniform quality can be maintained over the period of work, the grading of aggregate should controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions when required, the different sizes being stocked in separate stock piles. The material should be stock-piled for several hours preferably a day before use. The grading of coarse and fine aggregate should be checked as frequently as possible, the frequency for a given job being determined by engineer to ensure that the specified grading in maintained.

It is important to maintain the water-cement ratio constant at its correct value. To this end, determination of moisture contents in both fine and coarse aggregate shall be made as frequently as possible, the frequency for a given job being determined by the engineer according to weather conditions. The amount of the water to be added shall be adjusted to compensate for any observed variations in the moisture contents. For the determination of moisture content in the aggregates, IS: 2386 (part 3) may be referred to. The allow for the variation in mass of aggregate due to variation in their moisture content, suitable adjustments in the masses of aggregates shall also be made. In the absence of exact data, only in the case of nominal mixes, the amount of surface water may be estimated from the values given in the Table 22.

Table 22 (Surface water carried by aggregate) (Clause 4.6.8.4)

Aggregate	Approximate quantity of surface water	
	Percent by mass	Litres/m <sup>3</sup>
Very wet sand	7.5	20
Moderately wet sand	5.0	80
Moist sand	2.5	40
Moist gravel to crushed rock	1.25-2.5	20-40

4.6.8.7. **Mixing** - Concrete shall be mixed in mechanical mixer. The should mixer comply with IS -1791. It shall be fitted with hopper. The mixing shall be continuous until there is uniform distribution of the material and the mass is uniform in colour and consistency. If there is segregation after unloading from the mixer, the concrete should be remixed. The mixing time shall be not less than 2 minutes.

4.6.8.8. **Laying** - It shall be done as specified under para 4.2.4 of this specification.

4.6.8.9. **Curing** - It shall be done as specified under para 4.3.4 of this specification

4.6.8.10. **Approval of design mix** - The preliminary test for approval of design mix shall consists of three sets of separate tests and each set of test shall be conducted on six specimens. Not

more than one set of six specimens shall be made on any particular day. Of the six specimens of each set, three shall be tested at seven days and remaining three at 28 days. The preliminary tests at seven days are intended only to indicate the strength to be attained at 28 days.

**4.6.8.11. Work strength test** - Work strength test shall be conducted in accordance with IS - 516 on random sampling. Each test shall be conducted on ten specimens, five of which shall be tested at 7 days and remaining five at 28 days. Not less than one work test consisting of testing of test on 10 cubes shall be carried out for every 30 cubic meter of concrete or less as per the lot size as specified below -

Lot size - Concrete under acceptance shall be notionally divided into lots for the purpose of sampling, before commencement of work. The delimitation of lots shall be determined by the following -

No individual lot shall be more than 30 m<sup>3</sup> in volume.

- 1) At least one cube forming an item of the sample representing the lot shall be taken from the concrete of same grade and mix proportions cast in any day.
- 2) Different grades or mixes of concrete shall be divided into separate lots.
- 3) Concrete of a lot shall be used in the same identifiable unit of the structure.

**4.6.8.12. Standard of acceptance**

a) The average strength of group of cubes cast for each day shall not be less than the specified work cube strength. 20 per cent of cubes cast for each day may have values less than the specified strength provided that the lowest value is not less than 85% of the specified strength.

b) Concrete strength less than specified may as a special case be accepted in a member with the approval of engineer provided that the maximum stress in the member under the maximum design live load does not exceed the permissible safe stress appropriate to the lower strength of the concrete.

c) Concrete which does not meet the strength requirements as specified but has a strength greater than that of the lowest value of 85% may, at the discretion of the designer, be accepted as being structurally adequate without further testing.

d) Concrete of each grade shall be assessed separately.

e) Concrete shall be assessed daily for compliance.

f) Concrete is liable to be rejected if it is porous or honey combed, its placing has been interrupted without providing a proper construction joint, the reinforcement has been displaced beyond the tolerances specified, or construction tolerances have not been met. However, the hardened concrete may be accepted after carrying out suitable remedial measures to the satisfaction of the engineer.

4.6.8.13. An example illustration the mix design for concrete mix M 20 grade is given below -

**Design stipulation**

a	Characteristic compressive strength required in the field at 28 days	20N/mm <sup>2</sup>
b	Maximum sizes of aggregate	20 MM (angular crushed)
c	Degree of workability	0.9 compacting factor (slump 75 mm)

d	Degree of quality control	Good
e	Type of exposure	Mild

**Test data of material**

a	Cement used - ordinary Portland cement satisfying the requirements of IS: 269-1989	
b	Specific gravity of cement	3.15
c	Specific gravity of	
i)	Coarse aggregate	2.60
ii)	Fine aggregate (natural sand)	2.60
d	Water absorption of	
i)	Coarse aggregate	0.5 percent
ii)	Fine aggregate (natural sand)	1.0 percent
e	Free surface moisture of	
i)	Coarse aggregate	Nil (absorbed moisture also nil)
ii)	Fine aggregate (natural sand)	2.0 percent

**Sieve analysis**

a) Coarse aggregate

IS sieve Size mm	Analysis of coarse aggregate fraction (Percent passing)		Percentage of different fraction		
			I	II	Combined
20	100	100	60%	40%	100%
10	0	71.2	60%	40%	100%
4.75		9.4	0	28.5%	28.5%
2.63		0		3.7%	3.7%

The grading of combined fraction I and II in the ratio of 60 and 40 conform to Table 10 described above.

b) Fine aggregate

IS sieve sizes	Fine aggregate (percent passing)
100	-
2.36 mm	100
1.18 mm	93

600 micron	60
300 micron	12
150 micron	2

The sand conforms to grading zone III.

**Target mean strength** - As described earlier for degree of quality control 'good' the value of standard deviation is 4.6, therefore with a tolerance factor of 1.65 the value of target mean strength for specified characteristic cube strength =  $20 + 1.65 \times 4.6 = 27.6 \text{ N/mm}^2$ .

**Selection of water cement ratio** - From chart 1, the free water cement ratio required for target mean strength of  $27.6 \text{ N/mm}^2$  is 0.50. This is lower than the maximum value of 0.65 prescribed for mild exposure.

**Selection of water and sand content** - From Table 8 for 20 mm nominal maximum size aggregate and sand conforming to grading zone II water content as per cum concrete is 186 kg and sand content percentage of total aggregate by absolute volume is equal to 35%. For change in value of water cement ratio compacting factor, and sand belonging to zone III the following adjustment is required.

Change in condition	Adjustment required in	
	Water content	Percentage in total aggregate
For decrease in water cement Ratio by (0.6-0.5) i.e.0.10	0	-2
For increase in compacting Factor by (0.9-0.8) I.e. 0.10	+3	0
For the conforming Grading zone III	0	-1.5
Total	3	-3.5

Therefore, the required water content =  $186 + 186/100 \times 3 = 186 + 3.58 = 191.6 \text{ kg / m}^3$

And required sand content =  $35 - 3.5 = 31.5$  percent

#### **Determination of Cement Content**

Water-Cement ratio = 0.5

Water = 191.6 kgs

Cement =  $191.6 / 0.5 = 383 \text{ kg / m}^3$

Thus cement content is adequate for mild exposure condition as per IS: 456-2000 as described in table below.

#### **Determination of coarse and fine aggregate content**

From Table 18 for specified maximum size of aggregate of 20 mm, the amount of entrapped air in wet concrete is 2 per cent. Taking this into account and applying equations given above.

$$0.98 \text{ m}^3 = 191.6 + 383/3.15 + 1/0.315 \cdot f_a / 2.60) \times 1 / 1000$$

and

$$0.98 \text{ m}^3 = 191.6 + 383/3.15 + 1/0.315 \cdot C_a / 2.60) \times 1 / 1000$$

$$\text{or } f_a = 546 \text{ kg / m}^3 \text{ and } C_a = 1187 \text{ kg / m}^3$$

The mix proportion now works out -

Water	Cement	Fine aggregate	Coarse aggregate
191.6	383 kg	546 kg	1187 kg
or 0.5	1	1.42	3.0

For 50 kg cement, the quantity of materials are worked out as below -

a)	Cement	= 50 kg.
b)	Sand	= 71 kg
c)	Coarse aggregate	154.5 kg.
	Fraction I - 92.7	
	Fraction II - 61.8	
d)	Water	
1	For water cement ratio of 0.5 quantity	= 25.0 kg.
2	Extra quantity of water to be added for absorption in coarse aggregate at 0.5% by mass	= $154.5 / 100 \times 0.5 = 0.77 \text{ kg.}$
3	Quantity of water to be deducted for free moisture in sand at 2% by mass	= $(-) 171.0 / 100 \times 2 = (-) 1.42 \text{ kg.}$

Therefore actual quantity of water =  $25.00 + 0.77 - 1.42 = 24.35 \text{ kg}$

Actual quantity of sand required after allowing for mass of free moisture  
 $= 71.0 + 1.42 = 72.42 \text{ kg}$

Actual quantity of Coarse aggregate

$$\text{Fraction I} = 92.7 - (0.6 \times 0.77) = 92.24$$

$$\text{Fraction II} = 61.8 - (0.4 \times 0.77) = 61.49$$

Therefore the actual quantities of different constituent required for mix are -

Water = 24.35 kg

Cement = 50 kg

Sand = 72.42 kg

Coarse aggregate    Fraction I = 92.42 kg    Fraction II = 61.49 kg

**Measurements** shall be done in accordance with paras above.

**Tolerances** - Paras above shall apply.

**Rate** – Paras above shall apply with the exception regarding limitations for actual average compressive strength being less than specified strength which shall be governed by para above for acceptance and prorata rates worked out accordingly.

## 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 takes 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 streamered 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 hole 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 45° 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 oxidation.

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 filling 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 anywhere 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 (1 cement : 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 or 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 walling 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. Tothing 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.

### **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.

#### 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 coat 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

#### 15.7. 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.

### **SPECIFICATION OF PAINTING**

#### **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 paris 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.

### 15.33. 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 be 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
1.	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, supporting members shall not be measured separately	2 ( for painting 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 including standards, braces, rails stays etc. in timber or steel.	- do - (see note No. 12)	1 (for paint all over)
	Corrugated iron sheeting in roofs, side cladding etc.	- do - Measured flat (not girthed)	1.14 (for each side)
	AC semi-corrugated sheeting in roofs, side cladding etc.	- do -	1.20 (for each side)



AC semi-corrugated sheeting in roofs, side cladding etc. or Nainital pattern using plain sheets	- do -	1.10 (for each side)
Wire gauze shutters including painting of wire gauze.	- do-	1.00 (for each side)

Explanatory notes for Table 1:

1) Measurements for doors windows etc., shall be taken flat (and not girthed) over all including frames, where provided. Where frames are not provided, the shutter measurements shall be taken.

2) Where doors, windows, etc., are of composite types other than those included in Table 1 the different portion shall be measured separately with their appropriate coefficients, the centre line of the common rail being taken as the dividing line between the two portions.

3) The coefficients for door and windows shall apply irrespective of the size of frames and shutter members.

4) In case steel frames are used the area of doors, windows shutters shall be measured flat excluding frames.

5) When the two faces of a door, window etc. are to be treated with different specified finishes, measurable under separate items, the edges of frames and shutters shall be treated with the one or the other type of finish as ordered by the Engineer and measurement of this will be deemed to be included in the measurement of the face treated with that finish.

6) In the case where shutters are fixed on both faces of the frames, the measurement for the door frame and shutter on one face shall be taken in the manner already described, while the additional shutter on the other face will be measured for the shutter only excluding the frame.

7) Where shutters are provided with clearance at top or / and bottom each exceeding 15 cm height, such openings shall be deducted from the overall measurements and relevant coefficient shall be applied to obtain the area payable.

8) Collapsible gates shall be measured for width from outside to outside of gate in its expanded position and for height from bottom to top of channel verticals. No separate measurements shall be taken for the top and bottom guide rails rollers, fittings etc.

9) Coefficients for sliding doors shall be the same as for normal types of doors in the table. Measurements shall be taken outside to outside of shutters, and no separate measurements shall be taken for the painting guide rails, rollers, fittings, etc.

10) Measurements of painting as above shall be deemed to include painting all iron fittings in the same or different shade for which no extra will be paid.

11) The measurements of guard bars, expanded metal, hard drawn steel wire fabric of approved quality, grill work and gratings, when fixed in frame work, painting of which is once measured else where shall be taken exclusive of the frames. In other cases the measurements shall be taken inclusive of the frames.

12) For painting open palisade fencing and gates etc., the height shall be measured from the bottom of the lowest rail, if the palisades do not go below it, (or from the lower end of the palisades, if they project below the lowest rail), up to the top of rails or palisades whichever are higher, but not up to the top of standards when the latter are higher than the top rails or the

palisades.

15.33.6.5. Width of moulded work of all other kinds, as in hand rails, cornices, architraves shall be measured by girth.

15.33.6.6. For trusses, compound girders, stanchions, lattice girders, and similar work, actual areas shall be measured in sq. meters and no extra shall be paid for painting on bolt heads, nuts, washers etc. even when they are picked out in a different tint to the adjacent work.

15.33.6.7. Painting of rain water, soil, waste, vent and water pipes etc. shall be measured in running metres of the particular diameter of the pipe concerned. Painting of specials such as bends, heads, branches, junctions, shoes, etc. shall be included in the length and no separate measurements shall be taken for those or for painting brackets, clamps etc.

15.33.6.8. Measurements of wall surfaces and wood and other work not referred to already shall be recorded as per actual.

15.33.6.9. Flag staffs, steel chimneys, aerial masts, spires and other each objects requiring special scaffolding shall be measured separately.

15.33.7. Precautions - All furnitures fixtures, glazing, floors, etc. shall be protected by covering and stains, smears, splashings, if any shall be removed and any damages done shall be made good by the contractor at his cost.

15.33.8. Rate - Rates shall include cost of all labour and materials involved in all the operations described above and in the particular specifications given under the several items.

#### 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 new 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.

### **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/m<sup>2</sup>. 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.

#### RELEVANT BIS CODE FOR TECHNICAL SPECIFICATION

S. No.	IS Code	Description
<b><u>E. PLASTERING AND POINTING</u></b>		
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.
<b><u>F. PAINTING</u></b>		
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, rods 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) (3 <sup>rd</sup> Revision) (Amendment 2)
2	651-1992	Specification for salt glazed stoneware pipes and fittings(5 <sup>th</sup> revision)
3	1726-1991	Specification for cast iron manhole covers and frames(3 <sup>rd</sup> revision)
4	1729-2002	Specification for sand cast iron spigot and socket soil waste and ventilating pipes, fitting and accessories1 <sup>st</sup> 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 (3 <sup>rd</sup> revision) Reaffirmed 1993.
2	383-1970	Coarse and fine aggregate from Natural source for concrete (2 <sup>nd</sup> revision) Reaffirmed 1990.
3	456-2000	Code of practice for plain and reinforced concrete (3 <sup>rd</sup> 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). (3 <sup>rd</sup> revision) (Amendments 2) Reaffirmed 1991.
7	1322-1993	Bitumen felt for water proofing and damp proofing (4 <sup>th</sup> revision) (previously 13220-1982)
8	1791-1985	Batch type concrete mixers. (2 <sup>nd</sup> 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 bulking – 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. (1 <sup>st</sup> revision) Reaffirmed 1990.
12	2645-1975	Integral cement water proofing components (1 <sup>st</sup> revision) (Amendments 1) Reaffirmed 1992.
13	2686-1977	Cinder as fine aggregate for use in lime concrete (1 <sup>st</sup> revision) (Amendments 1) Reaffirmed 1992.
14	3068-1986	Broken butnt (clay) coarse aggregate for use in lime concrete. (2 <sup>nd</sup> revision) Reaffirmed 1991.
15	3812-1981	Flyash for use as pozzolana and admixtures (1 <sup>st</sup> revision) Reaffirmed 1992.
16	4643-1984	Section wrenches for fire bridge use (1 <sup>st</sup> 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

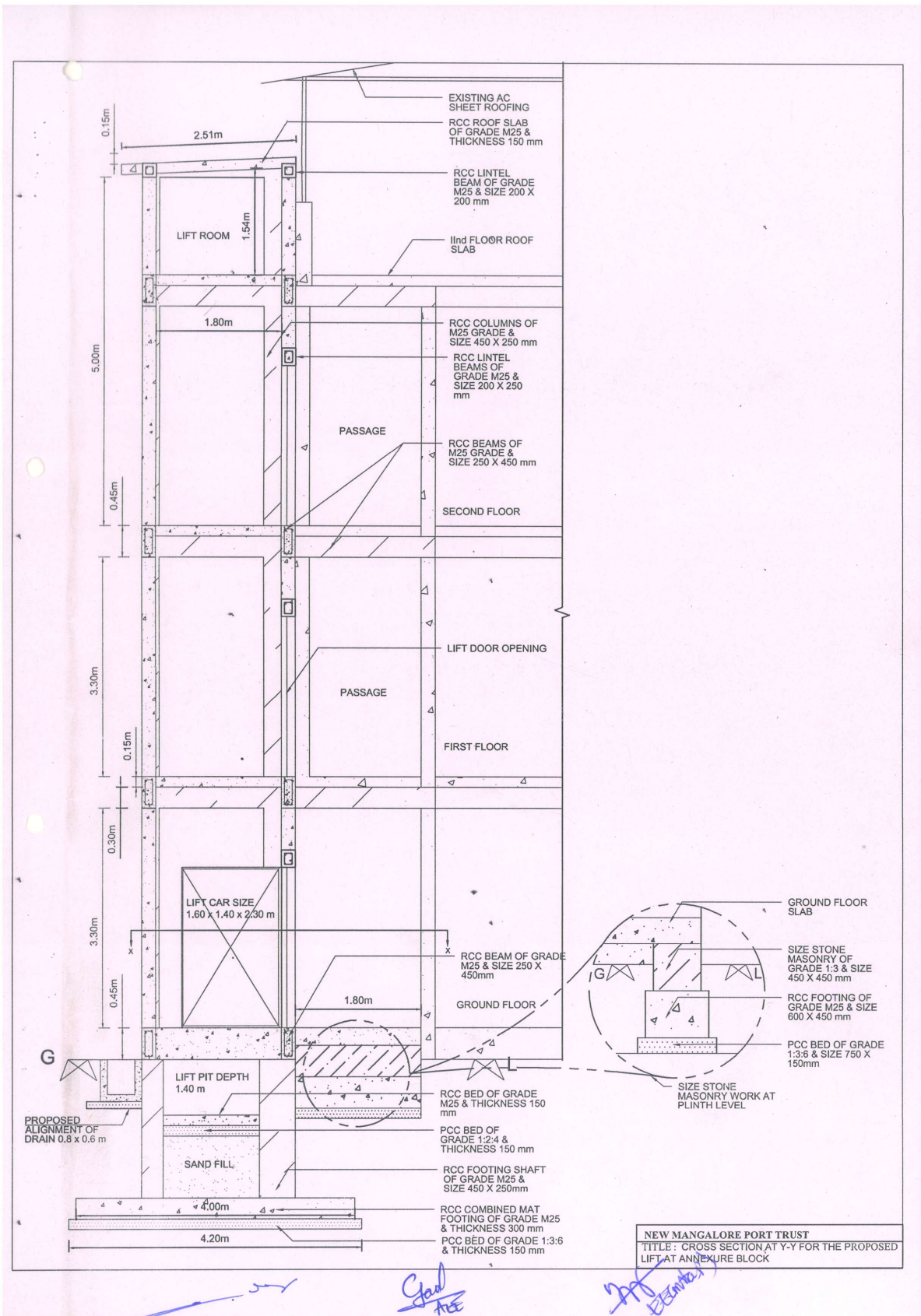
The Works are shown in the following drawings that are issued as a part of the Tender Documents. These drawings are not tentative and may be changed as per the actual requirement of the site and as per the Car size based on the OEM requirement and standards. The successful bidder has to prepare and submit the drawings for approval of Engineer-in-Charge:

Sl. No	Drawing No.	Description
1	8/06/Mtc-I/01	LOCATION PLAN
2	8/06/Mtc-I/02	PROPOSED PLAN
3	8/06/Mtc-I/03	CROSS SECTION
4	8/06/Mtc-I/04	LIFT GROUND FLOOR PLAN
5	8/06/Mtc-I/05	LIFT FIRST FLOOR PLAN
6	8/06/Mtc-I/06	LIFT SECOND FLOOR PLAN



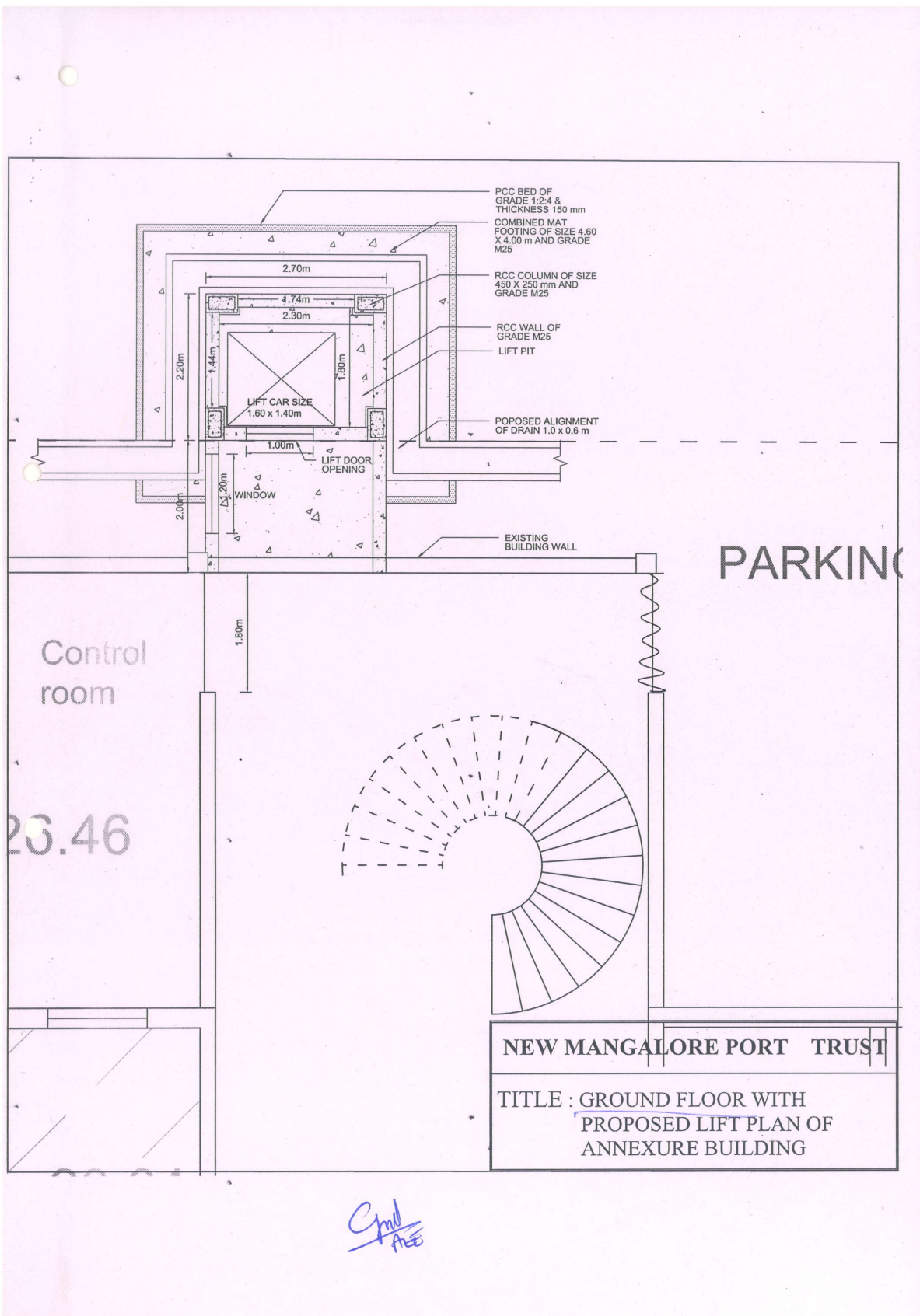




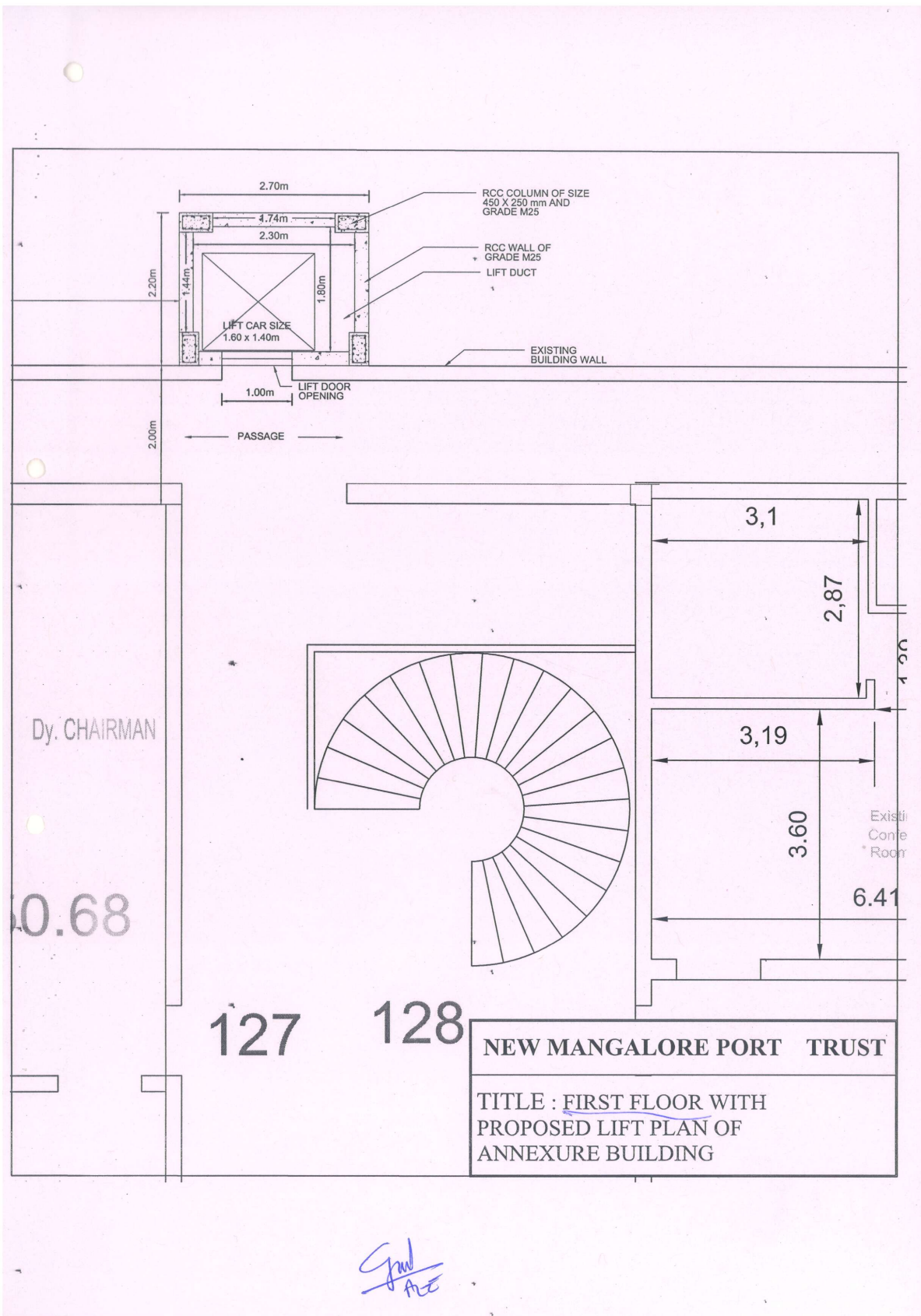


CROSS SECTION





LIFT GROUND FLOOR PLAN



LIFT FIRST FLOOR PLAN

**ALLIED WORKS:**

- a) All allied works as per the Bill of Quantities to be carried out by the Contractor in all respects invariably mentioned or not in the specification to complete the work in all respects.
- b) The materials required / intended for the work should be handled carefully and neatly installed / laid / commissioned and any damages during installation will be Contractors account and same shall be rectified immediately to its original condition.
- c) The Miscellaneous works to be carried out invariably whether clearly mentioned or not in the specifications and BOQ and to be completed in all respects the said project work

**GENERAL NOTES:**

- a) All the drawings of Design, Construction, Foundation Details, catalogues/Brochures of type Test certificates, routine Test certificates etc. should be submitted by the contractor in THREE sets invariably mentioned or not in the Tender Schedule. After the completion of work, As Built drawings in THREE sets to be submitted.
- b) All the drawings to be got approved by the Engineer –in –charge before Fabrication, Assembly, installation etc.
- c) All the works of installation, testing commissioning to be carried out in the presence of Engineer-in-charge.
- d) Since the project / works is on turnkey basis, the items / components not specifically mentioned but required, shall be considered and included in the quoted price at the time of submission of bid. No claim will be entertained after opening of Price bid.
- e) All the Hardware materials/Miscellaneous materials should be got approved by the Engineer – in-charge before installation and commissioning.
- f) The contractor should provide all facilities to test the materials at site.
- g) The total turn-key project should be guaranteed for a period of **12 months** from the last date of commissioning for all the materials and work carried out by the contractor. In the event of failure during the Guarantee Period, the restoration work shall be done free of cost by the Contractor within 24 Hours of giving notice or else, the expenditure incurred by New Mangalore Port Authority to carry-out the defective work will be recovered from the performance guarantee.

**PARTICULARS OF BIDDER:**

**All individual firms or each of the partners of an organization submitting the tender must complete the information in this form.**

1.	Full name of the Firm:	
2.	Head Office address:	
3.	Contact person name at Head office:	
4.	Telephone number/s:	
5.	Fax number/s:	
6.	E-mail Id	
7.	Branch Office address if any:	
8.	Contact person name at Branch office:	
9.	Telephone number/s:	
10.	Fax number/s:	
11.	E-mail Id	
12.	Works address:	
13.	Contact person name at Works:	
14.	Telephone number/s:	
15.	Fax number/s:	
16.	E-mail Id	
17.	Place of Registration/ Incorporation:	
18.	Year of Registration/ Incorporation	

Signature & seal of the Bidder

TENDER FORM

**(Note: - Bidders are required to fill up all the blank spaces in this Tender Form)**

To,

**The Chief Mechanical Engineer,  
New Mangalore Port Authority,  
Panambur, Mangalore – 575 010.**

**India**

1. Having examined the Instructions to Bidders, Conditions of Contract, Specifications and Schedules attached to the Tender with Annexure and having satisfied ourselves of the site conditions for the Tender for **“SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF PASSENGER LIFT AT ADMINISTRATIVE BUILDING, NMPA ”** we the undersigned, offer to execute the Contract as per conditions of contract, at rates for items of work in the Schedule of items of work and rates attached herewith.
2. We further undertake, if our tender is accepted, to deposit within 28 days from the date of receipt of the letter of acceptance, Performance Guarantees to the extent of **3% (Three percent)** of the contract price in the manner set forth in the GCC of tender.
3. We further undertake, if our tender is accepted, to enter into and execute within 14 days of our being called upon to do so, an Agreement in the form annexed and the conditions of contract with such modifications as are agreed upon.
4. 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.
5. We have submitted the Bid Security declaration as per the instructions.
6. We further agree that in the event of our withdrawing the tender before the receipt of the final decision or in the event of our failing to deposit the Performance Security in such form as contained in the GCC of tender or in the event of our tender being accepted, fail to execute an agreement in the form aforesaid within 14 days or extended time thereafter from the date of receipt of letter of

acceptance, we may be disqualified and debarred for a period of three (3) years from participating for tenders at New Mangalore Port Authority duly informing the MSME authorities if applicable.

7. We agree that the payment shall be made direct to us by the Port Authority in Rupees.
8. We understand that you are not bound to accept the lowest or any tender you may receive.

Dated this \_\_\_\_\_ Day of \_\_\_\_\_ in the capacity of \_\_\_\_\_ duly authorized to sign the Tender for and on behalf of

**(IN BLOCK CAPITALS)**

**Signature:**

**Witness**

**Address:**

FORM OF AGREEMENT

THIS AGREEMENT made at Mangalore this \_\_\_\_\_ day of \_\_\_\_\_ BETWEEN M/s. \_\_\_\_\_ (hereinafter called "the Contractor") which expression shall unless excluded by or repugnant to the context or meaning thereof be deemed to include his heirs, executors, administrators successors and permitted assigns) of the one part and THE BOARD OF NEW MANGLORE PORT AUTHORITY having its Office at Panambur, Mangalore ( herein after called "The Board") which expression shall unless excluded by or repugnant to the context or meaning hereof, be deemed to include their successors and assigns) of other part, WHEREAS the Board have accepted a tender by the Contractor for **SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF PASSENGER LIFT AT ADMINISTRATIVE BUILDING, NMPA** vide work order No.....dated.....

NOW THIS AGREEMENT WITNESSESTH AS FOLLOWS:

1. In this agreement words and expressions shall have the same meaning as are respectively assigned to them in the conditions of Contract hereinafter referred to.
2. The following documents annexed herein shall be deemed to form and be read and construed as part of this Agreement, viz –
  - a) The said tender
  - b) The acceptance of tender
  - c) The conditions of Contract
  - d) The scope of work/specifications.
  - e) The Price schedule and all other Annexures
  - f) The Contractor's all correspondence, by which the Contract is added, amended, varied or modified in any way by mutual consent.

3. In consideration of the payments to be made to the Contractor as hereinafter mentioned the Contractor HEREBY COVENANT with the Board for **SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF PASSENGER LIFT AT ADMINISTRATIVE BUILDING, NMPA** in conformity in all respects with the provision of the Contract.
4. The Board HEREBY COVENANT to pay to the Contractor in consideration of the work of “**SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF PASSENGER LIFT AT ADMINISTRATIVE BUILDING, NMPA**”, the Contract Price or and such other sum as may be payable at the time and in the manner prescribed by the Contract.
5. IN WITNESS WHEREOF the parties hereunto have set their hands and seals, the day and year first above written. This Agreement is assigned as CMEA...../2022..... dated...../...../2022 and contains with.....pages in all.

Signed, sealed and delivered

by \_\_\_\_\_ for and on behalf of

(Contractor)

Witness:

1.

COMPANY SEAL

2.

**CHIEF MECHANICAL ENGINEER**

**For and On behalf of the NMPA**

**(Board)**

**Witness**

1.

2.



**FORMAT OF PERFORMANCE SECURITY DEPOSIT BANK GUARANTEE**

1. In consideration of the Board of the New Mangalore Port Authority (hereinafter called “The Board”) which expression shall unless excluded by or repugnant to the context or meaning thereof be deemed to include its successors and assigns has awarded the Contract for “**SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF 500 KVA DG SET AT WHARF**” vide Work Order No. \_\_\_\_\_ (hereinafter called ‘the Contract’) to M/s. “**Name of the Contractor**” (hereinafter called the ‘Contractor’) which expression shall unless excluded by or repugnant to the context or meaning thereof be deemed to include his heirs, executives, administrators, successors and permitted assigns under the terms and conditions of the Contract, made between the Contractors and the Board, the Contractor is bound to submit a performance Guarantee of Rs.----- /- (Rupees-----) to Board, we the Corporation Bank, full address of the bank to be mentioned(hereinafter referred to as ‘the Bank’ ) at the request of the Contractors do hereby undertake to pay to the Board an amount not exceeding Rs. \_\_\_\_\_ /-( Rupees \_\_\_\_\_) against any loss or damage caused to or suffered or which would be caused to or suffered by the Board by reason of any breach by the Contractors of any of the terms and conditions of the said Contract.
  
2. We, \_\_\_\_\_ (Name of the Bank), do hereby undertake to pay Rs. \_\_\_\_\_ /- (Rupees \_\_\_\_\_) as the amounts due and payable under this guarantee without any demur, merely on a demand from the Board stating that the amount claimed is due by way of loss or damage caused to or which would be caused to or suffered by the Board by reason of the Contractor’s failure to perform the said Contract. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this Guarantee. However, our liability under this Guarantee shall be restricted to an amount not exceeding Rs. \_\_\_\_\_ /- (Rupees \_\_\_\_\_).
  
3. We, \_\_\_\_\_(Name of the Bank), undertake to pay to the Board any money so demanded notwithstanding any dispute or disputes raised by the Contractor in any

suit or proceeding before any court or Tribunal relating thereto, our liability under this present being absolute and unequivocal. The payment so made by us under this bond shall be a valid discharge of our liability for payment there under and the Contractor shall have no claim against us for making such payment.

4. We, \_\_\_\_\_(Name of the Bank), further agree with the Board that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contract and it shall continue to be enforceable till all the dues of the Board under or by virtue of the said Contract have been fully paid and its claims satisfied or discharged or till the Chief Mechanical Engineer of the said Board certified that the terms and conditions of the said Contract have been fully and properly carried out by the said Contractors and accordingly discharge this guarantee. Unless the demand or claim under this guarantee is made on us in writing on or before \_\_\_\_\_, we shall be discharged from all liabilities under this guarantee thereafter. This Guarantee will remain in force from the date hereof, i.e. till \_\_\_\_\_ and unless a demand or suit or action to enforce any claim under the guarantee is made within three months from the date of expiry of this guarantee, i.e. on or before \_\_\_\_\_, all your rights under this guarantee shall be forfeited and we shall be relieved and discharged from all liabilities under this guarantee thereafter PROVIDED, that the Bank shall at the request of the Board but at the cost of the Contractors, renew or extend this guarantee for such further period or periods as the Board may require from time to time.
  
5. We, \_\_\_\_\_(Name of the Bank), further agree with the Board that the Board shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Contract or to extend the time of performance by the said Contractors from time to time to postpone from any time or from time to time any of the powers exercisable by the Board against the said Contractors and to forebear or enforce any of the terms and conditions relating to the said Contract and we shall not be relieved from our liability by reason of any such variation or extension being granted to the Contractors or for any forbearance, act or omission on the part of the Board or any indulgence shown by

the Board to the Contractors or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision, have effect of so relieving us.

6. This Guarantee will remain valid for the entire period as agreed, even though there happens to be change in the constitution of the bank or that of the Contractor.
7. We, \_\_\_\_\_(Name of the Bank), lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Board in writing.
8. Our liability under this Guarantee shall not exceed Rs.\_\_\_\_\_/-(Rupees\_\_\_\_\_).
9. This Guarantee shall valid up to \_\_\_\_\_.
10. We, are liable to pay the guaranteed amount or any part thereof under this guarantee only & only if you serve us a written claim or demand on or before ----/----/202 .
11. The Bank Guarantee is en-cashable at our \_\_\_\_\_ branch at Mangalore, Karnataka

Dated ----- day of -----2021

For

(Authorised Signatory/s)

(Name & Code No.)

(For and on behalf of Bank.)

**Format for Declaration**

*(To be executed on bidder's letter head)*

To

**SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF PASSENGER LIFT  
AT ADMINISTRATIVE BUILDING, NMPA**

Ref:

The undersigned, having studied the pre-qualification submission for the abovementioned project, hereby states:

- (a) The information furnished in our bid is true and accurate to the best of my knowledge.
- (b) That in case of being pre-qualified, we acknowledge that the Employer may invite us to participate in due time for the opening of Price cover of the tender on the basis of provisions made in the tender documents to follow.
- (c) When the call for tenders is issued, if the legal, technical or financial conditions, or the contractual capacity of the firm or joint venture changes, we commit ourselves to inform you and acknowledge your sole right to review the pre-qualification made.
- (d) We enclose all the required pre-qualification data format and all other documents and supplementary information required for the pre-qualification evaluation.
- (e) We state that no changes have been made by us in the downloaded tender documents and also understand that in the event of any discrepancies observed, the printed tender document No. \_\_\_\_\_ is full and final for all legal/contractual obligations (delete if not required).
- (f) 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.
- (g) We also state that we 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.
- (h) We also undertake that, currently we don't have any litigation.

Date:

Place:

Name of the Applicant :

\_\_\_\_\_  
\_\_\_\_\_

Represented by (Name & capacity)

\_\_\_\_\_  
\_\_\_\_\_

**(To be executed on Non-Judicial Stamp Paper of Rs.100/-)**

**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 **“SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF PASSENGER LIFT AT ADMINISTRATIVE BUILDING, NMPA ”**. Or any other works incidental to such 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)

Bank Information for E-Payment

1	Name and full address of the Bidder	
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	MICR code (should be 9 digit)	
7	Telephone/Mobile/Fax/ e-mail of the Bidder	<b>Telephone:</b>
		<b>Mobile:</b>
		<b>e-mail:</b>
8	<b>Xerox copy of a cheque should be enclosed</b>	
9	<b>PAN</b> (Xerox copy of <b>Permanent Account Number</b> shall be enclosed)	

Signature and seal of the Bidder

**DISPUTES REVIEW BOARD AGREEMENT**

*(To be executed on Rs.100/- non-judicial Stamp Paper)*

THIS AGREEMENT, made and entered into this Day of \_\_\_\_\_20\_\_\_\_\_ Between ("the Employer/ Board") and ("the Contractor"), and the Disputes Review Board ("the DR Board") consisting of One/three DR Board Members, (Members from either party, i.e contractor and Employer/ Board)

- (1) .....
- (2) .....
- (3) .....

[ Note Delete whatever is not applicable]

WITNESSETH, that

WHEREAS, the Employer/ Board and the Contractor have contracted for the execution of (P r o j e c t n a m e ) ( t h e "Contract") and WHEREAS, the contract provides for the establishment and operation of the DR Board NOW THEREFORE, the parties hereto agree as follows -

- 1. The parties agree to the establishment and operation of the DR Board in accordance with this DR Board Agreement.
- 2. Except for providing the services required hereunder, the DR Board Members should not give any advice to either party or to the Engineer or Engineer's Representative concerning conduct of the Works.

The DR Board Members

- (a) shall have no financial interest in any party to the contract or the Engineer or Engineer's Representative, or a financial interest in the contract, except for payment for services on the DR Board\_
- (b) shall have had no previous employment by, or financial ties to, any party to the contract, or the Engineer or Engineer's Representative, except for fee based consulting services on other projects, all of which must be disclosed prior to appointment to the DR 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 Engineer's Representative, and any and all prior involvement in the project to which the contract relates;
  - (d) shall not, while a DR Board Member, be employed whether as a consultant or otherwise by either party to the contract, or the Engineer or Engineer's Representative, except as a DR Board Member.
  - (e) shall not, while a DR Board Member, engage in discussion or make any agreement with any party to the contract, or with the Engineer or Engineer's Representative, regarding employment whether as a consultant or otherwise either after the contract is completed or after services as a DR Board Member is completed;
  - (f) shall be and remain impartial and independent of the parties and shall disclose in writing to the Employer/ Board, the Contractor, the Engineer or Engineer's Representative, and one another any fact or circumstances which might be such to cause either the Port or the Contractor to question the continued existence of the impartiality and independence required of DR Board Members.
- 3 Except for its participation in the DR Board's activities as provided in the contract and in this Agreement none of the Employer/ Board, the Contractor, the Engineer or Engineer's Representative, and one another any fact or circumstances which might be such to cause either the Employer/ Board or the Contractor to question the continued existence of the impartiality and independence required of DR Board Members.
- 4 The Contractor shall
- a) furnish to each DR Board Members one copy of all documents which the DR 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/ Board, co-ordinate the Site visits of the DR Board, including conference facilities and secretarial and copying services.
5. The DR 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 DR Board's issuance of its Recommendations on all disputes referred to it.
6. DR Board Member, shall not assign or subcontract any of their work under this

## Agreement

7. The DR Board Members are independent and not employees or agents of either the Employer/ Board or the Contractor.
8. The DR Board Members are absolved of any personal or professional liability arising from the activities and the Recommendations of the DR Board.
9. Fees and expenses of the DR Board Member[s] shall be agreed to and shared equally by the Employer/ Board and the Contractor. If the DR 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
10. DR Board Site visits:
  - a) The DR Board shall visit the Site and meet with representatives of the Employer/ Board and the Contractor and the Engineer or Engineer's Representative at regular intervals, at times of critical construction events, and at the written request of either party. The timing of Site visit failing agreement shall be fixed by the DR 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/ Board, the Contractor and the Engineer or Engineer's Representative.
  - c) If requested by either party or the DR Board, the Employer/ Board will prepare minutes of the meetings and circulate them for comments of the parties and the Engineer or Engineer's Representative.
11. Procedure for disputes referred to the DR Board :
  - a) If either party objects to any action or inaction of the other party or the Engineer or Engineer's Representative, the objecting party may file a written notice of Dispute to the other party with a copy to the Engineer or Engineer's Representative stating that it is given pursuant to Clause *[number]* 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 can

not be resolved without the assistance of the DR Board either party may refer the dispute to the DR Board by written Request for Recommendation to the Board, the other party and the Engineer or Engineer's Representative stating that it is made pursuant to (*insert relevant clause no.*).

- d) The Request for recommendation shall state clearly and in full detail the specific issues of the dispute to be considered by the DR Board.
- e) When a dispute is referred to the DR Board, and the DR Board is satisfied that the dispute requires the DR Board's assistance, the DR Board shall decide when to conduct a hearing on the dispute. The DR Board may request that written documentation and arguments from both parties be submitted to each DR Board Members 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/ Board, and the Engineer or Engineer's Representative shall each have ample opportunity to be heard and to offer evidence. The DR Board's Recommendations for resolution of the dispute will be given in writing, to the Employer/ Board, the Contractor and the Engineer or Engineer's Representative as soon as possible, and in any event not more than 28 days after the DR 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 DR Board. Private sessions of the DR Board may be held at any location convenient to the DR Board,
- b) The Employer/ Board, the Engineer or Engineer's Representative and the Contractor shall have representatives at all hearings.
- c) During the hearings, no DR Board Member shall express any opinion concerning the merit of any facet of the case.
- d) After the hearing is concluded, the DR Board shall meet privately to formulate its Recommendations. All DR Board deliberations shall be conducted in private, with all individual views kept strictly confidential. The DR Board's Recommendations, together with an explanation of its reasoning shall be submitted in writing to both parties and to the Engineer or Engineer's Representative. The Recommendations shall be based on the pertinent contract provisions, applicable laws and regulations, and the facts and circumstances involved in the dispute.

The DR 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 DR Board]

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

The Employer / Board and the Contractor shall jointly sign a notice specifying that the DR 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.

**ANNEXURE -9**

**DETAILS OF ONGOING CONTRACTS AT NMPA BEYOND 30.01.2022**

SI no	Work Order Description	Work Order no. & date	Work Order Value	Department which has issued the Work order	Date of completion as per work order

Sign & Seal of the Contractor

**ANNEXURE 10**

**VERIFICATION OF LOCAL CONTENT**

Tender no & Name of the work	Bidder shall enter, the % of Local Content (%)
Tender No. 8/6/2022/EE(E)I/Lift <b>SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF PASSENGER LIFT AT ADMINISTRATIVE BUILDING, NMPA</b>	

Sign & Seal of the Contractor

**UNDERTAKING ON INDEMNIFICATION**

We \_\_\_\_\_ (Bidders Name ) hereby agree and undertake to indemnify, keep indemnifies, depended and hold harmless the NMPA and its Officers against all losses, penalties, costs and expenses, duties of any kind whatsoever which may arise on account of breach un-authorized act, fraud deed or any other acts of ours or any of our personnel. We hereby further agree and undertake to indemnify and keep indemnifies against any order passed by any executive, quasi judicial or judicial authority wherein the NMPA is compelled to obey the order which arise due to breach of contract by us.

We \_\_\_\_\_(Bidders name ) shall indemnify, protect and defend at our own cost, New Mangalore Port Authority and its agents & employees from & against any/all actions, claims, losses or damages arising out of;

- i. Any violation in course of execution of the contract of any legal provisions or any right of third parties.
- ii. Failure to exercise the skill and care required for satisfactory execution of the contract.
- iii. Shall indemnify NMPA against all claims for compensation by or on behalf of any workman employed by us in connection with the contract, for injury or death by accident under the Workman Compensation Act (Act VIII of 1923) as amended from time to time.

We \_\_\_\_\_(Bidders name ) shall be responsible for all commissions and omissions on part of manpower engaged for the purpose. NMPA shall not be responsible in any manner whatsoever, in matters of injury/death/health etc. of our employees performing duties under the contract.

We \_\_\_\_\_(Bidders name ) hereby undertake that ,

- a. The workforce deployed under this contract will be provided with all the necessary safety gears and equipment for the job.
- b. Bidder/deployed staffs will follow all the required safety procedures while executing the job.

Sign and Seal of the Bidder/ Bidders Authorized representative

**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 supply of / Construction of ..... 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:

Witness:

1.....

Signature with Name, Designation & Address

2.....

Signature with Name, Designation & Address



## Compliance of Technical Specifications

Sl. No.	Particulars	Specifications	Compliance (Yes/No)	Remarks/Comments if any
1.	Application	Passenger, handicap/Divyangjan friendly		
2.	Type	Machine Room less		
3.	Machine Type and location	Permanent Magnet, Gearless machine located inside the elevator shaft in the overhead		
4.	Capacity	15 Persons, 1020 kG		
5.	level/stops	G+2 (3 levels and 3 openings)		
6.	Speed	1.0 meter per second with jerk less acceleration, deceleration		
7.	Drive and control	Simplex Collective Selective control, AC VVVF		
8.	Power supply	AC 415 Volts, 3 phase/1 Phase, 50cycles/sec.		
9.	Car design/enclosure	Stainless Steel Hair Line finish of 304 Grade SS with mirror finish SS panel on rear centered and handrail etc., Inner surface of Car door shall be Hairline finish stainless steel		
10.	Car door	2 panel Automatic Centre Opening in Stainless Steel hairline finish with ACVF drive		
12.	Car door protection	Multiband full height infra-red detector.		
13.	Landing doors	2 panel Automatic Centre Opening in Stainless Steel hairline finish on all floors. Door shall match to the Car Door		
14.	Direction & Position indicators	Large display LCD Car Position		

Sl. No.	Particulars	Specifications	Compliance (Yes/No)	Remarks/Comments if any
		Indicator in COP at lower height		
15.	Car Flooring	Anti-skid flooring slip resistant material having a slip resistance value of 45–70 (optimally 50–65), as measured with 4S to sugar rubber on a pendulum test.  Granite/marble flooring		
16.	Car lighting	LED light with auto as well as manual control. Lighting levels in the lift minimum of 100 lux (approximately 50–75 lux at floor level and shall be confirmed using Lux meter)		
17.	Ventilation	Cross flow blower fan in car for ventilation		
18.	Travel	As per drg.		
19.	COP suitable for physically handicap & Visually impaired	Protruding type Braille encrypted. Car buttons at a height easily accessible by wheelchair bound or visually impaired passenger.		
20.	Hall Fixtures	LED/LCD hall position indicators to benefit visually impaired and physically handicap users. Hall indicators with car arrival gong at a height not more than 1200mm from floor.		
21.	Car Emergency backup	Emergency Battery operated power supply (EBOPS) for light, alarm and a fan to be provided with electric power supply to the light in the car, when the main power supply is not available.  The operation to be automatic and no need of manual intervention to be required.		

Sl. No.	Particulars	Specifications	Compliance (Yes/No)	Remarks/Comments if any
22.	Safety Gear	Over speed Governor progressive type operating on Electro Mechanical basis.		
21	Car size	As per approved drawing and standard		
22.	Door opening	As per approved drawing and standard (Centre)		
23.	Pit depth	As per approved drawing and standard		
24.	Overhead height	As per standard		
25.	Hoist way dimensions	As per standard		
26.	Entrance height	As per standard		
27.	Inside car height	As per standard		
<b>Special Features</b>				
28.	Full length infrared safety light curtain infrared operated doors safety system			
29.	Large display LCD Car Position Indicator in COP at lower height			
30.	Hand rails on three sides with height not more than 900mm from floor			
31.	Voice announcement for all COP operations for visually impaired user Overload Warning with audio visual indicators			
32.	Auto fan and Light Cutoff, Automatic Rescue Device			
33.	Door open/Door close button in car			
34.	Provision for IP Addressable CCTV in the lift 2MP, fixed dome type, 120dB WDR, ON board storage with 128GB memory stick, vandal proof housing for the Lift Cabin			
35.	Anti-Nuisance Travel			
36.	3 way intercom system			
37.	Full collective logic control system to facilitate the optimum function of the elevator			
38.	Adjustable Door opening time			
39.	Main entrance floor selection and home floor parking selection			

Sl. No.	Particulars	Specifications	Compliance (Yes/No)	Remarks/Comments if any
40.	Alarm button in Car operating panel with battery back up			
41.	Automatic operation for Car fan			
42.	Braille on Push buttons			
43.	Car call cancellation			
44.	Door close and door open buttons in car operating panels			
45.	Door Closing retries			
46.	Full load bypass			
47.	Red dot matrix scrolling display in Car operating panel			
48.	Red dot matrix scrolling display in landing operating panel on all floors			
49.	Jammed landing operating panel call button by-pass			
50.	Motor overheat protection			
51.	Overload function with audio visual indication in car operating panel			
52.	Phase failure and phase reversal protection			
53.	Automatic rescue device in case of power failure			
54.	Fireman emergency return			
55.	Firemen control			
56.	Voice Synthesizer			
57.	Auto/Attendant function			
58.	60 minutes Fire Retardant Landing Doors			

- Deviation against the tender technical specifications is liable for rejection.
- Detailed technical specification with data sheet, drawings with make proposed by the bidder shall be submitted along with the technical bids

**BILL OF QUANTITIES****Name of Work: SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF PASSENGER LIFT AT ADMINISTRATIVE BUILDING, NMPA**

Sl. No.	Description	Qty/Unit	Rate	Amount
<b>PART-I LIFT and associated electrical works</b>				
1.	Design, Supplying, Erecting, Testing and Commissioning of 15 passenger lift with speed of 1Mtr/sec, variable voltage variable frequency drive, without machine room for the available well size, operating at 415 Volts 3 Phase, 50 cycles AC supply, stainless steel car entrance door enclosures with suitable colour vinyl flooring, LED car illumination, emergency light, intercom and fan as desired by the user, central opening door with attendant operation, 7 segment display buttons, call register indicator, fireman drive, SS handrails inside car, full length infrared curtain in car door, automatic rescue device with batteries, voice announcing in regional/international languages. Braille buttons with one year warranty and maintenance with necessary scaffolding and minor civil works like fixing of guide rail, counter weight etc.	1 Set		
2.	Associated Electrical Works: Providing earthings and connections as required as per OEM and standard, SITC of DB including MCB/ELCB complete for feeding power to lift motor and other devices/equipments of lift. This also includes supply and laying required cables and terminations complete, providing shaft lights and connections as required. This includes any other minor electrical works as necessary for complete the commissioning of the lift in full shape.	1 JOB		
<b>PART-II LIFT Shaft work and associated civil works</b>				
3.	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 Ordinary rock and soft rock upto 300mm depth as per drawing and technical specifications, including setting out, barricading, caution lights, including dressing of excavated surfaces, disposing off or levelling the excavated stuff or sorting & stacking the selected stuff for reuse in a radius of 50 m and lift upto 1.5 m including cost of labour, tools, usage & other appurtenances required to complete the work.	55.00 Cum		
4.	Dismantling of existing structures like culverts, bridges, retaining walls and other structure comprising of masonry, cement concrete, wood work, steel work, including T&P and scaffolding wherever necessary, sorting the dismantled material, disposal of unserviceable material and stacking the serviceable material with all lifts and lead by Mechanical Means (A) Cement Concrete Grade M-15 & M-20.	10.00 Cum		
5.	Providing Size Stone masonry with hard stone in foundation & plinth with Cement mortar 1:6 (1 cement : 6 coarse sand)	1.00 Cum		
6.	Providing & construction laterite size stone masonry including cost and conveyance of all materials curing etc complete as per specification I.S. 3620/1979 having compressive strength not less than 3.5 N/mm <sup>2</sup> for saturated dry samples- For foundation in CM 1:6	8.00 Cum		
7.	Providing and laying in position Reinforced cement concrete for all substructures of building, irrigation works, sub structure works of bridges, drain works & other parallel works from 0.5m to 3.50m height. The granite/trap/basalt crushed graded coarse aggregates and fine aggregates as per relevant IS codes machine mixed with super plasticisers, laid	8.00 Cum		

	in layers, well compacted using needle vibrators, providing weep holes wherever necessary, including all lead & lifts, cost of all materials of 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 & formwork to be paid separately) Mix 1:2:4 (M15) using 20mm nominal size graded crushed coarse aggregates.			
8.	Providing and laying in position Reinforced cement concrete for all substructures of building, irrigation works, sub structure works of bridges, drain works & other parallel works from 0.5m to 3.50m height. The granite/trap/basalt crused graded coarse aggregates and fien aggregates as per relevant IS codes machine mixed with super plasticisers, laid in layers, well compacted using needle vibrators, providing weep holes wherever necessary, including all lead & lifts, cost of all materials of quality, 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 & formwork to be paid separately). M25 design Mix using 20mm nominal size graded crushed coarse aggregates.	16.00 Cum		
9.	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). M25 Design Mix Using 20 mm nominal size graded crushed coarse aggregates.	26.00 Cum		
10.	Providing and removing centering, shuttering, strutting, propping etc., and removal of form work for foundations, footings, bases of columns for mass concrete including cost of all materials, labour complete as per specifications.	16.00 Cum		
11.	Providing and removing centering, shuttering, strutting, propping etc., and removal of form work for columns, pillars, post and struts, square I rectangular/ polygon in plan including cost of all materials, labour complete as per specifications.	6.00 Cum		
12.	Providing and removing centering, shuttering, strutting, propping for beams, lintel beam , slabs , concrete wall suspended floor,roof, balconies etc., and removal of form work for vertical surface such as walls at any thickness, including attached pilasters, buttresses, plinth cills and string courses cost of all materials, labour complete as per specifications.	26.00 Cum		
13.	Additional lift charges for removing centering, shuttering, strutting, propping for beams, lintel beam , slabs , concrete wall suspended floor,roof, balconies etc., and removal of form work for vertical surface such as walls at any thickness, including attached pilasters, buttresses, plinth cills and string courses cost of all materials, labour complete as per specifications. from 5.00m and above.	17.00 Cum		
14.	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations and other similar works etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m	4.00 Cum		

	and lift upto 1.5 m.			
15.	Providing Thermo-Mechanically Treated Bars of grade Fe-550 steel reinforcement for R.C.C work ready to use "cut and bend" rebars of approved make from factory/workshop to construction site including placing in position, binding and anchoring to adjacent members wherever necessary complete as per Design including cost of material, labour, usage charges complete as per specifications.	5.545 MT		
16.	Providing and fixing new 9mm PVC laminated false ceiling suspended with the frame work and accessories completed from the roof slab, beams etc. by means of aluminium angles , J bolts, Tee runners and edge trim etc. including cost of materials , labours, lead and lift upto first floor including the cement patch work after removal of the existing damaged false ceiling finishing etc. complete as per specification.	10.00 Sqm		
17.	Providing 12 mm cement plaster finished with a floating coat of neat cement of mix :1:3 (1 cement: 3 fine sand) to brick masonry 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.	420.00 Sqm		
18.	Providing and applying white cement based putty of average thickness 1 mm, of approved brand and manufacturer, over the plastered wall surface to prepare the surface even and smooth complete as per specifications and as per directions of Engineer in charge.	26.00 Sqm		
19.	Wall painting with acrylic emulsion 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.	420.00 Sqm		
20.	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.	5.50 Sqm		
21.	Providing and fixing in position aluminium windows and ventilators as per approved drawings with sliding shutters using double track window frame section of size 61.85x31.75mm. With 1.2mm thick, bottom section weight 0.695 kg/m, sides and top sections 1.3 mm. thick weight 0.659 kg/m; and shutter comprising top and bottom section of size 40mmx18mm, 1.25mm thick 0.417 kg./m; shutter outer side 40mmx18mm, 1.25mm.thick weight 0.417 kg/m, shutter interlock section 40mmx 26.7mm, 1.1mm thick, weight 0.469 kg/m. the shutters mounted on nylon rollers with approved quality of fixtures such as aluminium handles tower bolts etc.; and providing and fixing 5.5mm thick plain glass for shutters fitted with rubber beading aluminium sections including cutting to required length, joints mitred subdividing the frame tenoned and rivetted in the assembled frame stiffened with end clips at corners angles etc, and fixed to the walls, lintels, floor beams/cills as the case may be with necessary steel screws, rawl plugs, or teak wood gatties including cutting masonry or concrete and making good the original surface using cement mortar, aluminium sections using aluminium section anodized to 12-15 microns.	2.20 Sqm		
22.	Providing and fixing M.S. grills of required pattern in frames	40.00 Kgs		

	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.			
23.	Providing and fixing of wall cladding using 20mm thick gang saw water cut Shiva gold granite, grey granite in CM 1:3 (1 cement : 3 coarse sand) proportion cut to required shape, pattern with paper joints, finished with cement mortal using white cement and colour pigments to match the colour of slab making through jointing with sealant, making holes 25mmx12mm grooves in joints including cost of all materials, mortar, labour, curing etc., complete.	73.00 Sqm		
24.	Providing & fixing of 12mm toughened Glass for entrance door and window including cost of glass making holes , cutting , hard ware and fixtures , logistics , handles all fixtures , handling charges, transporting and insatlation charges , labour charges , tools and plants charges, floor mount hydraulic door clouser and all other incidental charges etc. complete.	17.00 Sqm		
25.	Removing and refixing the existing ACP sheet provided to the LED display at the entrance, the rate including cost of addition al materials , labour charges , cost of shifting , cost of machinary, lift and lead etc . Complete as directed by the engineer in charge at new location	7.00 Sqm		
Total				

**Note:**

1. Applicable GST shall be mentioned separately.
2. L1 will be considered based on **BOQ** exclusive of GST.



**PART- IV**

**NMPA BANK DETAILS**

**Name of the Payee:**

**The FA & CAO, NMPA, Panambur, Mangalore** for remitting Tender fee through NEFT / RTGS.

1	Name of the bank	State Bank of India, Panambur, Mangalore -575 010
2	Bank Account no.	10205649448
3	IFSC Code.	SBIN0002249
4	MICR Code.	575002011

**CHECK LIST****PART – V****Tender No:** 8/6/2022/EE(E)/Lift**Dated:** 29.09.2022**SCHEDULE FOR CHECKLIST OF DOCUMENTS TO BE UPLOADED ALONG WITH  
TECH NO-COMMERCIAL BID**

<b>DETAILS OF DOCUMENT TO BE SUBMITTED</b>		<b>YES</b>	<b>NO</b>	
<b>TECHNICAL BID</b>	1	EMD & Tender fee or supporting document for exemption of EMD /Tender Fee as per clause 2.2.1 (n)		
	2	Supporting documentary evidence of work orders and satisfactory completion certificate issued by the client duly self attested and TDS certificate of the supporting work.		
	3	Copies of profit and loss Account statements, balance sheet and Auditor's report for the last three years, endorsed by Chartered Accountant with attestation.		
	4	Certificates a) GST Registration Certificate. b) Pan card copy c) ESI Registration Certificate d) PF Registration Certificate		
	5	Tender Document, sealed and signed by the bidder along with Pre-bid replies, Corrigendum/Addendums if any.		
	6	a) Annexure – 1 -Particulars of Bidder. b) Annexure – 2 – Tender Form c) Annexure –5 – Format of Declaration d) Annexure – 6 –Power of Attorney e) Annexure – 7 – Bank information for E-payment f) Annexure 8 - Dispute review Board agreement g) Annexure –9–Details of ongoing Contracts at NMPA h) Annexure – 10- Verification of Local Content i) Annexure – 11- Undertaking on indemnification j) Annexure – 12- Indemnity Bond k) Annexure-13 Compliance of Technical Specifications		
	7	Technical specification data sheet and make of proposed lift		
<b>PRICE Bid</b>	<b>PART-III - Price Schedule (Online Mode Only)</b>			