



S N BOSE NATIONAL CENTRE FOR BASIC SCIENCES

SECTOR-III, BLOCK-JD
SALT LAKE, KOLKATA-700106

e-TENDER DOCUMENTS

FOR

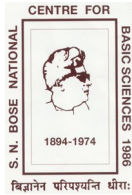
**CONSTRUCTION OF VSM LAB BUILDING FOR BALANCE CIVIL
WORKS AT SNBNCBS**

TENDER REFERENCE: SNB/ENGG/TENDER/2017/05 Dt. 13 .10.2017

C O N T E N T S

Sl. No.	Description	Page No.-
1.	Notice Inviting Tender	4
2.	Instruction to Bidders for e-Tendering	7
3.	Interpretation	11
4.	General Conditions of Contract	
	4.1 Earnest Money (EMD)	12
	4.2 Forfeiture of EMD	12
	4.3 Security Deposit	12
	4.4 Refund of Security Deposit	12
	4.5 Time and Extension for Delay	12
	4.6 Arbitration	13
	4.7 Removal of Improper Work	13
	4.8 Cancellation of Work	13
	4.9 Payment	13
	4.10 Clearing Site on Completion	13
	4.11 Statutory Deduction of Taxes	14
	4.12 Brief Specification	14
	4.13 Superintendence of Supervision	14
	4.14 Failure By Contractor to Comply with the Centre's Instruction	14
	4.15 Tenderer Shall Visit the Site	14
	4.16 Labour License and Insurance	14
	4.17 Contractor to Provide Everything Necessary	14
	4.18 Defects After Completion	14
	4.19 Escalation	15
	4.20 Excepted Matters	15
	4.21 Protective Measures	15
	4.22 Materials, Workmanship and Samples	15
	4.23 Variation/Deviation	16
	4.24 Force Majure	16
	4.25 Royalties & Patents	17
	4.26 Schedule of Completion Work	17
	4.27 Labour & Payment Wages to Labour	17
	4.28 Suspension	17
	4.29 Termination of Contract	17
	4.30 Compensation For Delay	17
	4.31 Agreement	17
	4.32 Conflict of Clauses	18
	4.33 Declaration	18
5.	Special Conditions of Contract	
	5.1 Handing Over of The Site	19
	5.2 Time of Completion	19

	5.3 Taxes and Duties	19
	5.4 Payment	19
	5.5 Advance	19
	5.6 Timing of Working Hours	19
	5.7 Accommodation of Workmen	19
	5.8 Entry of Contractor's Labours and Staffs	19
	5.9 No-smoking Zone	19
	5.10 Entry and Exist of Construction and Other Materials	19
	5.11 Bid Validity	19
	5.12 Materials	20
	5.13 Makes and Brands	20
	5.14 Testing of Materials and Workmanship	20
	5.15 Inspection and Testing at Manufacturer's Works	20
	5.16 Power	20
	5.17 Water Supply & Land for Contractor's Use	20
	5.18 Drawings	20
6.	Technical Specifications	21
7.	Preferred List of Materials	65
18.	Form of Agreement	67
19.	Bill Format	69



SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

[Funded by the Department of Science & Technology, Government of India]

BLOCK JD, SECTOR III, SALT LAKE, KOLKATA- 700 106

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EMAIL: sujit@bose.res.in

Ref. SNB/ENGG/NIT/2017-18/5

Date: 13.10.2017

Notice Inviting e-Tender

E-Tender is hereby invited for the following work in two parts (Technical and Price Bids) through E-Tender mode available at <http://eprocure.gov.in/eprocure/app> or click at SNBNCBS@CPPP with <http://newweb.bose.res.in/InfoAnnouncements/Tender.jsp>

Sl. No.	Name of Work
01	CONSTRUCTION OF VSM LAB BUILDING FOR BALANCE CIVIL WORKS AT SNBNCBS

You are requested to visit <http://eprocure.gov.in/eprocure/app> or click at SNBNCBS@CPPP within www.bose.res.in to participate in the E-Tender.

For participation in E-Tendering process, one time registration is to be made in the Central Public Procurement Portal (CPPP), if not already registered.

Schedule of Dates for E-Tendering:

Sl. No.	Activity	Date & Time
01	Publication Date	13-10-2017 at 16-00 Hrs
02	Document Download Start Date	14-10-2017 at 11:00 Hrs.
03	Pre-bid Discussion	23-10-2017 at 15:00 Hrs.
04	Bid Submission Start Date	24-10-2017 from 16:00 Hrs
05	Bid Submission End Date	06-11-2017 upto 17:00 Hrs.
06	Last Date of Physical Submission of EMD/MSME certificate and hard copy of scanned documents	08-11-2017 upto 17:00 Hrs.
07	Technical Bid Opening Date	10-11-2017 at 15:00 Hrs.



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sd/-

Shohini Majumder

Registrar

Ref: SNB/ENGG/NIT/2017-18/5

Date: 13.10.2017

Name of Work: CONSTRUCTION OF VSM LAB BUILDING FOR BALANCE CIVIL WORKS AT SNBNCBS

1. E-tender is invited under Two-bid system from bona-fide, resourceful and experienced PSUs/contractor firms with sound financial health, in prescribed format, by the Registrar on behalf of SNBNCBS for "**CONSTRUCTION OF VSM LAB BUILDINGS FOR BALANCE CIVIL WORKS AT SNBNCBS**, at Salt Lake, Kolkata -700106 ". Firms satisfying the following criteria may apply in the format given at **Annexure-I** along with relevant documents and testimonials.

1.1 Qualifying criteria:

i. Firms should have relevant experience of having successfully completed similar construction works in last five years. Minimum single work order value should be Rupees 8 lakhs or for two similar works value Rs 6.0 lakhs each or three similar works value 5.0 lakhs each .

ii. Firms should have working experience with CPWD / State PWD / MES / Railways / BSNL / Reputed Central or State PSUs /Autonomous Body.

iii. Average annual financial turnover during last 3 (three) years ending 31.03.2017 should be minimum of Rupees 40 lakhs. Firms should furnish either audited or certified by a Chartered Accountant in support of above criterion.

2. The Firms are requested to visit <http://eprocure.gov.in/eprocure/app> or click at SNBNCBS@CPPP within www.bose.res.in to participate in the E-Tender.

For participation in E-Tendering process, one time registration is to be made in the Central Public Procurement Portal (CPPP).

3. The last date of submission of tender is as per schedule in Page 4.

4. Regarding Details about Date of submission and opening etc. refer NIT.

5. In the event of any difficulties while uploading the e-tender, the tenderer may contract the help desk number of NIC i.e 1800 111 555 or any other valid number.

6. All updates/corrigendum/Amendment etc will be uploaded at Centre's Website and CPP Portal.

E-Tenders are invited from bidder for the following work:

- | | | |
|---|---|---|
| 1. Name of Work | : | CONSTRUCTION OF VSM LAB BUILDING FOR
BALANCE CIVIL WORKS AT SNBNCBS |
| 2. Time of Completion | : | 4 Months |
| 3. Estimated Cost in Rs. | : | Rs 12.00 Lakh |
| 4. Earnest Money Deposit | : | Rs. 24,000=00 (Rupees Twenty Four Thousand only) in the form of Demand Draft/ Bankers Cheque/Digital Transfer in favour of "S. N. Bose National Centre for Basic Sciences", payable at Kolkata. |
| 5. Cost of tender documents | : | NIL |
| 7. Last date and time of submission of tenders | : | Soft copy by 06.11.17 upto 17-00 hrs, Hard copies and EMD by 08.11.17 upto 17-00 hrs. |
| 8. Address of correspondence | : | Registrar, S. N. Bose National Centre for Basic Sciences ,Block-JD, Sector-III, Salt Lake, Kolkata- 700 106. |
| 9. Date of Pre Bid Discussion | : | as per schedule in Page 4 |
| 10. Date and time of opening of Technical Bid | : | as per schedule in Page 4 |
| 11. Date & Time of Price Bid opening | : | To be notified later. |
| 12. Hard Copy Submission | : | Cover-I shall contain EMD and cover II shall contain all other documents which may be placed in large envelope by superscribing the name of work, Tender ref no, Contact details of the agency etc. |
| 14. Place of Hard Copy submission | : | At the reception of S N Bose National Centre for Basic Sciences, Block-JD, Sector-III, Salt Lake, Kolkata 700 106 (Not in the Tender Box). |

Note:

- I. The Centre reserves the right not to open the Technical Bid if sufficient number of valid offers is not received.
- II. The Centre will not bound to accept the lowest tender and reserves the right to accept or reject any or all the tenders received and to place order to one or more firms without assigning any/one reason thereof. The notification of award of contract will be made in writing to the successful tenderer by the Centre.

sd/-
Shohini Majumder
Registrar

INSTRUCTIONS TO BIDDERS FOR e-TENDERING

Instructions/Guidelines for electronic submission of the tenders are mentioned below for assisting the bidders to participate in e-Tendering.

1. Registration of bidder:

Any bidder willing to take part in the process of e-Tendering will have to be enrolled & registered with the e-Procurement system, through logging on to <http://eprocure.gov.in/eprocure/app>.

2. Digital Signature certificate (DSC):

Each bidder is required to obtain a Class-II or Class-III Digital Signature Certificate (DSC) for submission of bids.

3. The bidder can search and download NIT & Tender Documents electronically from the website mentioned in <http://eprocure.gov.in/eprocure/app> using the Digital Signature Certificate. This is the only mode of collection of Tender Documents.

4. Submission of Documents (mandatory):

a) General process of submission

Bid to be submitted online through the website <http://eprocure.gov.in/eprocure/app>. All the documents uploaded by the Tender Inviting Authority form an integral part of the contract. Tenderers are required to upload all the tender documents along with the other documents, as asked for in the tender, through the above website within the stipulated date and time as given in the Tender. Tenders are to be submitted in two folders - one is Technical Bid and the other is Financial Bid. The tenderer shall carefully go through the documents and prepare the required documents and upload the scanned documents in Portable Document Format (PDF) to the portal in the designated locations of Technical Bid for the following :-

- i) EMD document (Draft/Pay order/Digital acknowledgement or valid NSIC/MSME document).
- ii) Certificates of Experience with valid completion certificate
- iii) Audited or CA certified statement in support of last three years' turn-over
- iv) Trade Licence
- v) PAN

vi) Service Tax/GST Registration certificate

Besides, the contractor may submit any other document in support of his credentials as he wishes to submit.

The bidder needs to download the Forms/Annexure, fill up the particulars in the designated Cell and upload the same in the designated location of Technical Bid. Bidder needs to download the BOQ, fill up the rates of items in the BOQ in the designated Cell and upload the same in the designated location of Financial Bid.

The documents uploaded shall be virus scanned and digitally signed using the Digital Signature Certificate (DSC). Tenderers should take note of all the addendum/corrigendum related to the tender and upload the latest documents as part of the tender.

5. Technical Bid:

The Technical Bid shall contain scanned copies and/or declarations in the following standardized formats in two covers (folders).

5.1 The **Statutory Cover** should contain the following documents:

Folder Name	Sn	Document Description
NIT	1	NIT Document
EMD	2	Scanned copy of Earnest Money Deposit (EMD) in the form of Demand Draft/ Pay Order/Digital Transfer in favour of "S. N. Bose National Centre for Basic Sciences", payable at Kolkata.
Item Details along with Terms & conditions	3	Technical details of the offered item in compliance with the specification mentioned in the NIT along with bidders terms & conditions to be furnished on bidders letter head duly sealed and signed.
Annexure	4	Duly filled ANNEXURE-I in the prescribed format with seal & signature.

5.2 **Non-Statutory Cover (My Documents)**

S/n	Category	Sub Category	Sub Category Description
01	Certificate Details	Bidders Address	Bidders Address Format Details
		Experience Certificate	Completion certificate from the clients with their contact number and address.
		Permanent Account Number	PAN & Trade License Certificate

		Company Registration Certificate	Registration Certificate Details
		Service Tax/GST	Service Tax/GST Registration Certificate
02	Financial Details	Bank details	Bank details of the beneficiary to be mentioned.
		Annual Turn over certificates from CA	Firms should furnish either Audited or certified by a Chartered Accountant in support of the criterion.
		Audited/Certified Profit and Loss Account and Balance Sheet Details for last 3 years	Average annual financial turnover during last 3 (three) years ending 31.03.2017 should be minimum of Rupees 40 Lakhs.
03	Work Details	Work Completed Certificate Copies	Firms should have relevant experience of having successfully completed similar works in last seven years.

6. Submission of original copies of documents of Earnest Money Deposit:

6.1 Place of submission: The original Demand Draft/Pay order/acknowledgement of digital transfer towards Earnest Money Deposit shall be submitted in the following office:

Registrar

S. N. Bose National Centre for Basic Sciences;

Block-JD, Sector-III; Salt Lake;

Kolkata – 700106.

In case, the original EMD is not received within due date, the technical bid of the concerned tenderer will not be opened.

6.2 Procedure of submission of Bids:

- a) **Technical bid:** The Techno-commercial part has to be submitted in Technical Bid Folder on CPP Portal enclosing all the documents as described in the clause no 5.1 and 5.2.
- b) **Price Bid :** The Price-bid has to be submitted in Financial Bid Folder on CPP Portal only. **Hard copy of the price-bid must not be submitted in the envelope under any circumstances and this will make the offer as liable for rejection.**

6.3 Time of submission of hard copies: The EMD in the form of original DD/Pay order/Digital transfer document of copy of NSIC/MSME certificate along with hard copies of uploaded scanned documents shall be submitted in a sealed envelope in the office as stated above within the date and time as specified in the NIT. If the bidder fails to submit the EMD within the due date and time, his tender will not be opened and his bid will stand rejected. The tender reference no. should be mentioned on top of the EMD envelope.

a. Opening and evaluation of tender:

7.1 Opening of Technical Bid

- i. Technical Bid will be opened by the Tender Inviting Authority or his authorised representative electronically from the website stated above, using their Digital Signature Certificate.
- ii. Technical Bid for those tenders whose original copies of DD/Banker's cheque/Digital transfer document towards EMD have been received will only be opened. Bid corresponding to which original DD/Banker's cheque/Digital transfer document towards EMD has not been received, will not be opened and will stand rejected. PSUs are exempted from depositing EMD.
- iii. Decrypted (transformed into biddable format) documents of the statutory and non-statutory Covers will be downloaded for the purpose of evaluation.

7.2 Techno-commercial Evaluation of Tender

- i) While evaluation, the Tender Inviting Authority or his authorised representative may summon of the tenderers and seek clarification / information or additional documents or original hard copy of any of the documents already submitted and if these cannot be produced within the stipulated timeframe, their proposals will be liable for rejection.
- ii) The list of tenderers, whose bids will be found technically eligible, will be uploaded in the web portals. Date of opening of financial bid will be intimated to the techno-commercially qualified tenderers.

7.3 Opening and evaluation of Financial Bid

- i. Financial Bid of the tenderers declared technically eligible, will be opened electronically by the Tender Inviting Authority from the web portal stated above on the prescribed date.
- ii. The encrypted copies will be decrypted and after opening of the Financial Bid the preliminary summary result containing inter-alia, name of bidders and the rates quoted by them will be uploaded.
- iii. The Tender Accepting Authority may ask any of the tenderers to submit analysis to justify the rate quoted by that tenderer.

Annexure-I

Name of Work: CONSTRUCTION OF VSM LAB BUILDING FOR BALANCE CIVIL WORKS AT SNBNCBS

Advertisement Ref

- 1. Name of the Firm:
- 2. Address:
- 3. Email:
- 4. Contact No.:
- 5. Contact Person:
- 6. PAN:Enclose Proof
- 7. GST No. :Enclose Proof
- 8. Service Tax Reg. No. (if any).....Enclose Proof
- 9. Document checklist: (Strike out which is not applicable)

Attachment	Document	Submitted	
		Yes	No
A	List of relevant work executed during last seven years indicating Executed / Order value. Completion Certificate for completed jobs and Work Order for ongoing job (if any) to be furnished in support as per criteria	Yes	No
B	Valid Registration for Trade licence, Service Tax /GST etc .	Yes	No
C	Certificate (either Audited or CA Certified) in support of last 3 years average annual turnover.	Yes	No

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Note: Offer received without any of the relevant information / certificate / document asked in the above may not be considered. The Centre reserves the right to accept or reject offer of the tenderer. The Centre's decision shall be final and binding on the tenderer.

Signature by authorized signatory of the firm with Official Seal and Date

Interpretation

In construing these conditions, the specifications, the Bill of quantities, tender and agreement, the following words shall have the meaning herein assigned to them except where the subject or context otherwise requires:

- i) **The Centre:** The term Centre shall denote Satyendra Nath Bose National Centre for Basic Sciences, Block –JD, Sector-III, Salt Lake, Kolkata-700106 or any of its employees /representatives authorised on their behalf.
- ii) **Site Engineer:** The term Site Engineer shall mean the person/s appointed and paid by the Centre to superintend the work.
- iii) **The Contractor/Agency/Vendor:** The Contractor/Agency/Vendor shall mean the individual or individuals, firm or company, whether incorporated or not, undertaking the works and shall include the legal personal representative of such individual or the persons composing such firm or company, or the successors of such firm or company and the permitted assignees of such individual, firm or company.
- iv) **Site:** The site shall mean the site where the works are to be executed in the campus as shown in the drawing.
- v) **Drawing:** The work is to be carried out in accordance with drawing, CPWD specifications, the Bill of quantities and any further drawings, instructions etc. which may be given by the Engineer-in- charge on behalf of Centre during execution of the work.

In case any detailed drawings are necessary, contractor shall prepare such detailed drawings and have it confirmed/approved by the Centre prior to taking up such work.

- vi) **The Work:** The Work shall mean the work or works to be executed under this contract.
- vii) **The Bill of Quantities (BOQ):** The Bill of Quantities' shall mean the schedule of quantities as specified and forming part of this contract.
- viii) **"Price Schedule of Quantities"** shall mean the Bill of quantities duly priced with the accepted quoted rates of the contractor.
- ix) **The Bid/Tender** shall mean the proposal /offer along with the supporting documents, submitted by the bidder for consideration by the Centre.
- x) **The Bid/Quotation document** shall mean the documents issued by the Centre to prospective bidders, containing various terms and conditions, scope of work, any requirements etc. or generally laid and in various sections spelling out the basis, procedure, modes, methods and formalities of the bidder to prepare their BIDs for submission to the Centre. The BID documents shall include the invitation to BID, instructions, proposal forms and all addenda/corrigenda/amendments issued by the Centre.

- xi) The **Letter of Acceptance (LOA)**: for the BID shall mean an official invitation from the Centre to successful bidder to the effect that his/their BID has been accepted in accordance with the provisions contained therein.
- xii) The **Letter of Acceptance (LOC)**: The letter by which the contractor is informed to commence the work after taking over the site from the Centre which may also be known as the work order. This LOC/work order will be issued after submission of Performance Guarantee Bond.
- xiii) The **Contract** means the documents forming the tender and acceptance thereof and the formal agreement executed between the Competent Authority of the Centre and the contractor, together with the documents referred to therein including these conditions, the specification, designs, drawings and instructions issued from time to time by the Engineer-in-charge and all these documents taken together, shall be deemed to form one contract and shall be complementary to one another.
- xiv) The **Month** shall mean the calendar month according to the Christian calendar. **Day** unless herein expressly defined otherwise shall mean Christian calendar day of 24 hours.
- xv) **Engineer in-Charge**: The technical representative as appointed by the Centre, being in charge of the work from the Engineering Section of the Centre.

General Conditions of Contract

Except where-provided for in the description of individual items in the Bill of Quantities and in the specification and Special conditions laid down herein after and in the drawings, the work shall be carried out as per standard CPWD, unless otherwise specifications and under the direction of the Engineer-in-charge of the Centre.

- i) **Earnest Money (EMD)**: The tenderer will have to deposit an amount as mentioned in the NIT in the form of Demand Draft/Pay Order/Digital Transfer drawn in favour of the **S N Bose National Centre for Basic Sciences** at the time of submission of tender as an Earnest Money, except those who are registered with the NSIC or MSME. The Centre is not liable to pay any interest on the Earnest Money. The Earnest Money of the unsuccessful tenderers will be refunded without any interest soon after the decision to award the work is taken or after the expiry of the validity period of the tender.

A sum of 5% of the gross amount of the bill shall be deducted from each RA bill of the contractor till the sum along with the sum already deposited as Earnest Money, with amounts to Security Deposit @ 5% of the work order value of the work. In addition the contractor will be required to deposit an amount equal to 5% of the work order value of the contract as Performance Guarantee within fifteen days of the issue of Letter of Acceptance.

Performance Guarantee May be accepted as Bank Guarantee of any bank (except co-operative bank/Gramin Bank) on a Kolkata Branch.

The Security Deposit and Performance Guarantee may be refunded without any interest within 14 (fourteen) days after the end of defects liability period provided he has satisfactorily carried out all the work and attended to all defects in accordance with the conditions of the Contract.

- ii) **Forfeiture of EMD**: EMD of a Tenderer will be forfeited, if the Tenderer withdraws or amends the quotation or impairs or derogates from the tender in any respect within the period of validity of the tender. Further, if the successful tenderer fails to furnish the required Performance Bank Guarantee or does not start the work within the specified period, the EMD will be forfeited.
- iii) **Security Deposit**: The Security Deposit shall be deducted from the Running Account Bills/Final Bill at 10% of the certified bill value. The EMD shall form part of the Security Deposit. The ceiling limit of deduction of Security Deposit is 5% of the Work Order value.
- iv) **Refund of Security Deposit**: The Security Deposit may be refunded without any interest after the expiry of the defect liability period as mentioned in Special condition of contract provided the Contractor has satisfactorily carried out all work and attended to all defects in accordance with the conditions of the work.

v) **Time and Extension for Delay:** The time allowed for execution of the Works as specified in the relevant clause of Special Condition of Contract or the extended time in accordance with these conditions shall be the essence of the Contract. The execution of the works shall commence from such time period as mentioned in Special Condition of Contract or from the date of handing over of the site whichever is later. If the Contractor commits default in commencing the execution of the work as aforesaid, the Centre shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the performance guarantee absolutely.

- a) As soon as possible after the Contract is concluded, the Contractor shall submit a Time and Progress Chart for each mile stone and get it approved by the Department. The Chart shall be prepared in direct relation to the time stated in the Contract documents for completion of items of the works. It shall indicate the forecast of the dates of commencement and completion of various trades of sections of the work and may be amended as necessary by agreement between the Centre and the Contractor within the limitations of time imposed in the Contract documents, and further to ensure good progress during the execution of the work, the contractor shall in all cases in which the time allowed for any work, exceeds one month (save for special jobs for which a separate programme has been agreed upon) complete the work as per mile stones given in Special Condition of Contract.
- b) If the work(s) be delayed by:-
 - (i) force majeure, or
 - (ii) abnormally bad weather, or
 - (iii) serious loss or damage by fire, or
 - (iv) civil commotion, local commotion of workmen, strike or lockout, affecting any of the trades employed on the work, or
 - (v) any other cause which, in the absolute discretion of the Engineer-in-Charge is beyond the Contractor's control.

Then upon the happening of any such event causing delay, the Contractor shall immediately give notice thereof in writing to the authority but shall nevertheless use constantly his best endeavors to prevent or make good the delay and shall do all that may be reasonably required to the satisfaction of the Engineer-in-Charge to proceed with the works.

- c) Request for rescheduling of Mile stones and extension of time, to be eligible for consideration, shall be made by the Contractor in writing within fourteen days of the happening of the event causing delay. The Contractor may also, if practicable, indicate in such a request the period for which extension is desired.
- d) In any such case the authority as indicated in the Special Condition of Contract may give a fair and reasonable extension of time and reschedule the mile stones for completion of work. Such extension or rescheduling of the milestones shall be communicated to the Contractor by the authority in writing. Non application by the contractor for extension of time/rescheduling of the milestones shall not be a bar for giving a fair and reasonable extension/rescheduling of the milestones by the and this shall be binding on the contractor.

vi) **Arbitration:**

- a) Except as otherwise provided elsewhere in the contract, if any dispute, difference, question or disagreement or matter whatsoever, shall, before and after extended period, hereafter arises between the parties, as to the meaning, operation or effect of the contract or relating to the contract or breach thereof, shall be referred to sole Arbitrator to be appointed by the Director of the Centre at the time of dispute.
- b) It is a term of the contract that the party invoking arbitration shall specify all disputes to be referred to arbitration at the time of invocation or arbitration under the clause.
- c) It is a term of the contract that the cost of arbitration will be borne by the parties themselves equally.
- d) The venue of arbitration shall be Kolkata.
- e) Subject to aforesaid, the provisions of the Arbitration and Conciliation Act 1996 and any statutory modification or re-enactment thereof rules made hereunder and for the time being in force shall apply to the arbitration proceeding under this clause.

vii) **Removal of Improper Work:** The Centre shall during the progress of the work have power to order in writing from time to time the removal of the improper work from the site within such reasonable time or

times as may be specified in the order of any materials which in the opinion of the Centre are not in accordance with specification or instructions, the substitution or proper re-execution of any work executed with materials or workmanships not in accordance with the drawings and specifications or instructions. In case the contractor refuses to comply with the order, the Centre shall have the power to employ and pay other agencies to carry out the work and all expenses consequent thereon or incidental thereto as certified by the Centre shall be borne by the contractor or may be deducted from any money due to or that may become due to the contractor. No certificate which may be given by the Centre shall relieve the contractor from his liability of unsound work or bad materials.

- viii) **Cancellation of Work:** The Centre reserves the right to cancel the work order, without assigning any reason thereof, if the contractor fails to i) submit the requisite amount of Performance Bank Guarantee in the form of DD or BG within a stipulated time period or ii) If the contractor fails to commence the work within 15 days of issue of LOC/Work order or iii) if the progress is found to be extremely poor without a valid reason.
- ix) **Payment:** Payment will be made after satisfactory execution of the work in part or full and after verification/certification of bill by the Engineering in-charge of the Centre on the bills submitted by the contractor in the prescribed format.
- x) **Clearing site on Completion:** On completion of the works the contractor shall clear away and remove from the site all constructional plant, surplus materials and rubbish to the satisfaction of the Centre.
- xi) **Statutory Deduction for Taxes:** The Statutory deduction of income tax/GST or any other tax as per applicable rules will be deducted from all interim and final payment to be made to the contractor.
- xii) **Brief Specification:** The work shall be carried out as per schedule of items of work, CPWD specification and direction of the Engineer-in-charge.
- xiii) **Superintendence of Supervision:** The Contractor shall give all necessary personal Superintendence during the execution of the work and this obligation and liability will continue (a) till completion of the work and (b) thereafter expiration of defects liability period after satisfactory completion of the work. The contractor shall also during the whole time of work when in progress employ a competent representative who shall be constantly in attention at the site while his men are at work. Any directions, explanations, instructions or notices given by the Centre to such representative shall be deemed to have been given and duly served on the contractor.
- xiv) **Failure by Contractors to Comply with Centre's Instruction:** The quantities shown in the schedule of quantities are tentative. The Centre reserves the right to execute only a part or the whole or any excess of the work thereof without assigning any reason thereof. If the contractor after receipt of written notice or verbal order from the Centre and requiring compliance within ten days fails to comply with such further drawings and/or Centre's instructions, the Centre may employ other person to execute any such work whatsoever that may be necessary to give effect thereto and pay all cost incurred in connection therewith and same shall be recoverable from the contractor by the Centre as a debt or shall have right to deduct same from any money due or to become due to the contractor.
- xv) **Tenderer shall Visit the Site:** Intending Tenderer shall visit the site and make himself thoroughly acquainted with the local site condition, nature and requirements of the works, facilities of transport condition, effective labours and materials, access and storage for materials and removal of rubbish. The Tenderer shall provide in their tender for cost of carriage, freight and other charges as also for any special difficulties and including police restriction for transport etc. for proper execution of works as indicated in the drawings. The successful Tenderer will not be entitled to claim of compensation for difficulties faced or losses incurred on account of any site condition which existed before the commencement of the work or which in the opinion of the Centre might be deemed to have reasonably been inferred to be so existing before commencement of work.
- xvi) **Labour Licence and Insurance:** On receipt of the work order, the contractor has to take the Workmen Compensation Insurance and also labour licence, if applicable, for the workmen being deployed under him for the entire duration of the work as per rules.
- xvii) **Contractor to provide Everything Necessary:** The Contractor shall provide everything necessary for the proper execution of the work according to the intent and meaning of the drawings, schedule of quantities and specifications taken together whether the same or may not be particularly shown or described therein

provided that the same can reasonably be inferred there from and if the Contractor finds any discrepancies therein he shall immediately and in writing, refer the same to the Centre whose decision shall be final and binding. The Contractor shall provide himself for ground and fresh water and electricity, fuel etc. for carrying out of the works at his own cost. The Centre shall on no account be responsible for the expenses incurred by the Contractor for hired ground or fresh water obtained from elsewhere

The rates quoted against individual items will be inclusive of everything necessary to complete the said items of work within the completion of the contract and beyond the unit price no extra payment will be allowed for incidental or contingent work, labour and/or materials inclusive of all taxes and duties whatsoever except for specific items, if any, stipulated in the contract documents.

The Contractor shall supply, fix and maintain at his own cost, for the execution of any work, all tools, tackles, machineries and equipments and all the necessary centering, scaffolding, staging, planking, timbering, strutting, shoring, pumping, fencing, boarding, watching, lighting etc. by night as well as by day required not only for the proper execution and protection of the said work but also for the protection of the erection, matters and things and the Contractor shall take down and remove any or all such centering, scaffolding, planking, timbering, strutting, shoring etc. as occasion shall be required or when ordered so to do and shall fully reinstate and make good all matters and things disturbed during the execution of the works to the satisfaction of the Centre.

- xviii) Defects after Completion:** The defect liability period of this work is 12 (twelve) months from the next date of satisfactory completion of the work. The contractor shall make good at his own cost and to the satisfaction of the Centre all defects, shrinkage, settlements or other faults which may appear **within the period stipulated in the Special Condition of Contract after satisfactory completion of the work**. In default, the Centre may employ and pay other persons to amend and make good such damages, losses and expenses consequent thereon or incidental thereto shall be made good and borne by the Contractor and such damages, losses and expenses shall be recoverable from him by the Centre or may be deducted by the Centre, in lieu of, such amending and making good by the Contractor, deduct from any money due to the Contractor, a sum equivalent to the cost of amending such work and in the event of the amount retained being insufficient, recover that balance from the Contractor from the amount retained under Clause No. (ii) together with any expenses the Centre may have incurred in connection therewith.
- xix) Escalation:** The rate quoted shall be firm throughout the tenure of the contract (including extension of time, if any, granted) and will not be subject to any fluctuation due to increase in cost of materials, labour, overhead, GST, other taxes etc.
- xx) Excepted Matters:** If the dispute or differences pertain to the under noted matters the decision in writing of the Officer designated in and signing the contract documents shall be final, conclusive and binding on the parties.
- i) Instructions.
 - ii) Transactions with Local Authorities.
 - iii) Proof of quality of materials.
 - iv) Assigning or under letting of the contract.
 - v) Certificate as to the causes of delay on the part of the contractor and justifying extension of time.
 - vi) Rectifying of defects pointed out during the Defects Liability Period.
 - vii) Notice to the contractor to the effect that he is not proceeding with due diligence.
 - viii) Certificate that the contractor has abandoned the contract.
 - ix) Notice of determination of the contract by the Centre.
- xxi) Protective Measures:** The contractor from time to time of being placed in possession of the site must make suitable arrangements for watching, lighting and protecting the work, the site and surrounding property by day, by night, on Sundays and other holidays. Contractor shall indemnify the Centre against any possible damage to the building, roads, or members of the public in course of execution of the work.

Contractor shall provide necessary temporary enclosures, gates, entrances etc for protection of the work and materials and for altering and adopting the same as may be required and removing on completion of the works and making good all disturbed works.

xxii) Materials, Workmanship and Samples: All the works specified and provided for in the specifications shall be executed in the best and most workmanlike manner with materials of the best and approved quality.

Materials conform to the relevant I. S. Standards or as specified in the specifications shall be supplied by the contractor for the execution of work at his own cost as directed by the Centre. The necessary charges for transporting etc, shall have to be borne by the contractor. No extra payment on this account should in any case be entertained. The contractor shall provide all assistance, instruments, machine labour and materials for examining measuring and testing of work and the quality, weight or quantity of any materials used and supply samples before incorporation in the work as may be selected and required by the Centre. All materials should be carried out as per latest I.S. specifications as advised by the Centre.

All materials (except where otherwise described) stores and equipment required for the full performance of the work under the contract must be provided through normal channels and must include charge for import duties, sales tax, octroi and other charges and must be the best of their kind available and the contractor/s must be entirely responsible for the proper and efficient carrying out of the work. The work must be done in the best workmanlike manner. Samples of all materials to be used must be submitted to the Centre when so directed, by the Centre and written approval from Centre must be obtained prior to placement of order.

During the inclement weather the contractor shall suspend concreting, plastering and like for such time as the Centre may direct and shall protect from injury all work when in course of execution. Any damage (during constructions) to any part of the work for any reason due to rain, storm, or neglect of contractor shall be rectified by the contractor in an approved manner at no extra cost.

Should the work be suspended by reason of rain, strike, lock-outs or any other cause, the contractor shall take all precautions necessary for the protection of work and at his own expenses shall make good any damage arising from any of these causes.

The contractor shall cover up and protect from damage, from any cause, all new work and any other requisite protection for the execution of the work whether by himself or special tradesmen or nominated sub-contractor and, any damage caused must be made good by the contractor at his own expenses.

xxiii) Variation/Deviation: The contractor on his own accord shall make no addition, omission or variation without authorisation of the Engineer-in-charge of Centre.

The rates for additional, altered, substituted work shall be arrived at in accordance with the following rules:

i) The net rates of prices in the contract schedule shall determine the valuation of (the rates for) the extra work (items) where such extra work is of similar character and is executed under similar conditions as the work priced therein.

ii) If the rates for the extra, altered or substituted (deviated) work are not provided for (available) in the contract schedule, they shall to the extent possible be derived out of rate given in that schedule for similar or near similar items for the purpose of evaluating the rate for such items, where necessary and when so directed, the contractor shall furnish detailed analysis for the said similar or near similar items in the contract schedule. For such portions of the analysis for the extra, altered or substituted (deviated) work for which prices cannot be abstracted from the corresponding analysis of rates for the said similar or near similar items in the contract schedule, market rates substantiated by purchase bills/vouchers dependable printed price schedules of building materials of different types shall be adopted, using factors and constants for quantum of material, labour T & P and sundries from standard analysis of rates adopted by the National Building Organisation, Ministry of Works & Housing, Govt of India in preparation of latest D.S.R. and adding 15% towards profits and overheads. When called upon to do so the contractor shall submit the required purchase bill/vouchers.

iii) In the case of additional, altered or substituted (deviated) with for which rates cannot be reasonably be derived as at (i) and (ii) above, the rates shall be worked out adopting market prices, substantiated' by purchase bill/vouchers, using factors and constants for quantum of materials, labour, T & P and sundries from standard analysis of rates adopted by the latest Delhi Schedule of Rates and addition 15% towards profit and overheads. When called upon to do so the contractor shall submit his purchase bills/vouchers to the architects and employer.

iv) The tender rates will hold good for any increase or decrease in the tender quantities up to a variation of 25% except in the case of item below plinth level where the variation will be up to 100% For variation beyond the above limit, rates for the respective items for quantity beyond the limits mentioned above may be worked out on market rates.

v) The question as to what particular items, being similar or near similar to the additional, altered or substituted (deviated) work in the contract schedule to be adopted for deviation of rates for the additional, altered for substituted (deviated) work and whether the said rates cannot be derived from similar or near similar items in the contract schedule will be decided by the Employer.

vi) In case, the contractor is required to submit the analysis of rates adopting the principles enunciated above and the Centre, after scrutinizing the analysis and other papers furnished will allow such rates as he considers reasonable.

vii) Where extra work is of such a nature that it cannot be properly measured/valued, the contractor shall be allowed day work priced at the net rates stated the tender or the priced schedule of quantities or if not so stated then in accordance with the minimum local day work rates and wage for the district notified by the concerned authority.

xxiv) Force Majeure: Contractor shall not be considered in default in delay in work occurs due to causes beyond his control such as acts of God, natural calamities, civil wars, fire, strike, frost, floods, riot and acts of unsurpassed power. Only those causes which have duration of more than seven (7) days shall be considered cause of force majeure. A notification to this effect duly certified by the statutory authorities shall be given by the contractor to the Centre within 10 days from the date of such Force Majeure condition by registered letter. In the event of delay due to such causes, the work schedule/completion time will be extended for a length of time equal to the period of force majeure or at the option of the Centre the order may be cancelled. Such cancellation would be without any liability whatsoever on the part of the Centre. In the event of such cancellation, the contractor shall refund any amount advanced or paid to them, by the Centre and deliver back any materials issued to them by the Centre and release facilities, if any, provided by the Centre.

The bidder will be solely responsible for any fatal / non fatal accident which occurs to their person during execution of work.

xxv) Royalties & Patents: The Contractor shall pay all royalties & license fees. He shall defend all suits or claims for infringement of any patents rights and shall save the Centre harmless from loss on account thereof.

xxvi) Schedule for Completion of Work: The contractor shall submit a time & progress chart within 15 (fifteen) days from the date of issue of LOA / work order.

xxvii) Labour & Payment of Wages to labour: No labour below the age of 18 (eighteen) years shall be employed on the work. The Contractor shall pay to labour employed by him wages not less than fair wages as per provision of the Contract Labour Act, 1970 & 1971 whichever is applicable.

xxviii) Suspension: If the contractor fails to start the work within 15 (fifteen) days from the date of issue of commencement letter, the Centre shall reserve the rights to proceed to invoke the clause of Termination of Contract.

xxix) Termination of Contract: If the contractor goes into liquidation or becomes insolvent or uses improper materials or fails to proceed with the progress of work to the satisfaction of the Centre, the Centre shall reserve the rights to abandon/terminate the Contract on one month's notice period.

xxx) Compensation For Delay:

If the contractor fails to maintain the required progress or to complete the work and clear the site as per the terms of the work order/agreement within the stipulated date of completion or the extended date of completion, the contractor shall without prejudice to any other right or remedy available under the law on account of such breach, pay as agreed compensation the amount at the rates stipulated below as the Authority may decide (whose decision in writing shall be final and binding) on the amount of tendered value of the work for every complete day/month (as applicable) that the progress remains below that specified in clause V of GCC or that the works remain incomplete.

This will also apply to items or group of items for which a separate period of completion has been specified.

- i) Compensation @1.5% per month of delay
for delay of work to be computed on per day basis

Provided always that the total amount of compensation for delay to be paid under this Condition shall not exceed 10% of the Tender Value of work or of the Tender value of the item or group of items of work for which a separate period of completion is given.

The amount of compensation may be adjusted or set-off against any sum payable to the Contractor under this or any other contract with the Centre. In case, the contractor does not achieve a particular approved milestone, or the re-scheduled milestone(s) in terms of Clause v, the amount shown against that milestone shall be withheld, to be adjusted against the compensation levied at the final grant of Extension of Time. With-holding of this amount on failure to achieve a milestone, shall be automatic without any notice to the contractor. However, if the contractor catches up with the progress of work on the subsequent milestone(s), the withheld amount shall be released. In case the contractor fails to make up for the delay in subsequent milestone(s), amount mentioned against each milestone missed subsequently also shall be withheld. However, no interest, whatsoever, shall be payable on such withheld amount.

- xxxii) Agreement :** The successful contractor is to enter into an agreement with the Centre as per a prescribed proforma (as per Annexure "A") on a Non-judicial Stamp paper of minimum value of Rs 100=00 without which no bill will be accepted for payment. Cost of Stamp paper will be borne by the contractor.
- xxxiii) Conflict in clauses:** The terms and conditions in the entire tender document and any revision from time to time shall be abided by the contractor. However, in case of any conflict between the meaning or interpretation amongst two or more clauses in the tender document at different locations, the condition/specification in the Special Condition of Contract shall over-ride the same mentioned in the GCC and the condition/specification indicated in the BOQ shall supersede all other conditions.
- xxxiiii) Declaration:** I/We have inspected the site of works and have made me/us fully acquainted with the local conditions in and around the sites of works. I/We hereby declare that (A) I/We have gone through the conditions laid down in the General Conditions of Tender along with a) Interpretation, b) Scope of Work, c) Terms and Conditions and d) Special Conditions. (B) Technical Specifications, items of work and understood the same. I/we on the basis of the same quoted our rates in the schedule of quantities attached with the Tender documents. (C) I/We shall also uniformly maintain such progress with the work, as may be directed by the Centre to ensure completion of same within the target date as mentioned in the Tender document

Signature of Tenderer

Address : _____

Date :

Seal of the

Firm/Company

SPECIAL CONDITIONS OF CONTRACT

Scope of Work: The work consists of balance civil works including roof sheeting with sandwich panel sheets. The civil, structural and other allied works are within the scope of this tender. It includes furnishing all materials, labour, tools and equipment and management necessary for the incidental to the execution and completion of the work. All work, during its progress and upon completion, shall conform to the lines, elevations and grades as shown on the drawings furnished by the Centre. Should any detail essential for efficient completion of the work be omitted from the drawings and specifications it shall be the responsibility of the contractor to inform the Centre.

Location: S. N. Bose National Centre for Basic Sciences, at JD Block, Salt Lake, Kolkata -700106

1. **Handing over of the Site:** On issue of the Work order/LOC, the site of work will be handed over by the Centre within 10 days from the date of issue. In case of the contractor being unable to take over the site due to his own lapses/shortcoming/unwillingness, the site will be deemed to be handed over on the 10th day (unless the handing of takes place later) and the date of completion will be counted from that day.
2. **Time of completion :** 4 months (including holidays)
3. **Taxes and Duties:** The rates quoted by the contractor shall be inclusive of all taxes and duties as per rules.
4. **Payment:**
 - a) On completion of the work to a reasonable extent, the contractor may submit Running bills as per the Bill format enclosed as annexure B (Measurement Sheet) and C (Abstract) in duplicate which, after due verification of the measurements and being jointly signed by the representative of the contractor and the EIC. The bill will be forwarded to the accounts section for processing of payment.
 - b) Earnest efforts will be made to release the payment within 21 days, if the bill is found to be in order and does not need re-submission. Security deposit and IT shall be deducted from the bill as per contract.
 - c) The contractor is advised to provide the details of his Bank account to which the payment will be directly credited. A copy of the certified bill will be provided to the contractor for record.
 - d) The payment made against any Running bill shall be considered as advance which will be adjusted against the subsequent and final bills. By getting payment against any item shall not relieve the Contractor from his overall contractual obligations for the entire contract as a whole and defect liability period will be counted after satisfactory completion of the work as stipulated by clause (xvii) of GCC and recorded by the EIC.

5. **Advance:** No mobilisation advance for the above work will be admissible.
6. **Timing of Working Hours:** The contractor will be allowed to work generally on all working days of the Centre between 7.00 AM to 6-00 PM. However, in case of exigencies, the contractor may be permitted to work beyond office hours or on holidays on prior and due permission from the Centre.
7. **Accommodation for Workmen:** No accommodation for the labours or any other representative of the contractor will be allowed any accommodation inside the Campus, unless specifically approved by the Competent Authority.
8. **Entry of Contractor's Labours and Staffs:** Being a protective zone, the entry to the Centre will be allowed only against a valid Gate pass issued by the Security personnel at the Gate. However, the contractor is to make work-passes for his labours for daily work inside the Campus by depositing the valid ID and a photograph of his workmen and representatives. No workmen under the age of 18 will be allowed to work inside the Campus.
9. **No-Smoking Zone:** The contractor is to note that the entire Campus of the Centre is Tobacco-free zone and in case of any labours or representative is found to violating the rules, the contractor will be subjected to penalty in the form of fine etc,
10. **Entry and Exit of Construction and Other Materials:** While bringing the materials inside the Campus, the contractor is to make Challans which will be retained by him for reconciliation of consumption and also for taking out his own construction equipments, tools and tackles, surplus materials etc.
11. **Bid Validity:** 90 days from the date of submission of Technical Bid.
12. **Materials:** The contractor shall use best quality materials for the work as per CPWD specifications. Before using the materials for the job, he is to get approval of the same from the EIC. All the necessary tests as per IS Code are to be conducted from a Government recognised Laboratory if demanded. The cost of such tests is to be borne by the contractor.
13. **Makes and Brands:** The contractor has to provide the materials of any make and brand out of the Preferred list of items described in the Technical specification. But the final selection of a particular make out of the preferred list shall be as per the approval and directive of the EIC for which no extra claim shall be entertained.
14. **Testing of Materials and Workmanship:** During execution of work and also before handing over the work, the contractor has to carry out all necessary testing of materials and workmanship as per IS Code and all Engineering practices and also as directed by the Engineer –in-charge.
15. **Inspection and Testing at Manufacturer's works:** For the special or very costly items like PUF sandwich panels, LV Switchgear Assembly, Electrical panels etc,(items to be decided by the EIC at the time of execution of work), the tenderer shall quote only for those manufacturers who has got the facility to conduct majority and important tests as per IS Code within their own or their vendor's works. Balance tests, if desired by the EIC, may be conducted in a NABL approved laboratory as chosen by the Centre at the cost of the Contractor. Before despatch of such items, the Contractor is to offer for an inspection and the same can be despatched to the site only against inspection report or despatch clearance by acceptance of valid Test certificates by the Centre.
16. **Power:** Unless otherwise mentioned, the contractor shall at his own cost arrange for necessary electricity required for running heavy equipments for construction purpose (i.e. welding etc.) and illumination of the construction site, hutments, stores etc. for entire period of contract. In case the contractor seeks power from the Centre and if sparable, the Centre will charge the cost of consumption of electricity based on meter readings (Meter and related accessories will be arranged by the contractor at his own cost), as per prevailing rate of electricity.
17. **Water Supply & Land for Contractor's use:** For the purpose of the job, if necessary, the contractor may establish Site Office, Godowns, labour hutments etc. with the permission of the Centre. If the contractor intend to use Centre's water (if sparable) for work purpose, (except for drinking purpose), If the contractor uses water from the source of Centre (except for drinking purpose) Water Charges shall be recovered from the Contractor @ 1% (one percent) on gross amount of the relevant items of work done.
18. **Drawings:** Before commencement of work, the contractor would be provided a working drawing showing the General Layout and arrangement and any other details as available with the Centre based on which the contractor may, if required, have to prepare detailed drawings for internal arrangement, colour scheme and any other item as desired by the EIC from time to time for his approval both in hard and soft copy. On approval, hard copy will be

issued to the Contractor for carrying out the work. After the job is completed, the contractor has to submit, an "As-built Drawing" at the time of submitting the Final Bill.

Signature of Tenderer

Address : _____

Date :

Seal of the Firm/Company

TECHNICAL SPECIFICATIONS

1.0 EXCAVATION AND EARTHWORK

1.1 General

The excavation will generally refer to open excavation of foundation wet or dry and in all sorts of soils.

1.2 Examine the Site

The Contractor shall visit and ascertain the nature of the ground to be excavated and the work to be done and shall accept all responsibility for the cost of the work involved.

1.3 Setting Out

The contractor shall set out the building or other involved works after clearing the site and get the same approved by Centre. It shall be the responsibility of the Contractor to install substantial reference marks, bench marks etc. and maintain them as long as required by the Centre. The contractor shall assume full responsibility for proper setting out, alignment, elevation and dimension of each and all parts of the work.

1.4 Ground Level and Site Level

Before commencement of excavation spot levels on an approved grid covering the entire plot shall be taken by the Contractor in consultation with the Centre and a proper record of these levels shall be kept jointly signed by the Contractor and the Centre. A block level plan showing all ground levels of the plot shall be prepared by contractor and shall also be jointly signed by the Contractor and the Centre.

1.5 Excavation & Preparation of Foundation for Concrete

Excavation shall include removal of all materials of whatever nature at all depths and whether wet or dry necessary for the construction of foundation and sub-structure (including mass excavation for

basement underground reservoir where applicable) exactly in accordance with lines, levels, grades and curves shown in the drawings or as directed by the Centre. The bottoms of excavation shall be leveled both longitudinally and transversely or Sloped as directed by the Centre.

Should the contractor excavate to a greater depth or width than shown on the drawings or as directed by the Centre, he shall at his own expense fill the extra depth or width in cement concrete in proportion as directed by the Centre but in no case with concrete of mix leaner than 1:4:8 cement concrete.

The contractor shall report to the Centre when the excavations are ready to receive concrete. No concrete shall be placed in foundations until the contractor has obtained Centre approval. In case, the excavation is done through different types of soil and if different rates are applicable as per provision in the Schedule of Quantities, the contractor must get the dimensions of the strata agreed by the Centre for payment. If no specific provisions is made in the schedule of quantities it will be presumed that excavation shall be in all types of soil and the contractor's rate shall cover for the same.

After the excavation is passed by the Centre and before laying the concrete, the contractor shall get the depth and dimensions of excavation and levels (and nature of strata as applicable as per Schedule of Quantities like hard rock, soft rock) and measurements recorded by the Centre.

1.6 Shoring

The sides of the excavations should be timbered and supported in such a way as is necessary to secure these from falling in, and the shoring shall be maintained in position as long as necessary. The contractor shall be responsible for the proper design of the shoring to be approved by Centre/Engineer-in-Charge to hold the sides of the excavation in position and ensure safety of persons & properties etc. The shoring shall be removed as directed after the items for which it is required are completed. No extra payment will be made for shoring.

1.7 Protection

If instructed by the Centre all foundation hits, and similar excavations shall be strongly fenced and marked with red lights at night to avoid accidents. Adequate protective measure shall be taken to make sure that the excavation does not affect or damage adjoining structures. All measures required for the safety of excavations, the people working in & around the foundation trenches, property and the people in the vicinity shall be taken by the contractor at his own cost. He shall be entirely responsible for any injury and damage to property caused by his negligence or accident due to his constructional operations, storage of materials etc.

1.8 Stacking of Excavated Materials

All materials excavated will remain the property of the Centre and rate for excavation shall include sorting out of useful materials and stacking them on site as directed. Materials suitable and useful for back filling, plinth filling or leveling of the plot or other use shall be stacked in convenient places but not in such a way as to obstruct free - movement of men, animals and vehicles or encroach on the area required for constructional purposes.

1.9 Backfilling

All shoring and form work shall be removed after their necessity ceases and trash of any sorts shall be cleaned out from the excavation. All space between foundation masonry or concrete and sides of excavation shall be refilled to the original surface with approved excavated materials in layers 15 cm in thickness watered and rammed. The filling shall be done after concrete or masonry is fully set and done in such a way as not to cause undue thrust on any part of the structure. Where suitable

excavated materials are to be used for refilling it shall be brought from the place where it is temporarily stacked and used in refilling.

No excavation of foundations shall be filled in or covered up until all measurements of excavations, masonry concrete and other works below ground level are jointly recorded. Black cotton soil shall not be used for back filling or in plinth filling.

1.10 Dewatering

Rates for excavation shall include bailing or pumping out water which may accumulate in the excavation during the progress of work either from seepage, springs, rain or any other cause and diverting surface flow if any by bunds or other means. Pumping out of water shall be done in such approved manner as to preclude the possibility of any damage to the foundation trench concrete or masonry or any adjacent structure. When water is met in foundation trenches or in tank excavations, pumping out water shall be carried out from auxiliary pit of adequate size dug slightly outside the building excavations. The depth of auxiliary pit shall be more than the working foundation trench levels. The auxiliary pit shall be refilled with approved excavated materials after the dewatering is over.

The excavation shall be kept free from water :-

- a) During inspection and measurement.
- b) When concrete and/or masonry works are in progress and till they come above the natural water level and
- c) Till the Engineer-in-Charge consider that the concrete/mortar is sufficiently set.

1.11 Surplus Excavated Materials

All excavated materials certified as surplus and not useful shall be removed by the Contractor from the site in an approved manner with the approval of the Local Authority as required to his own dump and shall be paid as a separate item as in the Schedule of Quantities. No extra claim on any account will be paid.

The items of removal of surplus excavated materials shall only be undertaken by the Contractor when specific instruction in this regard has been obtained from the Engineer-in-Charge. The contractor must also secure the approval of the Engineer-in-Charge regarding the quantity of surplus materials to be removed prior to commencement of this item of work.

1.12 Rates to Include for Excavation Items

Apart from other factors mentioned elsewhere in this contract, rates for the item of excavation shall also include for the following:-

- i) Clearing Site
- ii) Selling out works as required.
- iii) Providing shoring and shuttering to avoid sliding of soil and to protect adjacent structures and subsequently by removing the same, if not stated separately in the schedule of quantities.
- iv) Bailing and pumping out water as required and directed.
- v) Excavation at all depth (unless otherwise specified in the Schedule of quantities) and removal of all materials of whatever nature wet or dry and necessary for the construction of foundation underground reservoir etc and preparing bed for laying concrete.

vi) Sorting out useful excavated materials and conveying beyond the structure and stacking them neatly on the site for back filling or re-use as directed.

vii) Necessary protection works involving, labour, materials, and equipment ensure safety and protection against risk or accident.

viii) Drilling of small holes as directed to explore the nature of substrata if necessary.

1.13 Measurement for Excavation

Excavation for foundation of columns, beams, walls and the like shall be measured and paid net as per drawing, dimensions of concrete (bed concrete where so specified) and the lowest level in regard to length and breadth and depth shall be computed from the excavation levels and ground level's taken before excavation for that area. Any additional excavation required for working space, form work, planking, shuttering for concrete work, dewatering and strutting etc. shall not be measured and shall not be paid for separately but rates quoted for excavation shall include for all these factors. No increase in bulk after excavation shall be allowed.

1.14 Rates to Include for Backfilling Item

Apart from other factors mentioned elsewhere in this contract, rates for the item of backfilling item of work shall also include for the following :-

- i) Backfilling the trenches alongside masonry or concrete with approved excavated materials upto the natural ground level in layers as specified including watering and ramming.
- ii) **Earth filling in Plinth:** If there is approved surplus earth after backfilling the sides of excavations, the same will be used for plinth filling if required. Any additional quantities of good quality earth, if required for plinth filling, shall be brought to the site, by the contractor from outside. No borrow pits shall be opened on the site. Filling in plinth shall be done in layers of 15 cm thick each layer being consolidated by ramming and watering. The payment of back filling item shall be made on measurement of finished consolidated quantity, arrived by difference of levels taken before and after the back filling.
- iii) No payment shall be made for backfilling to the trenches excavated by the contractor for working space, form work, planking, shuttering for concrete work, dewatering and strutting etc with approved excavated materials upto the natural ground level in layers as specified including watering and ramming.

2.0 CONCRETE

2A General

A.1 Supervision

A competent person approved by the Centre shall be employed by the contractor whose first duty will be to supervise all stages in the preparation and placing of the concrete. All cubes should be made and necessary site tests carried out under his direct supervision in the presence of Centre/ Engineer-in-Charge.

A.2 Approval of Concreting Arrangement etc

Before commencement of construction the contractor shall submit detailed arrangements for concreting, system of form work and all other devices which he proposes to use for the construction of structural frame work for approval of Engineer-in-Charge/Centre.

A.3 Sample and Tests

Every facility shall be provided by contractor at site to enable the Centre to select samples, get contractor to collect samples and carry out tests on the materials and construction. At least 10% of the cube tests should be carried out in Laboratory/ Institution approved by the Engineer-in-Charge/Centre. If those tests shows that strength of cubes do not comply with the acceptance criteria of specifications, the contractor will be responsible for replacement of the defective construction. The necessary cost of all such sampling and testing has to be borne by the contractor.

A.4 Rejected Materials

All materials which have been damaged, contaminated or have deteriorated or do not comply in any way with the requirements of this specification, shall be rejected and shall be removed immediately from the site at the Contractor's own expense.

A.5 Loading of Floor Slabs

No materials shall be stored or stacked on suspended floors and roofs without the Centres/ Engineer-in-Charge' prior approval.

A.6 Coordination

The Contractor shall be responsible for the co-ordination with sub-contractors or other contractors for incorporating any inserts, electrical conduit pipes, fixing blocks, chases, holes etc in concrete members brick works as required. The contractor shall ensure that these requirements have been approved by the Centre before the operations are put in hand. All blocks, chases, inserts, holders etc. to be left in the concrete shall be of the sizes specified and be accurately set out and placed before pouring concrete.

The Contractor's rates quoted for concrete items shall include all these factors. No holes and chases shall be cut in concrete without prior approval of the Centre.

A.7 Inserts to Concrete

The contractor should note that he Shall provide necessary wooden plugs, m.s inserts, sleeves etc: required for the works for which no extra payment will be made. He will have to provide if so directed, any inserts, wooden plugs sleeves for other contractors, such as Electrical Contractor', Fire Fighting Contractors, Contractor for Lifts etc for which he will be entitled for payment but in case the other contractors provide such inserts, then he will have to take proper measures (at his expense) and care not to disturb their work while laying concrete.

A.8 Equipment

The contractor shall keep at work site testing equipment for aggregate and concrete, viz. test sieves, balance, slump cones, concrete cube testing machine etc all items required conforming to relevant I.S. specification. Dial gauge of cube testing machine should have been calibrated recently from a Govt. approved laboratory.

2.B Materials

All materials shall be of approved quality as per relevant I.S. specifications/or as specified in the contract.

B.1 Cement

- a) Ordinary portland cement and Portland Slag Cement shall conform to the I.S. specification I.S. 269 and IS 455 of latest edition.
- b) Cement at site shall be stored in dry weatherproof godowns (or shed) built at the cost of the contractor. Cement must not be stacked in more than 10 bag height. Sufficient space shall be provided for circulation and rotation of bags in order to minimise the length of storage of any of the bags. The floor of the godown shall consist of wooden planks resting on base prepared of dry bricks laid on edge.

The contractor shall be fully responsible for the quality of cement brought by him at the work site. The contractor shall ensure that the cement brought to the work site conforms to the requirements of IS 269 or IS 455 and shall procure manufacturer's certificate to this effect, in his own interest. In case the contractor has any doubt regarding the quality of cement brought on work site by him, it is upto him to have it tested at his own expenses & make sure that cement is of right quality.

- d) Centre can order on the contractor to have the cement tested or they can take samples in the presence of contractor from cement bags stored at work site and forward them to a approved Laboratory for testing & the contractor shall be responsible for the cost of testing including transporting of samples to the laboratory.

Daily record of cement received and consumed shall be maintained by the Contractor in cement register at site and submitted to Engineer-in-Charge if called for. Theoretical consumption vis-a-vis materials brought at site by the Contractor shall also be submitted with proper documents with every bill for verification. A chart showing the consumption of cement for different items of work is annexed. Consumption of cement in the corresponding items of work under the contract shall be computed on the basis of the quantities shown in the table subject to a variation of plus/minus three percent (The weight of 1 cum of cement shall be taken as 1,440 kg). For the items not available in the enclosed cement consumption chart, C.P.W.D schedule shall be followed.

- e) Cement of doubtful quality shall not be used until satisfactory results are obtained after testing. All cement not conforming to specifications and cement that has deteriorated, damaged or set shall not be allowed to be used. All such cement shall be immediately removed from work site by the contractor. The cost of all such cement shall be borne by the contractor.

B.2 Aggregate

Aggregate shall conform to IS 383 of latest edition.

B.3 Fine Aggregate: Sand

- a) The fine aggregate - sand shall be hard, strong, dense, durable clean with uncoated grains. The maximum size of the particles shall be 4.75 mm (3/16 in) and shall be graded down. The sand shall not contain any harmful materials such as iron, Pyrites, coal, mica, silt, clay, alkali, sea shells organic impurities, loam etc. or in case of reinforced concrete work, any materials which might attack the reinforcement or detrimental to concrete. Aggregate, which are chemically reactive with the alkalis of the cement, shall not be used. The maximum quantity of deleterious materials shall not exceed the limit specified in the relevant I.S. Specifications. The silt content shall be within 8%.

- b) **Grading:** The natural sand used for work shall have a grading conforming to grading zones of I and II of I.S. 383 of latest edition.

B.4 Coarse Aggregate

- a) Coarse aggregate shall consist of hard, dense, durable uncoated crushed rock. Gravel aggregate shall be allowed to be used only if specially specified in the bill of quantities. Otherwise it shall be taken that only crushed rock shall be permitted as coarse aggregate.
- b) The aggregate shall be free from soft, friable thin or long laminated pieces. Aggregate shall be free from injurious amounts of alkali, organic matter and other deleterious materials. Flaky or weathered stones shall not be used. The maximum percentage of deleterious materials shall not exceed those specified in the relevant I.S. specification.
- c) The contractor shall arrange to supply coarse aggregate of nominal size conform to the grading in the limits specified in IS-383 of latest edition.
- d) **Size of Aggregate:**
- i) Generally for reinforced concrete work, nominal maximum size of aggregate be 20 mm graded suitably.
- e) In selecting the aggregate, the contractor shall satisfy himself that the source is suitable for regular supply and a watch shall be maintained that the particles shape and grading remain reasonably uniform throughout the progress of work.
- f) Where so directed by Centre aggregate shall be washed by approved methods at Contractor's expenses.

B.5 Water

Water used for both mixing and curing shall be clean and free from injurious amounts of deleterious materials which are likely to affect the strength or durability of concrete.. Water containing any sugar shall not be allowed for use. Water is to be tested In accordance with I.S. 456 of latest edition. The pH values of Water shall generally be not less than 6.

2C Mixing and Placing of Concrete

C.1 Cement

Cement shall be batched by weight even though aggregate are batched by volume. Where the weight of the cement is deter-mined by accepting the maker's weight per bag, a number of bags as directed by Centre shall be weighed separately to check the nett weight. Where the cement is weighed on the site and not in bags, it should be weighed separately from Aggregate.

C.2 Aggregate

The aggregate shall be batched by volume, the form as used shall be of the correct sizes to be certified by the Centre before use. Heaping of aggregates on the form is prohibited and aggregates shall be filled level in form and struck off with a horizontal timber or steel rule. ,Where sand is measured by volume, bulkage allowance as determined by the Centre shall be accounted for while measuring sand.

C.3 Water

Water shall be measured either by volume in calibrated tanks/vessels having conical shape narrow at top or water shall be weighed. Water shall not be measured using ordinary buckets which are wider at top and narrower at the base. The measurement of water to control and maintain a constant water cement ratio is of utmost importance and adequate attention to this end by the contractor to the satisfaction of the Centre shall be made so as to produce concrete of adequate workability as required.

C.4 Mixing of Concrete

a) Machine Mixing

Concrete shall be mixed in Mechanical Mixer. Mixing shall be continued until there is uniform distribution of materials and the mass is uniform in colour and consistency. The mixing time from the time of adding water shall be in accordance with I.S. 1791 of latest edition but in no case mixing shall be done for less than two minutes.

b) Hand Mixing

Hand mix: shall not be permitted except for unimportant structural members and purely at the discretion of the Centre. When hand mixing is permitted it shall be taken to ensure that the mixing is continued until the mass is uniform in colour and consistency: If hand mixing is permitted by the Engineer-in-Charge/Centre, the contractor shall use 10% extra cement for hand mixing for which no extra payment will be made.

C.5 Transporting, Placing, Compaction and Curing of Concrete

C.6 Transporting

Concrete shall be handled from the place of mixing to the place of final deposit as rapidly as practicable, by method which will prevent the segregation or loss of any of the ingredients. If segregation occurs during transport, the concrete shall be remixed before use. The concrete shall be placed in position and compacted before the initial set of cement has commenced and shall not be subsequently disturbed. During hot or cold Weather concrete shall be transported in deep container to reduce loss of water by evaporation during hot weather and loss of heat during cold weather. Deep containers are specified on account of their lower ratio of surface area to mass.

C.7 Dropping of Concrete

Concrete shall not be dropped into position from a height greater than 1.0 metre unless directed otherwise by Centre/Engineer-in-Charge.

C.8 Debris etc Removed

All debris, saw dust etc. shall be removed from the shuttering before any concrete is placed. Care shall be taken to see that the shuttering is watertight and has been properly treated with approved composition to prevent absorption of water.

C.9 Protection and Placing in Layers

Concrete shall be placed into the forms in layers not exceeding 300 mm (approx) in thickness. Concrete after placing and finishing shall be protected by use of covering as approved by the Centre during first stage for hardening against high winds, heat, rain, surface water etc. No shock or vibration shall be allowed to imparted to forms supporting fresh finished concrete.

C.10 Compaction

Concrete shall be thoroughly compacted during operation of placing by the use of Mechanical Vibrators. Sufficient number of vibrators (including stand by) of adequate capacities shall be used for compaction of concrete. Vibration shall be carried out by trained men and in the presence of a qualified supervisor trained in the use of vibrators and vibrated concrete. In certain portions where vibration is not effective, careful rodding and taping shall be carried out and sufficient men employed to ensure that thorough consolidation takes place. Where manual compaction becomes necessary, the workability of the mix should be controlled to strength requirement.

C.11 Continuous Concreting

Concreting shall be carried out continuously upto predetermined positions of construction joints. The position and arrangement for construction joints shall be approved by the Centre/Engineer-in-Charge. Rest pauses for meals etc. shall be subject to the Centre' approval.

C.12 Packing round Reinforcement

In the case of reinforced concrete work, the concrete shall be carefully consolidated and packed round the reinforcement and care shall be taken to ensure that reinforcement is not displaced during the placing and compaction of concrete. If reinforcement moves out of its place, it must be brought back in position immediately.

C.13 Curing

All concrete work shall be water cured for a minimum period of 7 days after concreting or as directed by Centre. Horizontal surfaces shall be kept covered with water ponding by means of bunds and Vertical surfaces like those of columns, fins etc, by burlaps 'kept constantly wet with water sprays. Mere sprinkling of water on vertical surface without sacks will not be allowed. In respect of concrete made out of pozzalana cement, curing shall be continued for another 8 days.

C.14 Trained Supervisor

It is essential that the contractor's supervisor who is in charge of the construction of all concrete work whether reinforced or not, shall be skilled in this class of work and shall superintend personally the whole construction and pay special attention to :-

- a) The quality, testing, proportioning and mixing of the materials and particularly control of water cement ratio
- b) Laying of materials in place and thorough consolidation of the concrete to ensure solidity and freedom from voids.
- c) Position of reinforcements.

2.D Tests for Concrete

Tests shall be conducted in accordance with I.S: 516 of latest edition.

Test Cubes

- a) Works tests cubes shall represent quality of concrete incorporated in the work and taken out in sets of 6 cubes. The concrete for preparation of one set of 6 cubes shall be taken from one batch of mixed concrete discharged from mixer. The cubes shall be moulded in accordance with Indian Standard Code of Practice.
- b) A minimum of one set of 6 cubes shall be taken for every 20 cum or part thereof in case of beam, slabs. & connected columns; one set for 5 cum or part thereof of concrete poured for columns and they shall be considered as representative for said quantity. This is an average

figure, and may be increased to cater for special conditions at the discretion of the Centre at site.

- c) The cubes shall be cured as per IS Code of Practice. The entire operation of casting, arranging and despatch of cubes to Laboratory will be carried out by the Contractor under the supervision of the Centre's Site Engineer/Engineer-in-Charge. Out of 6 cubes, 3 cubes shall be tested at an age of 7 days and balance at an age of 28 days in an approved Laboratory
- d) The cubes shall be initialed, numbered, dated jointly by the contractor's representatives and the Site Engineer of Centre' representative with a piece of wire or nail so that an indentation of the initials is left on the cubes.
- e) The contractor shall arrange to transport the cubes to the approved laboratory and arrange to have the test results forwarded (in duplicate) directly from the laboratory to the Centre. The contractor shall bear all expenses in connection with the preparation of test cubes, i.e provision of moulds, cost of concrete, labour and transportation charges to the approved laboratory, laboratory testing charges etc and his rates for concrete items should be quoted accordingly.
- f) A Register shall be maintained at site by the Contractor with the following-details entered and initialed by the Contractor and the Site Engineer/Engineer-in-Charge.
 - i) Reference to specific structural members receiving the batch of concrete from which the cubes were cast.
 - ii) Mark on cubes:
 - iii) The mix of concrete.
 - iv) Date and time of casting.
 - v) Slump
 - vi) Crushing strengths as obtained at the end of 7 days for 3 cubes out of a set of 6 and at the end of 28 days for the other 3 cubes.
 - vii) Laboratory in which tested and reference to test certificate.
 - viii) Any other information directed by the Centre.
- g) A record of the quality of concrete incorporated in the work that is represented by the quality of concrete of the set of cubes along with the description of the structural members where concrete has been deposited shall be mentioned.

2.E Vibration of Concrete

a) Water Cement Ratio

The water cement ratio (by weight) for all vibrated concrete (except controlled concrete) shall generally conform to relevant I.S. provision and it shall not be varied unless otherwise directed. In respect of "Design Mix" the water cement ratio shall be as determined in the laboratory mix design suitable for vibrated concrete.

b) Placing

Concrete shall be placed in layers not over 45 to 60 cm (18 to 24 inches) deep and each layer shall be vibrated into places by methods which will not permit the ingredients to separate. Surfaces shall be smooth and free from voids caused by stone pockets, where necessary vibration shall be supplemented by hand spading to secure these results.

c) Number and Size of Vibrators

Vibrators shall be of sturdy construction, adequately powered. The vibration shall be sufficiently tense to cause the concrete to flow or settle readily into place and visibly affect the concrete over a radius of at least 450 mm (1811) when used in concrete having slump of one inch. A sufficient number of vibrators (at least one vibrator for a rate of concreting of 1.5 cum. (50 cft) per hour shall be employed so that at the required rate of placement, vibration throughout the entire volume of each layer of concrete and complete compaction are secured.

d) Manipulation of Vibrators

Internal vibrators shall be kept constantly moving in the concrete and shall be applied at points uniformly placed not further apart than the radius over which the vibrator is visibly effective. The vibrator shall not be held in one location long enough to draw a pool of grout from surrounding concrete. The vibration shall be such that the concrete becomes uniformly plastic and there shall be at least 200 seconds of vibration per square metre (20 second of vibration per sq.ft.) of surface of each layers of concrete, computed on the basis of visibly affected radius and taking overlap into consideration.

2.F a) Grade of Concrete

The concrete shall be of grades designated as M-15, M-20, M-25, M-30 of cube crushing strengths as specified in I.S. Code 456 of latest edition.

Note: The designation of concrete mix : Letter M refers to the mix and the number to the characteristic compressive strength of 15 cm cube of 28 days, expressed in N/sq.mm.

b) i) Ordinary Cement : Concrete made without preliminary tests but by adopting volumetric concrete mix, shall be called "ORDINARY CONCRETE" unless ordinary concrete as per Table 3 I.S. 456 of latest edition.

ii) Nominal Volumetric Mixes : If in the bill of quantities concrete is specified in volumetric proportions such as 1:4:8, 1:3:6, 1:2:4, 1:1 1/2:3, 1:1:2 etc. it shall be taken to mean that the proportions by volume of cement; sand and coarse aggregate shall be in the order in which the mix is specified.

Table-I

Minimum cement content for different volumetric mix of concrete are as under :
 Volumetric Proportion of Cement Concrete
 Cement : Fine Aggregate : Course Stone Aggregate

Minimum Cement Content Kg/cum

1:1 ¹ / ₂ :3	412
1:2:4	317
1:3:6	235

c) Strength Requirements of Concrete

Where ordinary portland cement is used, the compressive strength requirements for various grades of concrete shall be as given in Table 2 of LS. 456 of latest edition. It shall be the contractor's responsibility to obtain specified strengths for the various grades of concrete. Where rapid hardening Portland cement is used, 28 days' compressive strength requirements specified shall be met at 7 days.

d) Design Mix Concrete

Concrete made with preliminary tests by designing concrete mix in a laboratory shall be called "DESIGN MIX CONCRETE and shall be designated as M-20, M25 and M-30.

i) Concrete Mix for Various Grades of Design. Mix Concrete : Concrete mixes shall be designed for various grades of concrete (M-20, M-25, M-30) by the contractor to achieve the respective strength, durability and workability necessary for the job by the most economical use of various ingredients. The design should be made conforming to the relevant IS Specifications (IS-456, IS-516 of latest edition) in respect of proportioning -Of fine aggregate to coarse aggregate, maximum quantity of dry aggregates and water cement ratio, the minimum cement content as mentioned in the Schedule of Quantities. The contractor will arrange for the testing of various trial mixes of sufficient number (as per direction of the Engineer-in-Charge/Centre) at his own cost in laboratory approved by the Engineer-in-Charge/ Centre for the preliminary test for different grades of concrete. The Engineer-in-Charge/ Centre will adopt the concrete mixes for the respective concrete grades from the test results of the said trial mixes, conducted and certified by the approved laboratory and the contractor will accordingly proceed with the concreting at work site. Constant Check on grading and mix proportion shall be done by the contractor who will always be responsible to produce quality concrete of required grades as per the acceptance criteria of IS 456 of latest edition. If there is any change in the quality of aggregates (both coarse_ and fine), necessary alteration to the mix proportion should further be approved by the Engineer-in-Charge/Centre before the same are used at work site.

The Engineer-in-Charge will always have the unquestionable right to revise the minimum cement content as decided above, if in his opinion, there is any chance of deterioration of quality of aggregate or other reason.

2.G Classification of Concrete of Lower or Higher Strength than Specified

Where the strength of concrete mix (for ordinary concrete or design mix concrete) as indicated by tests, lies in between the strengths of any of two grades, such concrete shall be classified as a grade belonging to the lower of the two grades between which its strength lies. In case the cube test strength show higher strengths than those specified for the particular grade, the concrete Shall not be placed in any higher grade nor shall contractor be entitled for any extra payment on such account.

2.H Cement Concrete Mudmat

Concrete for the purpose shall be in the proportion of (1:3:6) 1 part of cement, 3 parts Of sand and 6 parts of stone chips and 1:4:8 (1 cement, 4 parts of sands and 8 parts of Stone chips/jhama khoa) may be mixed by volumetric batching as mentioned in the Schedule of Quantities.

2.1 Form Work

1.1 Materials and Design

- a) The form work shall be of approved dressed timber of not less than 3.5 cms thick except where otherwise stated. As an alternative sufficiently rigid steel! ply. Board shuttering of approved design may be used. Joints of the shuttering must not allow loss of liquid from concrete. In timber shuttering the joints shall therefore be either tongued or grooved or the joints must be perfectly closed and lined with craft paper or other types of approved materials. In case of steel shuttering also the joints are to be similarly lined. If any particular material or materials be specified in the Schedule of Quantities for formwork such particularly specified material or materials shall be used in work. The from work shall be constructed as to remain sufficiently rigid during placing of the concrete. AD shuttering and framing must be adequately stayed and braced to the satisfaction of the Centre for properly supporting the concrete during the period of hardening. The forms shall have sufficient strength and rigidity to hold concrete and withstand the pressure of ramming and vibration without deflection from the prescribed lines and levels. The surface of all forms in contact with concrete shall be clean, rigid, watertight and smooth. Suitable devices shall be used to bold corners, adjacent ends and edges of panels of other forms together in accurate alignment.
- b) The form work shall conform to the shape, lines and dimensions to suit the R.C.C. members as shown on drawing. Form work shall be adequately designed to support the full weight of workers, fresh placed concrete without yielding to settlement or deflection and to ensure good and truly aligned concrete finish in accordance with the construction drawings. A camber in all direction of 6 mm for every 5 metre .span in all slab and beam centering shall be given to allow for unavoidable sagging due to compression or other causes.
- c) The form work shall be so designed that the sides of the beams shall be first struck leaving the soffit of beams and supporting props in position. Props shall be designed to allow accurate adjustment & to permit of their being struck without jarring the concrete.
- d) Temporary openings shall be provided at the base of columns forms and at other points where necessary for facilities of cleaning and observations immediately before concrete is deposited.
- e) **Vertical Shuttering** : The vertical shuttering shall be carried down to such solid surface as is sufficiently strong to afford adequate support and shall remain in position until the newly constructed work is able to support itself. Props shall be securely braced against lateral deflection. Steel props of approved quality shall be used. In case timber props and bullies are allowed to use these shall be of minimum 10 cm diameter and shall be straight and adequately strong. Bamboo props shall not be used. The spacing of such struts shall be designed to carry loads imposed on it without undue deflection of the members supported by the props and shall be approved by the Centre. Any alterations suggested by them shall be carried but at Contractor's expenses. Bracing shall be provided as directed without extra cost. The contractor shall allow in his rates for providing props and struts for any height shown in the working drawings issued to the contractor from time to time.

1.2 Water Tightness

The Contractor shall ensure that the forms are checked for water tightness just before concreting operation starts and shall make good any deficiencies. If instructed by the- Centre building paper or any other approved materials will have to be used without any extra charge for the same.

1.3 Cleaning and Treatment of Forms

All rubbish, particularly wood chippings, shavings and saw dust, shall be removed from the interior of the forms before the concrete is placed and the form work in contact with the concrete shall be cleaned and throughly wetted or treated with an approved composition. Care shall be taken that such

approved composition is kept out of contact with the reinforcements, Interior of all moulds and boxes must be thoroughly washed out with hosepipe or otherwise so as to be perfectly cleaned and free from all extraneous matter before deposition of concrete. Prior approval of the formwork should be taken from Engineer-in-Charge before placing reinforcement on the formwork.

1.4 Stripping

Form shall be left in -place until their removal is authorized by the Centre and shall then be removed with care so as to avoid injury to concrete. Under no circumstances shall form be struck until the concrete reaches strength of at least twice the stress to which the concrete may be subjected at the time of striking. The strength referred to shall be that of concrete using the same cement and aggregate with the same proportion, and cured under conditions of temperature and moisture similar to these existing on the work. Where possible, the formwork should be left longer as it would assist the curing.

1.5 Stripping Time

In normal circumstances (generally where temperatures are above 20°C and where ordinary Cement is used) forms shall be struck after expiry of the following periods unless otherwise directed at site by the Centre.

Location	Striking time in days	
	Ordinary Portland Cement	Pozzalana Cement
a) Vertical sides of walls, slabs, beams and columns	2	4
b) Bottom of slabs upto 4.5 M span	7	14
c) Bottom of slabs above 4.5 M span. Bottoms of beams upto 6.0 M span	14	21
d) Bottoms of beams over 6.0 M span & arch rib bottoms above 6.0 M span.	21	30
For rapid hardening cement, 3/7 of the above periods will be sufficient in all cases except vertical sides of walls, slabs, beams and columns which should be retained for a minimum period of 24 hours.		

1.6 Formwork in Lifts for Continuous Surface

Where forms for continuous surface are placed in successive units, (as for example in columns or walls) the forms shall fit tightly over the completed surface so as to prevent leakage of mortar from the concrete and to maintain accurate alignment of the surface.

1.7 Procedure while Removing the Formwork

All formwork shall be removed Without such shock or vibration as would damage the reinforced concrete. Before the soffit and struts are removed the concrete surface shall be exposed where necessary in order to ascertain that the concrete has sufficiently hardened. Proper precautions shall be taken to allow for the decrease in the rate of hardening that occurs with all cement in the cold weather.

1.8 Tolerance

The following shall be the maximum permissible tolerance:

- a) In general, setting out dimensions upto 4M in length a tolerance upto 3 mm will be allowed.
- b) On lengths of more than 4 M tolerance of not more than 5 mm will be allowed.
- c) On the cross sectional dimensions of columns, beams, slabs, facias, chajja, mullions, grills, fins, louvers, and such other members, tolerance of more than 3 mm will not be allowed.
- d) The top surface of concrete floor slab will be within 6 mm of the level and line shown on the drawings.
- e) Columns and walls and other vertical members shall not be more than 3 mm out of plumb in their storey height and not more than 6 mm out of plumb in their full height.
- f) If work is not carried out within the tolerance set out above in (a) to (e), the cost of all rectification measures of dismantling and reconstructing as decided by the Centre shall be borne by the contractor. In case of work dismantled, the same not to be measured and paid for.

2.J Defective or Poor Concrete — Procedure for Dealing With

J.1 General

If in the Centre's opinion there is doubt as to the strength of the structure due to the works test cube failing to attain specified strength due to poor workmanship like honeycombing etc or any reason attributable to negligence on the part of the contractor then the Centre's/Engineer-in-Charge's decision regarding dismantling, of such concrete or rectification if concrete is allowed to be retained in its place shall be final and binding on the contractor.

J.2 Where Concrete in Structure is Allowed to be Retained

In the case of concrete showing the result of the tests strength less than those specified, the quantities in cubic metre certified by the Centre as so deficit may be allowed to remain in such a case subject to deduction for such sums as are or may become due under the contract not exceeding Rs. 50.00 per cum of the quantity so certified in case where deficiency does not exceed five percent and Rs.100.00 per cum of the said quantity where the deficiency exceeds five percent. The Centre/Engineer-in-Charge shall have full power in their absolute discretion to fix the actual rate of deduction subject only to that the rate so fixed shall not exceed the maximum as provided above.

J.3 Concrete Ordered to be Dismantled

If the deficiency exceeds standard Deviations arrived as per IS 456 of latest edition, the Centre may at their discretion direct the portion of concrete certified by them so as deficient in strength to be dismantled from the structure and replaced by concrete of specified strength and the contractor shall in that case have to carry out that direction at his own cost irrespective of the amount of loss, inconvenience and difficulties involved. Concrete thus dismantled will not be measured and paid for.

J.4 Concrete Retained with rectification

Where the Centre consider that defective concrete be strengthened, the contractor shall carry out all rectification work as per direction of Centre at contractor's expense. The concrete of lower strength thus accepted shall, however, be paid for concrete as mentioned above after necessary strengthening.

J.5 Quality of Defective Concrete Represented by Cubes

In all cases of defective concrete as revealed by work test cubes strength falling below the specified strength, the quantity of concrete thus affected and represented by the cubes will be decided by the Centre whose decision shall be final and binding on the contractor.

J.6 Honey Combing

a) Where honeycombed surface are noticed in the concrete, the contractor shall not patch up the same until examined by the Centre and decision given regarding the acceptance with rectification or rejection of the same. If the contractor patches up such defects without the knowledge of the Centre

the Centre will be at liberty to order demolition of the concerned concrete members to the extent they consider necessary. In such case, the contractor at his expense, shall demolish and reconstruct defective work. The demolished work shall not be measured and paid for.

b) If in the opinion of the Centre the honeycombing is harmful to the structure and where so directed by the Centre/Engineer-in-Charge the full structural members affected by honeycombing as decided by Centre shall be dismantled and reconstructed to Centre' approval at the contractor's expense. The demolished concrete will not be measured and paid for.

c) Where in the opinion of the Centre the Structural members containing honeycombing can be allowed to be retained with rectification, the rectification shall be carried out as directed by the Centre by gunniting (with cement mortar 1:3 proportion)the areas concerned at the contractor's expense.

d) If such honeycombed areas are not severe in the opinion of the Centre and where so directed shall be patched up with cement mortar consisting of 1 part of cement and 3 parts of sand after removing defective concrete up to sound concrete surface to the satisfaction of Centre/ Engineer-in-Charge all at the expense of the contractor.

J.7 Other Defects

Any other defects in concrete shall be made good as directed by the Centre at the contractors expenses.

2.K Contractor's Rates to Include

The rates of the contractor for providing and laying cement concrete in various grades or proportion in the schedule of quantities shall, apart from any other factors specified elsewhere in the tender documents, include for the following :

a) For all factors and method of work described in this specification and relevant Indian Standards.

b) For all materials, labours, tools and 'plants, scaffolding, staging etc mixing conveying and placing concrete in position, ramming, vibrating, toweling, curing, and removing the scaffolding after the work is complete.

- c) Unless otherwise specified in the Schedule of Quantities the cost for concrete items shall include for providing, stays, struts, bolts, nuts and every item necessary to keep the forms rigid, smoothing the surface to receive concrete as per detailed drawing, striking and stripping formwork after the concrete is cured or as specified, hacking the concrete surfaces required to receive plaster etc. Where shuttering is described as a separate item in the schedule of quantities, rate for shuttering shall be inclusive of all the works mentioned in this para apart from other factors mentioned in specification for form work and also elsewhere in this contract. Shuttering to curve structure will be measured and paid as detailed in Schedule of Quantities.
- d) The reinforcement in case of reinforced concrete work will be paid for separately unless otherwise stated in the particular items, but rate shall include for pouring concrete and packing around reinforcement.
- e) The measurement of concrete will be as per detailed drawing, shapes and size based on net structural sizes as per drawing i.e. exclusive of plaster.
- f) Rates for concrete items shall cover for any shape of structural members like columns, beams, fascia, fins, louvers etc. and for cantilever beams, slabs, etc including curve structures.
- g) Formation and treatment of construction joints, and expansion joints where water bars of approved materials or joint fillers like "Shalitex" are specified such materials shall be paid as per separate rates.
- h) Design of mixes, if required by specification, testing in an approved laboratory, tests of materials and work required in the opinion of the Engineer-in-Charge and described in these specification.
- i) Fixing all inserts like pipe, plugs, forming holes etc as described.
- j) Weigh-batching using a Mechanical Weigh Batcher of a batching plant or where so specified for volumetric batching.
- k) For taking out dowel bars, fan hooks, etc. through shuttering.
- l) For forming drip moulds in chajja, sills etc. as shown in the drawings or as described.
- m) For work at all levels.
- n) In cases where at the junctions of beams, column and slab the composition of concrete mix of specified strength be different for columns, beams and slab then in such cases only the richer concrete among those specified for in all these members shall be used at the junctions and rate quoted for columns, beams and slabs or any members entering such junctions shall allow for the same. Rate shall also cover for spill over of rich concrete in beams to natural angle of repose of wet concrete required from practical consideration while concreting the junctions.

2.L Steel Reinforcement

L.1 Mild Steel Bars

Mild steel reinforcement bars shall conform to I.S. 226 of latest edition "Standard Quantity" or I.S. 432 of latest edition "Grade 1". Other qualities of steel shall not be acceptable.

L.2 High Strength Deformed Bars

Where high strength deformed steel bars and wires are specified, the material shall be as manufactured by M/s. Hindusthan Steel, M/s. Tata Iron & Steel Company Ltd or other manufacturers conforming to IS 1786 of latest edition accompanied by a certificate from manufacturer.

Test: Necessary tests on steel reinforcements bars & wires shall be carried out by the contractor as per instruction of Centre at an interval mentioned in this contract at no extra cost.

L.3 Cleaning of Reinforcement

Before steel reinforcement is placed in position, the surface of the reinforcement shall be cleaned of rust, dust, grease and any other objectionable substances.

L.4 Bar Bending Schedule of Reinforcement

On receipt of structural drawing, Contractor shall prepare bar bending schedule of reinforcement and shall obtain approval of the Centre.

L.6 Cutting of Reinforcement

Before steel reinforcement bars are cut, the contractor shall study the lengths of bars required as per drawing and shall carry out cutting only to suit the sizes required as per drawing.

L.6 Placing and Security

Reinforcement bars shall be accurately placed and secured in position and firmly supported or wedged by precast concrete blocks of suitable thickness at sufficiently close intervals so that they will not sag between the supports or get displaced during the placing of concrete or any other operation of the work. Contractor Shall maintain reinforcement in its correct position without displacement and correct specified cover. The contractor shall be responsible for all costs for rectification required in case the bars are displaced out of their correct position.

L.7 Binding Wire

The reinforcement shall be securely bound wherever bars cross or whenever required for with 20 gauge soft black annealed steel wire.

L.8 Welding

Welding of bars shall not be carried out unless specifically authorised in writing by Centre/ Engineer-in-Charge as per LS. Code of Practice in place of splicing. However, no extra payment shall be allowed for the same.

L.9 Bends etc

Bends, cranks, etc. in steel reinforcement shall be carefully formed, care being taken to keep bends out of winding. Otherwise all rods shall be truly straight. If any bend shows signs of cracking the rod shall be removed immediately from the site. Minimum radius of 9 times diameter of the bar shall be used unless otherwise specified in the drawings. However, in respect of standard hooks the radius of bend shall be 2 times the diameter of bar. Heating of reinforcement of bars to facilitate bending will not be permitted. The bars shall always be bent cold. In case of mild steel reinforcement bars of larger sizes where cold bending is not possible they may be bent by heating with written permission of the Centre. Bars when bent shall not be heated beyond cherry red colour and after

bending, shall be allowed to cool slowly without quenching. The bars damaged or weakened in any way in bending shall not be used on the work. High strength deformed bars shall in no case be heated to facilitate bending or cranking.

L.10 Inspection of Reinforcement

No concreting shall commence until the Centre have inspected the reinforcement in position and until their approval have been obtained. A notice of at least

72 hours shall be given to the Centre by the contractor for inspection of reinforcement. If in the opinion of the Centre any materials are not in accordance with the specification or the reinforcement is incorrectly spaced, bent or otherwise defective, the contractor shall immediately remove such materials from the site and replace with new and rectify any other defects in accordance with the instruction of the Centre and to their entire satisfaction.

L.11 Nett Measurement

Reinforcements shall be placed as shown on the structural drawings and payment will be made on the nett measurements from drawings. Only such laps, dowels, chairs and pins in reinforcement as approved by the Centre or shown on drawings shall be paid for. The contractor shall allow in his quoted rates for all wastage which will not be paid separately.

L.12 Stock Piling of Steel

Steel required shall be stock piled well in advance of need in the work. Contractor shall stock pile 1/3 requirement within 15 days, 2/3rd requirement at 1/4 contract time and full requirement at (1/2 contract time or to suit the accepted work programme.

L.13 Cover for Reinforcement

Cover shall be measured from the outer surface of main reinforcement. Cover shall be as follows if not specified/shown in construction drawings.

- a) At each end of a reinforcing bar, 25 mm or twice the diameter of such rod or bar, whichever is greater.
- a) For longitudinal reinforcing bar in beams 25 mm or the diameter of such rod or bar, whichever is greater.
- b) For tensile, compressive shear or other reinforcement in a slab (5 mm or the diameter of such reinforcement whichever is greater.
- d) For reinforcement in any other member such as a lintel, chajja, canopy or pardi, 15 mm or the diameters of such reinforcements, whichever is greater. For main reinforcement in isolated footings (side and bottom) clear cover shall be 50 mm.
- f) For column bars clear cover shall be 40 mm, unless otherwise specified as in drawing. In case of columns of minimum dimension of 200 mm or under, whose reinforcing bars do not exceed (2 mm, minimum cover of 25 mm should be provided.
- g) For bars in slabs of strip footings and mat foundations the clear cover shall be 50 mm. Beam bars shall be placed over slab bars in respect of beam & slab type foundations.

L.14 Rates quoted for Reinforcement in Addition to Any Factors mentioned elsewhere shall also include for

- a) All cutting to length, labour in bending and cranking, forming hooked ends, handling, hoisting and everything necessary to fix reinforcement in work as per drawing.
- b) Decoiling, straightening (coiled bars, bent bars to facilitate transporting).
- c) Cost of binding work required as described.
- d) Cost of precast concrete cover blocks to maintain cover and holding reinforcement in position.
- e) For fabricating and fitting reinforcement in any structural member irrespective of its location, dimensions and level.
- f) Removal of rust and every other undesirable substances, using wire brush etc as described.
- g) Work at all levels.
- h) Rolling tolerance and wastage.
- i) Stock piling of reinforcements as described.

2.M Damp Proof course

Damp proof course shall be 40 •mm125 mm thick (as specified in the Schedule of Quantities) artificial stone 1:1 1/2:3 (1 part cement, 1/2 parts sand and 3 parts stone chips of 6 mm graded down Approved waterproofing compound of proportion as specified by manufacturer should be mixed with the concrete- during mixing, as per manufacturer's specification. Before laying the concrete on the wall, the top surface shall be thoroughly cleaned of dirt, loose particles, cake mortar dropping and latiance, if any kind by scrubbing with coir or steel wire brush or by hacking if necessary. The surface shall be moistened before laying the concrete. The concrete should be laid in every case over the full width of the superstructure walls or as shown in the drawing. The top surface shall be finished with double chequered marks for adhesion of mortar for brickwork. Proper curing should be done before starting the brickwork over the damp proof course.

If any particular materials or any other treatments be specified in the schedule of quantities for damp proof course such particular materials or specifications shall be followed.

2.M Reinforced Cement Concrete

After the excavation as per cl.1.5, upto required depth, single layer B. F. S to be laid over which cement concrete 1:2:4 (1 cement: 2 course sand : a graded stone aggregate of 20mm nominal size) at least required thickness as decided by the Engineer- in –charge over which RCC slab of required thickness to be cast to the entire flat floor area. Whole work to be executed as per CPWD specification.

Similarly for providing RCC footing for required nos of RCC column of required size and shape with provision all arrangement to provide / rest manufacturer and statement of items of work.

3.0 BRICK WORKS

3.1 Bricks

- a) The bricks shall be locally available kiln burnt bricks of generally regular and uniform size, shape & colour, uniformly well burnt but not overburnt. The bricks shall be free from cracks, chips, flaws, stones or lumps of any kind and the rating of effloresence shall not be more than

"moderate", when tested as per IS. 3495 of latest edition. They shall not have any part unburnt. They shall not break even after being- dropped on the ground on their flat face in a standard condition from a height of 60 cm.

- b) The size Of brick shall normally 250 mm x 125 mm x 75 mm or 230 mm x 115 mm x 65 mm. Bricks of one standard size shall be used on one work unless specially permitted by the Centre.
- c) After immersion in water, absorption by weight shall not exceed 20% of dry weight of the brick when tested according to IS 1077. Unless otherwise specified the load to crush the brick when tested according to IS 1077 shall not be less than 50 Kg/Sq.cm.
- d) Prior approval of Centre shall be obtained for the brands of bricks to be used in the work after compliance with the above specifications/tests.

3.2 Mortar

Unless otherwise specified, mortar for brick work shall .be composed of 1 part of cement to 6 parts of approved sand for walls of one brick thick (25 cm) and over and one part of cement to 4 parts of approved sand for half brick thick and brick on edge walls.

3.3 Construction Details

- a) Soaking: All brick shall be immersed in water for 24 hours before being put into work so that they will be saturated and will not absorb water from the mortar.
- b) Bats: No bats or cut bricks shall be used in the work unless absolutely necessary around irregular openings or for adjusting the dimensions of different course and for closers, in which case, full bricks shall be laid at corners, the bats being placed on the middle of the courses.
- c) Laying: The bricks shall be laid in mortar to line, level and shapes shown on the plan, slightly pressed and thoroughly bedded in mortar and all joints shall be properly flushed and packed with mortar so that they will be completely filled with mortar and no hollows left anywhere. Bricks shall be handled carefully so as not to damage their edges. They should not also be thrown from any height to the ground but should be put down gently. All course shall be laid truly horizontal and all vertical joints made truly vertical. Vertical joints on one course and the next below should not come over one another and shall not normally be nearer than quarter of a brick length. For battered faces beading shall be at right angles to the face

Fixtures, pluos, frames etc. if any, shall be built in at place shown in the plans while laying the courses only and not later by removal of bricks already laid. The top layer of bricks of one or more thick wall coming in contact with R.C.C. beam/slabs and at window sill level etc shall be laid on edge as per direction.

Care shall be taken during construction to see that edges of bricks at quoins, sills, heads etc. are not damaged.

The verticality of the walls and horizontality of the courses shall be checked very often with plumb bob and spirit level respectively.
All external wall should have fair face on exterior surface.

- d) Bond: Unless otherwise specified, brick work shall be done in English Bond. All walls, coming in contact with reinforced concrete columns, beams etc. should be properly bonded by inserting reinforcements. Extra labour shall be included in the rates (reinforcements will be measured and paid separately against reinforcement item provided in the Schedule of Quantities.
- e) Joints: Joints shall not exceed 10 mm (about 3/8") in thickness and this thickness shall be uniform throughout. The joints shall be raked out not less than 10mm (about 3/18") deep when the mortar is green where pointing is to be done. When

the brick surface are to be plastered, the joints shall be raked to a depth of 5 mm when the mortar is green, so as to provide good key to plaster.

- f) Uniform Raising: Brick work shall be carried up regularly in all cases where the nature of work will admit, not leaving any part 60 mm lower than another. But where building at different levels is necessary, the bricks shall be stepped so as to give later at uniform level and effective bond. Horizontal courses should be to line and level, and face plumb as shown on the plan. The rate of laying masonry may be upto a height of 80 cm (about 32") per day if cement mortar is used, and 45 cm (about 18") if lime mortar is used.

3.4 Scaffolding

The scaffolding must be of approved type strong and rigid stiffened with necessary cross bearers and safe to prevent injury to persons or materials. The contractor shall have to allow other trades to make reasonable use of his scaffolding as directed by the Centre/ Engineer-in-Charge. If for the interest of work the contractor have to erect scaffolding in the other properties including local bodies or Corporation, the arrangement for the same including the cost of licensing fees etc. shall have to be borne by The contractor and the Centre should be kept free from any liability on this account. Put log holes shall be made good by bricks to match the face work when put logs are removed after ensuring that the holes behind are solidly filled in with 1:4:8 cement concrete.

3.5 Curing

All brick works shall be kept well watered for 14 days after laying. While pozzalana cement is used for mortar the curing shall be extended by one week at contractor's expense.

3.6 Half Brick/Brick on Edge Work

Half brick thick and brick on edge walls, shall be provided with H.B. wire netting of approved quality as -reinforcements. For -half brick thick wall and brick on edge wall H.B. wire netting reinforcements of approved quality shall be provided at every third course and in alternate course respectively according to standard practice.

3.7 Rates to Include

Apart from other factors mentioned elsewhere in this contract, the rates for items of brick work shall include for the following:

- a) All labour, materials, use of tools, equipment and other items incidental to the satisfactory completion of brick masonry at all heights and levels.
- b) Erecting and removing of all scaffolding, ladders and plant required for the execution of, the work to the height and depths and shapes as shown on the plan or as ordered by the Centre including extra labour and materials for using cut bricks in the construction of wall of varying

thickness other than one brick, one and half brick, half brick and brick on edge walls as per drawings.

- c) Constructing brick work to lines, levels, batters, pillars, curve, projection, cutting, toothing etc. in strict conformity with the drawings and to any position or shape, to any heights or levels including raking out joints and housing frames, fixtures etc
- d) Necessary charges of outside scaffolding work for construction of external brickwork from outside to have fairface on exterior surface.
- e) Curing brick work.
- f) Extra labour for bonding brick work to RC works as specified.
- g) Removing of all stains and adhering mortar lumps on the brick work surface.
- h) Cost of reinforcement in half brick walls and brick on edge walls.
- i) Raking out joints for receiving plaster as specified.

3.8 Measurements

- a) Half brick thick and brick on edge walls shall be measured in sq.m unless otherwise mentioned.
- b) One brick wall and thicker walls shall be measured in cum. Brick walls upto and including 3 brick in thickness should be measured in multiples of half bricks which shall be deemed to be inclusive of mortar joints. Widths of more than three bricks in walls will be measured actually and limited to the width specified.
- c) No deduction or addition shall be made on any account for:-
Ends of dissimilar materials (i.e. joists, beams, lintels, posts, girders, rafters, purlins, trusses, corbels steps etc.) upto 0.1 sqm in section.
- d) For details of measurements not mentioned elsewhere in the contract, the method of measurement should be as per relevant LS. Code.

3.9 Brick Flat Soling

For soling the bricks shall be of approved, quality, hard, tough, durable, dense, clean, free from soft spots, cracks decay and other defects. Brick bats shall not be used. All the fillings shall be watered and compacted to get maximum consolidation. All necessary trimming or filling for laying of the soling in line and required grade shall be done.

The sub-grade shall be marked by stacks and strings for required depth for laying of soling. The cushioning will also consist of local sand.

The bricks shall be laid on flat (unless otherwise specified) touching each other. Brick shall be laid in parallel rows breaking bond or in herring bond pattern as directed and firmly embedded true to line and filled with local sand. Measurement shall be in sqm.

The in-situ and precast terrazzo paving shall be composed of 7 parts marble chipping of the required colour & 4 parts cement marble powder mix, the whole rolled or trowelled to a dense even surface free from holes and blemishes

4.0 Structural Steel: Standard structural work as per IS: 800

4.1 Structural

Built-up sections are made from hot rolled plates conforming to ASTM A-572 Gr50 (345 MPa) steel. The plates are joined together on one side of the web by a continuous automatic submerged arc welding process to produce the section required.

Hot rolled sections except beams are mill sections complying with IS:2062 (240 MPa) steel.

ERW pipes, sections and crane beams are mill formed sections conforming IS 2062 for 240 MPa yield.

Black (non coated) cold formed sections of thickness 1.6 mm, 2.0 mm and 2.5 mm are made of hot rolled sheet to ASTM A607 Gr50(345 Mpa) steel.

Bracing rods and sag rods are made of steel bars conforming to IS:2062 with a minimum yield strength of 240MPa.

4.2 Fasteners

Primary structural connection are made with electro galvanized (silver) high strength bolts Gr. 8.8 steel conforming to IS 3757

Purlins and girts are connected to their supporting members by machine bolts Gr. 4.6 steel conforming to IS 1363 electro-galvanized (yellow).

Anchor bolts are made of rods conforming to ASTM F1554 with a minimum yield strength of 250 MPa.

Roof and wall panels are fastened by No. 12 carbon steel self-drilling screws hot-dip galvanized with polymer coated finish with an integral washer head to which an EPDM elastomer layer is bonded.

4.3 Non-Metals

Adhesive sealing tapes are made of an elastomeric butyl rubber based extruded sealant on silicon release paper. End lap sealant is nitrilized silicon sealant. Fiberglass insulation is as per IS 8183, 50 / 100 mm thick, with a vapor barrier (foil scrim Kraft/ reinforced white vinyl/reinforced white metalized film scrim kraft facing). Density shall be no less than 16 Kg/m³. No wire mesh is required under the insulation.

4.4 Paint

4.4.1 Shop Primer

Primary steel shall be cleaned to Specification St2.

One shop primer coat of Red Oxide Zinc Chromate shall be applied with an average dry film thickness of 25 microns on all red steel.

Shop primer provides protection for elements while in transit and construction, and is not intended to be for permanent protection.

4.5 Standard Accessories

4.5.1 Louvers

S-type fixed louvers shall be 0.5mm silicon polyester coated Galvalume sheet in white colour with insect screen.

4.5.2 Vents

Gravity flow Ridge Vents shall be 300 mm, 500 mm or 600 mm throat, in 3000 mm long units of 0.5mm silicon polyester coated Galvalume sheet in white colour.

4.5.3 Roof Extensions

Sidewalk Roof Extensions shall be 900 mm cantilevered roof members located at the eave and sloped at the same pitch as the main structure roof slope.

End wall Roof Extension shall be 900 mm cantilevered “C” and “Z” sections which are continuous span extensions of the main building end bay purlins and eave struts.

Roof Extensions structural members (except rafters) shall be completely concealed when optional soffit panel is specified.

4.5.4 Structural Canopy

Side wall Canopies shall be 1500 mm cantilevered rafters attached at the eave, or at any point below the eave, supporting 200/250 mm deep “Z” purlins.

Optional soffit panel shall conceal only canopy purlins, leaving rafters exposed, unless otherwise specified.

4.5.5 Fascias

Vertical and Curve line fascias shall be of the bracket mounted type.

Vertical fascias shall consist of hot rolled “I” section or cold formed “C” section fascia posts supported by a hot rolled section bracket that is cantilevered from the rigid frames columns at side walls and from the end wall posts at end walls, with cold formed 200/250 mm deep “Z” and “C” sections as top and bottom girts respectively. An intermediate “C” girt oriented vertically shall be supplied to support valley gutters when required.

Vertical fascias shall project 600 mm from the steel line. The height of the fascia shall vary depending on actual requirements.

Fascia cladding shall be of 0.5 mm thick (nominal) pre-painted Hi-Rib panels. Soffit panels and back side panels are provided only when specified.

Curveline Fascias shall consist of the same type of construction as vertical fascias but shall be supplied with curved steel panels having the same corrugation profile as the Hi- Rib panel and shall be available in three types:

Type-I shall have a circular panel at the bottom of the fascia only.

Type-II shall have a circular panel at the top and bottom of the fascia.

Type-III shall be single panel profile curved at the mid height of the fascia.

4.5.6 Trims and Liner Panels

Trims shall be made of pre-painted Al-Zn steel, 0.5 mm minimum thickness. All trims shall be White except for corner trims and fascia trims which shall match the panel colors.

Gutters shall be nominal channel made of 0.5 mm Al-Zn steel, pre-painted White. Downspouts shall be in 100mm square in 0.5mm alum/zinc steel pre-painted in white.

Liner panel shall be 0.5 mm galvanized steel pre-painted with White finish Hi-Rib panels. All liner trims shall match the liner panel color.

4.5.7 Colour Shade

The colour shade for the roof and wall cladding sheets shall be selected by the Centre/Engineer-in-Charge.

4.6 Anchorage on Foundation

Anchor bolts shall be designed and set according to the foundation layout provided by the consultant. Structural calculations shall be provided if asked for.

5.0 FLOOR FINISHING WORKS

5.1 IRONITE FLOOR FINISH

- a) It shall consist of an underbed and a topping (incorporating iron particles) laid over an already laid and matured concrete base.
- b) Thickness: Unless otherwise specified the total thickness of the finish shall be minimum 50 mm for horizontal surface of which topping shall not be less than 12 mm. While topping shall be of uniform thickness, the under bed may vary in thickness to provide necessary slope. The vertical surface shall project 6 mm from adjacent plaster or other finishes. Necessary cutting into the surface receiving the finish shall be done to accommodate the specified thickness.
- c) Material: The hardening compound shall be uniformly graded iron particles, free from non-ferrous metal impurities, oil, grease, sand, soluble alkaline compounds or other injurious materials. When desired by the MMCI/HPCL Engineer-In-Charge, actual samples shall be tested.
- d) Mix
The under bed for floor and similar horizontal surfaces shall consist of a mix of 1 part of cement, 1 part of sand and 2 parts of stone aggregates by volume. The stone aggregates shall be 10 mm down well graded. Just sufficient water shall be added to give workable consistency.
- e) Proportion of metallic hardener shall be as specified or as indicated by the manufacturer. However, in absence of any such direction 1 part metallic hardener shall be mixed dry with 4 parts cement, by weight. To this mixture 6 mm nominal size stone aggregates shall be added in proportion of 1 part cement mixed with hardener to 2 parts of stone aggregates by volume and uniformly mixed. Minimum quantity of water shall be added to make it workable.
- f) Laying
The concrete floor shall be laid in panels of 1m x 1m or as directed by the Engineer. Alternate panels shall be laid on one day followed by the other group of alternate panels the next day. The

edges of the panels shall be supported either by wooden strips or flat angle iron pieces fixed in position property. The concrete floor shall be laid upto the required grade. The forms if any shall remain sufficiently projecting to take the finish. The surface shall be roughened by wire brush as soon as possible.

- g) The junction of floor and walls, floors and dado or skirting shall be rounded off as directed.
- h) Wooden strips or flat iron pieces shall be removed from their places before the succeeding alternate layers are laid. The finish shall be laid while the concrete underbed is still very 'green' within about 3 hours of laying of the later. The finish shall be of uniform thickness and even dense surface without trowel marks, pinhole etc. The topping layer shall be pressed firmly and worked vigorously and quickly to secure full bond with the concrete base. Just when the initial set starts the surface shall be finished and smoothed with steel trowel. The finish floor shall be cured for 7 days by keeping it wet.

5.2 VITRIFIED TILES:

Materials:

a) **Non-Skid Joint less Vitrified** tiles shall be of the colour and pattern approved by the Engineer and the size shall be 60 cm. x 60 cm. x 10 cm. They shall conform to IS : 15622 in respect of constituent materials , manufacture , shape , dimensions , tolerances , wearing layers, colour and appearance , general quality, strength resistance to wear , water absorption etc. Prior to use , the samples of tiles shall be approved by the Engineer who shall keep them in his office for reference. Tiles shall be properly cured by immersion in water before incorporation.

Tiles shall conform to the detailed specification , and shall be of colour and pattern as approved by the Engineer , who shall keep samples in his office for reference. Mortar for bedding the tiles shall be in the proportion of one part of cement to four parts of sand. The mortar shall be thoroughly mixed either manually or mechanically. The water added shall be the minimum required to give sufficient plasticity in laying and compacting. Care shall be taken in the preparation of the mortar to ensure that there are no hard lumps that would interfere with the even bedding of the tiles.

5.3 CONSTRUCTION DETAILS FOR NEW FLOOR:

a) A bed of cement mortar consisting of one part of cement to four parts sand shall be laid and properly levelled to an average thickness of 20 mm. , the surface being kept slightly rough to provide a key for the tiles.

b) Neat cement paste of honey like consistency shall be spread over the mortar bed over such an area as would be covered by about twenty tiles.

c) Tiles should be soaked in water for 15 minutes and allowed to dry for an equal amount of time before being laid.

d) The tiles shall then be coated with a thin coat of cement paste on the back and fixed in place and gently tapped with a wooden mallet till it is properly bedded and level with the adjoining tiles. The joints between tiles shall be fine and nearly imperceptible (1.1/2 mm maximum.).

e) After tiles have been laid in a room or a days work completed , surplus cement paste that has come out of the joints should be wiped clean. A thick slurry of coloured pigment with white cement ,

matching the colour of the tiles is then spread over the laid tiles and rubbed so as to seal even the thinnest joint between the tiles.

f) The floor shall be cured for 3 days.

5.4 Skirting:

Skirting shall be 15 cms. high unless otherwise specified and shall perfectly match with the adjacent flooring. Mortar used shall be 1 :4 cement mortar and joining shall be done by a thick slurry of coloured pigment with white cement , matching the colour of the tiles is then spread over the laid tiles and rubbed so as to seal even the thinnest joint between the tiles.

5.5 GLAZED TILES:

General:

This item relates to the furnishing of materials and installations of glazed tiles in flooring, dado, and also in counters, shelves, sill etc. as per requirement.

Materials:

The tiles shall be of first quality of approved manufacturers. Tiles shall be of size 300x300 mm or more (thickness to be specified by the manufacturer) of 1st quality conforming to IS : 15622. No chipped ,cracked, crazed or warped tiles shall be used. Glazed rounded corners and cups (convex or concave) shall be provided at corner of walls , edge, junctions of floor and dado etc., if so specified. The mortar shall be in the proportion 1 : 3. Preparation of mortar & fixing shall be as specified for vitrified tiles.

Laying:

The fixing shall generally conform to IS : 1443.

Workmanship:

The surface to be covered shall be plastered rough to a thickness of 20 mm. Fix 12 mm size stone chips (5 no. one in each corner and one in the middle of each tile with Adhesive viz., Arelidite of equivalent for keying action) and the tiles shall be soaked in water for at least 2 (two) hours prior to fixing at site. A thin layer of cement paste shall be buttered on the back of the tile and on the side after which the tile shall be pressed and tapped home taking care that the corner tiles are perfectly matching. After the backing coat has set the tile joints shall be grouted with neat, white cement slurry with necessary pigment. All surplus slurry that remains on the surface shall be carefully wiped off before it sets. Care shall be taken to ensure that the finished surface is absolutely plumb and to proper levels without any profusions , waviness or zig- zag. Joints between tiles shall be uniform in straight level lines. After completion of the entire work or part of it , the surface shall be cleared of all stains , cement etc., by washing with oxalic acid (1:10) or any other approved compound.

6.0 ALUMINIUM DOOR, WINDOW ETC.

6.1 All aluminium doors, windows, jallies, curtain wall etc. shall be procured from A class manufacturer subject to the approval of Centre. Aluminium sections for fabricating framework of doors, windows, jallies, etc. shall be of extruded sections as manufactured by Indian Aluminium Co Ltd or approved equivalent. Extruded section shall have a wall thickness as specified in the Schedule of Quantities or detail drawings. All sections shall be approved by the Centre before fabrication is taken up, Doors, frames and mullions, transoms shall be anodised to required thickness in a bath of sulphuric acid to

provide a uniform casting. A protective transparent coating shall be applied to the Sections before shipment from the Factory. All works for doors, windows, and frames etc. shall be fitted and shop assembled to a first class job, and ready for erection. Shop joints shall be made to hair lines and then welded or braced. Work on the above, other than described shall be carefully fitted and assembled with neat joints with concealed fasteners. Wherever possible, joint shall be made in concealed location and on edges of doors field connections of all work may be made with concealed screws or other approved type of fasteners. All fasteners connecting between aluminium members or between aluminium and concrete shall be either high strength aluminium or of stainless steel. Glazing beads shall be shop fit type without visible screw and shall be of sizes to accommodate various thickness of glazing as specified in the Schedule of Quantities. All works shall be adequately braced and reinforced as necessary for strength and rigidity. The members of the frame work shall be of one piece and no joint shall be allowed unless the same has prior approval of Centre/ Engineer-in-Charge. Fabrication drawings for the aluminium curtain waft, jallies etc shall be prepared by the contractors based on the design of the Engineer-in-Charge indicating the detailed of frame work, fixing arrangement and other necessary details well in advance of the actual fabrication work and casting of structural element supporting the jallies, curtain wall etc and to be approved by the Centre. A sample of the jalli, curtain wall etc unit fabricated as per approved drawing shall be produced for approval of Centre before commencement of bulk fabrication of jall I units curtain wall etc at shop.

6.2 HANDLING & STORAGE OF FABRICATING MATERIALS

All aluminium doors, windows, curtain wall, jallies etc shall be packed and crated properly before despatch, to ensure that there will be no damage to the fabricated materials. Loading in to 'Wagons/ Truck' shall be done with all care to ensure safe arrival of materials at site in undamaged condition. All the fabricated materials at site shall be stored under cover in such a way to prevent damage or distortion. Special care shall be taken to prevent staining of aluminium products by mortar etc. after erection at site.

6.3 ACCEPTANCE CRITERIA

6.3.1 For Fabricated Items:

- a) Overall dimensions shall be within + 1.5 mm of the size shown on drawings.
- b) Mullions, transoms etc. shall be in one length and permissible deviations from straightness shall be limited to + 1.5 mm from the axis of the member.
- c) Door and window shutters shall operate without jamming. The clearance at head and jamb for door shutters shall not exceed 1.5 mm. For double leaf doors, the gap at the meeting stiles shall not be more than 1.5 mm.
- d) Door leaves shall be undercut where shown on drawings.
- e) Doors, windows, frames and curtain wall frame work etc. shall be on a true place, free from warp or buckle.
- f) All welds shall be dressed flush on exposed and contact surfaces.
- g) Correctness of location and smoothness of operations of all shop installed hardware and fixtures.
- h) Provision for hardwares and fixtures like floor spring etc as directed to be installed at Site.
- i) Glazing beads shall be cut with mitred corners.

- j) Glazing clips, fixing devices etc. shall be supplied in adequate numbers
- k) Shop coats shall be properly applied.
- l) Exposed aluminium surfaces shall be free from scratches, stains and discolouration. Anodised surfaces shall be present a uniform and pleasing look.
- m) Anodising thickness shall be minimum 20 micron.

6.3.2 For Installed Items:

- a) Installations shall be at correct location, elevation and in general, on a true vertical plane.
- b) Fixing details shall be strictly as shown on drawings.
- c) Assembly of composite units shall be strictly as per drawings with mastic caulking at transoms and mullions, gaskets, weather strips etc. complete.
- d) All openable sections shall operate smoothly without jamming.
- e) All frames on external walls shall be mastic caulked to prevent leakage through joint between frames and masonry.
- f) Locks, fasteners, floor spring etc. shall be fitted in position properly. Keys shall be non-interchangeable.
- g) Cutting to concrete or masonry shall be made good and all abrasions to shop paint shall be touched up with paint of same quality as shop paint.

6.4 METHOD OF MEASUREMENT

- a) Supply and installation of doors shall be measured in number of each type used or in sqm as specified in the Schedule of Quantities. The types shall be as shown on drawings and described In Schedule of Items.
- b) Supply of windows shall be measured in square metres correct to two places of decimal. The width and height shall be measured overall from out to out of the frame. The height and width shall be measured correct to 0.5 cm. The Jai & curtain wall shall be measured in sqm.. The height and width shall be measured correct to 0.5 cm.

7. METAL ROLLING SHUTTERS / ROLLING GRILLS

Metal Rolling Shutters and Rolling Grills shall conform to IS:6248, and shall be as per drawings issued by the Engineer. The Contractor shall submit for EIC’s approval, the shop drawing covering all details of fabrication, construction and installation. After approval of shop drawing the Contractor shall submit one sample for approval before mass fabrication.

Rolling shutters shall be of following alternative types depending on the method of operation.

Sl. No.	Type	Clear Area of Shutter	Remarks
i.	Self Coiling or Pushing Pull Type	Up to 8 sq.m	Without ball bearing
		8 to 12 sq.m	With ball bearing

ii.	Gear Operated	12 to 25sq.m	With ball bearing. Operated by bevel gear box and crank
		25 to 35 sq.m	With ball bearing operated by chain wheel and hand
iii.	Electrically Operated type	35 to 50 sq.m	

7.1 Materials

Cold Rolled Steel Strips

Cold Rolled Steel Strips used for rolling shutter lath sections shall conform to temper No. 5, Dead soft quality of IS 513.

Mild Steel Sections

Mild Steel Sheets and Plates used for manufacturing the guide channels, brackets and lock plate shall be of hot rolled steel of thickness not less than 3.15 mm conforming to IS:5986. These shall be free from surface defects and the edges shall be cleanly sheared.

Steel Pipe

Mild Steel Pipes used for the suspension shaft of the roller shall be heavy duty pipe suitable for mechanical purposes and shall conform to IS:1161.

Cast Iron Castings

Cast Iron Castings used for roller pulley wheels, U-clamps and bevel gears shall conform to Grade 15 of IS:210. These shall be free of blow holes, surface defects such as cracks, burrs etc.

Springs

The springs used in the roller for counter balancing the rolling shutter shall be made either from high tensile spring steel wire or flat spring steel strip. The spring steel wire used for helical spring shall conform to Grade 2 of IS:4454. Flat spring steel strip used for spiral spring shall be from 0.8 to 1.0 percent carbon steel strip especially hardened and tempered.

Aluminium Alloy Sheets

Aluminium Alloy Sheets used for curtains in case of rolling grills, shall conform to 52000 (NS4), 53000 (NS5) or 64430 (HS30) of IS:737.

Aluminium Alloy Extrusions

Aluminium Alloy Extrusion for the components of rolling shutters of aluminium shall conform to 53000 (NE5) or 64430 (HE30) of IS:733.

7.2 Fabrication

Curtain

This shall be built up from interlocking lath sections. The lath sections shall be from 18 gauge (1.25 mm) section for curtains up to 9 metres in width. Curtain above 9 metres in width should be divided in two parts with provision of one middle fixed or movable guide channel or supported from the back to resist wind pressure. The lath section shall be rolled so as to have interlocking curls at both edges and a deep corrugation at the centre with a bridge depth of 16 mm to provide sufficient curtain stiffness for resisting manual pressure and normal wind pressure. Each lath section shall be continuous single piece without any welded joint. When interlocked, the lath section shall have a

distance of 75 mm between rolling centres. Each alternate lath section shall be fitted with a malleable cast iron or mild steel clips securely riveted at either end, thus locking the lath section at both ends and preventing lateral movement of the individual lath sections. The clips shall be so designed as to fit the contour of the lath sections.

Lock Plate

The Lock Plate provided at the bottom of the shutter, shall be composed of a mild steel plate 3.15 mm thick, reinforced with mild steel angle 35 x 35 x 5 mm at bottom of the plate. The lock plate shall be fitted with sliding bolts at either end to engage with suitable receiving pockets at the bottom of the guide channel. The sliding bolts shall be capable of being locked by means of padlocks both from outside and inside. The lock plate shall also be provided with pulling handles, one handle for 2.5 m width and 2 handles for widths above 2.5 m. Pulling handles shall be fixed on both inside and outside faces of the lock plate.

Guide Channels

These shall be of mild steel deep channel section of rolled, pressed or built up (fabricated) construction. The thickness of the sheet used shall not be less than 3.15 mm. The depth of the guide should be such that there is sufficient clearance between curtain and inner surface of guide. The curtain shall project into the guide at least 40 mm for shutters up to 3.5 m width and 60 mm for greater widths. There shall be a clearance of 10 mm between guide wall and the end clips of the curtain. Where the shutter is installed in heavy windy zones, special wind locking arrangements shall be provided to prevent the curtain coming out of the guide. The clear gap on either side of the curtain and inner faces of the guide channel shall be 5 mm. The depth and width of the guide channel shall be as follows:

Clear Width of	Depth of Guide Channel
Up to 3.5 M	65
3.5 to 8.0 M	75
8.0 m and above	100

Width of Guide Channel shall be 25 mm for lath sections with bridge depth of about 12 mm and 32 mm for lath sections with bridge depth of 16 mm.

Fixing Cleats

Each guide shall have a minimum of 3 fixing cleats. The spacing of cleats shall not exceed 0.75 m. Alternatively, the guide channels may also be provided with suitable dowels hooks or pins for embedding in the walls. The guide channel shall be attached to the wall plumb and true.

Bracket Plate

This shall be fabricated out of mild steel plate of 3.15 mm thick. Thicker plates may be used depending upon the height of the shutter. Dimensions shall be as given in IS:6248. The bracket plate may be square, circular or hexagonal with a U-shaped cast iron or mild steel clamp riveted or welded to it at the centre. The bracket plate should have sufficient cross sectional area to resist the shear arising out of the weight of the curtain, suspension shaft etc. and shall be held rigidly by suitable foundation bolts.

Roller

The suspension shaft of the roller shall be made of steel pipe conforming to heavy duty of IS:1161. The diameter shall be sufficient to limit deflection of shaft under the weight of the rolling shutter. The deflection of the shaft shall not exceed 5 mm per metre width of the shutter. Diameters of the steel

pipe for various widths up to 6 m and height 5 m shall be as per IS:6248. Sizing of pipe diameter for greater widths and heights shall be designed giving due consideration for deflection limit mentioned above. The pipes of the suspension shaft which are clamped to the brackets shall be fitted with rotatable cast iron pulleys to which the curtain is attached. The pulleys and the pipe shaft shall be connected by means of pretensioned helical springs to counterbalance the weight of the curtain and to keep the shutter in equilibrium in any partly opened position.

Hood Covers

These shall be made of mild steel sheets not less than 0.9 mm thick, and shall be hexagonal, square or circular contour depending on the contour of the bracket plate. The hood cover shall be stiffened with angle or flat stiffeners at top and bottom edges to retain shape. The hood cover shall be fixed to the bracket plate by means of angle cleats. The hood cover shall also be supported all along the top at suitable intervals to prevent sagging.

Gears, Worms etc

These shall be machine cut. Worm gear wheels shall be of high grade cast iron or mild steel or phosphor bronze. The worms shall be of mild steel or gun metal or phosphor bronze.

Security Devices

For shutter widths exceeding 2.5 m, any one or both of the following security devices may be provided. Anchoring Rods as described in IS:6248. These shall be provided at the rate of one per extra 2.5 m width or part thereof above a clear width of 2.5 m.

Central Hasp and Staple

This shall be provided at the centre of the bottom lock plate. The hasp shall be embedded in the floor at the centre. The staple shall be fitted at the centre of the bottom lock plate outside in an accurate position so that the hasp may properly engage with staple when the shutter is in a closed position. The hasp shall be embedded within the floor so as not to cause any obstruction. Normally one central hasp and outside staple will be sufficient for any width of shutter.

7.3 Optional Features:

Intermediate Posts or Mullions:

These shall be either of fixed, sliding or removable type, and are used for unusually wide openings or for providing multiple door entries. The mullion also forms the guide channels between the various sections of the rolling shutter. The sliding mullion may also be winch operated for large sizes. The fixing of the intermediate post shall be plumb and true when in position before closing the rolling shutter.

Wicket Door:

Large rolling shutter fixed at the main entrance of mills and factories may also be provided with a subsidiary door known as wicket door. This is a hinged service door allowing pedestrian traffic without the need of rolling up the shutter. The wicket door size shall be 600 x 1200 mm for ordinary use and 900 x 1800 mm for large installations. Sizes larger than these are not recommended as these cause difficulties in installation and operation. The wicket door shall be of good robust construction and shall be fitted with a good lever lock operated by key and lockable from both inside and outside. The wicket door shall be erected in such a way so as not to foul with the main rolling shutter when opening or closing. The wicket door shall be swung clear of the opening before the Rolling Shutter is raised.

Galvanising:

All components of the rolling shutter may be hot dip galvanised with a zinc coating containing not less than 97.5% pure zinc. The weight of the zinc coating shall be not less than 230 g/sq. m and the coating shall be free from flaking or peeling.

7.4 Operation

Push Pull Type

Push Pull Type shall be operated manually by pulling hooks with appropriate pulling handles in the lock plate. The length of the pulling handle shall be sufficient to push the lock plate up to the top most position.

Gear Operated Type

These shall be operated by two types of arrangement:

- i. by bevel gear box and crank handle
- ii. by chain wheel and chain. The height of the bevel gear box or the bottom of the hand chain shall be 0.85 m from floor. If specified on drawing, the crank handle operation or hand chain operation shall be provided on both sides of the wall. The gear reduction shall be calculated to reduce the pressure exerted on the crank handle or the pull exerted on the hand chain to not more than 16 kgs.

Electrically Operated Type

These shall be operated by an electric motor operating on 400/440V, 3 phase 50 cycles A.C. supply. Arrangements shall also be made for emergency mechanical operation of the rolling shutter in the event of failure of the electric equipment or electricity. The emergency mechanical operation shall be by an auxiliary chain wheel and hand chain drive. The motor shall have a push button control, with a minimum of 3 buttons marked "Up", "Down" and "Stop". Limit switches shall also be provided to cut off current to the motor when the shutter reaches the limit of its travel in the "Up" or "Down" directions.

7.5 Rolling Grills

These are similar in design and operation to Rolling shutters. Hence, all provisions of Rolling shutters are applicable to rolling grills except for the curtain. The rolling grill curtain may be manufactured out of 8 mm diameter mild steel or aluminium alloy round bars.

Rolling Shutter Cum Grill

These shall be provided in situation where certain amount of ventilation and safety is called for, e.g. in substations and transformer rooms. The rolling shutter may have a small grill portion as specified in the drawing the height of this grill shall generally be 500 mm.

7.6 Painting

All components of Rolling shutter except springs and inside of guide channel shall be thoroughly cleaned free of rust, mill-scale, dirt, oil etc. and two coats of red oxide zinc phosphate epoxy paint shall be applied. Two coats of approved epoxy finish paint shall be applied after installation. Other painting systems shall be employed if specified on the drawings.

Marking

Each shutter shall be clearly and legibly marked with the following information:

- i. Manufacturer's Name or Trade Mark
- ii. Size
- iii. Year of Manufacture.

8.0 CEMENT PLASTER (INTERNAL & EXTERNAL)

- a) **Preparation of Surface:** The walls to be plastered to have all joints raked out to a depth of 10 mm, if not already done. R.C.O surface shall be properly hacked to get good key to the plaster. All dust and oily matter, if any, shall be brushed and cleaned and surface to be plastered shall be kept wet for 6 hours before plastering is commenced.
- b) **Proportion of Mortar:** The plaster in walls, lintels, columns, ceiling, ceiling beams, projected slabs, rails, chajja, marquise, domes etc shall be done with sand cement mortar in the proportion as described in the Schedule of Quantities. No more cement mortar shall be prepared than that can be used within half an hours.
- c) **Application of Plaster:** The mortar shall be applied evenly with force on the surface to be plastered. The mortar surface shall be finished at once by being rubbed over with a trowel till the cement appears on the surface. All corners, angles and junctions shall be truly vertical and horizontal as the case may be, carefully and neatly finished. Rounding of corners and junctions where required shall be done without extra charge. The mortar shall adhere to the surface intimately when set and there should be no hollow sound when struck.
- d) When neat cement finish is specified over the plaster surface, a coat of pure portland cement slurry, 1.5 -mm thick shall be applied and well rubbed to the plaster surface while the plaster surface is still fresh.
- e) When no finish is specified, the plastered surface shall be rubbed well to an even plane with a wooden float for external surface and finished smooth with a steel trowel for internal surface.
- f) **Rates to include :** Apart from other factors mentioned elsewhere in the contract rates for the item of plaster shall include for the following :-
 - i) Erecting, dismantling and removing The scaffolding.
 - ii) Preparing the surface to receive the plaster.
 - iii) Providing cement plaster of the specified average thickness
 - iv) All labour, materials, use of tools and equipment to complete the plastering as per specification.
 - v) Curing for 7 days.
 - vi) Any moulding work if shown on the drawings or as specified unless separately provided in the tender.
 - vii) Plaster work in bends, arises, rounded angles, fair edges, narrow returns, quiriks 'V' joints, splays, drip mouldings, making good to metal frame junctions with skirting's of dados narrow

width and small quantities, making Good round pipes, conduits, timbers, sills, brackets, railings, etc and making good after all the sub-contractors or nominated sub-contractors have done their work.

viii) Neat cement finish when specified in the item.

g) **Mode of Measurement:** Plaster shall be measured in square metre.

Walls: The measurement of wall plastering shall be taken between the walls or partitions (the dimensions before plastering shall be taken) for the length, and from the top of floor or skirting depending upon the situation to the ceiling for the height.

Deductions: For jambs soffits, sills, etc. for openings not exceeding 0.5 sq.m each in area, ends of joists, beams, posts, girders, steps etc. not exceeding 0.5 sqm each in area, and openings not exceeding 3 sqm each, deductions and additions shall be made in the following manners:-

a) No deductions shall be made for ends of joists, beams, posts, etc and openings not exceeding 0.5 sqm and no additions shall be made for reveals, jambs, soffits sills etc. of these openings nor for finishing the plaster around ends of joists, beams, posts, etc,

b) Deductions for openings exceeding 0.5 sqm but not exceeding three sqm each shall be made as follows and no addition shall be made for reveals, jambs, soffits, sills etc. of these openings

- i) When both faces of wall are plastered with the same type of plaster, deduction shall be made for one face only.
- ii) When two faces of wall are plastered with different type of plasters or if one face is plastered and other pointed, deductions shall be made in the plaster or pointing on the side on which the width of reveals is less than that on the other side but no deduction shall be made from plaster or pointing on the other side. Where widths of reveals on both faces of wall are equal, deduction of 50 per cent of area of from areas of plastering and/or pointing as the case may be.
- ii) When width of door frame is equal to thickness of wall or is projecting beyond thickness of wall, full deduction for opening shall be made from each plastered/pointed face of the wall.
- iv) In case of openings of area above 3 sqm each .deductions shall be made for the openings but jambs, soffits and sills shall be measured.

Ceiling

i) Ceiling shall be measured between the walls or partitions and the dimensions before plastering shall be taken.

ii) Ceiling with projected beams shall be measured over beam and the plastered sides of beams shall be measured and added to plastering on

9.0 PUTTY PUNNING

Surface preparation:

- Ensure that the surfaces on which apply putty is plastered or made with the cementitious materials.
- Give separate treatment or remedial measure for dampness, fungus, efflorescence, fungus, leakage etc. on walls.

- Ensure that the surface is totally clean. It should be free from dust, loose particles, residual paints, grease, oil, wax, or any other contamination.
- Remove all loose or poorly adhering material from the surface by rubbing down using emery paper, wire brush or putty blade and thereafter wipe out.
- Moisten the walls with sufficient quantity of clean potable water and allow them to dry before application of putty. Ensure that the surface is just wet and moisture content of the wall in ideal condition below 12%. Over wetting resulting in accumulation of water on a surface should be avoided.

Mixing and Applying:

- Apply one coat of primer before the application of putty and dry it overnight as per manufacturer's instructions and directed by Engineer-in-Charge.
- Apply the first coat on a vertical surface as 'bottom to top' fashion by using a putty blade/spatula/trowel or any finishing tool.
- Leave the first coat dry completely for a minimum 6 to 8 hours.
- After drying of the first coat of putty, just rub the surface gently with emery paper in order to remove the loose particle.
- After finishing the first coat, start applying the second coat.
- Leave the surface to dry completely for hours. Third coat may apply if required as per direction of Engineer-in-Charge similarly. After complete drying of final coat, rub the surface very gently to remove unevenness with the help of using sand paper of not less than No.-500 to get a glossy white surface.
- The thickness of putty punning should be limited to maximum 1.5mm.
- The finished surface shall not show any sign of disintegration, topping or pilling. The surface shall be protected from injury and damage.

9.1 Rates to include

Apart from other factors mentioned elsewhere in this contract, rates for the item of putty punning shall include the following:

- i) Erecting, dismantling and removing the scaffolding.
- ii) Preparing the surface to receive the said finish.
- iii) Providing putty punning of the required thickness to make the surface perfect smooth and even including cost of materials.
- iv) Any moulding work if shown in the drawings or as specified.
- v) Finishing in bends, arises, rounded angles, fair edges, narrow returns, quirk, 'V' joints, splays, drip mouldings, making good to metal frames, junctions with skirting or dados, narrow widths and small quantities, making good round pipes, conduits, timbers, sills, brackets, railings etc. and making good after all the subcontractors or nominated sub-contractors have done their works.

9.2 Mode of Measurements

The measurement shall be in square metre. The mode of measurement shall be as applicable to that for plaster.

10.0 PLASTIC EMULSION PAINT

10.1 Material

The emulsion paint and primers in general shall be of approved quality colour and shade of approved manufacturers.

10.2 Scaffolding

This shall be double or single as required and directed. If ladders are used, pieces of gunny bags or cloth bags shall be tied on their tops to avoid damage or scratches to the plastered surfaces etc. proper stage scaffolding shall be erected when painting the ceiling.

10.3 Preparation of the Surface:

The surface to be painted shall be cleaned and all cracks, holes and surface defects shall be repaired with plaster of paris for spot, filling, and with filler prepared with whiting, water and a little quantity paint for filling and levelling the wider areas.

10.4 Priming Coat

The priming coat of the cement primer of approved quality make shall be applied over the completely dry surface in the manner as recommended by the paint manufacturers.

10.5. Application of Emulsion Paint

The recommendation of approved paint manufacturer, whose product is used, shall be followed regarding the preparation of the surface and the application of the priming and finishing coats. The contractor shall arrange for technical assistance and supervision from the paint manufacturer, during the execution of the painting work. After the priming coat has been applied and perfectly dried, all holes, scratches, if any, shall be repaired as mentioned in 'preparation of surface' and then the second coat of approved shade and manufacturer shall be evenly applied and allowed to dry. The third coat shall be carefully applied to achieve smooth and even surface after the previous coat has dried up. Minimum 3 coats of paint shall be applied inclusive of primer coat. If a proper and even surface is not obtained to the satisfaction of the Centre in 3 coats, Contractor shall carry out additional coats of painting to approval, at contractor's expenses. Care shall be taken that dust or other foreign materials do not settle or disfigure the various coats.

10.6 Rates to Include:

Apart from other factors mentioned elsewhere in this contract, the rates for the item of plastic emulsion paint shall include for the following :-

- i) All labour, materials and equipment necessary to carry out the work.
- ii) Supplying the approved emulsion paint for priming and finishing coats.
- iii) Preparing the surface for receiving the primer and finishing coats.
- iv) Scaffolding including its erections and dismantling.
- v) Application of one primer coat and minimum two coats of finishing. If a proper and even surface is not obtained to the satisfaction of Centre in 3 coats mentioned above, the contractor shall carry out additional coats of painting to approval at contractor's expense.
- vi) Protection to painted surface till dried and handed over.
- vii) Expense, if any, for supervision and technical assistance supplied by the approved paint manufacturers.

10.7 Mode of Measurement

The measurement shall be in square metre. The mode of measurement shall as applicable to that for white washing.

11.0 FALSE CEILING:

These specifications refer to the supply and installation of False ceiling.

Materials :

a) Suspension System:

The main load bearing member shall be a rectangular pressed metal formed section of size 2" x 1.5" fabricated from 22 gauge G.I. sheet. The cross runners or furring channel shall be in the form of a trough 2" x 3/8" fabricated from 24 gauge G.I. sheet. Wall angles shall be 1" x 1". The main runners or load bearing members shall be suspended from the Roof by means of a metallic expansion fastener. The hanger rods with threaded ends and 2 heavy M.S. Check nuts shall hold the main runners with level adjusting holding clamp of size 3" x 1". The main runners shall be fixed at 3 feet centre to centre and the cross runner shall be fixed to the underside of the main runners at a distance not greater than 1"-6" and at right angles to the main by means of Galvanised Clips diagonally, made of 10/12 SWG G.I. Wire.

b) Ceiling Tiles:

The ceiling tiles shall be 12 mm hard reflecting Mineral fibre ceiling tile or Gypsum board as specified. They shall be of approved quality and manufacture.

Workmanship:

After the runners are fixed at the required height they shall be checked for straightness. They shall be made perfectly level by means of the threaded hangers. Before fixing the tiles, the upper surface and edges of the tiles shall be treated with double coat of double boiled linseed oil or water-resistant varnish. They shall then be screwed on to the underside of the cross runners. Care must be taken that the tiles present an absolutely flat and level surface and that all joints are perfectly straight. All joints shall be sealed with filler of approved quality.

12.0 STANDARD SPECIFICATIONS

Unless otherwise specified elsewhere in this contract, all work under this contract shall be carried out in accordance with the technical specification and the latest issue of the Indian Standard Specification applicable to the particular class of work. If Indian Standards are not formulated for any particular material of work, the relevant British Standard Specification shall apply. Relevant issue of I.S. specifications as applicable to the particular work have been described along with the specification for the respective Works, In case of any confusion or dispute regarding the meaning and interpretation of any specification for the respective works, the decision of the Centre shall be final and binding on the contractor.

13.0 APPROVED LIST OF MATERIALS

Unless otherwise stated elsewhere in this contract all materials to be used in the work shall be with ISI mark or equivalent as approved by the Centre. Contractors intent to use any material other than ISI mark prior approval of the Centre should be obtained.

(Please see Page- 93-94)

14.0 SAFETY CODE

Scaffolds

- i) Suitable scaffolds shall be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except in the case of short duration work which can be done safely from ladders. When a ladder is used, it shall be of rigid construction made either of good quality wood or steel. The steps shall have a minimum width of 450 mm and a maximum rise of 300mm. Suitable hand holds of good quality wood or steel shall be provided and the ladder shall be given an inclination not steeper than 114 to 1(1/4 horizontal and 1 vertical).
- ii) Scaffolding or staging more than 4 m above the ground floor, swung or suspended from an overhead support or erected with stationary support shall have a guard rail properly bolted, braced or otherwise secured, at least 1 m above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.
- iii) Working platforms, gangways and stairways shall be so constructed that they do not sag unduly or unequally and if the height of the platform, gangway or stairway is more than 4m above ground level or floor level, they shall be closely boarded and shall have adequate width and be suitably fenced as described in (ii) above.
- i) Every opening in the floor of a building or in a working platform shall be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 1m. Wherever there are open excavations in ground, they shall be fenced off by suitable railing and danger signals installed at night so as to prevent persons slipping into the excavations.
- ii) Safe means of access shall be provided to all working places. Every ladder shall be securely fixed. No. portable single ladder shall be over 9 m in length while the width between side rails in rung ladder shall in no case, be less than 290 mm for ladder upto and including. 3 m in length. For longer ladders this width shall be increased at least 20 mm for each additional metre of length.
- vi) A sketch of the ladders and scaffolds proposed to be used shall be prepared and approval of the Engineer obtained prior to construction.

Other Safety Measures

- vii) All personnel of the contractor working within the plant site shall be provided with safety helmets. All welders shall wear welding goggles while doing welding work and all metal workers shall be provided with safety gloves. Persons employed on metal cutting and grinding shall wear safety glasses.
- viii) Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any. of the sites of work shall be so stacked or placed as to cause danger or inconvenience to any person or the public.

Excavation & Trenching

- ix) All trenches, 1.25 m or more in depth shall at all times be supplied with at least one ladder for each 30 m in length or fraction thereof. The ladder shall be extended from bottoms of the trench to at least 1 m above the surface of the ground. Sides of trenches which are 1.5 m or more in depth shall be stepped back to give suitable slope or securely held by timber bracing so as to 'avoid the danger of sides collapsing. The excavated materials shall

not be placed within 1.5 m of the edges of the trench or half of the depth of the trench whichever is more. Cutting shall be done from top to bottom. Under no circumstances undermining or undercutting shall be done.

- x) The contractor shall take all measures on the site of the work to protect the public from accidents and shall be bound to bear the expenses of defence of every suit, action or other proceedings at law that may be brought by any persons for injury sustained owing to neglect of the above precautions and to pay any such persons or which may with the consent of the contractor, be paid to compromise any claim by any such person.

Demolition

- i) Before any demolition work is commenced and also during the process of the work :
 - a) All roads open areas adjacent to the work site shall either be closed or suitably protected.
 - b) No electric cable or apparatus which is liable to be a source of danger over a cable or apparatus used by the operator shall remain electrically charged.
 - c) All practical steps shall be taken to prevent danger to persons employed from the risk of fire or explosion or flooding. No floor, roof or other part of the building shall be so over-loaded with debris or materials as to render it unsafe.

Personal Safety Equipment

- xii) All necessary personal safety equipment as considered adequate by the Engineer should be kept available for the use of the person employed on the site and maintain in a condition suitable for immediate use and the contractor should take adequate steps to ensure proper use of equipment by those concerned.
 - a) Workers employed on mixing asphaltic materials, cement and lime mortars shall be provided with protective footwear and protective goggles.
 - b) Those engaged in white washing and mixing or stacking of cement bags or any materials which is injurious to the eyes shall be provided with protective goggles.
 - c) Those engaged in welding works shall be provided with welder's protective eyesight lids.
 - d) Stone breakers shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.
 - e) When workers are employed in sewers and manholes, which are in use, the contractor shall ensure that the manhole covers are opened and are ventilated at least for an hour before the workers are allowed to get into manholes and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent accident to the public.
 - f) The contractor shall not employ men below the age of 14 years and women on the work of painting with products containing lead in any form. Wherever men above the age of 18 are employed on the work of lead painting the following precautions should be taken:
 - i) No paint containing lead or lead products shall be used except in the form of paste or readymade paint.
 - ii) Suitable face masks should be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint dry rubbed and scraped.
 - iii) Overalls shall be supplied by the contractor to the workmen and adequate facilities shall be provided to enable the working painters to wash during the cessation of work.

- xiii) When the work is done near any public place where there is risk of drowning all necessary equipments should be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision should be Made for prompt first aid treatment of all injuries likely to be sustained during the course of the work.

Hoisting Machine

- xiv) Use of hoisting machines and tackle including their attachments anchorage and supports shall conform to the following standards or conditions :
1. a) These shall be of good mechanical constructions sound material and adequate strength and free from patent defect and shall be kept in good repair and in good working order.
b) Every rope used in hoisting or lowering materials or as means of suspension shall be of durable quality and adequate strength and free from patent defects.
 2. Every crane driver or hoisting appliance operator shall be properly qualified and no person under the -age of 21 years shall be in charge of any hoisting machine including any scaffolding which or give signals to operator.
 3. In case of every hoisting machine and of every chain ring hook, shackle shovel and pulley block used in hoisting or as means of suspension the safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall be plainly marked with the safe working load. in case of a hoisting machine having a variable safe working load, each safe working load and the conditions under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.
 4. In case of departmental machines, the safe working load shall be notified by the Engineer. As regards contractor's machines, the contractor shall notify the safe working load of the machine to the Engineer whenever he brings any machinery to site of work and get it verified by the Engineer concerned.
- xv) Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliances should be provided with efficient safeguards, hoisting appliances should be provided with such means as will reduce to the minimum of the risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations which are already energised, insulating mats, wearing apparel, such as gloves, sleeves and boots as may be necessary, should be provided. The workers should not wear any rings, watches and carry keys or other materials which are good conductors of electricity.
- xvi) All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe condition and no scat-fold, ladder or equipment shall be altered or removed while it is in use.
- Adequate washing facilities should be provided at or near places of work.
- xvii) These safety provisions should be brought to the notice of all concerned by display on a notice board at a prominent place at work spot. The person responsible for compliance of the safety code shall be named therein by the contractor.
- xviii) To ensure effective enforcement of the rules and regulations relating to safety precautions the arrangements made by the contractor shall be open to inspection by the Labour Officer, Engineers of the Department or their representatives.

- xix) Notwithstanding the above clause from (1) to (xviii), there is nothing in these to exempt the contractor from the operations of any other Act or Rule in force in the Republic of India.

15.0 ROOF SHEET:

Prefabricated Polyurethane Sandwich Panels:

15.1 References

The Indian Standards listed below contain provisions which, through reference in the text, constitute provisions of this Indian Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties agreements based on this Indian Standard are encouraged to investigate the possibility of applying the most recent editions of the Indian Standards indicated below:

IS No.	Title
IS: 101 (Pt.3/Sec.2)- 1989	Methods of Sampling and Test for Paints, Varnishing and related products part 3 Tests on paint film formation sec-2 film thickness
IS: 277- 2003	Galvanized Steel Sheets (Plain and Corrugated)
IS: 513- 2008	Cold reduced low carbon steel sheets and strips
IS: 1608- 2005	Mechanical Testing of metals-Tensile Testing
IS: 3069-1994	Glossary of terms, symbols and units relating to Thermal Insulation materials
IS: 3346- 1980	Method of Determination of Thermal conductivity of Thermal Insulation materials (two slabs, guarded hot plate method)
IS: 9489- 1980	Method of test for Thermal Conductivity of materials by means of heat flow meter
IS: 9844- 1981	Methods of Testing corrosion Resistance of Electroplated and Anodized Aluminium coatings by Neutral Salt Spray Test
IS: 11239 (Pt.1-14)	Methods of Test for Rigid Cellular Thermal Insulation Materials
IS: 12436-1988	Preformed Rigid Polyurethane and Polyisocyanurate Foams for Thermal Insulation
IS: 13286- 1992	Surface Spread of Flame for Thermal Insulation materials- Methods of Test
IS: 14246- 1995	Continuously pre-painted galvanized steel sheets and coils

15.2 Terminology:

For the purpose of this standard, definitions of terms, symbols and units given in IS: 3069 shall apply.

15.3 Material Compositions:

The inner and outer surface of each panel shall consist of a 0.5 mm thick hot dipped high tensile galvanized steel/galvalum sheets which may be trapezoidal on one side and colour coated with Architectural Polyester, Silicon Modified Polyester, Fluoropolymer or Plastisol whereas the other side of sheet may be plan with colour coating. Polyols and Isocyanates are injected between two colour coated metallic sheets kept apart for maintaining the desired thickness. The chemicals shall essentially be free from chlorofluorocarbons. The polyurethane foam thus formed shall be closed cell. These panels are intended for use within the temperature range of -40° to + 110°C. Each panel is to be completed with tongue and groove joint and to be provided with or without camlocks to ensure rigid interlocking between two panel. Thickness of the panel will be as per BOQ.

15.4 Requirements:

The materials used for construction of panels and panels itself confirm to the requirements given in tables when tested in accordance with methods prescribed in 15.3

Requirements for Rigid Preformed Cellular Urethane Foam Thermal Insulation Materials

Sl. No.	Characteristics	Requirement	Method of Test
1.	Density, Kg/m ³	40 ± 2	IS: 11239 (Pt.2)
2.	Dimensional Stability (for 24 hours), percent Max at +70 ± 2°C	± 2	IS: 11239 (Pt.3)
3.	Dimensional Stability (for 24 hours), percent Max at -40°C	± 2	IS: 11239 (Pt.3)
4.	Compressive Strength at 10 percent Deformation, KN/m ² , Min	205	IS: 11239 (Pt.11)
5.	Closed Cell Content, percent Min	85	IS: 11239 (Pt.5)
6.	Horizontal Burning, mm, Min	125	IS: 11239 (Pt.12)
7.	Water Vapour Transmission, µg/m ² s, Min	5.5	IS: 11239 (Pt.4)
8.	Thermal Conductivity, W/mK, Min at 10°C mean temperature	.023	IS: 3346/9489
9	Thermal Conductivity, W/mK, Min at 24°C mean temperature	.025	IS: 3346/9489
10	Water Absorption, Volume at 100% RH	0.2	

15.5 Standard Size and dimensions:

The panels shall be supplied as per site conditions. Thickness of panels shall be 60mm.

15.6 Tolerance:

The permissible tolerances are

- i) Length- +15mm and -0mm
- ii) width- +10mm and -0mm
- iii) Thickness- ±3mm

Requirements for colour Coated Metallic sheets

Sl. No.	Characteristics	Requirement	Method of Test
1.	Thickness of Paint Coating, micron, Min Top coat	20	IS: 101 (Pt.3/Sec.2)
2.	Thickness of Paint Coating, micron, Min Bottom coat	7	IS: 101 (Pt.3/Sec.2)
3.	Weight of Metallic coating (on both sides), gm/m ² , Min for Zinc coating	175	IS: 277
4.	Weight of Metallic coating (on both sides), gm/m ² , Min for Zinc Aluminium Alloy coating (Al-55% and Zn-45%)	150	IS: 277
5.	Cross Hatch	No lifting of paint by tape	IS: 14246
6.	Yield Stress, Mpa, Min	240	IS: 1608
7.	Tensile Strength, Mpa, Min	240	IS: 1608
8.	Pencil Hardness on painted surface	No scratch on tested portion	IS: 14246
9	Impact Resistance	No cracking or peel of paint coating	IS: 14246
10	Bend Test done with mandrel diameter of 2t	No cracking or peeling of paint film on the bent portion	IS: 14246
11	Salt Spray in 5% NaCl solution for	No corrosion and no	IS: 9844

15.7 Fixing procedure of PUF Sandwich panel, Roof Ridge and gutter :

Fixing of roof panels Roof panels should be secured on fixing positions by providing suitable GI fastners, washers, bolts etc as per manufacturer's specification and recommendation:

1. Panels' downstream edge (gutter), one screw with original saddle cap, on each rib.
2. Intermediate supports, one screw with original saddle cap, on joint rib, plus one more on alternating internal ribs.
3. Eventual overlapping position, one screw with original saddle cap on each rib.
4. Panels' upstream edge (ridge), one screw with metal washer and EPDM gasket, on each low rib (between main ribs), underneath ridge flashing element. In addition to primary fixing (securing panels on structure), secondary fixing elements should also be applied along panels' joint, in order to improve joint tightness, and ensure a uniform effect of panels. Such fixing elements (e.g. Ø6.3x25mm plus saddle cap), are placed on joint rib, between supporting purlins, and at maximum distance 1200mm During drilling, fixing (and eventually cutting) operations, metal chippings are produced, that can damage panels' surface either by scratching, or by their rapid corrosion. Such metal chippings should be carefully removed with a vacuum cleaner, immediately after each operation

PREFERRED LIST OF MATERIALS APPROVED BRAND / MANUFACTURER

Unless otherwise specially approved by the Centre, the following makes are to be binding on the contactor for execution of work, subject to approval of the Engineer-in-Charge.

Sl. No.	NAME OF MATERIALS	MANUFACTURER
1.	Cement	ULTRATECH / LAFARGE / AMBUJA / ACC or any brand approved by the Authority.
2.	Steel	SAIL / TATA / RINL
3.	Ceramic Tiles	Kajaria / Orient / Johnson / NITCO
4.	Vitrified Tiles	Kajaria / Orient / Johnson / NITCO
5.	Calibrated Factory (Autoclave) Processed marble slab	Floriarna / Kalinga stone or any –brand approved by the Authority.
6.	Flush Door	Mayur / Oxford / Globe I Green Ply/Century with ISI mark.
7.	Water Proofing Compound	Nils, BASF, M/s. Pidilite, M/s, Sika Qualcrete, M/s. Choksey Chemicals Pvt Ltd.
8.	Aluminium Doors, Windows, Curtain ,Wall, Structural Glazing	M/s. Nitson & Amitsu, M/s. Alfa Aluminium, M/s. Tara Engineering, M/s Hydro Building System
9.	Aluminium Extruded Sections	M/s. Hindalco, M/s.. Zindal, M/s. Century.
10.	Glazing	M/s. Saint Gobain Glass (I) Ltd, Ws. Pilkington Glass India Ltd, Ws. Ashai India Glass Ltd.
11.	Hardware Fittings, Locks	M/s. Acme, Mts. Hafele, Ws. Godrej, M/s. Dunex, M/s Hettich, M/S. Kich or as approved by the Authority.
12.	Door Closures & Floor spring	M/s. Hafele, Ws. Hettich, M/s. Godrej or as approved by the Authority.
13.	Water Proof Adhesive for Tile Fixing	M/s. Bal-Endura, Ws. Pidilite, M/s. Sika, M/s. MYK Laticrete.

14.	Exterior Acrylic Emulsion Paint	Asian Paints, ICI
15.	Synthetic Enamel Paints, Distemper, Plastic Emulsion Paint	Asian Paints, ICI
16.	False Ceiling	Amstrong, Gypsum India
17.	Sandwich Puf Panel Roof Sheet	Epack, Omkar Puf, Jindal Mectec, Invogue
18.	G.I. Pipe	TATA, JINDAL
19.	G.I. fittings	HB
20.	Bath fittings	Jaquer, ESS ESS
21.	Sanitary fittings	Parryware, Hindware

Note:

1. The Engineer-in-Charge shall have the final say about the items amongst the above-mentioned make/brand that shall be used in the project and the contractor shall have no claim on this account for choosing a particular brand/make by the Centre. For the other items for which makes/brands are not mentioned, prior approval of the same has to be obtained before use.
2. If the approved brands mentioned above are not available (which the contractor has to prove with documentary evidence), equivalent make as may be approved by the Engineer-in-Charge, only to be used for the work.

Annexure -A

(To be typed on a Non-judicial Stamp paper of Rupees One Hundred)

FORM OF AGREEMENT

This agreement made the day of 2017 BETWEEN THE Satyendra Nath Bose National Centre for Basic Sciences, Block –JD, Sector-III, Salt Lake, Kolkata-700106 (Herein after called the Centre) of the one part

And

M/s .(Name of the Contractor..... of.....(Address).....in the state of West Bengal (there in after called "the Contractor") of the other part WHEREAS as the Centre is desirous that certain works should be constructed, viz (Name of the work).....and has accepted a tender by the contractor for the construction, completion and maintenance of such woks.

NOW THIS AGREEMENT WITNESSETH as follows :

1. In this agreement words and expression shall have the same meanings as are respectively assigned to them in the conditions of contract-hereinafter referred to.
2. The following documents shall be deemed to form and be read and construed as part of this agreement, viz :
 - (a) The said Tender
 - (b) Invitation to Tender
 - (c) Instructions to Tenderers.
 - (d) General Conditions of Contract for construction works
 - (e) Special Conditions of Contract

(f) Specifications

(g) Tender Schedule, Bill of quantities, quoted rate and amount against each item.

(h) Drawings

(i) Letter of Intent/Award

3. In consideration of the payments to be made by the Centre to the Contractor as hereinafter mentioned the contractor hereby covenants with the Centre to construct, complete and maintain the works in conformity in all respect with the provisions of the contract.

4. The Centre hereby covenants to pay the contractor in consideration of the construction completion and maintenance of the works the contract price at the times and in the manner prescribed by the contract.

5. In witness whereof the parties hereto of SNBNCBS and the Contractor subscribe their respective hands, sign and seal in token of having accepted the aforesaid terms and conditions of the day, month and year mentioned above.

Signed, sealed and delivered by SNBNCBS

Signed, sealed and delivered by contractor

Signed and delivered in Kolkata

in the presence of :

Witness 1 :

Name and address

Witness 1

Name and address

Witness 2

Name and address

Witness 2

Name and address

Annexure -B

MEASUREMENT SHEET

Name of the Job :

Contract No and Date:

Name of Agency:

Date of Commencement

Date of completion:

Measurement taken upto :

Bill No..... RA/Final Bill:			Measurement Sheet Page Ref :					
Item No	Particulars	Unit	Details of actual measurement				Quantity	Remarks
			No	L	B	H		

The measurement recorded above are accepted with full satisfaction

Stamped signature of the contractor

Measurement certified By

Measurement countersigned by

Designation:

Designation:

ANNEXTURE "C"

ABSTRACT BILL												
Running Account Bill No...../Final Bill												
Name of work :												
Name of agency:												
Work order no and date:												
Date of Commencement								Date of completion				
Merasurement taken upto:												
Item No	Items of work	Unit	BOQ Qty	Quantity			Rate (Rs)	Part rate (Rs)	Amount (Rs)			
				Since previous bill. (Rs.)	This Bill	Cumulative upto date			Upto previous	This Bill	Cumulative upto date amount	
1	2	3	4	5	6	7	8	9	10	11	12	

Total											
Security deposit											
Less paid upto last Bill											
Amount payable											

This is to certify that the work against the above bill has been completed satisfactorily and as per specification of respective item. The work has been duly supervised during execution

Bill certified by	Bill verified by	Bill countersigned by
Designation	Designation on Accounts Officer	Designation